TOXICITY OF THREE CHEMICALS AND NEEM INSECTICIDE AGAINST SPRING POPULATIONS OF DUBAS BUG, OMMATISSUS LYBICUS DE BERGEVIN (TROPIDUCHIDUE: HOMOPTERA) IN OMAN

Article *in* Fresenius Environmental Bulletin · November 2018

CITATION
1

READS
244

3 authors:

Fatma G Al-Rawahi
Ministry of Agriculture and Fisheries, Oman
4 PUBLICATIONS **2** CITATIONS
SEE PROFILE

Tawfiq M. Al Antary
University of Jordan
271 PUBLICATIONS **412** CITATIONS
SEE PROFILE

Monther T. Sadder
University of Jordan
66 PUBLICATIONS **759** CITATIONS
SEE PROFILE

© by PSP Volume 27 – No. 12/2018 pages 8580-8584 Fresenius Environmental Bulletin

TOXICITY OF THREE CHEMICALS AND NEEM INSECTICIDE AGAINST SPRING POPULATIONS OF DUBAS BUG, *OMMATISSUS LYBICUS* DE BERGEVIN (TROPIDUCHIDUE: HOMOPTERA) IN OMAN

Fatma G Al-Rawahi[1], Tawfiq M Al-Antary[2,*], Monther T Sadder[1]

[1]Department of Horticulture and Field Crops, School of Agriculture, University of Jordan, Amman,11942, Jordan
[2]Department of Plant Protection, School of Agriculture, University of Jordan, Amman, 11942, Jordan

ABSTRACT

The date palm is the main host of dubas bug, which is also known as the palm bug. Dubas bug, *Ommatissus lybicus* De Bergevin is a destructive pestin Gulf countries. The intensive use of insecticides in Oman to control the dubas bug might lead to resistance. An entomological field study was conducted to test pesticides against dubas bug insect on spring generation in Al-Batinah region in sultanate of Oman. Four pesticides were used: Decis, Oberon, Mospilan and Ecodaneem (which is neem extract) and the control was sprayed by water only. There were no significant differences for the five used plots one day before spraying treatments. Insect densities of alive dubas nymphs after 10 days of the spraying treatments were decreased gradually in the treatments. At the present study, the pesticides treatments were carried in the first week of April which explained the decreased populations of nymphs in all treatments including the control. However, the number of alive nymphs in the Oberon treatment was the highest without significant difference with the control treatment. In conclusion, the efficacy of the tested insecticides was Oberon, Ecodoneem, Mospilan and Decis, in a descending order.

KEYWORDS:
Date palm trees, Dubas bug, Insecticides, Neem, Toxicity

INTRODUCTION

The date palm (*P. dactylifera*) is the oldest cultivated plant in the dry subtropical regions of north Africa, the Arabian Peninsula, southern Iran, Afghanistan, and Pakistan. Cultivation of the date palm was known in the seventh millennium B.C in Sumeria, Assyria, and Egypt [1, 12]. Iraq is the leading date-producing country, with a yield of approximately 350,000 tons annually [2, 3]. Dates are something of a self-contained nutritional super-fruit, and an excellent source of protein, vitamins and minerals.

Over forty varieties of date are grown in Oman, with over 150,000 tons of fruit produced annually. It is the largest crop in the country and, until the discovery of oil, far and away the most economically important [1]. Most fruits are harvested between August and December. In many places, dates are still handpicked, although mechanical shakers may be used in larger plantations. There are an estimated eight million date palms trees in Oman, and travelling around the Batinah region you'll rarely be out of sight of the endless plantations which blanket the coast. There are two types of dates. One is the raw date which accounts for 64 per cent of the total produce and is consumed in raw form by people in various ways.

According to the report by El Mardi [4], there were 20 kinds of best dates which are being produced in Oman include Nahal, Khasab, Fardh, Khanizi, Khalas Al Dhahira, Madluki, Barni, Abu Daan, Zabd, Abu Naranjah, Masli, Jabri, Handhal, Suwaih, Barshi, QashAbyadh, Tabaq, Abu Maan, Hilali Al Hassa and Baql. In Oman, date palms occupy an estimated 85 per cent of the total area under fruit cultivation and about 50 per cent of the total agricultural land [5].

The date palm is the main host of dubas bug, which is also known as the palm bug. Lepesme [6] has reported that the first description of dubas bug was made by Fieber in Spain in 1875, after he collected samples from ornamental trees (*Chamaerops humilis*). It is an important pest of date palm, *Phoenix dactylifera* in Gulf countries [7, 8, 9, 10, 11, 12]. This destructive pest is active on leaflets, rachis, fruiting bunches and spines during the different stages of date palm tree [13, 14, 12]. It causes several direct and indirect damages to the date palm. The direct damage of this pest appeared when the nymphs and adults feed and suck sap from leaflets and rachis in spring and autumn [12, 15].

This pest is active on leaflets, rachis, fruiting bunches and spines during the different stages of date palm tree [16, 13, 14] and causes several direct and indirect damages to the infested date palm and other palm members. The direct damage of this pest appeared when the nymphs and adults feed and suck

sap from leaflets and rachis in spring and autumn [12, 15]. However, the indirect damage can be also explained by the deterioration of date palm fruits and other fruits of trees that planted underneath through honey dew that attracts the dust, dry leaflets and rot fungi. Gassouma [17] demonstrated that in the case of heavy infestation, dubas bug can reduce the crop yield by 50%. Moreover, fruits of infested palm trees are also reported to be smaller and ripen more slowly.

Organophosphate (OPs) chemicals are reported to be the most widely used group of insecticides in the world, particularly in Oman and Jordan [12, 25, 26]. OPs have a wide range of pest control applications as contact, systemic and fumigant insecticides [12, 19, 24, 25]. In most countries OPs are widely used because, they are cheaper than the newer insecticides. They are unstable and therefore break down quickly in the environment. The second main groups of pesticides are the synthetic pyrethroids (PYr). PYr were introduced at the end of 1970's and their uses have increased in agriculture, and public health. Pyrethroids are a cost-effective and friendly environment type of insecticides due to their low toxicity to mammals, and minimal accumulation in the environment [12, 20, 25, 26].The intensive use of insecticides in Oman to control the dubas bug might lead to resistance which allow this pest to escape from insecticide application. Moreover, pesticide resistance in agriculture systems has been recognized as one of the world's most significant environmental problems for nearly two decades [12, 21, 22, 23, 25, 26].Neem as a botanical insecticide as been used to control the dubas bug. However, neem is a plant extract that is not harmful to human health or the environment, when used alone or in combination with summer oil proved to be an ideal alternative to chemical insecticides for controlling dubas bug. Neem and neem plus summer oil has shown to be effective against this pest [12, 24, 25]

Therefore, the objective of this study is to evaluate of the toxicity of two insecticides from different groups and a neem product in the field against the dubas bug on date palm trees in the field.

MATERIALS AND METHODS

The Experimental Work. An entomological field study was conducted to test pesticides against dubas bug insect on spring generation in Al-Eer village in Wadi Bany Awf in Al-Battenah region in Sultanate of Oman. Al Batinah region occupied an important location on the coast of Gulf of Oman. It lays between Khatmat Malahah in the north and Ras al-Hamra in the south and confined between the Al Hajar Mountains in the west and the Gulf of Oman in the east. Most of Oman's population lives in that region, because of the green plains between the Al Hajar Mountains and the sea.

Al Batinah region contained twelve provinces(Wilayat). It contains the largest number of provinces. These are: Sohar and Ar Rustaq. Murry village (23°39'14"N) (56°20'44"E) in the Wilayat of Al Rustaq in Governorate of South Al Batinah is one of the beautiful villages famous for agriculture and tourist spots.

The field experiment was carried on spring generation of the dubas bug insect on April 6, 2018. The farm is located in Al-Eer village in Wadi Bany Awf in Al-Battenah region in Sultanate of Oman. The field surrounded by mountains from the four places. The chosen field was totally planted by date palms. It contained about 300 trees of the date palm and being infested every year by the dubas bug. The farm was irrigated by Falaj system which means underground water channel. The most common cultivar of the dates was Naghal. The rest were Fard, Khesab and Khenazi, Fahel and Kheshosh. The field was interplanted with different plants which were mostly used for animal feeding. The date trees were generally 4o years in age. Also, new date palm trees were planted. The average height for each old tree was 7 m and 50cm in diameter. The space between every two trees was from 3-5m. The study was arranged in a completely randomized design (CRD). There were five replicates for each treatment. The replicate was consisting of five trees represented as a plot. There were four treatments and untreated control (water only) was randomly distributed in the five plots. The trees were labeled by different colored long ribbons on April 6, 2018, one week before treatment. The barrier between each two trees was untreated tree. The treatments were: Oberon, Mospilan, Decis, E-codaneem and control.

Spraying Treatment. The experiment was conducted in Al-Ear village in Al-Rustaq region in Sultanate of Oman. There were four pesticides and the control as shown in Table 1.

Calibration for spraying using water only was carried out by a motor equipped with 200L tank and high pressure high volume nozzles. The calibrated trees (50 trees) were sprayed with water only to the complete coverage state i.e. to the point of run-off of water from the trees, and then calculated for five trees. The spraying was started with the control and then the different treatments. Tank was washed with water and then sprayed away from treated trees and then filled with the needed dilution from each pesticide, separately.

Leaflet Sampling. A pre leaf spray count was carried out one day a head before pesticide spraying as mentioned in (Table 1). The sample size was 2 leaves from each tree. There were five trees for each treatment chosen randomly from each plot which contained more than 50 trees. 20 leaflets from each leaf were chosen randomly from two leaves. These 20 leaflets were labeled by colored tape on each leaf.

The numbers of the nymphs were counted 7 and 10 days after treatments. The mean number of the nymphs on each leaflets and each plot was calculated.

RESULTS AND DISCUSSION

Insects Densities Before Treatment on Spring Generation. The mean densities of the spring generation of dubas bug nymphs on leaflets one day before treatment sampled on April 7, 2018 from Al-Ear village in Sultanate of Oman are shown in Table 2. There were no significant differences between the means of densities one day before treatment for the five used plots (spraying treatments). These results indicated that the dubas bug populations were distributed randomly in all used plots for treatments of spraying with the different pesticides. In the present study, most of alive dubas bug populations were in the third and forth nymphal instar. Abd-Allah et al. [27] reported that during spring generation, dubas bug nymphs peak was between 2nd and 4th week of March in Sultanate of Oman.

Insect Densities After Treatment on The Spring Generation. The mean densities of the spring generation of dubas bug nymphs on leaflets after treatments on April 7, 2018 from Al-Ear village in Sultanate of Oman are shown in the Table 3.

There were no significant differences between the mean of densities of dubas bug after 7 days of the treatment. The density of alive nymphs of dubas bug in the control and Oberon treatments were the highest compared with the other treatments but without significant differences. But when comparing the densities for each treatment with those before treatment, always the means were highest (Tables 2 and 3) indicating that the dubas nymphs were still emerged from eggs. However, densities of alive nymphs in the Oberon and E-codaneem treatments were the highest, although it did not differ significantly than the other treatments. On the contrary, Fanigliulo et al. [28] indicated that Oberon was very effective in the control of mites at both doses of 45 and 60 g/hl.

Insect densities of alive dubas nymphs after 10 days of the spraying treatments were decreased gradually in the treatments (Table 3). This was due to the continue of nymphs emerged to adults on sampled leaflets and effect of pesticides application. However, MAF [29] stated that dubas bug nymphs of the spring generation started to give adults in 2nd week of April, in Oman. At the present study, the pesticides treatments were carried in the first week of April which explained the decreased populations of nymphs in all treatments including the control. Although, still there were significant differences between Decis, Mospilan and E-codaneem applied treatments and the other treatments, but they did not differ significantly. However, the number of alive nymphs in the Oberon treatment was the highest without significant difference with the control treatment. In Oman, Organophosphate and pyrothroid insecticides have been wildly used in dubas bug control programmes mainly one aerial spray [30, 34].

TABLE 1
Pesticides names, formulations and the used amounts

Treatment	Formulation	Empirical formula	Amount of pesticide (ml or gm)/200L H2O	Common name	Group
Decis	25EC	C22H19Br2NO3	200ml	Deltamethrin	Pyrethroids
Oberon	240 SC	C23H30O4	150ml	Spiromesifen	Spinosins
Mospilan	20 SP	C10H11CIN4	100gm	Acetamiprid	Neonicotinoides
E-codoneem	32.1 EC	C35H44O16	600ml	Azadirachtin	Botanicals
Control			Only water		

TABLE 2
The mean densities of the spring generation dubas bug nymphs on leaflets one day before spring treatment (2018)

Treatments	No. of dubas bug nymphs before treatments (Mean ± SE)
Decis	6.00±0.61 a
Miospilan	6.25±0.60 a
E-codaneem	6.00±2.31 a
Oberon	9.00±3.06 a
Water	5.88±2.90 a

Means in the column followed by same letter are significantly not different using LSD ($p < 0.05$).

TABLE 3
The mean densities of the spring generation dubas bug nymphs on leaflets 7 and 10 days after spring treatment in 2018.

Treatments	No. of dubas bug nymphs after treatments (Mean ± SE)*		
	7 days	10 days	Over all
Decis	1.25±0.66 a	0.63±0.47 a	0.94±0.31 a
Miospilan	2.25±1.65 a	1.75±1.13 a	2.00±0.25 a
E-codaneem	2.88±2.05 a	4.50±2.73 a	3.69±0.81 a
Oberon	3.00±0.58 a	10.25±0.72 b	6.63±3.63 a
Water	3.50±0.29 a	11.67±2.67 b	7.59±4.09 a

*Means in the same column followed by same letter are significantly not different using LSD test ($p< 0.05$).

Insect densities of alive dubas nymphs as overall means within the whole experimental work from 7 days of spraying to 10 days of the same applications were shown in Table 2. There were no significant differences between all accumulative means of the treatments. In general, alive counted dubas bug number in the control treatment was the highest. This indicates that all used pesticides are effective in decreasing the dubas bug population, leading to effective control. Decis treatment (0.94 nymphs/ leaflet) showed the lowest number of alive dubas bug but without significant differences compared with the other tested pesticide. Mospilan treatment (2.00 nymphs/leaflets) gave alive dubas bug number less than E-codaneem (3.69 nymphs/leaflets) and Oberon (6.63 nymphs/leaflets), although they didn't differ significantly.

However, in conclusion, the efficacy of the tested insecticides was Oberon, Ecodoneem, Mospilan and Decis, in a descending order. Several workers [31, 32] had showed in their experiments that Decis was one of the most effect insecticides against the nymphs of the dubas bug and other insects in Oman. Dubas bug insecticide treatment is required when more than 75% of eggs have hatched and/or fourth nymphs are dominant in the population [33].

ACKNOWLEDGEMENTS

This work was performed with the support of University of Jordan and the Directory of Agriculture and live stock research in Sultanate of Oman for the finance support and providing equipment needs for my experiments to accomplish this work.

The authors have declared no conflicts of interest.

REFERENCES

[1] Al-Marshudi, A.S. (2002) Oman traditional date palms: production and improvement of date palms in Oman. Tropiculture. 20(4), 203–209.

[2] Al-Yahyai, R. (2007) Improvement of date palm production in the Sultanate of Oman. Acta Hort. 736, 337–343.

[3] Al-Farsi, M., Alasalvar, C. and Morris, A. (2005) Compositional and sensory characteristics of three native sun-dried date (*Phoenix dactylifera* L.) varieties grown in Oman. J Agric Food Chem. 53, 7586–7591.

[4] El Mardi, M.O. (1995) Traditional date culture. College of Agriculture, Sultan Qaboos University Press, Sultanate of Oman.

[5] Jaradat, AA. and Zaid, A. (2004) Quality traits of date palm fruits in a center of origin and center of diversity. Food Agric Environ. 2(1), 208–217.

[6] Lepesme, P. (1947) Les insects des palmiers. Paul Lechevalier Editeur, Paris. 903p.

[7] Al-Abbasi, S.H. (1988) Biology of *Ommatissus binotatus* De Berg. (Tropiduchidae: Homoptera) Under Laboratory Conditions. Date Palm Journal. 6, 412-425.

[8] Elwan, A.A. and Al-Tamiemi S.S. (1999) Life cycle of Dubas bug *Ommatissus lybicus* De Berg (Homoptera: Tropiduchidae) in Sultanate of Oman. Egyptian Journal of Agriculture Research. 77, 1547-1553.

[9] Al-Jboory, I.J. (2000) Dubas palm *Ommatissus lybicus*. College of Agriculture, Baghdad University, Bulletin Indicator.

[10] Al-Jboory, I.J., Al-Sammariae, A.I., Whab, J.F. and Ahmed, W.A. (2001) Evaluation of thiamithoxam in a different application techniques to control Dubas bug *Ommatissus binotasus lybicus* (Deberg). Arab Journal of Plant Protection. 19(20), 107-112.

[11] Ahangaran, M.H. (2001) Dubas bug and activities of controlling first generation of the pest in Bam region in 1999 and 2000. Ministry of Agriculture of Iran, Deputy of Research. Education and Extension of Agriculture. 22p.

[12] Al Momany, A. and Al Antary, T. (2008) Pests of Home and Garden. Publications of the University of Jordan, Amman. 513p.

[13] Bitaw, A. and Ben Saad. A. (1990) Survey of date palm trees insect pests in Lybia. Arab Journal of Plant Protection. 8, 72 -76.

[14] Al-Jamali, N.A., Al-Hkfaji A.A. and Askander, T. (2008) Study on activity of new pesticides to control of autumn generation of Dubas bug *Ommatissus lybicus* De Berg (Homoptera: Tropiduchidae). Journal of Science of Kerbala Univ. 3, 73-78.
[15] Kinawy, M. and Al Siyabi, A. (2012) Major arthropod pests of date palm in Arab countries. First Regional conference about management of date palm pests, UAE 23-25 Sep. 2012, 18p.
[16] Hussain, A.A. (1963) Biology and control of the Dubas bug *Ommatissus binotatus* lybicus De Berg. (Homoptera: Tropiduchidae) infesting date palms in Iraq. Bull. Entomol Res. 53, 737-745.
[17] Gassouma, M.S. (2004) Pest of date palm (*Phoenix dactylifera*). Proc. Regional workshop on Date Palm development in Arabian Peninsula Abu Dhabi, UAE.
[18] Al Antary, T.M. (1996) Pesticides and Toxicity. Publication of University of Al Quds Al Maftouh, Amman. 443p.
[19] Yoon, K.S., Kwon, D.H., Strycharz, J.P., Hollingsworth, C.S., Lee, S.H. and Clark, J.M. (2008) Biochemical and molecular analysis of deltamethrin resistance in the common bed bug (Hemiptera: Cimicidae). Journal of Medical Entomology. 45, 1092-1101.
[20] FAO. (2012) Guidelines on Prevention and Management of Pesticide Resistance, FAO, Rome.
[21] EPA (2009) A review of the Relationship Between Pyrethrins, Pyrethroid Exposure and Asthma and Allergies. US Environmental Protection Agency. 28.
[22] FAO statistics (2017) http://www.fao.org/faostat/en/.Contacts. FAO-Statistics@fao.org.
[23] Ghidan, A.Y., Al-Antary, T.M., and Awwad, A.M. (2016) Green synthesis of copper oxide nanoparticles using *Punica granatum* peels extract: Effect on green peach Aphid. Environmental Nanotechnology, Monitoring and Management. 6, 95-98.
[24] ICARDA, (2017) Applying integrated solutions to eradicate pests. International Center for Agricultural Research in the Dry Areas, Aleppo, Syria.
[25] Madanat, H.M., Al Antary, T.M. and Zarqa, M.H.A. (2016) Toxicity of six ethanol plant extracts against the green peach aphid *Myzus persicae* Sulzer (Homoptera: Aphididae). Fresen. Environ. Bull. 25, 706-718.
[26] Al-Antary, T.M., Al-Lala, M.R.K. and Abed-Wali, M. (2012) Response of seven populations of the two-spotted spider mite (*Tetranychus urticae* Koch) for bifenezate acaricide on cucumber (*Cucumis sativus* L.) under plastic houses in Jordan. Advances in Environmental Biology (AEB). 6(7), 2203-2207.
[27] Abd-Allah, F.F., Al-Zadjali, T.S. and Al-Khatri, S.A. (1998) Biology of *Ommatissus lybicus*-Bergevin under field and laboratory conditions during spring 1995. Proceeding of the International Conference on Integrated Pest Management. Sultan Qaboos University, Sultanate of Oman. 75-79.
[28] Fanigliulo, A., Massa, C.G., Ielpo, L., Pacella, R. and Crescenzi, A. (2010) Evaluation of the efficacy of Oberon (Spiromesifen), to contain infestations of mites and whiteflies on Capsicum annuum L. Communications in Agricultural and Applied Biological Sciences. 75(3), 341-344.
[29] MAF (1997) Dubas bug, *Ommtissus lybicusa*, in: P.P.D.P.P.R. Centre (Ed.) Ministry of Agriculture and Fisheries. December 1997, Muscat. 3-18.
[30] MAF (2008) Annual report. Ministry of Agriculture Oman, Sultanate of Oman.
[31] Whalon, M., Mota-Sanchez, D. and Hollingworth, R. (2008) Analysis of global pesticide resistance in arthropods. Global Pesticide Resistance in Arthropods. CABI, 5-31.
[32] Al Sarai Al Alawi, M. (2015) Studies on the control of Dubas bug, *Ommatissus lybicus* DeBergevin (Homoptera: Tropiduchidae), a major pest of Date Palm in the Sultanate of Oman. Ph.D. Thesis. Imperial college, London.
[33] Mokhtar, A.M., Al-Nabahani, S.S. and Al-Tamimi, S.S. (2001) Using the production of honeydew as indication to estimate the population of Dubas bug *Ommatissua Lybicus* De Berg. in the date palm grooves in Oman. Research Annual Report of Entomology, Jimah Research Station Ministry of Agriculture and Fishieries. Bahla Sultanate of Oman. 3-13.
[34] Al-Antary, T. and. Al-Mommany, A. (1990) Pests of Garden and Home. 1st edition. Dar Al Arabiah for Publication and Distribution, Cairo. 390p.

Received: **27.07.2018**
Accepted: **14.09.2018**

CORRESPONDING AUTHOR

Tawfiq M Al-Antary
Department of Plant Protection,
School of Agriculture,
University of Jordan,
Amman, 11942 – Jordan

e-mail: tawfiqalantary@yahoo.com