

Potentials of utilizing biological measures for the management of lesser date moth *Batrachedra amydraula* in Iraq

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ABSTRACT

The lesser date moth *Batrachedra amydraula* (LDM) is considered as a key pest attacking fruits in almost all date palm growing regions in Iraq. Larvae begin attacking flowers and bore in to newly formed fruits and move to subsequent stages of fruits development. Biological agents such as the egg parasitoid, *Trichogramma evanescens*, the larvae parasitoids *Bracon hebetor* and biological pesticides such as *Bacillus thuringiensis kurestaki* and Spinosad were implemented against this pest under field conditions during 2009-2013. Light traps were used for the purposes of monitoring adults emergence and timing of application. All treatments showed significant effect in reducing infestation level of the pest compared to non treated fields. However, effectiveness was varied according to the season, the biological control agents and surrounding environment. The present study was undertaken to investigate the feasibility of using biological measures for controlling this pests at different locations in the country. The bio-pesticide *Bacillus thuringiensis* was applied singly as a spray for a large scale trial in eight date palm growing provinces with total areas reached up to about 1000ha during 2012. Results showed a variable effectiveness against the pest ranged between 35 to 79% according to site and

application time. Same results were reported when the combinations of the bacteria *Bacillus thuringiensis* with the egg parasitoid *Trichogramma evanescens* and the larvae parasitoid *Bracon hebetor*, were tested against LDM. Significant yield increase was observed for all bio agents compared to control. Therefore, these bioagents are suggested to be a safe alternative in any IPM program for the control of lesser date moth in Iraq.

Key word: Biological pesticides, Parasitoids, Pest management, Date palm, Iraq.

INTRODUCTION

Iraq is considered as one of the oldest countries cultivating date palms. Palms trees and fruits are subjected to infestation by many key pests which can be found where ever these trees are cultivated in the world including Iraq. However, infestation severity and pest distribution are varied according to pest, host plant and surrounding environment (Al-Baker, 1972; Ali, 2007; El-Haideri and El-Hafeedh, 1986; Zaid, 2002). The most known serious and wide spread economic pests include the lesser date moth *Batrachedra amydraula* Meyrick which can be found in almost all date palm growing areas, the dubas bug *Ommatissus lybicus* Debergevin is intensively found in central region and middle Euphrates Provinces of the country, the date palm borers including

Oryctes elegance Prell., *Oryctes agamemnon arabicus*, the long horn stem borer *Jebuseae hammershmitti* Riche and frond borer *Phonopate frontalis* Fahraeus . These borers

can be found everywhere in date palm orchards with the presence of an ecological variation in their distribution according to pest species and the health condition of date palm trees in the intended region. The dust spider mite *Oligonychus afrasiaticus* (Megregor) is a fruit pest which presents a real threat influencing date quality in some seasons. Other pests such as scale insects and some fruit pests are also found in many regions and they are considered as secondary pests however, their status can be changed at any time depending on environmental factors (Abel–Hussain, 1985; El-Haideri and El-Hafeedh, 1986; Khalaf et al., 2013).

The lesser date moth is infesting all date palm varieties with some variations according to variety, region and season. Larvae begin their attack to flowers before fruit setting and continue during the subsequent developmental stages with an intensive increase in Hababook and Chemri stages feeding on content. The infected fruits become dry and turn red in color from which the insect referred to its name (Hummarra). High infestation causes dropping of large quantities of fruits underside the tree leading to big losses in date yield. There are three generations for this pest in most date palm growing areas however, the duration of generation and their peaks are varied according to the region and climatic factors (Al-Fahadawy, 1988; Aziz, 2005; Ali et al., 2010; Al-Safi, 1977; El-Juhany, 2010; Kakar et al., 2010). The chemical insecticides are considered the principle measures used in wide spread application against this pest in most date palm growing regions in the world including Iraq. The organophosphate and carbamate groups were used during the 60th–80th decades of the past Century, followed by the pyrethroid group and some other recently introduced insecticides (Al-Jboory et al., 1999; Al-Mhamed, 2001; Bahar et al., 2010). These insecticides are used either as dust with pollination or as ground and aerial spray (Al-Jboori et al., 2007; Ali et al., 2010; Al-Samarraie et al., 1988; Ba-Angood, 1978). However, the use of wide spectrum insecticide resulted in many negative consequences on human health and environment in addition to the effect on non target organisms including beneficial insects and natural enemies. Therefore, efforts were devoted toward the use of safe or less toxic materials which are called environmentally friend pesticides including biological insecticides such as the formulations of the bacteria *Bacillus thuringiensis* which are considered the most common biological insecticide used against many insect pests. These insecticides were used alone or in combination with other pesticide in an integrated mean for the control of many agricultural pests (Dhoubi et al., 2007; Sayed et al., 2001). A good results were also obtained for the use of biological insecticide and natural enemies against the lesser date moth and other date palm pests (Ali et al., 2010; Lysandrou et al., 2010; Gerling, 2006; Mohammad, 2011; Sayed, 2010). Since previous studies indicated that biological agents could be an effective and safe alternative, several field trials were implemented in many of

date palm growing regions in Iraq and a satisfactory results were obtained (Mohammad et al., 2011; 2013a; 2013b). On another hand some International projects such as Improved Livelihoods of Small Farmers in Iraq through Integrated Pest Management and Organic Fertilization (IRAQ-ICARDA-IFAD PROJECT) and Harmonized Support for Agriculture Development (HSAD) Project in Iraq (USAID-IRAQ-ICARDA PROJECT) in addition to the ongoing national projects are also devoting a large parts of their activities to improve date palm production and protection with the emphasize on the use of natural agents and biological insecticides in an integrated mean for the control of date palm pests. Therefore, the present study was conducted to investigate the feasibility of the use of biological insecticides and natural enemies for the control of lesser date moth in Iraq.

MATERIALS AND METHODS

Information and data obtained from previous studies and from those still ongoing projects concerning the use of biological insecticides and natural enemies against the lesser date moth in Iraq were used as a base line for the present study and for comparison and discussion. A large scale trials for the application of the biological insecticide *Bacillus thuringiensis* (Bt) were also conducted in eight Provinces with a total areas of more than 1300h. during the season of 2012. Provinces included in the trials were Basra, Dewanyia, Babil, Wasit, Najef, Baghdad, Al-Anbar and Dayala. The biological insecticide Bt. was applied at rate of 1.5-3 g/l according to formulation and 6-7 liters of the dilution were used per tree as a spray by ground spraying machines after about two weeks of completion of pollination. Readings on initial infestation in each indented regions were taken before application, and two other readings were also made after treatment. The first one was made after two weeks of application and the seconds reading was conducted after two weeks of the first reading. For each reading three date palm trees were selected randomly in each region within each Province. Three strands were taken randomly from each of the four directions of the tree with a total of 12 strands /tree. Samples were placed in plastic bags and taken to the laboratory for examination. Number of total fruits, infested fruits per stand and percentage of infestation were then calculated. A number of 100 dropped fruits were also collected from under side the trees for examination and recording of percentages of infestation. Total infestation was used for calculation the efficiency of the treatments (Henderson and Telton, 1955). In order to determining the influence of biological insecticide Bt. on date yield, one bunch was cut from each direction of the tree at harvesting time then the number of fruits per strand, weight of bunch and the total yield per tree were recorded.

RESULTS AND DISCUSSION

Previous studies on the periodical activity of the lesser date moth using pheromone or light traps indicated the presence of 2 -3 overlapping generation per year in Iraq. The beginning, peak and duration of each generation was varied according to the season and surrounding environment. Results concerning accumulated adults catch in light or pheromone traps in some regions of Middle Iraq during the month of April for some of the past years is presented in (Fig.1). Number of adults was varied with the season due to the variation of surrounding environment and governing climatically factor. Dust storms, rainy thunder storms, wind, extreme decrease in daily temperature and other climatically factors would influence flight activity of adults (Mohammad, 2011; Aziz, 2005). Therefore, trap catch of lesser date moth adults could be considered as qualitative rather than quantitative indicator for the presence of the pest. Accumulated thermal heat units were also used to determine adult emergence and showed that 10% of adults emergence during Spring required an accumulation of 446.06 heat units and most adult emergence occurred during April, which mostly coincide with the flowering stage of date palm trees with an obvious variation between seasons in Iraq, (Al-Dolimey, 2004; Ali, et.al.2010, Mohammad,2011; Aziz,2005). As for the purpose of the present study control measures were implemented depending on actual total infestation in fruits on bunches and in dropped fruits which ranged between 2.6 to 5.5 depending on location and time of reading during 2012. Data presented in (Fig.2) indicated that the biological insecticide Bt. was effective in reducing infestation of lesser date moth. However, the efficiency of the control was varied according to region being 79% in Basra and 35% in Al-Anbar. Good results were also obtained in Babil, Baghdad, Diwanya, and Wasit Provinces. Other previous field trials showed that the efficiency of the biological insecticide BT. was about 66 - 75 during the seasons of 2009 - 2011. (Mohammad, 2011; Mohammad et.al., 2013a). Trees treated with Bt. Resulted in various yield increase depending on location, cultivar and time of application .The highest percentage of yield increase was more than 100% recorded for Sayer cultivar in Basra and the lowest percentage was 16% recorded in orchards planted with mixed cultivars in Najaf Province during 2012. The reduced efficiency of the biological insecticide which was recorded at Najaf, Dayala, and Al-Anbar Provinces, could be attributed to several factors other than the insecticide including timing of application, effectiveness of the ground spraying machines, the coverage of fruits bunches, in addition to the skills of the personals involved in application of the biological insecticide. Previous studies also indicated that the use of the biological insecticide Spinosad resulted in control efficiency of about 54 -60% during 2010 and 2011 seasons respectively. Other previous studies indicated that natural enemies such as the egg parasitoid *Trichogramma evanescens* and the larvae

parasitoid *Bracon hebetor* were implemented in large scale trials and showed very promising results when applied in proper timing. Results indicated that the efficiency of the egg parasitoid was 68 and 57% during 2010 and 2011 respectively while it was 52 and 64% for the larvae parasitoid during the same seasons respectively (Mahammad,2011; Mohammad et.al., 2011;2013b). These results and the results of the present study showed that biological insecticides and biological agents are promising and safe alternative that can be used in an integrated pest management program for the control of the lesser date moth in Iraq. Since the beginning of the periodic activity of lesser date moth coincides with seasonal flowering of date palm trees which is usually occurs during the month of April with some earliness in southern regions of Iraq, therefore, Survey for fruits infestation should be considered as essential requirement along with adults catch in the light traps, for decision making concerning the control measures against this pest on date palm trees. Farther more, control practices should cover the whole date palm growing areas in order to avoid reinfestation and insure better efficiency of the treatment. A reliable monitoring system is essentially needed to determine proper timing of adult emergence and control decision. Studies on heat units requirement for stages development and adult emergence should take priority in this system (Ahmed and Al-Rubaiee, 2000). Previous studies indicated that the lesser date moth required an accumulated heat units of 626 DD for development of egg and subsequent stages to adults emergence when reared at constant temperature under laboratory conditions (Aziz,2005). However, field studies showed some differences in heat units requirements which were varied according to the season of the study. These variations might be attributed to the length of hibernation periods of larvae and the time required for breaking this hibernation under each certain condition. The establishment of consistent economic threshold for lesser date moth population and infestation is another essential factor which is still need a comprehensive investigation including all aspects of date palm production and protection. Previous studies showed that an economic threshold for lesser date moth was developed based on infestation percentages and number of larvae in 100 fruits sample collected from under side the trees correlated with the input and output requirement of date palm production and protection. The outcome of the study was when percentage of infestation reaches 14.01% and 5.42% and number of larvae reaches 3/100 and 1/100 dropped fruits for the cultivars Zahdi and Khastawy respectively therefore, the infestation level is at the economic threshold and action should be taken (Al-Dolimey, 2004). However, infestation in dropped fruits may not reflect the real infestation because other pest species may be found and feed on dropped fruit (Ahmed and Al-Rubaiee, 1996). Therefore efforts are still needed to conduct more trials and large scale work in order to establish reliable economic threshold taking in to account the action of physical and

biological factor of the environment including the role of the natural enemies in each date palm growing region and the cultivated variety. The implementation of reliable pest management program will help improving farmer income in addition to reducing environment and health hazards.

CONCLUSION

All biological control agents and bio-pesticides proved to be promising safe alternative that can be implemented as an integrated control elements against the lesser date moth in Iraq. The egg and the larvae parasitoids are considered as local natural enemies since they were collected from certain regions in Iraq and proved more adapted to the local environment as successful bio-control agents against the lesser date moth. However, the unstable climatically conditions such as the continuous occurrence of dust storms, rain storm and the extreme rise of temperature for several days during spring presenting a real challenge facing the application of bio-control agents against this pest. Timing of releasing bio-control agents or application of bio-pesticides should be decided according to a good sampling procedure that would help in determine a reliable economic threshold which is an essential need for control practice against this pest. The national programs and the international projects, such as Improved Livelihoods of Small Farmers in Iraq through Integrated Pest Management and Organic Fertilization (IRAQ-ICARDA-IFAD PROJECT) and Harmonized Support for Agriculture Development (HSAD) Project in Iraq (USAID-IRAQ-ICARDA PROJECT), which were implemented as a joint activities with the MoA, devoted much efforts of their activities on the use of natural agents and biological insecticides in the integrated pest management practices against date palm pests. All of these projects proved to be effective when applied in a proper timing. More over all biological control means and agents are considered safe environmentally and well integrated elements in any crop management system.

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Figures

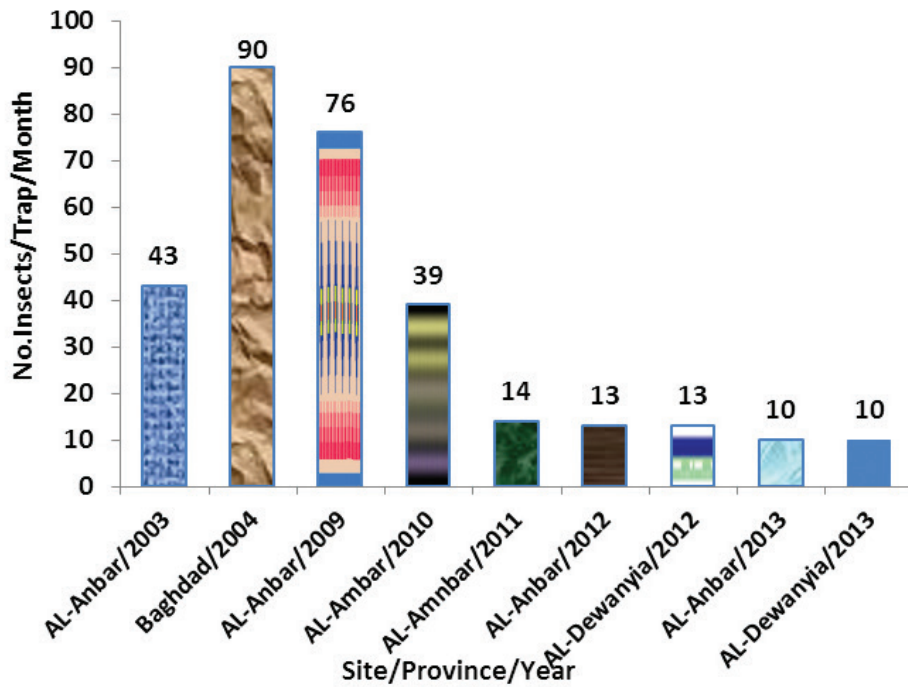


Fig.1 Number of lesser date moth adults caught by light and pheromone traps at different locations during the month of April for the years 2003,2004,2009,2010-2013.

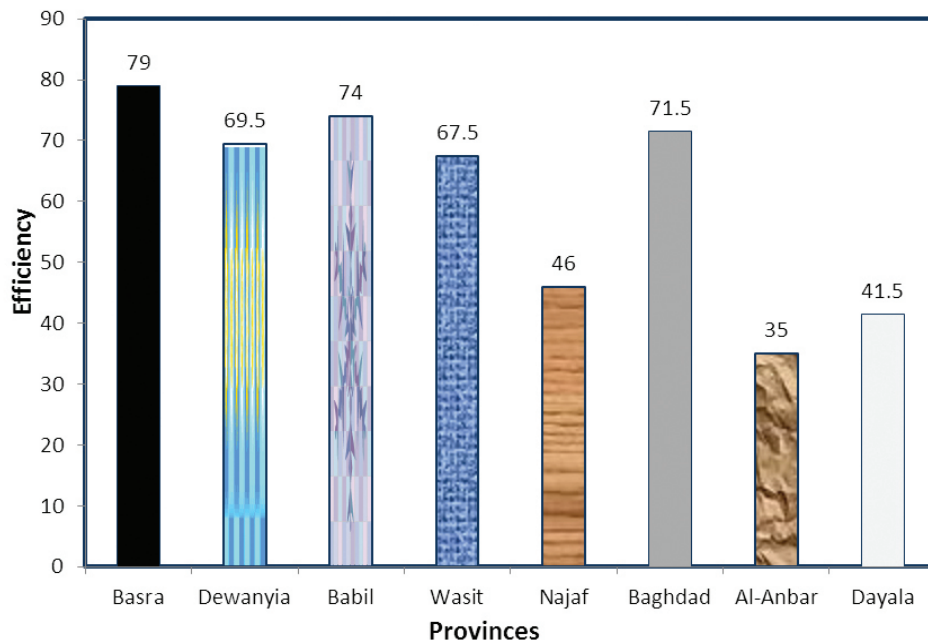


Fig.2 Efficiency of the bio- pesticide Bt. against the lesser date moth at different Provinces in Iraq during 2012.