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SEASONAL FLUCTUATION OF STINK BUG *MUSTHA SPINULOSA* (LEFEBVRE, 1831) (HEMIPTERA, PENTATOMIDAE) ON SOME TREES IN ERBIL CITY

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ABSTRACT

Phytophagous stink bugs (Hemiptera, Pentatomidae) are economically important insect pests of fruit, vegetable, nut and field crops. This study was carried out during the season of 2013 in orchards within Erbil city, to follow the stink bug *Mustha spinulosa* (Lefebvre, 1831) seasonal fluctuation on some fruit trees: olive, plum, apricot, pear, apple and almond.

The stink bug reaches its maximum abundance throughout the second week of August (38.2/tree) coinciding with mean temperature and relative humidity of 33.40°C and 28.14% respectively, and the highest total mean of the number of the insect was recorded on the olive trees (181.8/tree). The study reveals that the stink bug attacked 22 trees (fruit and forest) while it has not attack any herbal plant.

Key words: Fruit trees, *Mustha spinulosa*, Pentatomidae, Seasonal fluctuation, Stink bug.

INTRODUCTION

The stink bugs belong to the superfamily Pentatomoidea, family Pentatomidae of the order Hemiptera, and suborder Heteroptera (Borror *et al*, 1989). They have a single generation annually and in almost all species the adult is the overwintering stage (Dolling, 1991). The Family is very important from an agricultural point of view; they feed by inserting their stylets into the food source to suck up nutrients so they cause injury to plant tissue, and consequently the plant wilts (Panizzi *et al*., 2000). Because some of them feed on several plant species of economic importance they are regarded as major pests, (Panizzi and Grazia, 2001).

In Erbil city, many kinds of fruit trees are grown due to the suitability of environmental conditions, such as trees of plum, apricot, apple, olive, almond and pear (RSO, 2008). These trees are infested with many sap-sucking insects, the stink bugs are one of the common insects. The tree gets damaged due to sucking juices by these insects, later it becomes weak and vulnerable to other diseases (Muhammed, 1994).

Review of literature shows poor information about the stink bug *Mustha spinulosa* (Lefebvre, 1831), in which most of the previous data focused only on host recording. Kirkaldy (1909) demonstrated in his catalogue that the genus *Mustha* Amyot & Serville, 1834 had six species almost all from Persia (Iran); it is also recorded from many other areas such as Iraq and Pakistan, while Stichel (1960) listed five species under *Mustha* from Palaearctic region. Puchkov (1965) in his revising Halyini, keyed five genera under tribe Halyini i.e. *Mustha*, *Apodiphus*, *Iskenderia*, *Halys* and *Carcenoplistus* from Russia. According to Ahmad and Kamaluddin (1984) *Mustha* apparently is a Palaearctic genus and has been reported from Yugoslavia, Albania, Bulgaria, Greece, Syria, Cyprus, Iraq, South Russia, Iran, and Turkey. Hoberlandt (1995) identified seven species of *Mustha* in Iran.

Bolu *et al*. (2005) in his study revealed that *M. longispinis* Reuter, 1890 was the most important species among insects that attacks almond trees in Turkey while Ozgen *et al*. (2005) recorded that *M. longispinis* attacked pistachio trees, also they concluded that this species could be considered as one of the important pests among other pentatomid bugs species that should be considered in the future. In another study done in two provinces of Turkey, Tezcan and Onder (2003) found that *M. spinulosa* was one of the injurious phytophagous insects that attacked cherry trees, while Orçan and Kivan (2017) found only one specimen from this insect on apple trees. Linnavouri (2008) in his study in northern Iran found *M. spinulosa* in hilly forests on deciduous trees such as *Quercus*, *Prunus*, *Crataegus* and *Cupressus*. Muhammed and Al-Iraqi (2010) recorded numerous fruit and non-fruit trees as a host for this insect in Erbil city- Iraq.

In this perspective, the present paper aims to clarify the seasonal fluctuation of *M. spinulosa* on some fruit trees in Erbil city during the growing season 2013, and so this represents the first study on this genus in our area.

MATERIALS AND METHODS

Survey

Many orchards and parks which were planted with both forest and fruit trees within Erbil city have been visited weekly; whole trees (both fruit and forest) were examined by visual searches to determine the host plants of stink bug *M. spinulosa*. The insect was identified by Mr. Linnavouri (Personal contact) while the hosts were identified in Herbarium section at the College of Science, University of Salahaddein-Erbil.

Seasonal fluctuation

The population of *M. spinulosa*, on fruit trees was monitored in orchards planted within Erbil city, from January till December 2013; a weekly visiting through direct visual inspection of *M. spinulosa* on the infested trees under the study was done, from each orchard five trees similar in size and age were selected and the numbers of adults were recorded periodically, with calculating the mean number of bugs in specimen/week, for each type of olive, plum, apricot, pear, apple and almond taking into consideration the prevention the spraying of pesticides during the period of study. The daily average of temperature and relative humidity was obtained from the meteorological station of Erbil city.

RESULTS AND DISCUSSION

Survey of Host Plants

The survey shows that the stink bug *M. spinulosa* feed on several host plants from forest and fruit trees. The stink bugs lay their eggs on the pine trees, after hatching the first nymph instar stays on the same tree. After 1st molting the nymph can crawl through branches to other trees which are planting near the pines such as *Cupressus* sp., *Casuarina* sp, and *Eucalyptus* sp.; when the adults appear they fly to other hosts which are mentioned in the Table (1), so as to start feeding on sap cells from the stems. The insect does not migrate to other places for hibernation like other stink bugs, but stay in the same environment.

Table (1): Determination of fruit and forest trees attached by stink bug *M. spinulosa* during season 2013 in Erbil city orchards and parks.

Host plants	Family	Feeding stage
Fruit trees		
Mulberry	Moraceae	Adult
Olive	Oleaceae	Adult
Plum	Rosaceae	Adult
Apricot	Rosaceae	Adult
Apple	Rosaceae	Adult
Almond	Rosaceae	Adult
Pear	Rosaceae	Adult
Fig	Moraceae	Adult
Loquat	Rosaceae	Adult
Walnut	Juglandaceae	Adult
Sumac	Anacardiaceae	Adult
Forest trees		
Cypress	Cupressaceae	Adult, nymph
Pine	Pinaceae	Adult, nymph
She-oaks	Casuarinaceae	Adult, nymph
Blue gum	Myrtaceae	Adult, nymph
Oak	Fagaceae	Adult
Black locust	Fabaceae	Adult
Arborvitae	Cupressaceae	Adult
Neem	Meliaceae	Adult
Poplar	Salicaceae	Adult
Oriental plane	Platanaceae	Adult
Princess tree	Paulowniaceae	Adult

The seasonal fluctuation on fruit trees

The data in Table (2) revealed that the stink bug *M. Spinulosa* began to appear on olive trees from the first week of May with a low number (4 individuals/trees) coinciding with the mean temperature and relative humidity of 24.36°C and 42.71% respectively. Afterwards the maximum number of the insect was recorded during the first week of June (25.6 individuals/trees) under the average temperature 30.60°C and relative humidity 38.86. Then variable numbers are found till they disappeared during the first week of October.

Table (2): Mean number of stink bug *M. spinulosa* population on the studied fruit trees during season 2013 in Erbil city orchard.

Date	Olive	Plum	Apricot	Pear	Apple	Almond	Total Mean
07/05/2013	04.0	2.2	01.6	0	0	0	07.8
14/05/2013	09.4	2.4	03.4	0	0	0	15.2
21/05/2013	11.0	2.8	03.2	0	0	0	17.0
28/05/2013	19.4	2.2	02.4	1.0	0.6	0	25.6
04/06/2013	25.6	1.6	01.0	0.6	0.8	0	29.6
11/06/2013	09.0	2.4	01.4	1.0	1.0	0	14.8
18/06/2013	08.2	2.8	01.0	0.6	0.8	0	13.4
25/06/2013	05.2	3.6	02.0	0.6	0.4	0	11.8
02/07/2013	04.4	2.4	01.8	0.8	0.6	0	10.0
09/07/2013	04.0	2.0	02.2	0.6	1.0	0	09.8
16/07/2013	07.0	2.0	05.8	1.0	1.0	0	16.8
23/07/2013	10.0	1.8	06.4	1.6	1.2	1.4	22.4
30/07/2013	08.6	6.2	07.8	2.6	2.0	2.4	29.6
06/08/2013	12.6	7.0	08.0	2.4	2.4	4.0	36.4
13/08/2013	14.2	7.4	09.0	2.2	2.4	3.0	38.2
20/08/2013	11.0	8.8	09.4	2.6	2.0	2.8	36.6
27/08/2013	06.6	8.4	09.6	2.2	2.0	3.4	32.2
03/09/2013	04.2	6.2	10.2	4.0	1.6	3.8	30.0
10/09/2013	04.0	8.0	07.0	5.0	2.6	5.8	32.4
17/09/2013	01.8	2.6	03.4	3.4	1	4.6	16.8
24/09/2013	01.6	0	05.6	3.0	0	4.0	14.2
01/10/2013	0	0	04.0	2.0	0	2.4	08.4
08/10/2013	0	0	04.0	1.8	0	2.0	07.8
15/10/2013	0	0	0	1.0	0	0	01.0
22/10/2013	0	0	0	0	0	0	0
Total	**181.8**	**82.8**	**110.2**	**40**	**23.4**	**39.6**	**477.8**

The individuals on the plum trees were represented by relatively low numbers during the first week of May (2.2 individuals/trees) coinciding with the mean temperature and relative humidity of 24.36°C and 42.71% respectively. Thereafter the number increased to reach the maximum during the third week of August (8.8 individuals/trees) under the average

temperature 34.39 °C and relative humidity 28.00%. Then the number decreased gradually and disappeared completely through the fourth week of September.

On the other hand, the results indicated that the insects presence on apricot trees started at the first week of May (1.6 individuals/trees) coinciding with the mean temperature and relative humidity of 23.36°C and 42.71% respectively. Thereafter the numbers increased to reach the maximum during the first week of September (10.2 individuals/trees) under the average of temperature 35.06°C and relative humidity 28.71%. Then the number which it decreased and ended completely through the second week of September.

The results also showed that *M. spinulosa* began to appear on pear trees from the fourth week of May (1.0 individual/trees) coinciding with the mean temperature and relative humidity of 33.39°C and 32.63% respectively. After that the numbers varied and reached the maximum during the second week of September (5.0 individuals/trees) under the average of temperature 33.20°C and relative humidity 30.14%. Then the number which it decreased gradually and vanished completely through the third week of October.

The results revealed that *M. spinulosa* began to appear on apple trees from the fourth week of the June (0.6 individual/trees) coinciding with the mean temperature and relative humidity of 33.39°C and 32.63% respectively. After that the numbers fluctuated and reached the maximum during the second week of September (2.6 individuals/trees) under the average of temperature 33.20°C and relative humidity 30.14%, and after one week, the insects completely disappeared the fourth week of September.

The infestation of the almond trees was delayed, the stink bug appeared to attack trees at the third week of July (1.4 individuals/trees) coinciding with the mean temperature and relative humidity of 34.79°C and 30.13% respectively. Later, the numbers increased to reach the maximum during the second week of September (5.8 individuals/trees), under the average of temperature 33.20°C and relative humidity 30.14%. Then the number decreased gradually and went out of sight during the second week of October. Panizzi and Grazia (2001) found that the relationship between the pentatomids and their hosts depended on several factors involving: the life history of pentatomids, characteristics of the plant, and the abundant and their adaptation to the weather conditions. Additionally, Mouraa *et al.* (2017) mentioned that, phytophagous insects might choose host plants depending on the conditions that would enhance offspring performance.

However, some insect species may also select plants based on attributes that enhance their performance regardless of the consequences for offspring survival. The host selection by phytophagous insects is often explained by the optimal oviposition theory. This hypothesis states that females should select host plants based on their capacity to provide suitable resources for offspring development, such as food and shelter (Gripenberg *et al*. 2010). Low densities of stink bug on apple trees suggest that it is an unsuitable developmental host (Nielsen and Hamilton, 2009).

The obtained data in Table (1) showed that the highest total number of the insects during the growing season was noticed on the olive trees (181.8 individuals/trees), followed by the

apricot trees (110.2 individuals/trees), while apple trees showed lowest numbers of insects (23.2 individuals/trees), and the number of insects oscillated along with seasonal growth on the fruit trees in the orchard of Erbil city. The olive tree is a drought-tolerant species which can have an exceptionally long life-span. It is limited only by frost and high temperatures and to a lesser extent by soil fertility; additionally, olive trees have a huge branching which can used by the insect for hiding. Sap cells may have a role in attracting the insects (McGhee, 1997).

The highest number of the insects was recorded in the second week of August which was 38.2 individuals under the average of temperature 33.40°C and relative humidity 28.14% and the lowest number was recorded in the second week of October which was (1.0 individuals/trees) under the average of temperature 27.39°C and relative humidity 32.00%. Based on the total mean numbers of *M. spinulosa*, it was found that the insect appearance on the fruit trees start from the first week of May (7.8 individuals) and continues along with June, July, August and September, and it will end in the second week of October. On the other hand the results indicated that the insect population reached their maximum numbers during the second week of August (38.2 individuals), coinciding with the mean temperature and relative humidity of 33.40°C and 28.14% respectively. Thereafter the stink bugs disappear and migrate to forest trees in the third week of October, coinciding with the mean temperature and relative humidity of 19.58°C and 34.75% respectively (Diag. 1).

According to Penn State (2006), the numbers of stink bugs present in trees at any given time during the season are greatly dependent on the weather, the surrounding vegetation (alternate host plants), the orchard history and chemical composition of sap cell which is changed according to the environmental condition and other factors.

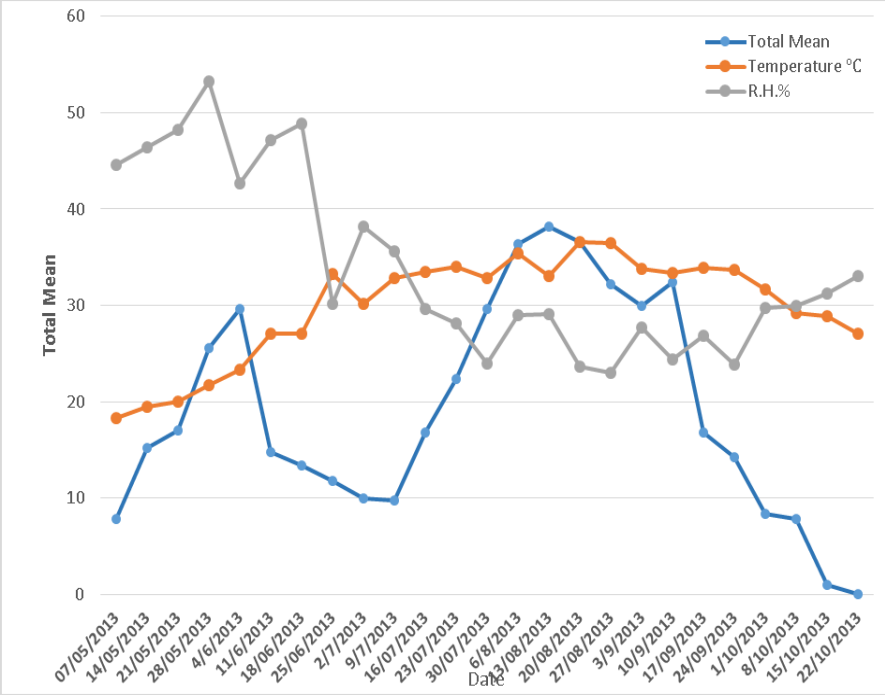

Diagram (1): Total mean number of *M. spinulosa* population on the studied fruit trees at Erbil city with temperature and relative humidity during season 2013.

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التباين الموسمي لحشرة البق النتن *Mustha spinulosa* (Lefebvre, 1831) (Hemiptera, Pentatomidae) على بعض الاشجار في مدينة اربيل

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الخلاصة

البق النتن الذي يعود الى عائلة Pentatomidae رتبة Hemiptera من الحشرات نباتية التغذية التي تصيب كل من اشجار الفواكه والخضروات والمكسرات اضافة الى محاصيل حقلية. اجريت هذه الدراسة في بساتين وحدائق مدينة اربيل خلال عام 2013 وذلك لدراسة التباين الموسمي للبق النتن *M. spinulosa* على 6 انواع من اشجار الفاكهة: الزيتون و الاجاص والمشمش و العرموط و التفاح و اللوز.

بلغت ذروة نشاط البق النتن خلال تواجده على اشجار الفاكهة في الحقل خلال الاسبوع الثاني من شهر اب (38.2/شجرة) بالتزامن مع معدلات درجات الحرارة والرطوبة النسبية 33.40 و 28.14% على التوالي ، واعلى نسبة للحشرة تم تسجيلها على اشجارالزيتون (181.8/شجرة).

اظهرت الدراسة ان الحشرة تتغذى على 22 عائل (اشجار فاكهة وغابات) ، ولم تسجل تغذية الحشرة على اي نبات عشبي.