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# IMPACT OF ARTIFICIAL INFESTATION OF *Lixus junci* BOH. LARVAE ON THE WEIGHT OF FOLIAGE AND ROOTS AND ON SUGAR CONTENT OF SUGAR BEET PLANTS

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## ABSTRACT

This work was conducted in the farm of Delta Sugar Company Research, Kafr El-Sheikh during the two seasons (2005/2006-2006/2007) in order to study the effect of different infestation levels of *Lixus junci* Boh. larvae to sugar beet leaf petioles on foliage consumption, root, losses and sugar components of sugar beet plants. The results indicated that the fresh leaf and fresh root weight in the three infestation levels (5, 10 and 15 larvae/2 plants) not affected by the infestation with *L. junci*, but, the root sugar content% affected by the insects in the three infestation levels. Thus, it could be recommended the application of the Integrated Pest Management (IPM) to reduce the damage of this insect before the females laying their eggs.

## INTRODUCTION

Under Kafr El-Sheikh circumstances, sugar beet mining beet weevil, *Lixus junci* Boh. (Coleoptera : Curculionidae), this insect is becoming a serious pest particularly in newly reclaimed lands, which fed on and damage sugar beet plants causing partially or completely defoliation and resulting yield reduction in quantity and quality, many authors such as, (Assem 1966, Isart 1973, Iskander 1982, Sengonca 1983, El-Sherif *et al.,* 1985, Guriuis 1985, Rivany and Melamed 1986, Bassayouny 1987, Zawrah 2000 and Hussein 2001.

Also, in Egypt Guirus (1985) and Rivnay & Melamed (1986) studied the biology of *L. junci* under laboratory and field conditions for 2-3 seasons. Females remainder deposited up to 300 eggs each after pre-oviposition periods that fell from 2-3 weeks during April-May, while reach 9-10 days in June. Females apparently needed to feed on green leaf tissue in order to oviposite normally. The eggs were laid singly in the petioles, after hatch larvae bored in the petioles and head of the thick roots and pupate in the tunnels. Larval stage varied from about five weeks at 28°C.

Sengonca (1983), El-Sherif *et al.* (1985), El-Zoghbey (1999) and Zawrah (2000) stated that *L. junci* as a pest on sugar beet plants in late of February and continued till the end of the season for two seasons, the highest number of infestation occurred during February and March (28&38)/100 plants in the first season and (57&73)/100 plants during April and May in the second season at Kafr El-Sheikh Governorate. Hussein (2001) showed that the suitable plant age for infestation by *L. junci* it's ranged from 24-26 weeks old, under laboratory conditions at (22°C and 66% RH). The total number of eggs was 324/16 females, with an average of 20.25 eggs/female. The egg incubation period under constant temperatures and

relative humidity were (27±1°C and 70±0% RH). Ranged from 6-9, 24-39 and 2-5 days for egg, larval and pupal stages, respectively. The hatchability was 92.33% from the amount of deposited eggs (300 eggs).

The present study was carried out in the farm phenology (Delta Sugar Company) during two successive seasons (2005/06-2006/07) for the following objectives:

Determine the assess damage and losses in sugar beet yield due to artificial infestation by beet weevil: Value of fresh leaf weight/2 plants, Value of fresh root weight/2 plants and Value of root sugar content percentages.

## MATERIALS AND METHODS

**1. Rearing conditions:**

A stock colony of *L. junci* was established from large number of adults collected from the field during February-April (2005/06-2006/07). The collected insects were put in insectory cages with leaves petioles transferred from the field, these adults deposited eggs, and then these eggs collected on filter-paper desk in Petri dish, put under constant conditions of 27±1°C and 70±5% RH (Hussein, 2001).

**2. Pot plants kept inside wooden frame cages covered with wire gauze:**

This work was conducted as semi-field experiments in the farm of Delta Sugar Company Research, Kafr El-Sheikh during the two seasons (2005/2006-2006/2007) in order to study the effect of different infestation levels of *L. junci* larvae to sugar beet leaf petioles on foliage consumption, root, losses and sugar components of sugar beet plants.

In 12 pots (50 cm diameter) filled with the same soil in the farm were prepared on mid-October, they were seed with sugar beet seeds of Samba Variety. Pots were distributed into four groups, three pots each, digged in the farm soil and kept inside wooden frame cages (75X75x75 cm) covered with wire gauze. Pots with sugar beet plants were irrigated and fertilized practice except chemical control. Plants in each pot were thinned to only two plants per pot (El-Khouly, 1998). On mid-march the three groups of sugar beet pots were artificially infested with the newly hatched larvae of *L. junci* at levels 5, 10 and 15 larvae/pot and non-infested (checked) (four groups) for two seasons, respectively. This insect preferred infesting the plants after 25 weeks from planting (Hussein, 2001).

**3. Artificial infestation:**

An attempt was conduct to estimate the damage of sugar beet after artificial infestation by the newly hatched larvae of *L. junci* in out door conditions at the farm.

The newly hatched (first instar larvae) were taken by fin brush and were embedded in groves on leaves petioles. Petioles were filled up in the wax in order to the petioles preserve the moisture. The same procedure was used with the first, second and third cage levels, where the numbers of larvae were 5, 10 and 15/replicate (2 sugar beet plants). The fourth one was left as a check. After complete liberation, the newly hatched larvae, become yellowish in colour, starts its active life immediately. After feeding the larvae

become, gradually creamy white in colour with brownish head capsules, per long tunnels into the petioles and mid-ribs, larvae boring may extend to reach the crown or roots.

Examination was carried out every week. The infested plants were left under cages still the end of the growing season (May 15th) for the two seasons were estimated at the harvest fresh weight of leaves, fresh weight of roots and root sugar content for sugar beet crop.

**4. Determination of technological characteristics:**

The root sucrose percentages were determined in the cleaned roots by using Saccharometer on a lead basis according to the procedure of Le Docte (1927) in Delta Sugar Company, Kafr El-Sheikh Governorate.

**a. Sugar recovery (SR) (white sugar):**

Sugar recovery percentage was determined according to the procedure of Delta Sugar Company using the following equation:

**SR =** Pol-0.29-0.343 (K+Na)-αNX 0.94.

**Where : Plo =** Sucrose%

**b. Sugar losses in wastes:**

The percentage of sugar losses wastes percentage was determined according to the procedure of Delta Sugar Company using the following equation:

**D =** (K+Na, 34++αNX 0.094-0.129).

**c. Juice purity:**

Purity was obtained according to Sapronov *et al.* (1979) using the following equation:

**Purity =** Sucrose% X 100 (soluble solid%).

The microcomputer program ANOVA was used for statistical analysis, the spilt plot design was applied and the Duncan's multiple range tests were used for separating means (SAS, 1988).

Data were statistically analyzed according to Duncan (1955) method.

## RESULTS AND DISCUSSION

The sugar beet plant suitable age for infestation by *L. junci* which ranged from 161 to 183 days old (Hussein, 2001).

**1. First season (2005-06):**

**1.1. Symptoms of infestation:**

After invested larvae begin feeding by boring inside the petioles and mid-ribs of sugar beet leaves causing long tunnels, which may extend to reach the crown and roots. Larval mine appears as brownish strip with the whole rim sollown. Feeding of the 5th instar larvae on the plant tissue normally occurring after 39 days and causing pale, dropped and easily broken, the tunnel holes may serve as point of entry for additional damage caused by decay and saprophytic intruders.

**1.2. Damage and losses:**

Data tabulated in Table (1) showed the effect of the artificial infestation by *L. junci* larvae on sugar beet yield and yield components, fresh leaf weight, fresh root weight and root sugar content%.

Mean fresh weight levaes/2 plant recorded 390.59 gm in case of check (untreated) and decreased to 361.8, 361.1 and 347.09, when 5, 10, and 15 larvae infested every level, respectively.

This value not affected by increasing the number of larvae used in the artificial levels.

Few reduction of mean fresh root weight took the same trend. The root yield was 943.7 g/2 plants (in case of non-infestation) and decreased to 917.5, 889.5 and 880.79, when the every level was infested by 5, 10 and 15 beet weevil larvae. This value not affected by increasing the number of larvae as amount of yield roots.

The value of root sugar beet content was affected by the increasing of the number of beet weevil larvae infesting the plants.

Sugar content% was obtained at the levels of *L. junci* larvae/5, 10 and 15 /2 plants estimated that 17.43, 16.6 and 15.1% from 18.7 check to 0.0 larvae/2 plants/level, respectively.

The value of root sugar beet content% consistently decreased severally by increasing of the number of beet weevil larvae used in artificial infesting. These results are agreement with those obtained by Bassyouny (1987).

Statistical analysis of the data, showed insignificant differences between fresh leaf weight in the three infestation levels (5, 10 and 15 larvae/2 plants) due to the infestation with *L. junci*, ($F = 0.27$ at $P < 0.05$) and LSD = 55.50. Also, data indicated that insignificant differences between fresh root weight in the three infestation levels due to the infestation with *L. junci*, ($F = 0.499$ at $P < 0.05$) and LSD = 93.66. On the other hand, statistical analysis, showed highly significant differences between root sugar content% in the three infestation levels due to the infestation with *L. junci*, ($F = 69.48$ at $P < 0.05$) and LSD = 0.498.

**Table (1): Effect of artificial infestation by beet weevil *L. junci* larvae on certain sugar beet yield components at the 1st season (2005-2006).**

| Level of infestation | No. of larvae/ 2 plants | Fresh leaf weight/plant (g) | Fresh root weight/plant (g) | Root sugar content% |
|---|---|---|---|---|
| **5 larvae** | 5 | 361.8[a] | 917.5[a] | 17.43[a] |
| **10 larvae** | 10 | 361.1[a] | 889.5[a] | 16.6[b] |
| **15 larvae** | 15 | 347.0[a] | 880.7[a] | 15.1[c] |
| **Control (Check)** | 0 | 390.5 | 943.7 | 18.7 |
| **F** | **-** | **0.27[ns]** | **0.499[ns]** | **69.48*** ** |
| **LSD** | **-** | **55.50** | **93.66** | **0.498** |

**2. Second season (2006-07):**

The obtained results in the 2nd season are approximately similar with those obtained from the 1st season.

Data shown in Table (2) explained that the impact of the artificial infestation by *L. junci* (newly hatched larvae) on petioles and mid-ribs of sugar beet leaves. Evaluated the yield components, fresh leaf weight, fresh root weight and root fresh sugar content%.

Mean fresh weight of leaves decreased to 337.7, 328.3 and 320.5 g/2 plants when every level was infested by 5, 10, and 15 larvae infested every level, respectively while reach 343.5 g/2 plants in case control (check) it was found significant cleared between the different levels.

Value of mean fresh root weight was 1000.13, 997.0 and 892.0 g/2 plants, when the every level was infested by 5, 10 and 15 beet weevil larvae, while gave 1041.0 g (in case of non-infestation).

This value not affected by increasing the number of larvae as amount of yield roots.

Insignificant variations were appeared between the different levels of infestation. The important value of root sugar beet content was affected by increasing the number of beet weevil larvae infesting the plants. Sugar content% was gained at the levels of *L. junci* larvae (5, 10 and 15) estimated that 17.3, 16.5 and 15.3% from 19.0 check to 0.0 larvae/plants/level, respectively.

Thus, it could be concluded that 5 or more larvae of beet weevil attacking sugar beet plants, cause reduction in quality and quantity to accumulate sucrose in the root yield.

**Table (2): Effect of artificial infestation by beet weevil *L. junci* larvae on certain sugar beet yield components at the 2nd season (2006-2007).**

| Level of infestation | No. of larvae/ 2 plants | Fresh leaf weight/plant (g) | Fresh root weight/plant (g) | Root sugar content% |
|---|---|---|---|---|
| **5 larvae** | 5 | 337.7[a] | 1000.13[a] | 17.3[a] |
| **10 larvae** | 10 | 984.9[b] | 2990.9[a] | 16.5[b] |
| **15 larvae** | 15 | 320.5[c] | 892.1[b] | 15.3[c] |
| **Control (Check)** | 0 | 320.5[c] | 892.1[b] | 15.3[c] |
| **Mean** | - | | | |
| **F** | - | **15.24**** | **503.12***** | **23.69**** |
| **LSD** | - | **7.64** | **9.49** | **0.714** |

The highest population of this insect (serious pest) was noticed during the 3rd week of March when the plant age has 161 days old and the end of two presented seasons ((Hussein, 2001).

Effect of infestation beet weevil larvae agreement with sucrose accumulation critical period in root sugar content. This insect began to appear on sugar beet plants, which causing to minimize new accumulation sucrose as utilization food consumption or to invert sucrose into glucose followed newly re-greening in crown zone. Also, happens undisere metabolic processes. Processions photosynthesis changed to normal anabolism to abnormal catabolism. Impurities appear in juice purity for alkaline soils during the determination of sugar content percentages.

Statistical analysis of the data, showed significant differences between fresh leaf weight in the three infestation levels (5, 10 and 15 larvae/2 plants) due to the infestation with *L. junci*, ($F = 15.24$ on $P < 0.05$) and LSD =

7.64. Also, data indicated that highly significant differences between fresh root weight in the three infestation levels due to the infestation with *L. junci*, (F = 503.12 on P < 0.05) and LSD = 9.49. Also, statistical analysis, showed significant differences between root sugar content% in the three infestation levels due to the infestation with *L. junci*, (F = 23.69 on P < 0.05) and LSD = 0.714.

Accordingly, integrated pest management should be implementing to get higher yields of sugar beet. Observations on the infestation and damage of sugar beet plants revealed that the most of damage is caused by the different five larval instars, which were more active. The insects attack the plants (the petioles, mid-ribs, crown and roots) causing considerable losses to the crop.

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## الضرر الناتج عن العدوي الصناعية بيرقات سوسة البنجر علي المجموع الخضري والجذور للمحتوي السكري لمحصول بنجر السكر

**محمد إبراهيم الخولي**

**معهد بحوث وقاية النباتات- مركز البحوث الزراعية – الدقي – جيزة – مصر**

أجريت هذه الدراسة لتقدير الضرر الناتج عن العدوي الصناعية بيرقات سوسة البنجر بمزرعة شركة الدلتا للسكر كفر الشيخ كتأثير شبه حقلي علي مدي موسمين زراعيين متتاليين (٢٠٠٥/٢٠٠٦, ٢٠٠٦/٢٠٠٧) علي الترتيب.

تمت الزراعة في منتصف شهر أكتوبر للموسمين في أصص بقطر ٥٠ سم مملؤة بتربة المزرعة حيث تم زراعة نباتين في كل أصيص وتم تغطية الأصص بفقص سلكي (٧٥ X ٧٥ X٧٥سم) كما تم ترتيب هذه الأقفاص في ثلاثة مستويات للإصابة بالإضافة الي الكنترول (بدون معاملة) كل مستوي إصابة رتب في ثلاث مكررات (١٢ أصيص لكل قفص سلكي) ، تمت العدوي الصناعية بمعدل ٥ ، ١٠، ١٥ يرقات حديثة لكل مستوي علي حدة (ثلاث مستويات إصابة) والمستوي الرابع هو المقارنة (الكنترول) بدون عدوي. حيث أجريت العدوي الصناعية لكل المعاملات في وقت واحد وهو (بعد ٢٥ أسبوع من الزراعة) العمر المفضل للإصابة.

دلت النتائج المتحصل عليها أن محصول الأوراق والجذور لم يتأثر معنويا بالإصابة. ولكن محصول السكر (النسبة المئوية للسكروز) يتدهور بشدة وبالتالي يتأثر السكروز المتراكم بالدرنات الجذرية كما ونوعا.

وأقترح تفعيل دور المكافحة المتكاملة لمكافحة هذه الحشرة الخطيرة في الأطوار الكاملة قبل أن تضع الإناث بيضها في أعناق أوراق بنجر السكر.