# Effect of Certain Defoliant Materials on Mulberry Trees and Silkworm *Bombyx mori* L. Productivity in Jordan

***I. Al-ghabeish, **sumaya Abu-Danoun and **I.A. El-Karaksy**
*Faculty of Al-Salt, Al-Balqa, Applied University, Al-Salt, Jordan, **Dept. of Bioagricultural Technology, Fac. of Agricultural Technology Al-Balqa, Applied University, Al-Salt, Jordan

## ABSTRACT

In order to harvest mulberry leaves easily from the big and huge trees, formerly cultivated in developing countries, two different materials Ethephone and Naphthalene acetic acid (NAA) were tested in certain concentrations. Results showed that Ethephone at 3000 and 4000 ppm and NAA at 10, 30 and 40 ppm have no effect as defoliants. Ethephone at 6000 ppm proved to be the safe foliar spray, which can be used, since the quality and percentage of dropped leaves was the best. The fed larvae of *Bombyx mori* L. on the dropped leaves were not different than those raised on untreated leaves in all measured biological and technological parameters under study.

## INTRODUCTION

As a fact that silkworm *Bombyx mori* L. is a monophagous insect that feed mainly on mulberry leaves, so the mulberry tree has much to do with the success of silkworm rearing and it is one of the chief reasons for the economic difficulties of sericulture, since this limits silkworm raising in time and place.

In the developing countries, such as Egypt, Syria, Jordan, Lebanon, etc.. mulberry plants are usually cultivated as wild trees around the field of different crops or on the sides of roads, only for shade or fruits. These trees represent a big problem in harvesting their leaves for feeding silkworm, whereas they are huge, big and high.

Efforts to solve these problems are directed by means of defoliants for many fruit trees such as Apple trees, Olive, Coffee and Guava (Dozier and Bardes, 1973, Antognozzi, 1981; Clows and Graves, 1982 and Kobavash, 1987).

Recently, certain defoliant materials were used in harvesting cotton crop (Gwarhmy and Hayes, 1997). The present study is aimed to find out the most suitable defoliant at favourable concentration that can be used safely on mulberry trees without any harmful side effects on the growth and productivity of the raised *Bombyx mori* L. larvae on the fallen leaves.

## MATERIALS AND METHODS

The present study was carried out during silkworm *B. mori* spring rearing season of 2003.

**Substances used :-**

The used defoliant materials in this study had been chosen on the basis of the previous studies on certain fruit trees as Olives and Guava, and field

crops such as cotton as detailed in the available literatures. The two defoliant materials are the following :

1- Ethephone (2, chloroethyl phosphonic acid), manufactured by CIBA-GEIGY, AG, Basel, Schweiz- 800 Scw.
2- Naphthalene Acetic Acid (NAA), manufactured by Union Carbide Agricultural Products Co., Inc., Amplex, PA, 19002 Fermont, Cal.

**Preliminary tests :-**

Preliminary tests were conducted in a trial to reach the suitable material as well as the suitable concentration in which should be safe on mulberry trees and on the nutrition of silkworm larvae and their productivity. The suggested concentrations for the test were 2000, 3000, 4000, 5000, 6000 and 7000 ppm for Ethephone, and 10, 20, 30 and 40 ppm for Naphthalene acetic acid (NAA).

**Application of defoliant materials :-**

The abovementioned materials and concentrations were applied on the selected mulberry trees *Merus alba* variety Indian in the mulberry field of Faculty of Agricultural Technology, Al-Balqa, Applied University, Al-Salt at Homrat el-Sahen.

Each concentration was applied on three branches from each three mulberry trees as replicates, which were randomly selected. Particularly for Ethephone, glycerine was added at a rate of 1% to the spraying solution to delay evaporation of the solution. In Israel Ben-Tal (2001), found that glycerine did not enhance Ethephone uptake but it sole contribution was to postpone dryness, thereby extending the period of time during which absorbance occurred.

After one, two, three and four days of application, each of the treated branches were shaken and the percentage of defoliation was estimated. The preliminary experiment showed that Ethephone at 6000 ppm was only the best defoliant that can be safely used for performing the second part of this study represented in silkworm feeding.

The principal experiment was designed on the basis that the fallen mulberry leaves on the third day after spraying Ethephone at 6000 ppm are to be used for feeding the fourth and fifth larval instar of *B. mori*. There fore, every two days, three trees were randomly selected and treated by the mentioned concentration, starting three days before the beginning of the considered larval instar. Other trees were untreated to serve as a control. A small manual automizer was used for application.

**Insect and rearing method :-**

The experiment was performed on the mulberry silkworm *B. mori* Japanese hybrid which had been imported from Syria in 2002 and has been reared in the Faculty of Agricultural Technology, Al-Balqa, Applied University, Al-Salt, Jordan.

Larvae were reared according the conventional method under the prevailing hygrothermic conditions of 26.5°C and 56% R.H. Only the fourth and fifth larval instars were used in the experiments.

The effect of fallen leaves on larval duration, weights of larvae, silk gland, fresh cocoon and cocoon shell were estimated. The numbers of deposited eggs were counted. The mortality percentage was also considered.

**Statistical analysis :-**

"t" test in pairs was used to evaluate the effect of fallen leaves on the studied biometrics and productivity of *B. mori* comparing with that of untreated leaves.

## RESULTS AND DISCUSSION

Results of preliminary experiment presented in Tables 1 and 2 show that the use of Ethephone at 3000 and 4000 ppm, and Naphthalene acetic acid (NAA) at 10, 30 and 40 ppm have no effect as defoliants on the treated mulberry trees. On the other hand, percentage of defoliation increased as the concentration of Ethephone increased from 5000 to 7000 ppm. This result is in agreement with the finding of Kobavashi (1987) who used Ethephone at certain concentrations on Guava trees.

Eventhough, either Ethephone at 7000 ppm or Naphthalene acetic acid at 20 ppm caused the highest percentages of defoliation in the third day of application, but the fallen leaves seemed to be burned at their edges and consequently lost their validity for larval feeding. Such trend of results were reported by Hosny *et al.,* (1996) when Ethrel and Alsol as defoliant materials were applied in certain higher concentrations on mulberry trees in Egypt.

Therefore, the second part of the experiment was designed to feed *B. mori* larvae on those leaves which dropped after three days of spraying Ethephone at the concentration of 6000 ppm.

**Effect of fallen leaves on the biology and productivity of *B. mori* :**

The presented results in Table 3 reveal that all studied biological parameters of both fourth and fifth larval instars represented in weight of larvae (0.509 and 2.683 g.), larval duration (7 and 13 days), percentage of mortality (3.34 and 0.0%), weight of silk gland of full grown larvae (0.540 g.) and weight of pupa (1.489 g.) when larvae fed on fallen mulberry leaves did not differ from those fed on untreated leaves.

On the other hand statistical analysis of data by t-test in pairs proved that there was no significant differences between either silk or egg production when larvae fed on fallen leaves or on untreated leaves. The same trend of results were obtained by Hosny *et al.,* (1998) when *B. mori* larvae were fed on fallen leaves by means of Ethrel as a defoliant for mulberry leaves.

## CONCLUSION

It could be concluded that Ethephone at 6000 ppm can be safely used as a defoliant material on mulberry trees, since larvae fed on the dropped leaves gave the similar biological parameters as those finding in control. This method, can thus solve the problem of mulberry leaves harvesting from the big

and high trees, and to remove the overmatured leaves before the beginning of summer and autumn rearing, saving labor efforts and costs.

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Table 1. Percentage of defoliation within three days after spraying Ethephone at different concentrations on mulberry trees.

| Concentration (ppm) | Rep | No. of treated leaves | No. of dropped leaves | | | % dropped leaves | | | Mean % |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1st day | 2nd day | 3rd day | 1st day | 2nd day | 3rd day | |
| 3000 | 1 | 105 | 00 | 00 | 14 | 00 | 00 | 13.33 | 10.96 |
| | 2 | 98 | 00 | 00 | 11 | 00 | 00 | 11.22 | |
| | 3 | 72 | 00 | 00 | 6 | 00 | 00 | 8.33 | |
| 4000 | 1 | 104 | 00 | 00 | 11 | 00 | 00 | 10.58 | 10.32 |
| | 2 | 77 | 00 | 00 | 7 | 00 | 00 | 9.09 | |
| | 3 | 62 | 00 | 00 | 7 | 00 | 00 | 11.29 | |
| 5000 | 1 | 95 | 00 | 00 | 83 | 00 | 00 | 87.37 | 82.77 |
| | 2 | 126 | 00 | 00 | 101 | 00 | 00 | 80.16 | |
| | 3 | 104 | 00 | 00 | 84 | 00 | 00 | 80.77 | |
| 6000 | 1 | 76 | 00 | 00 | 70 | 00 | 00 | 92.11 | 88.79 |
| | 2 | 93 | 00 | 00 | 85 | 00 | 00 | 91.40 | |
| | 3 | 105 | 00 | 00 | 87 | 00 | 00 | 82.86 | |
| 7000 | 1 | 92 | 00 | 00 | 84 | 00 | 00 | 91.30 | 90.81* |
| | 2 | 79 | 00 | 00 | 70 | 00 | 00 | 88.61 | |
| | 3 | 107 | 00 | 00 | 99 | 00 | 00 | 92.52 | |

Table 2. Percentage of defoliation within three days after spraying Nahpthalene acetic acid (NAA) at different concentrations on mulberry trees.

| Concentration (ppm) | Rep | No. of treated leaves | No. of dropped leaves | | | % dropped leaves | | | Mean % |
|---|---|---|---|---|---|---|---|---|---|
| | | | 1st day | 2nd day | 3rd day | 1st day | 2nd day | 3rd day | |
| 10 | 1 | 49 | 00 | 00 | 00 | 00 | 00 | 00 | 0.0 |
| | 2 | 68 | 00 | 00 | 00 | 00 | 00 | 00 | |
| | 3 | 34 | 00 | 00 | 00 | 00 | 00 | 00 | |
| 20 | 1 | 50 | 25 | 00 | 00 | 5000 | 00 | 00 | 50.93* |
| | 2 | 57 | 32 | 00 | 00 | 56.14 | 00 | 00 | |
| | 3 | 30 | 14 | 00 | 00 | 46.64 | 00 | 00 | |
| 30 | 1 | 42 | 4 | 00 | 00 | 9.52 | 00 | 00 | 12.55* |
| | 2 | 37 | 6 | 00 | 00 | 16.22 | 00 | 00 | |
| | 3 | 84 | 10 | 00 | 00 | 11.90 | 00 | 00 | |
| 40 | 1 | 31 | 4 | 00 | 00 | 12.90 | 00 | 00 | 12.62* |
| | 2 | 44 | 5 | 00 | 00 | 11.36 | 00 | 00 | |
| | 3 | 59 | 8 | 00 | 00 | 13.60 | 00 | 00 | |

* Dropped leaves seemed to be burned at their edges.

Table 3. Effect of feeding *B. mori* larvae on dropped leaves treated with Ethephone at 6000 ppm on some biological parameters and productivity.

| Parameters | Treatment | Control |
|---|---|---|
| Duration of 4th larval instar (day) | 7 | 7 |
| Duration of 5th larval instar (day) | 13 | 13 |
| % mortality of 4th larval instar | 3.34 | 2.67 |
| % mortality of 5th larval instar | - | - |
| A. Weight of 4th larval instar (g.) | 0.509 ± 0.04 | 0.504 ± 0.053 |
| B. Weight of 5th larval instar (g.) | 2.683 ± 0.183 | 2.652 ± 0.170 |
| C. Weight of silk gland (g.) | 0.540 ± 0.023 | 0.551 ± 0.036 |
| D. Weight of pupa (g.) | 1.489 ± 0.066 | 1.503 ± 0.075 |
| E. Weight of fresh cocoon (g.) | 1.844 ± 0.113 | 1.853 ± 0.096 |
| F. Weight of cocoon shell (g.) | 0.349 ± 0.023 | 0.338 ± 0.037 |
| G. No. of deposited eggs eggs/female | 393 ± 26.31 | 411 ± 39.64 |

Each value represent the mean ± Sd of A = 25; B = 20; C and G = 5; D, E and F = 25 records. barber

## الملخص العربى

# تأثير بعض المواد المسقطة للأوراق على أشجار التوت وإنتاجية ديدان حرير القز

إيهاب الغبيش*، سميه أبو دنوب**، ابراهيم القراقصى**

*كلية السلط، **كلية الزراعة التكنولوجية – جامعة البلقاء التطبيقية – السلط – الاردن

لتسهيل عملية جمع اوراق التوت من الأشجار الكبيرة والعالية والمنزرعة عشوائياً فى الدول النامية فقد تم إختبار مادتين من المواد المسقطة للأوراق والتى تستخدم فى أشجار الفاكهة وهما الايثيفون والنفثالين اسيتيك اسيد بتركيزات مختلفة. بينت النتائج المتحصل عليها ان الايثيفون بتركيز ٣٠٠٠، ٤٠٠٠ جزء فى المليون وأيضا النفثالين اسيتيك اسيد بالتركيزات ١٠، ٣٠، ٤٠ جزء فى المليون لم يكن لهم أى تأثير كمسقطات لأوراق التوت. أظهر فقط الايثيفون بتركيز ٦٠٠٠ جزء فى المليون انه يمكن استخدامه بأمان على أشجار التوت لإسقاط أوراقها. كما بينت التغذية على هذه الأوراق انه لم يكن هناك فرق فى الصفات البيولوجية لديدان حرير القز وأيضاً إنتاجها من الحرير والبيض مقارنة بأوراق التوت من الأشجار الغير معاملة مما يؤكد أهمية هذه المادة بالتركيز المذكور فى تسهيل عملية جمع أوراق التوت وذلك توفيراً فى العمالة والجهد.