

**THE DIVERSITY OF APHID IN ORANGE GROVES OF THE MITIDJA - COMPARING
POPULATIONS LEVELS OF APHIS SPIRAECOLA PATCH AND TOXOPTERA AURANTII
BOYER DE FONSCOLOMBE (HEMIPTERA: APHIDIDAE) ON ORANGE TREE WITH
MEAN TEMPERATURE**

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ABSTRACT

The objective of this study, conducted in orange groves located at the eastern part of the plain of Mitidja was to determine the diversity and relative abundance of aphid species and estimate population levels of the most common and dangerous species in citrus. The weekly sampling conducted between April 25 and June 6, 2012, has identified 18 species aphid, the most dominant is *Aphis spiraecola* with 32.05% of the total, followed by *Toxoptera aurantii* with 17.31 %. These results have stimulated us to follow the evolution of these two species during the spring of 2013. To estimate their importance, 15 weekly collections were made between April 11 and July 21, 2013 at the I.A.T.M.S. (Institute of Agricultural Technology Middle Specialized). Both species have appeared to orange tree on April 18 to a value of Average Weekly mean Temperatures (A.W.M.T.) equal to 16.46°C. During the following weeks the number of two species remains low. It was around June 9 to (A.W.M.T.) equal to 19.44° C, the colonies *Aphis spiraecola* actually grow, reaching their maximum level 7 July (A.W.M.T.=22.47°C) with 5542 individuals (37.84%). After that date, increased while the number of *Aphis spiraecola* fell sharply to permanently disappear from the arboreal stratum to July 21 (A.W.M.T. =25.30°)

KEYWORDS: *Aphis spiraecola*, *Toxoptera aurantii*, Orange Tree, Diversity, Mean Temperature, Mitidja

INTRODUCTION

In Algeria, citrus growing is a very important socio-economic activity. In 2013 it took up an area of 64,771 ha and presented a production of 12,048,510 quintals, so a yield of 209.6 quintals/ ha. Culture of the orange tree alone occupied an area of 47, 58 ha and presented a production of 8,906,742 quintals, a yield of 215.2 quintals/ha (MARD, 2014). Citrus culture employs an average of 140 days/ha/year, plus those generated by the environmental sector (processing and marketing) (Biche, 2012). In spring, from vegetation, several aphid species are likely to be damaging to citrus seedlings. Two of them are particularly dangerous: black citrus aphid (*Toxoptera aurantii*) and the green citrus aphid (*Aphis spiraecola*). In their actions, curl-ups, and the most tender part of the shoot takes a curved shape, sometimes flowers and fruits are attacked (Deravel D'esclapong., 1990). *A. spiraecola* is the most feared pest of citrus orchards. It is a vector of Citrus tristeza virus (CTV) (Turpeau et al., 2013). According Chapot and Delucchi (1964) *Toxoptera aurantii* attack young shoots, flowers and very young fruit, it causes leaf curling, flower abortion and secretes abundant honeydew that promotes the growth of sooty mold.

METHODOLOGY

The present study was conducted in the orange groves of the Institute of Agricultural Technology Middle Specialized (I.A.T.M.S.) of the Common Heuraoua (3 ° 16 'E, 36 ° 46' N) in the eastern part of the plain Mitidja. It extends over an area of 1 ha and consists of 238 orange tree Thomson variety. This region ranked first in Algeria regarding the citrus with 44% of national production by Biche (2012).

For 2012, 06 collections were made between April 25 and June 6, 2012. To study the diversity of Aphids were used plastic bins, yellow (ϕ : 20 cm, h: 15 cm) filled with water and detergent to a third part, because according to Roth (1972) the preferred color for the most insects is yellow "lemon". Five traps are placed on the ground and five other attached to foliage of orange trees. The collection are done once every 7 days using a brush, aphids placed in test tubes containing 70% alcohol on which are noted the date, culture, location and place of capture, to be determined later. The water trap is renewed after each sample. Determining aphid species was performed based on identification keys Leclant (1999a), Leclant (1999b), Leclant (2000) and Turpeau et al (2013).

To estimate the levels of *Aphis piraecola* and *Toxoptera aurantii* populations, 15 weekly samples were taken between April 11 and July 21, 2013. Each output 5 trees are randomly selected and each shaft 10 young leaves. These are removed and introduced in to a plastic bag which may be mentioned species and the date. The bags are transported to the laboratory where the samples are placed under a binocular microscope for counting individuals.

The speed of development and fecundity of aphids depend directly on the temperature. They multiply actively in a given temperature range (Turpeau et al, 2013). For this reason we compared the evolution of *Aphis piraecola* and *Toxoptera aurantii* 'populations with temperature, we calculated the average temperature Middle From week of sampling. The average temperatures are recorded by the meteorological station of Dar-El-Beida (longitude: 3.22 °, latitude: 36.68°)

The ecological index used in this study is the centesimal frequency (relative abundance), it is equal to the percentage of individuals of the species (n_i) relative to the total number of individuals N all species combined (Dajoz, 1971). The formula is given as follows:

$$F \% = N_i \times 100 / N$$

N_i = Number of individuals of a species.

N = total number of individuals of all species.

RESULTS AND DISCUSSIONS

Evaluation of the Diversity and Relative Abundance of Aphid in Orange Groves of the Eastern Part of the Mitidja

During the 6 weeks of sampling using yellow sticky traps, 156 adult individuals were collected, shared between 18 species, all belonging to the Sub family Aphidinae, Tribe Macrosiphini represented by 12 species (66.67%) and 59 individual (37.81%). The remaining 6 species (33.33%) were of the tribe of Aphidini, Which is the most represented numerically with 94 individuals (60.26%) and it has a large number of species of agricultural importance. the genre *Aphis* is majority with 4 species and 66 individuals, *A. spiraecola* is dominant with 50 individuals (Table 1). *Aphis spiraecola* is polyphagous insect. The primary hosts are *Spiraea* spp. and *Citrus* spp. (Andreev R. et al, 2009). The genre of *Toxoptera* is represented by a single species, *T. aurantii* with 27 individuals is the only species and the Last Genre is *Schizaphis* with one species and one individual (Table 1).

Table 1: Diversity, Relative Abundance of Aphid Species Harvested in Yellow Traps to the I.A.T.M.S

Tribe	Genre	Species	N	%
Aphidini	<i>Aphis</i>	<i>A. spiraecola</i> (Patch, 1914)	50	32,05
		<i>A. craccivora</i> (Koch, 1854)	3	1,92
		<i>A. fabae</i> (Scopoli, 1763)	8	5,13
		<i>A. gossypii</i> (Glover, 1877)	5	3,21
	<i>Toxoptera</i>	<i>T. aurantii</i> (Boyer de Fonscolombe, 1841)	27	17,31
	<i>Schizaphis</i>	<i>S. graminum</i> (Rondani)	1	0,64
Macrospini	<i>Acyrtosiphon</i>	<i>A. pisum</i> (Harris, 1776)	3	1,92
	<i>Aulacorthum</i>	<i>A. solani</i> (Kaltenbach, 1843)	12	7,69
	<i>Brachycaudus</i>	<i>B. cardui</i> (Linnaeus, 1758)	4	2,56
		<i>B. Schwartzi</i> (Börner, 1931)	3	1,92
		<i>B. helichrysi</i> (Kaltenbach, 1843)	4	2,56
	<i>Hyadaphis</i>	<i>H. foeniculi</i> (Passerini, 1860)	1	0,64
	<i>Hyperomyzus</i>	<i>H. lactucae</i> (Linnaeus, 1758)	7	4,49
	<i>Lipaphis</i>	<i>L. erysimi</i> (Kaltenbach, 1843)	1	0,64
	<i>Macrosiphum</i>	<i>M. euphorbiae</i> (Thomas, 1878)	13	8,33
	<i>Myzus</i>	<i>M. persicae</i> (Sulzer, 1776)	5	3,21
	<i>Sitobion</i>	<i>S. avenae</i> (Fabricius, 1775)	5	3,21
	<i>Capitophorus</i>	<i>C. horni</i> (Börner, 1931)	4	2,56
		Total	156	100

N: Number, %: Relative abundance

For relative abundance, *Aphis spiraecola* is the most represented with 32.05% of the total, followed by *Toxoptera aurantii* with 17.31%. To a lesser degree *Macrosiphum euphorbiae* (8.33%), *Aulacorthum solani* (7.69%) and *Aphis fabae* (5.13%), because according Leclant (2000), these species are encountered on citrus. Other species are poorly represented with rates ranging from 0.64% to 4.49% (Figure 1). According to Ben Halima-Kamel et al. (1994), different species of aphids recorded on Citrus do not have the same levels of proliferation and *Aphis spiraecola*, *Aphis gossypii* and *Toxopteraaurantii* are most important.

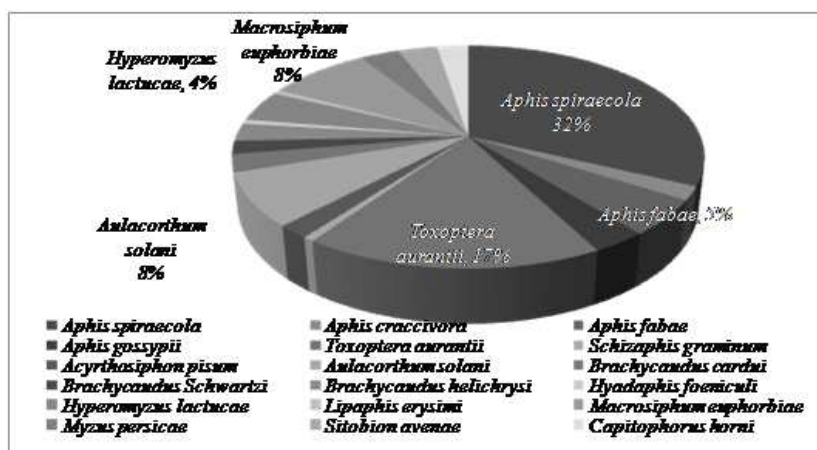


Figure 1: Relative Proportions of Aphid Species Harvested in the Yellow Traps in I.A.T.M.S

Estimated Level of Population *Aphis Spiraecola* Patch and *Toxoptera Aurantii* Boyer De Fonscolombe (Hemiptera: Aphididae)

Changes in populations of *Aphis spiraecola* and *Toxoptera aurantii* on the orange tree variety THOMSON as they emerge April 18, 2013 until their total disappearance July 21, 2013 led to the results presented in Table 2. Because according Loussert (1989), attacks citrus aphid declare especially in spring and fall, thanks to the development of new branches. Both species appeared on April 18, *Aphis spiraecola* most represented with 501 individual (3.421%) against *Toxoptera aurantii* with 149 individual (1.017%). At the onset of favorable development of aphids conditions, population growth *Aphis spiraecola* do not stop to increase up to the maximum level 07 July 5542 with aphids (37.84%), Based on Ben Halima-Kamel (2005), the level of infestation depends on the sap flow. Indeed, Ben Halima-Kamel (1995) reported that during the second sap flow, the level of population is higher than that of the first and third vegetative growth. *Aphis spiraecola* is 96,34% of the total number of aphids collected during the 15 weeks of sampling. Indeed, *A. spiraecola* is the dominant species on Citrus (Ben Halima-Kamel et al., 1994). While *Toxoptera aurantii* counted only 3.66% of the total, the maximum level is recorded on June 23 with 1.75% of the total, after that the population will decline until finally disappear on arboreal stratum July 14. According Piguet (1960) *Toxoptera aurantii* occurs in most citrus plantations, but does not grow much in the normal adult plantations there never outbreak.

Table 2: Evolution of Populations and Relative Abundance of *Aphis Spiraecola* and *Toxoptera Aurantii* on the Leaves of the Orange Tree on Different Dates in the Orange Grove of I.A.T.M.S

Date	<i>Aphis spiraecola</i>		<i>Toxoptera aurantii</i>	
	N	%	N	%
11-avr	0	0,000	0	0,000
18-avr	501	3,421	149	1,017
28-avr	78	0,533	0	0,000
05-mai	0	0,000	0	0,000
12-mai	20	0,137	5	0,034
19-mai	0	0,000	0	0,000
26-mai	35	0,239	0	0,000
02-juin	0	0,000	0	0,000
09-juin	113	0,772	0	0,000
16-juin	1714	11,703	7	0,048
23-juin	2091	14,277	256	1,748
30-juin	2778	18,968	117	0,799
07-juil	5542	37,840	2	0,014
14-juil	1238	8,453	0	0,000
21-juil	0	0,000	0	0,000
Total	14110	96,340	536	3,660

N: Number, %: Relative abundance

Comparing Populations levels of *Aphis Spiraecola* Patch and *Toxoptera Aurantii* Boyer De Fonscolombe with Mean Temperature

Both species appeared on April 18, with different frequencies, 3.421% for *Aphis spiraecola* and 1.017% for *Toxoptera aurantii*. The value of the average weekly average temperatures recorded that day at this region is equal to 16.46° C, higher by 2.43° C from that recorded on April 11. The following week the number of two species remains low. It was not until June 9, to an average weekly average temperatures (A.W.M.T.) equal to 19.44 ° C, the colonies *Aphis spiraecola* actually grow to peak with 5542 individuals (37.84%) in July 7 to A.W.M.T. equal to 22.47 ° C. After this date will increase by A.W.M.T. against the number of colonies *Aphis spiraecola* will drop sharply to permanently disappear from the arboreal stratum to July 21 to A.W.M.T. equal to 25.30 ° C. According Wang and Tsai (2000), the optimal temperature range for growth of the population *A. spiraecola* is 20-30 ° C. For *Toxoptera aurantii*, there has been no over

growth, the maximum number is recorded on June 23 at a A.W.M.T. equal to 21.51 ° C with 256 individuals (1.75%) (Figure 2). Temperature is also an important abiotic factor that affects the normal development of *T. aurantii* (Smaili et al., 2009). According to Agarwala and Bhattacharya (1995), *Toxoptera aurantii* performed optimally at 20 ° C in respect of larval development, fecundity and adult longevity.

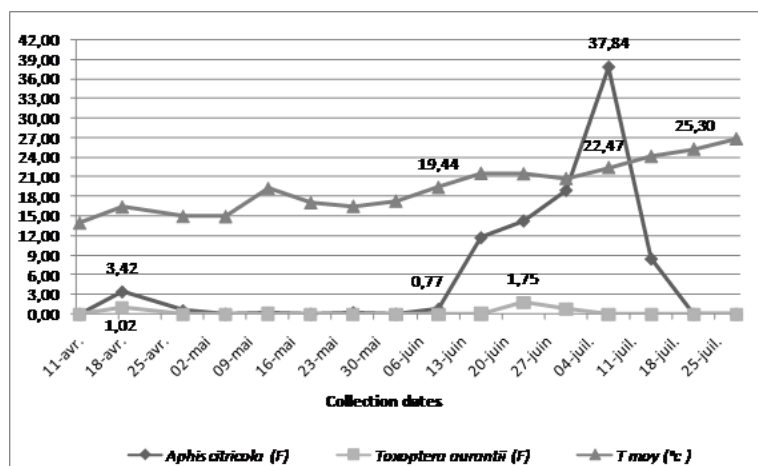


Figure 2: Comparing Populations Levels of *Aphis Spiraecola* Patch and *Toxoptera Aurantii* with Mean Temperature

CONCLUSIONS

The study of the diversity of aphids in the orange groves of the Institute of Agricultural Technology Middle Specialized (I.A.T.M.S.) revealed the presence of 18 species, the most dominant species is *Aphis spiraecola* with 32,05% followed by *Toxoptera aurantii* with 17, 31%. Regarding the effect of temperature on the population level *Toxoptera aurantii* and *Aphis spiraecola*, the latter peaked with 5542 individuals or 37,84% of the total to a weekly average mean temperature equal to 22.47 ° C. For *Toxoptera aurantii*, there has been no over growth, the maximum number is recorded on June 23 at a A.W.M.T. equal to 21.51 ° C with 256 individuals (1.75%).

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