

SOME ASPECTS CONCERNING THE INFLUENCE OF METEOROLOGICAL FACTORS ON COLORADO BEETLE BIOLOGY IN SUCEAVA CONDITIONS, IN THE RANGE COMPRISED BETWEEN ADULTS EMERGENCE AND PONTE FIRST COATING

Mihai TĂLMACIU¹, Bogdan Cătălin ENEA², Nela TĂLMACIU¹

email: catalin_i75@yahoo.com

Abstract

From all meteorological factors, first were studied effect of temperature and humidity, because these factors influence the breeding intensity and further development of the insect. An analysis of climatic fluctuations in Suceava, suggests that the winters in a certain extent have warmed, the precipitation quantities from the cold season and summer temperatures have increased considerably, which makes the insect development and biology to default other facets to years of occurrence in the Suceava.

Taking into consideration the data recorded during 2006-2009, the average adult stage from hibernate adult emergence in G1, until to pontes depositing was on average 18 and 16 days. If in 2006-2008 duration of this phase do not differ significantly between the two appearances of adults, in 2009 duration of the same stage was eight days longer in the first phase compared to the second stage. This major difference can be attributed to the large number of days (ten) with low temperatures.

Key words: rainfall regime, temperature, days with "unfavorable potential"

Climatic conditions have a significant influence on the spreading, population dynamics, life cycle, the pressure of infestation and appearance of Colorado beetle in the potato crop. The climate change due to temperature increase could have a major impact on populations of harmful insects (Bale JS, et al, 2002). It has a high affinity for higher temperatures for feeding, deposit eggs, shortening the incubation period reducing larval development (Hiiesaar K. et al., 2001, Semaškien R., Šmatas R., 2006). Low temperatures is the main obstacle to the spread and survival of this species (Hiiesaar K. et al., 2001)

From all meteorological factors, first it was studied effect of temperature and humidity, because these factors influence: emergence, breeding and development of the insects. These factors depending on the intensity of their manifestation contribute to the emergence and increase in very large limits of damages to potato crops.

We pursued, under natural conditions, some aspects of biology and ecology of the pest, illustrating of the interdependencies between stages duration from Colorado beetle ontology and the main characteristics of thermal and precipitation regimes in Suceava.

RESULTS AND DISSCUSIONS

Referring to first stage, in according with observations made, we can notice that the duration of them was 18 days and if the average of last three year was 20 days, 2008 was remarked by the longest period (12 days) from the hibernate adults occurrence until the first pontes emergence. Take into consideration the duration of hibernate adults "semilethargy" was shorter in 2006 compared to other years, shortening of the first stage with 6-12 days, may be attributed to a higher female biological potential, which contributed to the passage earlier in the breeding stage (Fig. 1).

MATERIAL AND METHOD

This paper addresses a fundamental problem in the Colorado beetle namely the influence of meteorological factors on insect biology in the range of adult emergence and early depositing of the first pontes, in the context of climate change in the last years. We analyzed phases from hibernate adult emergence - deposit of first eggs (E1) and first generation adult emergence - deposit eggs (S II)

The studies were conducted during the years 2006 - 2009 in ARDS of Suceava in the laboratory of Plant Protection.

¹ USAMV Iasi

² SCDA Suceava

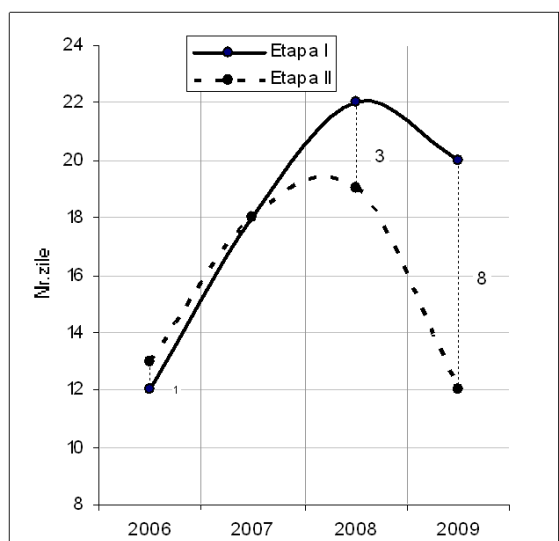
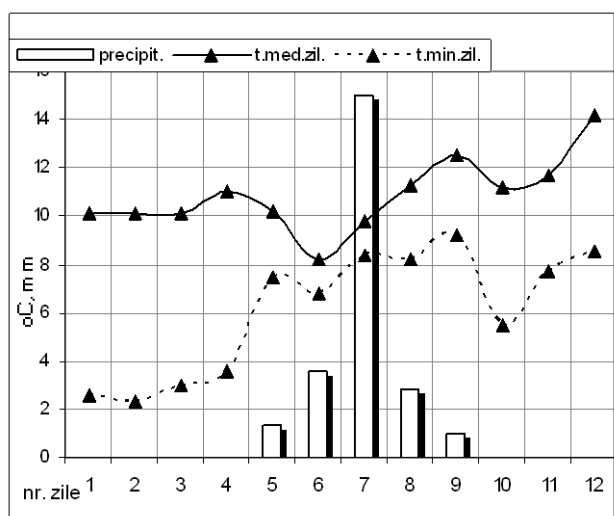
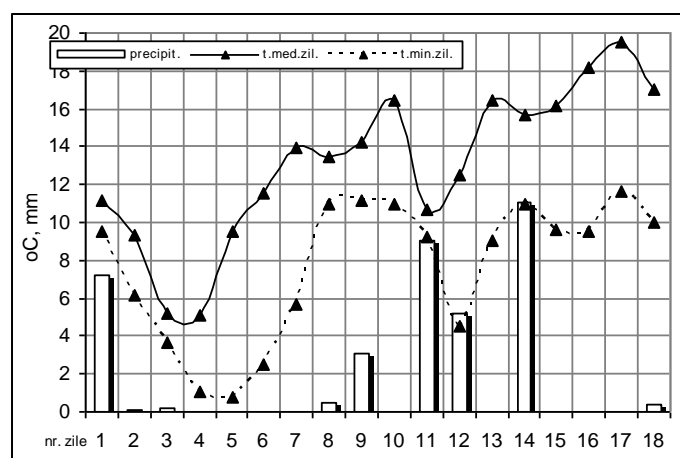


Figure 1 The differences (in days) between two stages

Almost continuous air warming and reduced rainfall have been created favorable conditions for completing in 12 days of the first biological stage in 2006 (fig.2.a). The only one negative moment can be considered in the days 6-7 after lowering the average temperature until to 8.2°C associated



a



b

Figure 2 Climatic conditions from the first stage, year 2006 (a) and 2007 (b)

If in 2007 the first phase duration was 18 days, in 2008 it reached 22 days (fig.3.a) High frequency of rainy days (13) and abundance of them (118 mm) emphasized enough effects of low temperature (average below 10°C), whose frequency was 45%. It is necessary to mention that of the 13 days of rain, five of them had temperatures between 1.4 and 7°C.

In year 2009, as in 2006, the duration of the first biological stage was mainly driven by the thermal

with a rain of 3.6 mm, followed a day, the seventh, with a heavy wetting due to the 15mm of precipitation (Table 1). Given the set can be considered that in 2006 there were meteorological conditions acceptable for deposit eggs of Colorado potato beetle females.

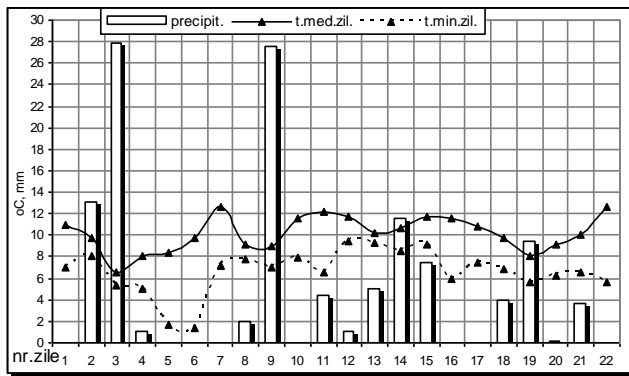
First stage in 2007 was characterized by less favorable weather conditions, particularly in terms of heat, i.e. lowering of the minimum temperatures below 5°C (of which in two days they fell to -1.1°C) for 5 days (of which four successive days 3 to 6 V) (fig.2.b). It can not be neglected any impediments caused by four days of rain, which in three days, quantities ranged between 5.2 and 11.1 mm.

It is estimated that in the first stage in 2007 there were at least four days, according to Table 1, where weather conditions were unfavorable for pontes, i.e.: days 3-5 when average temperatures were below 10°C and lows temperatures (in air) were of 3.7-1.1°C and respectively, -0.5°C and the twelfth day (10 May) when the minimum temperature dropped to 4.5°C, and the amounts of precipitation were 9.0 mm the day before and 5.2 mm in current day.

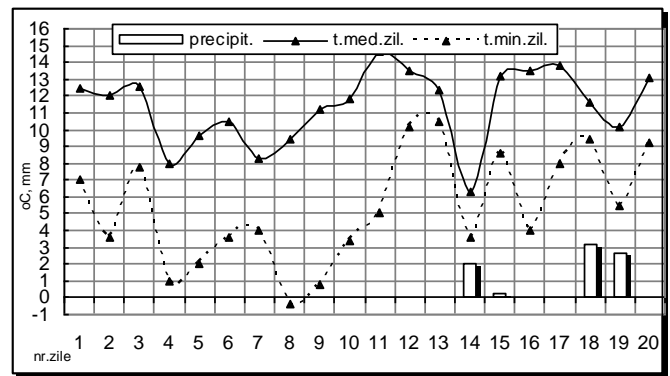
of the air (fig. 3. b). Comparing the second part of the graph of 2005 (beginning with ninth day), as in 2006 (excluding precipitation from the seventh day), it can be assumed that there is an acceptable resemblance. So, that it would result the prolongation of the deposit eggs duration with eight days was due to the special nature of the thermal regime, illustrated by lowering the average temperature from 12°C, to 8.5-9.5°C, and lowering of the minimum temperatures

Table 1
Synthesis of meteorological characteristics of stage I and II (2006 – 2009)

Observations	Stage I				Stage II			
	2006	2007	2008	2009	2006	2007	2008	2009
Year								
Stage duration (no. of the days)	12	18	22	20	13	18	19	12
Nr. of the days with t_{min} below 5°C	4	5	3	10	-	-	-	-
Nr. of the days with t_{min} below 15°C	-	-	-	-	8	16	10	7
from which: first 1/3	4	4	3	5	6	6	6	3
second 1/3	-	1	-	3	-	4	4	2
third 1/3	-	-	-	2	2	6	-	2
The absolute minimum temperature	2,3	-1,1	1,4	-0,4	-	-	-	-
No. of the days with precipitations	3	4	13	3	4	6	10	5
from which: with t_{min} below 8°C	1	1	5	2	-	-	-	-
with t_{min} below 15°C	-	-	-	-	4	3	4	4
No. of the days with t_{min} below 10°C	-	-	-	-	-	-	-	-
No. of the days with t_{min} below 5°C	3	3	4	5	-	-	-	-
No. of the days potentially unfavorable	1-2	4	8	5	-	3	6	1
Current number of days with potentially negative influence	6-7	3-5, 12	2-6,9, 18,19	4,5,7, 8, 14	-	10,16, 17	7,11, 16-19	2



a



b

Figure 3 The climatic conditions from stage I, years 2008 (a) and 2009 (b)

from 7,5°C to 4°C. The thermal regime of the first stage of 2009, even if is illustrated by an average temperature of 11,3°C (tab. 1), the second value after 2007, the days frequency of minimum temperature below 5°C was the highest (50%) compared with years 2006 - 2008, when the frequency was 33%, 28% and 23% respectively. In the end it was appreciated the most unfavorable conditions have been registered for five days (in chronological order 4, 5, 7, 8 and 14). In year 2009, as in 2006, the duration of the first biological stage was mainly driven by the thermal regime of the air (fig. 3. b). Comparing the second part of the graph of 2005 (beginning with ninth day), as in 2006 (excluding precipitation from the seventh day), it can be assumed that there is an acceptable resemblance. So, that it would result the prolongation of the deposit eggs duration with eight days was due to the special nature of the

thermal regime, illustrated by lowering the average temperature from 12°C, to 8.5 to 9, 5°C, and lowering of the minimum temperatures (in the first eight days), from 7,5°C to 4°C. The thermal regime of the first stage of 2009, even if is illustrated by an average temperature of 11,3°C (tab. 1), the second value after 2007, the days frequency of minimum temperature below 5°C was the highest (50%) compared with years 2006 - 2008, when the frequency was 33%, 28% and 23% respectively. In the end it was appreciated the most unfavorable conditions have been registered for five days (in chronological order 4, 5, 7, 8 and 14). The second stage, due to the adults' emergence of the first generation and start of the pontes stage, had some specific features (Figure. 4 a, b). The average time was four days shorter than the first stage, although some values (18-19 days) were

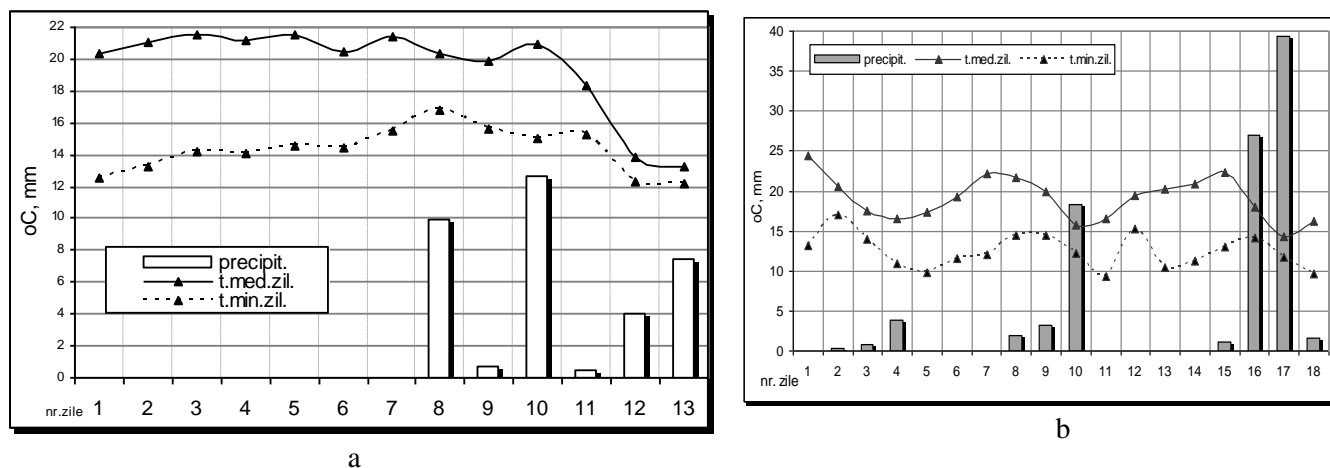


Figure 4 The climatic conditions from stage II , years 2006 (a) and 2007 (b)

Although in 2007 and 2008 average temperatures and higher amounts of 0°C and 10°C did not differ significantly, the thermal regime of these years has some particularities, namely: the average temperatures low in the last three to five days with 5-7,5°C in 2007 (from 22.5°C to 15°C) (fig.4.b),

while in 2008 the average temperature was kept constant between 17 and 17.5°C, and in terms of minimum temperatures in 2007 (also, in the last three to five days dropped from 14.5 to 9.5°C, while in 2008 they remained within the limits of 15 to 16.5°C (fig. 5.a)

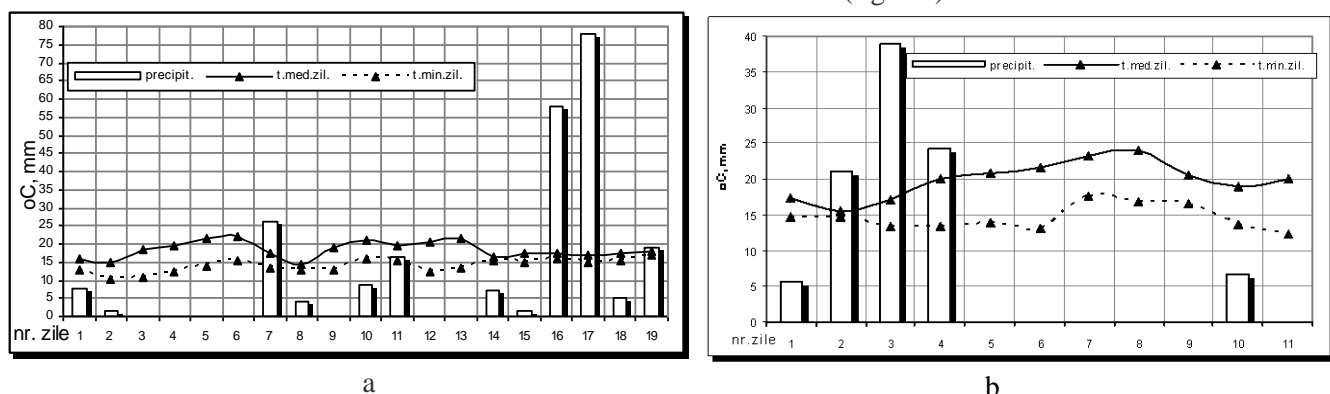


Figure 5 The climatic conditions from stage II , years 2008 (a) and 2009 (b)

recorded in the first stage I; durations of 12-13 days were recorded during the years with the highest average temperature values namely, 20,2°C in 2009 and 19, 5 °C in 2006, when the minimum temperatures do not have dropped below 12°C. Thanks to these thermal parameters, (very favorable) did not fill the unfavorable influence on pontes stage, even in year 2009, where rainfall was plentiful enough (97 mm in five days with rain according to table 1).

These features of the thermal regime eased the negative influence of rainfall, so that the time of the second stages in years 2007 and 2008 were very similar: 18 and respectiv19 days. Particularly given the rainfall regime it can be considered that in 2007 there were three days with potentially unfavorable for ponte and in 2008 six days (Table 1).

CONCLUSIONS

Analysis of meteorological conditions shows that during colder time (Phase I) was not determined practically significant by mean air temperature, while in warmer season (stage II) the average temperature significantly influenced (negatively) on the duration ($r = -0.935$ °). Instead,

the amount of thermal units ("cumulated ") increased significantly with prolongation of fifth stages ($r = 0.944^x - 0.966^{xx}$). Taking into consideration the sense and size of the correlation coefficients, it should be noted that the duration of one stage is not dependent only on averages of meteorological factors, but also by their dynamics (mode) and especially by interaction between them.

Some meteorological factors, through their continues single or complex action, on Colorado potato beetle populations can cause changes that lead to delay or accelerate the development stages, to increase or decrease the numeric populations density, and ultimately, damages.

An analysis of climatic fluctuations in Suceava, suggests that the winters have warmed in a certain extent, the precipitation quantities from the cold season has increased and summer temperatures have increased considerably, which makes the insect development and biology to default other facets to years of occurrence in the Suceava.

Taking into consideration the data recorded during 2006-2009, the average adult stage from hibernate adult emergence in G1, until to pontes depositing was on average 18 and 16 days. If in 2006-2008 duration of this phase do not differ significantly between the two appearances of adults, in 2009 duration of the same stage was eight days longer in the first phase compared to the second stage. This major difference can be attributed to the large number of days (ten) with low temperatures.

REFERENCES

- Bale J. S., Masters G. J., Hodkinson I. D., 2002** - *Herbivory in global climate change research: direct effects of rising temperatures on insect herbivores*, Global Change Biology, vol. 8, p. 1–16.
- Hiisaar K., Kuusik A., Jõudu J. et al.** *Laboratory experiments on cold acclimation in overwintering Colorado potato beetles, *Leptinotarsa decemlineata* (Say)* // Norwegian Journal of Entomology. – 2001, vol. 48, p. 87–90 .
- Semaškien R., Smatas R., 2006** - *Bulvi kenkjai - Lauko augal ligos ir kenkjai*, p. 157–165.