THE INFLUENCE OF SUMMER TEMPERATURES ON THE EVOLUTION OF MINED INSECTS

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Abstract

Lately, mining moths were observed in apple orchards with very strong attacks. Emergence of strong infestations depends on many factors, but the most important climatic factor is temperature. It is known that in plant protection, climatic conditions have a very important role in pest evolution. In 2010 – 2011, at S.C.D.P. Iaşi was followed the evolution of mined insects, in apple orchard, through an analysis of climatic factors. Observations were made on the predominant species: *Phyllonorycter corylifoliella Hbn* and *Phyllonoryctre blancardella F.* In both species was monitored the dynamic attack depending on weather conditions, which were taken by the AgroExpert Weather Station. Following biological observations, was found that in 2010, the emergence of biological stages for both species was achieved much earlier than in 2011. It depends on climatic factors, especially temperature, factors that determine the number of generations for these pests. In the environmental conditions of Iasi county, both species (*Phyllonorycter blancardella* and *Phyllonorycter corylifoliella*) showed 3 generations per year.

Key words: biology, mining moth, climatic factors, evolution;

INTRODUCTION

Many pests, especially moths, can cause severe damage to agricultural systems, although not all moths are pests of agriculture. (Armelle V., and colab 2005). Betwen all the pests, a group of microlepidoptere - mining moths was noted recently by strong and powerful attacks in the apple orchards (Drosu Sonica and colab.,1995). The emergence of strong infestations depends on many factors, most important climatic factors, especially temperature. It is known that, in plant protection, climatic conditions have an important role in the evolution of pests. Micro-lepidopterian biology knowledge is very important, especially when control measures are required (Beşleagă Ramona and colab, 2008; Cardei E., Beşleagă Ramona, 2009). In 2010-2011, at Station for Research-Development in fruit Growing Iaşi, a major development was monitored mined insects encountered in apple orchard, through an analysis of climatic factors.

MATERIAL AND METHOD

Research on mining moth evolution were developed during 2010 - 2011, in a grove of apple in the S.C.D.P. Iaşi.

Observations were made on the predominant species: *Phyllonorycter corylifoliella Hbn* and *Phyllonoryctre blancardella F.* Species identification was done by direct observation in the orchard. Their determination was performed at Stereomicroscope by collecting biological material consisting in leaves which were attacked by insects, in various stages of development.

In both species was monitored the dynamic of evolution and attack depending on weather conditions.

Analysis of climatic conditions for the period of observation was made by AgroExpert Weather Station.

RESULTS AND DISCUSSION

From observations made between 2010 – 2011 it appears that environmental conditions of Iasi county, both species (*Phyllonorycter blancardella and Phyllonorycter corylifoliella*) had 3 generations per year.

The results of biological observations taken at S.C.D.P. Iaşi were presented in tables 1 and 2.

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Table 1

The evolution of *Phyllonorycter blancardella F.* species in condition of Iaşi country

Year		First generation				Second generation				3rd generation			
		adult	egg	larvae	pupae	adult	egg	larvae	pupae	adult	egg	larvae	pupae
2010	First apper..	19.04	1.05	12.05	5.06	16.06	20.06	1.07	16.07	27.07	1.08	6.08	22.08
	$\sum(t_n-t_0)$	84,9	158,0	276,7	533,9	694,0	744,7	906,7	1127,4	1327,7	1403,2	1406,1	1779
2011	First apper..	28.04	10.05	21.05	4.06	18.06	25.06	1.0	18.07	31.07	4.08	10.08	31.08
	$\sum(t_n-t_0)$	85,8	156,6	262,5	487,6	647,6	761,7	845,7	1076,8	1323,3	1351,6	1442,6	1576,9

Table 2

The evolution of *Phyllonorycter corylifoliella Hbn*. species in condition of Iaşi county

Year		First generation				Second generation				3rd generation			
		larvă	pupă	adult	ou	larvă	pupă	adult	ou	larvă	pupă	adult	ou
2010	First apper..	5.05	12.05	23.05	30.05	3.06	19.06	28.06	3.07	20.07	8.03	18.03	27.03
	$\sum(t_n-t_0)$	204,4	276,7	376,5	460,8	511,3	758,7	863,1	935,4	1201,8			
2011	First apper..	10.05	16.05	28.05	1.06	7.06	24.06	1.07	12.07	26.07	12.03	25.03	6.04
	$\sum(t_n-t_0)$	173,3	322,4	434,5	489,3	511,3	820,7	906,7	935,4	1307,2			

Development and reproduction is conditioned on a complex climatic factors (Paşol P. and colab., 2007). Emergence of biological stages was correlated with a value of effective temperature. The observations made in 2010 found that for both species, the first adults emerged earlier: April 19 for Phyllonorycter blancardella species and May 5 for *Phyllonorycter corylifoliella*, different from 2011, when adults emerged later (April 28 – *Phyllonorycter blancardella* and May 10 for *Phyllonorycter coryifoliella*). Analyzing the data shows that for all other stages of development (pupae, larvae and eggs) their first appearances took place earlier in the year 2010 compared to 2011. This is due to climatic factors, especially temperature, factors that determine the number of generations for these pests (table 2). In tables 3 and 4 are shown the mean daily temperature (t_n) and $\sum$ of effective temperature $\sum (t_n-t_0)$, for 2010 and 2011, which exceeded the biological limit (t_0). From both tables we can see that average temperatures recorded in 2010 were higher than in 2011. For example, the number of days with temperatures below 6^oC (biological limit), recorded in April 2011 were 7 (days), to 2010, when in the same month there is no day below 6^oC recorded. In 2010-2011, there were a number of deviations from normal values, such as those in the fall of 2010.

CONCLUSIONS

In conclusion, we can say that 2010 was a warmer, especially in autumn, and 2011 with normal heat, but dry, especially in the second half.

Correlating all the results above, we can say that the life cycle of mined insects, in the climatic conditions of Iasi county, has three generations per year, such as: for *Phyllonorycter blancardella species*, the evolution was presented as: G I April - June; G II: June - July; G III: July – September, and for *Phyllonorycter corylifoliella*: G I: May - June; G II: June - July; G III: July – March (next year).

- life cycle of the two presented insects (*Phyllonorycter blancardella* and *Phyllonorycter corylifoliella)* they had 3 generations per year.

- *Phyllonorycter corylifoliella* hibernate as mature larvae and larvae first appear in the first decade of May.

- *Phyllonorycter blancardella* hibernate as pupae and adults are making their first appearance in April;

- the temperatures recorded in 2010 – 2011, have favorably influenced the evolution of mined insects;

- micro-lepidopterian biology knowledge is very important, especially when control measures are required.

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Table 3

Average daily temperature (t_n) and effective temperature ($\sum t_n$-t_o) for mined insects recorded in 2010, at S.C.D.P. Iaşi

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o
1	9,3	0,3	18,1	158,0	20,1	489,3	22,5	906,7	24,7	1403,2	13,2	1917,4
2	10,0	4,3	18,2	170,2	17,5	500,8	21,5	922,2	25,2	1422,4	11,5	1922,9
3	10,9	9,2	18,0	182,2	16,5	511,3	19,2	935,4	25,2	1441,6	14,3	1931,2
4	10,6	13,8	17,3	193,5	17,6	522,9	17,8	947,2	24,5	1460,1	15,7	1940,9
5	11,1	18,9	16,9	204,4	17,0	533,9	19,0	960,2	23,2	1477,3	16,9	1951,8
6	11,7	24,6	17,1	215,5	17,2	545,1	18,9	973,1	26,4	1497,7	13,5	1959,3
7	12,4	31	15,9	225,4	19,5	558,6	18,4	985,5	27,5	1519,2	14,0	1967,3
8	6,6	31,6	15,3	234,7	22,1	574,7	17,0	996,5	24,7	1537,9	12,3	1973,6
9	11,4	37	15,0	243,7	23,6	592,3	20,0	1010,5	22,4	1554,3	12,6	1980,2
10	11,0	42	15,2	252,9	24,9	611,2	19,4	1023,9	23,9	1572,2	11,5	1985,7
11	10,6	46,6	17,5	264,4	26,1	631,3	21,5	1039,4	24,7	1590,9	14,3	1994
12	8,8	49,4	18,3	276,7	27,4	652,7	22,2	1055,6	25,6	1610,5	14,0	2002
13	12,3	55,7	17,9	288,6	27,9	674,6	22,8	1072,4	26,7	1631,2	15,1	2011,1
14	11,0	60,7	18,2	300,8	25,4	694	23,7	1090,1	26,9	1652,1	15,8	2020,9
15	9,5	64,2	17,4	312,2	20,3	708,3	24,4	1108,5	26,2	1672,3	17,1	2032
16	11,3	69,5	16,2	322,4	17,8	720,1	24,9	1127,4	27,1	1693,4	18,2	2044,2
17	9,2	72,7	11,7	328,1	16,4	730,5	24,6	1146	23,4	1710,8	18,9	2057,1
18	11,8	78,5	12,0	334,1	19,9	744,4	25,4	1165,4	20,9	1725,7	15,9	2067
19	12,4	84,9	12,9	341	20,3	758,7	24,8	1184,2	19,7	1739,4	12,8	2073,8
20	8,0	86,9	14,4	349,4	22,0	774,7	23,6	1201,8	19,4	1752,8	11,4	2079,2
21	11,2	92,1	14,6	358	22,9	791,6	23,8	1219,6	18,7	1765,5	12,7	2085,9
22	8,3	94,4	15,2	367,2	20,2	805,8	24,5	1238,1	19,5	1779	13,2	2093,1
23	11,1	99,5	15,3	376,5	13,3	813,1	25,1	1257,2	21,8	1794,8	13,1	2100,2
24	11,1	104,6	16,1	386,6	13,6	820,7	25,0	1276,2	23,4	1812,2	14,0	2108,2
25	12,4	111	17,9	398,5	12,7	827,4	21,8	1292	23,6	1829,8	15,7	2117,9
26	12,0	117	17,2	409,7	17,0	838,4	21,2	1307,2	20,7	1844,5	18,1	2130
27	12,2	123,2	19,2	422,9	18,9	851,3	21,5	1322,7	22,7	1861,2	17,8	2141,8
28	10,7	127,9	17,6	434,5	17,8	863,1	20,3	1337	24,5	1879,7	16,5	2152,3
29	13,3	135,2	19,0	447,5	18,9	876	20,3	1351,3	15,6	1889,3	14,0	2160,3
30	16,7	145,9	19,3	460,8	20,2	890,2	22,1	1367,4	16,2	1899,5	11,5	2165,8
31			20,4	475,2			23,1	1384,5	16,7	1910,2		

Table 4

Average daily temperature (t_n) and effective temperature ($\sum t_n$-t_o) for mined insects recorded in 2010, at S.C.D.P. Iaşi

	APRIL		MAY		JUNE		JULY		AUGUST		SEPTEMBER	
	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o	t_n	$\sum t_n$-t_o
1	10,5	1,5	16,4	133,8	20,8	441,3	17,5	845,7	19,6	1336,9	19,8	1786,8
2	11,0	6,5	10,7	138,5	20,8	456,1	17,2	856,9	20,7	1351,6	16,5	1797,3
3	8,5	9	10,6	143,1	21,6	471,7	14,6	865,5	20,7	1366,3	19,1	1810,4
4	5,8	9	9,5	146,6	21,9	487,6	16,3	875,8	18,7	1379	18,6	1823,0
5	6,3	9,3	8,7	149,3	21,1	502,7	18,1	887,9	18,8	1391,8	19,8	1836,8
6	9,2	12,5	7,7	151	22,3	519	18,9	900,8	21,4	1407,2	20,6	1851,4
7	11,9	18,4	7,3	152,3	22,2	535,2	19,9	914,7	23,1	1424,3	19,2	1864,6
8	9,9	22,3	10,3	156,6	22,1	551,3	23,4	932,1	24,3	1442,6	18,4	1877,0
9	8,1	24,4	14,4	165	21,4	566,7	24,7	950,8	21,6	1458,2	13,8	1884,8
10	4,5	24,4	14,3	173,3	16,7	577,4	23,5	968,3	17,1	1469,3	15,1	1893,9
11	3,9	24,4	12,3	179,6	15,8	587,2	24,6	986,9	16,4	1479,7	19,2	1907,1
12	4,9	24,4	14,7	188,3	17,5	598,7	22,2	1003,1	16,8	1490,5	21,2	1922,3
13	5,8	24,4	17,3	199,6	15,7	608,4	22,7	1019,8	19,2	1503,7	22,5	1938,8
14	4,6	24,4	15,7	209,3	17,5	619,9	25,2	1039	20,5	1518,2	22,3	1955,1
15	5,5	24,4	17,6	220,9	18,3	632,2	26,0	1059	21,2	1533,4	20,4	1969,5
16	7,3	25,7	16,8	231,7	21,2	647,4	23,8	1076,8	21,8	1549,2	18,7	1982,2
17	9,9	29,6	12,9	238,6	23,9	665,3	22,9	1093,7	20,5	1563,7	17,1	1993,3
18	11,5	35,1	17,7	250,3	24,8	684,1	25,2	1112,9	19,2	1576,9	18,6	2005,9
19	12,7	41,8	18,2	262,5	24,4	702,5	26,5	1133,4	20,5	1591,4	19,7	2019,6
20	10,6	46,4	19,5	276	18,2	714,7	27,6	1155	21,9	1607,3	18,2	2031,8
21	12,0	52,4	19,6	289,6	18,0	726,7	19,9	1168,9	18,9	1620,2	17,1	2042,9
22	10,9	57,3	19,2	302,8	21,8	742,5	19,2	1182,1	18,9	1633,1	16,5	2053,4
23	10,7	62	21,5	318,3	25,2	761,7	20,5	1196,6	23,0	1650,1	16,6	2064,0
24	12,7	68,7	21,3	333,6	23,3	779	18,8	1209,4	21,9	1666	15,2	2073,2
25	13,9	76,6	20,0	347,6	15,4	788,4	21,3	1224,7	21,7	1681,7	13,9	2081,1

26	15,2	85,8	17,0	358,6	14,3	796,7	23,8	1242,5	22,9	1698,6	14,4	2089,5
27	15,8	95,6	18,0	370,6	15,4	806,1	22,5	1259	21,5	1714,1	16,2	2099,7
28	14,6	104,2	18,5	383,1	14,3	814,4	21,8	1274,8	19,9	1728	16,4	2110,1
29	15,5	113,7	19,4	396,5	15,6	824	23,5	1292,3	21,1	1743,1	11,9	2116,0
30	15,7	123,4	21,4	411,9	16,2	834,2	22,4	1308,7	21,1	1758,2	13,9	2123,9
31			20,6	426,5			20,6	1323,3	20,8	1773		

REFERENCES

Armelle, V. and D. Silvia, 2005 - *Changes in volatile emissions from apple trees and associated response of adult female codling moths over the fruit-growing season.* Journal of Agricultural and Food Chemistry 53: 4083-4090.

Beşleagă Ramona, Georgescu T., Cardei E., Tălmaciu M., Diaconu A.,2008 - *"Dinamica populațiilor de molii miniere ale mărului, corelată cu duşmanii lor naturli, în condiții diferite de protecție fitosanitară.* Lucrări ştinnțifice, seria Horticultură, vol 51, Editura Ion Ionescu de la Brad , Iaşi

Cârdei E., Beşleagă Ramona, 2009 – *Rezultate privind biologia, ecologia şi combaterea integrată a minierului placat Phyllonorycter corylifoliella Hbn., în plantațiile de măr.* Lucrări ştinnțifice, seria Horticultură, vo52, Editura Ion Ionescu de la Brad, Iaşi

Drosu Sonica, Hondru N., Paşol P., 1995 – „*Influența factorilor abiotici asupra dezvoltării moliei marmorate – Phyllonorycter blancardella F.* Analelel ICDP, vol XXVII

Paşol P., Ionela Dobrin, Loredana Frăsin, 2007 – „*Tratat de Entomologie specială*". Editura Ceres, Bucureşti.