

EXPERIMENTAL DATA ON CHEMICAL CONTROL OF MAIN PATHOGENS AND PESTS IN AN APPLE ORCHARD IN NORTH-EASTERN ROMANIA IN 2019

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Abstract: The researches were carried out in 2019 in an apple plantation with Jonathan, Golden Delicious, Starkrimson varieties grafted on MM106 in the fields of the Fălticeni Development Centre belonging to the Development Research Station for Fruit Growing Iași (North Eastern Romania). The climatic conditions in 2019 were favorable for the development of pathogens *Venturia inaequalis*, *Podosphaera leucotricha* and *Monilinia fructigena*. In the conditions of fungicide treatments, the varieties sensitive to apple scab on fruits were Starkrimson and Golden Delicious with an attack degree between 4.5 and 10.5%. Pest species *Cydia pomonella* and *Adoxophyes reticulana* showed a frequency of attack of 45% and 15%, respectively in the case of untreated control. The results of the studies highlight the importance of applying phytosanitary treatments correlated with climatic conditions and resistance of varieties to the attack of diseases and pests.

Keywords: apple chemical protection, pathogens, insect pests, Fălticeni, Romania

INTRODUCTION

Apple crop in Romania covers an area of about 53 thousand ha with a production of 643 thousand tons resulting in an average production per hectare of about 12 tons (FAO, 2018). Constantly changing environmental factors favor the emergence of various problems in apple cultivation from the phytosanitary point of view, the development of pesticides that cause losses in terms of quality and quantity is highlighted.

The main pathogens causing problems in apple culture are considered to be *Venturia inaequalis* (Cke), *Erwinia amylovora* [(Burill) Winslow et al.] *Podosphaera leucotricha* (Ell. et Ev), *Monilinia laxa* (Aderh et Ruhl) and *Monilinia fructigena* (Aderhet Ruhl). (Chițulescu & Cristea, 2018). Among the apple pests, *Aphis pomi* (De Geer), *Eriosoma lanigerum* (Hansm), *Quadraspidiotus perniciosus* (Comst), *Adoxophyes reticulana* (Hb) and *Cydia pomonella* (L.) are the most dangerous (Roșca et al., 2011; Beșleagă et al., 2013; Baloniu & Mitrea, 2017, Herea et al., 2019).

The aim of this paper was to assess the behaviour of some apple cultivars to the main pest and diseases attack under phytosanitary treatments in the conditions of the Moldova region (North Eastern Romania).

MATERIAL AND METHOD

The researches were carried out in 2019 in an apple plantation with Jonathan, Golden Delicious, Starkrimson varieties grafted on MM106 in the field of the Fălticeni Development Center belonging to the Development Research Station for Fruit Growing Iași situated in the Moldova region (North Eastern Romania).

To control pests and pathogens, a number of 10 phytosanitary treatments were applied in the apple orchard in correlation with the biological characteristics of pest's evolution of

climatic conditions and apple trees phenology (table 1). The Agroma type spraying machine was used for pesticides applying. The program of phytosanitary treatments included contact and systemic fungicides and insecticides. To avoid resistance emergence, the fungicides were applied alternately in accordance with the infection pressure of the pathogens and their period of action. Fungicides have been applied in the mixture with insecticides against the main pathogens and pests which cause problems annually in apple plantations in the area of study.

Table 1. Phytosanitary treatments applied in apple plantation in Fălticeni in 2019

No. Crt.	Fungicide/Insecticide	Dose/ha	Crop Phenophase	Pathogen/Pest
1	BouillieBordelaise WDG Ovipron	5.0kg 10.0 l	BBCH 01-51 Dormancy- Inflorescence emergence	<i>Venturia inaequalis</i> , <i>Podospaera leucotricha</i> , <i>Erwinia amylovora</i> <i>Aphis</i> spp., <i>Adoxophyes reticulana</i> , <i>Quadraspidiotus perniciosus</i>
2	Chorus 50WG Kumulus DF Boroet Mospilan 20 SG	0.75kg 4.0 kg 1.0 l 0.45kg	BBCH 57 Pink bud stage	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>Aphis</i> spp, <i>A. pomorum</i> , Physiological and nutritional diseases
3	Luna experience Decis 25 WG Nissorun WP Codicevo	0.75 l 0.045kg 0.4 kg 3.0kg	BBCH 59 Most flowers with petals forming a hollow ball	<i>V. inaequalis</i> , <i>P. leucotricha</i> . <i>Hoplocampa testudinea</i> , <i>Aphis</i> spp., <i>Panonychus ulmi</i> , Physiological and nutritional diseases
4	Flint plus Dithane M45 Reldan 22 EC	1.875kg 2.0kg 2.2 l	BBCH 71 Fruit size up to 10 mm	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>Monilinia fructigena</i> <i>Cydia pomonella</i> , <i>Aphis</i> spp.
5	Maccani Dithane M45 Coragen Codicevo	2.2 kg 2.0kg 0.15l 3.0kg	BBCH 71-72 Fruit size up to 10 mm - Fruit size up to 20 mm	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>M. fructigena</i> , <i>C. pomonella</i> , Physiological and nutritional diseases.
6	Systhane forte Dithane M45 Decis 25 WG	0.3 l 2.0 kg 0.05kg	BBCH 72 Fruit size up to 20 mm	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>M. fructigena</i> , <i>Aphis</i> spp, <i>C. pomonella</i> , <i>Q. perniciosus</i>
8	Topsin 500SC Coragen	1.4 l 0.15 l	BBCH 73 Second fruit fall	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>M. fructigena</i> , <i>C. pomonella</i>
9	Folicur solo Calypso Kerafol	2.5l 0.3 l 3.0 l	BBCH 74 Fruit diameter up to 40 mm	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>C. pomonella</i> , <i>Aphis</i> spp, Physiological and nutritional diseases.
10	Fontelis Mospilan SG	0.75 l 0.3 kg	BBCH 75 Fruit about half final size	<i>V. inaequalis</i> , <i>P. leucotricha</i> , <i>Q. perniciosus</i> , <i>Eriosoma lanigerum</i>

The pomiculture year 2018-2019 in Fălticeni was characterized by an average annual temperature of 9.7°C and a sum of precipitation of 665.2 mm. During the vegetation period in 2019, large amounts of precipitation were recorded in April, of 78.3 mm (normal 53.5 mm.) and 108.5 mm in May (normal 86.2 mm). The number of days with precipitation was between 2 days (in October) and 14-20 days (in April, May and June). Annual total days of precipitation were 119 days. The wettest month was May, with 20 days of rainfall.

The large amount of rainfall in April and May as well as the high number of rainy days (34 days) in this period created very favorable conditions for primary infections of pathogens *V. inaequalis* and *M. fructigena*.

Observations for secondary infection of pathogens were performed in August, and were determined the attack of pathogens that cause fire blight, powdery mildew, apple scab and fruit moniliosis. The frequency, the intensity and the degree of attack on fruits or shoots were recorded for the pest *C. pomonella* and *A. reticulana*.

The pheromones atraPOM and atraRET of autochthonous production (Raluca Ripan Chemical Research Institute Cluj-Napoca) were used to monitor the two species of lepidoptera and establish the optimum time of phytosanitary treatments (Boboc et al., 2019).

RESULTS AND DISCUSSIONS

Our observations in the spring revealed that the first spots of *Venturia inaequalis* on leaves appeared on Golden Delicious on 8th May while the first symptoms on fruits were recorded on Starkrimson and Golden delicious on 29th May. Data on the attack of *V. inaequalis* is showed in table 2. Our data show that the Starkrimson variety behaved as the most sensitive variety to apple scab infections, both leaves and fruits. Of the three apple cultivars analysed, the least affected by disease symptoms was Jonathan variety, both leaves and fruits, reaching a degree of attack of 1.5% on leaves and fruits. In the untreated variant, the frequency of apple scab attack was very high, of 91.08%, on leaves and 83.3% on fruits.

Table 2.The attack of *V. inaequalis* on apple in 2019

	Apple cultivar	<i>V. inaequalis</i>					
		Leaves			Fruits		
		F %	I %	DA %	F %	I %	DA %
1.	Jonathan	25.0	10.0	2.5	10.0	15.0	1.5
2.	Golden Delicious	45.0	15.0	6.75	25.0	18.0	4.5
3.	Starkrimson	60.0	25.0	15.0	35.0	30.0	10.5
4.	Untreated	99.0	92.0	91.08	98.0	85.0	83.3

Results on the attack of pathogens *Monilia fructigena*, *Erwinia amylovora* and *Podosphaera leucotricha* are presented in Table 3.

Table 3. The attack of *M. fructigena*, *E. amylovora* and *P. leucotricha* on apple in 2019

	Apple cultivar	<i>M. fructigena</i>			<i>E. amylovora</i>			<i>P. leucotricha</i> on shoots		
		F %	I %	DA %	F %	I %	DA%	F%	I%	DA%
1.	Jonathan	1.5	80.0	1.2	3.0	80.0	2.4	15.0	25.0	3.75
2.	Golden Delicious	5.0	90.0	4.5	0.0	0.0	0.0	3.0	5.0	0.15
3.	Starkrimson	3.0	85.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
4.	Untreated	25.0	100.0	25.0	55.0	90.0	49.5	99.0	80.0	79.2

The Jonathan variety was the least affected by most monilia (1.2%). The fire blight pathogen affected only Jonathan cultivar in apple variant protected with specific chemical fungicides (2.4%). Untreated apple was the most affected by moniliosis and fire blight.

The powdery mildew on shoots had a frequency between 3% for the Golden variety and 15.0% for the Jonathan variety, an intensity of 5% for the Golden delicious variety and 25% for the Jonathan variety, and the degree of attack was 0.15% in the Golden delicious variety and 3.75% in the Jonathan variety, very low attack values compared to the untreated control. The Starkrimson cultivar was fully protected by specific fungicides. Very high values

were also recorded for powdery mildew on shoots in unprotected apple variant, a frequency of 99%, intensity of 80% and a degree of attack of 79.2%.

The codling moth, *Cydia pomonella* is one of the most important pests of apple, being regularly present in all apple orchards in Romania and as well as in North-Eastern part of the country (Ungureanu-Tanasa, 2006). *Adoxophyes reticulana* is also found in this area where climatic conditions are favorable for developing of two complete generations (Herea et al., 2019).

Observations on the attack of the codling moth and the summer fruit tortrix on fruits were made at fruit maturity (BBCH 75-80). Data on attack of the two pests are presented in table 4.

Table 4. The attack of the main insect pests on apple in 2019

	Apple cultivar	<i>C. pomonella</i>			<i>A. reticulana</i>		
		F%	I%	DA%	F%	I%	DA%
1.	Jonathan	3.0	80.0	2.4	1.0	60.0	0.6
2.	Golden Delicious	5.0	85.0	4.25	0.0	0.0	0.0
3.	Starkrimson	3.0	70.0	2.1	0.0	0.0	0.0
4.	Untreated	45.0	90.0	40.5	15.0	75.0	11.25

In the case of codling moth, there was a degree of attack between 2.1% (Starkrimson) and 4.25% (Golden Delicious) representing the treated variant, the untreated variant with specific insecticides recorded a degree of attack of 40.5%. The summer fruit tortrix provoked a low degree of attack, respectively 0.6% for the Jonathan variety, being the only variety attacked by this pest in the treated plantation. The untreated variant showed an attack rate of 11.25%.

CONCLUSIONS

In terms of climatic conditions, the year 2019 was a very favorable for development of pathogens that produce apple scab, powdery mildew and favorable for development of fire blight and moniliosis.

In the treated variant, the degree of attack for apple scab was reduced, between 10.5% and 4.5% for the Starkrimson and Golden delicious varieties, and for the Jonathan variety for up to 1.5%, being the result of effective control with specific products.

For powdery mildew on shoots the degree of attack was reduced to 3.8% in the Jonathan variety, and for moniliosis was 1.2% - 4.5% (Jonathan and Golden varieties) very low values compared to the untreated control.

Very favorable conditions for development were also for the pests *Cydia pomonella* and *Adoxophyes reticulana*. The insecticides used caused the degree of attack of the two lepidoptera to keep the value below the economic damage threshold.

A relatively good state of health of the plantations in 2019 was achieved by applying with good results the foliar fertilizers with NPK, magnesium, boron, amino acids, five applications, simultaneously with the application of insecticides and fungicides.

REFERENCES

BALONIU, L., MITREA, R. (2017). Results regarding the efficiency of some insecticide products in controlling *Cydia pomonella* in Maracineni area between 2014 - 2015. *Annals of the University of Craiova-Agriculture, Montanology, Cadastre Series*, 46, 2, 13-18.

- BEȘLEAGĂ, R., TĂLMACIU, M., DIACONU, A., TĂLMACIU, N., CÂRDEI, E., CORNEANU, G. (2013). Control of the codling moth (*Cydia pomonella* L.) in accordance with the special evolution of biology of Iași county. *Journal of Food, Agriculture & Environment*, 11, 1, 634-640.
- BOBOC, C. I., PERJU, I., UNGUREANU, I. V., SÎRBU, S., IUREA, E., GHERGHEL, M. I., CHELARU, S. M. (2019). Researches concerning the fight against *Cydia pomonella* L. from the apple tree plantation in the nord east area of Romania. *Current Trends in Natural Sciences*, 8, 15, 149-155.
- CHIȚULESCU, L., CRISTEA, S., (2018). Efficacy of some treatments on *Monilinia fructigena* (Aderh. &Ruhl.) Honey fungus attack on apple. *Annals of the University of Craiova-Agriculture, Montanology, Cadastre Series*, 47, 2, 75-81.
- HEREA, M., TALMACIU, M., BOBOC, C., TALMACIU, N., (2019). Observations Regarding the Abundance, Dynamics and Damage Caused by the *Cydia pomonella* L. and *Adoxophyes Reticulana* Hb. In Apple Tree Orchard. *Proceedings of the International Scientific Congress "Life sciences, a challenge for the future" Filodiritto International Proceedings*, 215-219.
- ROȘCA, I., OLTEAN, I., MITREA, I., TĂLMACIU, M., PETANEC D., BUNESCU H.Ș., ISTRATE, R., TĂLMACIU, N., STAN, C., MICU, L.M. (2011). *Tratat de entomologie general și specială, Editura Alpha MDN, Buzău*, 658-661.
- UNGUREANU-TANASA, C. C. (2006). Contribuții la studiul biologiei, ecologiei și combaterii integrate a principalilor dăunatori din plantațiile de măr din județul Botoșani., [https://www.uaiasi.ro/ro/files/doctorat/Rezumat_Ungureanu_Catalina, pdf](https://www.uaiasi.ro/ro/files/doctorat/Rezumat_Ungureanu_Catalina.pdf), 141-142.

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