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PROTECTION OF THE APRICOT CROP AGAINST DISEASES IN THE OSTROV FRUIT GROWING AREA

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Abstract: Due to its physiological, ecological and technological peculiarities of the species, apricot culture involves a whole series of challenges and requires special attention and fruit growers' skillness. Being an early flowering plant, sensitive to various diseases and pests, root asphyxiation, spring frosts and other unfavorable factors, yields are often reduced and are a factor that is limiting the areas and farmers' interest in the expansion and development of this crop. Also, the complex of diseases and pests to which this culture is exposed may cause the manifestation of the enigmatic disease called apoplexy or premature demise of the apricot. The paper highlights the importance and special role of effective disease control in an apricot orchard in the southern area of Dobrogea in order to obtain a quantitatively and qualitatively increased yield. A total of 11 phytosanitary treatments were applied to control brown rot, gumspot of stone fruit, scab and powdery mildew. The assessments at 7-10 days after each treatment for Comandor and Farbaly varieties proved a good efficacy ranging from 86.67 to 100%. So that the production of apricots intended for sale was approx 12 tons per hectare.

Keywords: *diseases, control, treatments, efficacy*

INTRODUCTION

Due to the quality and technological properties of its fruit, the apricot (*Prunus armeniaca* Mill.) is one of the most highly appreciated fruit species among consumers. Apricot trees come into bearing relatively quickly, achieve high and sustained yields year after year, and when grafted on the most suitable rootstocks, succeed on a variety of soil types (Bălan et al., 2008). On the other hand, poor resistance to diseases and returning frosts limit the ability to adapt to new growing environments and thus to spread the crop (Ghena & Branişte, 2003).

In Romania, apricot is cultivated on an estimated surface of 3-5% among all cultivated trees. This is because of temperature restrictions and susceptibility to spring hostile weather. The Ostrov-Băneasa area, located in the south-west of Dobrogea, in the neighborhood of the Danube, is a well-known area for apricot growing, offering favourable climatic and soil conditions for this activity. It benefits from higher thermal resources, shelter from the wind provided by the terraces, strong water albedo which ensures more intense sunshine and the thermoregulating effect of the water masses which increase atmospheric humidity (Chira et al., 2008).

Apricot is annually attacked by a large number of diseases which cause troubles, both in the orchard and in storage. The complex of diseases and pests linked with climatic variations lead to the enigmatic disease apoplexy which causes premature apricot dieback (Tomșa & Tomșa, 2003). Therefore, it is mandatory the preventive, safety treatments with contact and systemic fungicide products to provide the most effective protection.

The most common diseases in the Ostrov-Băneasa study area are: fruit monilliosis and mycotic branch blight, blossom blight or brown rot *Monilinia laxa* (Aderh & Ruhland) Honey, fruit monilliosis *M. fructigena* Honey, leaf blight and fruit spot *Stigmina carpophila* [(Léveillé) Adaskaveg, Ogawa & Butler], powdery mildew *Podosphaera tridactyla* [(Wallroth) de Bary], brown leaf spot *Venturia carpophila* (E. E. Fischer).

Brown rot caused by *M. laxa* is a devastating disease, endemic in Europe causing epidemics in most stone fruit orchards (Wormald, 1954; Byrde & Willets, 1977; Batra, 1991; Holb, 2004). The moniliosis is favoured by high humidity, low temperatures and generally this disease appears in spring, especially after heavy rains. *M. laxa* mainly affects flowers, young shoots and fruits. On flowers, it causes ovary abortion, on shoots it causes drying, on fruits it causes brown rot (Fideghelli et al., 1978). Infected blossoms wilt and turn brown. Infected fruit develops circular, light brown spots that rapidly expand to decay the flesh. Spurs on trees may be blighted close to harvest following systemic fungal invasion from infected fruit including 'mummies' (Diekmann & Putter, 1996). The destruction of flowers by moniliosis can affect an orchard or growing area all the more if the number of varieties in the orchard is smaller and the trees are in the same growing stage (Cociu et al., 1999). Wounded and unwounded fruit show susceptibility to the pathogen during growth (Mari et al., 2003). *M. fructigena* can be differentiated from *M. laxa* based on culture characteristics, isozyme variation and vegetative interactions (Penrose et al., 1976; Sonoda et al., 1982).

Stigmina carpophila disease is reported all over Europe which causes in favourable years a qualitative depreciation of the fruits, significant defoliation which can lead to physiological decline of the trees and yield loss. The disease can manifest itself on leaves, fruit and shoots. Leaves show round, 2-4 mm diameter, light brown spots with a brown or reddish border (Gheorghieș & Geamăn, 2003). The attack causes necrosis of the tissues, which then break off and fall out with the border and the leaves appear perforated, forming the "shot hole" symptom. Intensely attacked fruits at the young stage fall off and are tasteless. They are easily infected by moniliosis (Tomșa & Tomșa, 2003).

Venturia carpophila is an important fungal pathogen in the family *Venturiaceae*, the causal agent of scab in apricot and other species of *Prunus* L. Brownish-olive spots appear on the leaves, especially on the underside of the leaf area (Gheorghieș & Geamăn, 2003; González-Domínguez et al., 2017). Typical symptoms on fruit are black freckles, spots, and/or scabs of variable size that render the fruit unfit for market (Chen et al., 2017). Multiple spots may merge and form bigger lesions and can lead to massive skin cracking (Fisher, 1961).

Apricot powdery mildew caused by *P. tridactyla* is a common disease of the genus *Prunus*. It prefers the young stages of plants (Baicu & Șesan, 1996), attacking the leaves and shoots on which it forms a very fine, white, powdery mycelial coating that develops into a brown color with age. The disease is dangerous in nurseries, when a strong attack causes the leaves to wither and fall, leaving the seedlings defoliated (Severin et al., 2001). Some products applied for moniliosis can also control this disease (Gheorghieș & Geamăn, 2003).

The aim of this study was to highlight the importance of disease control in apricot orchards in the Ostrov-Băneasa area so that farmers should harvest increased production of handsome and healthy fruits.

MATERIALS AND METHODS

The research was carried out between January 2021 and Octomber 2022 at Frank 93 Prod SRL, Ostrov village, Constanta County. There were two apricot orchards, one of 13 ha with Comandor variety and the other of 2 ha with Farbaly variety, with rows of free-weed trees alternating with grass covered intervals. Two planting schemes were used, of 5x4.5 m

(Comandor planted 1992) and 4x3 m (Farbaly planted 2012). Both varieties were grafted on mirobolan.

Figure 1. Location of orchards

The maintainance of the orchard consisted on conventional practices for apricot production: autumn plowing on intervals between rows during plant dormancy, autumn prunning to ensure well spaced 1-year-old wood for fruiting and to shorten long shoots back to about 25-35 cm, the application of mastic (seeinland) on wounded branches, painting the tree trunks witk chalks. No treatment was applied to one row of each plot, which served as a control check. Fungicides were sprayed according to the scheme in the Table 1. Treatments were carried out with the Goldoni Star 75 tractor and an attached spraying equipment, the trailered atomizer 2000 liters AGR-P, Agri Ionica production.

Comandor is an apricot variety obtained in Romania by crossing between B17/52 and Mr 43/1 (Cociu et al., 1999), with ovoidal fruits and slightly flattened laterally, orange-yellow coloured, covered with pale red slightly spotted. The fruit pulp is light orange, with juicy consistency balanced taste, sweet and aromatic, dehiscent from the kernel. The ripening time is in the beginning of August. The tree is medium-small sized, with strong branches. It shows early fruiting as begins to bear fruits in the third year after planting. Flowering is late and the tree shows good resistance to frost and overwintering. There are a few lost flower buds in years with climatic accidents. Farbaly (IPS, France) has medium - large vigour, straight growing and good branching. This variety comes into bloom lately and flowers are not frost exposed. It bears fruits on long shoots. The fruits are reliable, fairly robust, elliptical with good firmness and cracking resistant, orange - skinned and half red on sun - bathed part of the fruit. The flesh is juicy and plenty of flavour. It is self-fertile cultivar, PPV virus resistant, but susceptible to Sharka. Trees wil bear fruits 3-4 years after planting. Both apricot varieties are grafted on mirobolan (*Prunus cerasifera*).

Diseases incidence (Pesinc %) was evaluated before each spray and after ten days until the latest treatment by visually rating 100 leaves, shoots, flowers or fruits (depending on part rated) on five trees per row, counting the percent of infected plant parts. It was used the following formula: $\text{Pesinc\%} = \frac{(n*100)}{N}$, where n represents number of plant organs affected and N is number of organs assessed (Vlad, 2020). The assessment of efficacy in the treated plots was made in relation to the untreated plot on an overall plot basis (scale 0-100%).

The efficacy of fungicide was calculated according to Abbott`s formula:

$$\text{Efficacy \%} = \frac{\text{Pesinc\% in untreated control - Pesinc\% in treated plot}}{\text{Pesinc\% in untreated control}} \times 100$$

. All data were subjected to statistical analysis provided by ARM-9 (P=.05, Student-Newman-Keuls) software. P-value was inserted below every chart to prove statistical differences between untreated check and treated plots.

Table 1. The fungicides used to control apricot diseases and the time of application in the orchard

Treat. No	Product (Active ingredient, conc.)	Rate	Time of application (BBCH)
1	Bouillie Bordelaise WDG (Copper from Bordeaux mixture, 200 g/kg)	5 kg/ha	00 / (dormancy, leaf buds and thicker flower buds closed, covered by dark brown scales)
2	Bouillie Bordelaise WDG	5 kg/ha	00 / (dormancy, leaf buds and thicker

	(Copper from Bordeaux mixture, 200 g/kg)		flower buds closed, covered by dark brown scales)
3	Curenox 50 (Metallic copper from copper oxychloride, 500 g/kg)	1.5kg/ha	51/ (inflorescence buds swelling: buds closed, light brown scales visible)
4	Merpan 80 WDG (captan, 800 g/kg) Orius 25 EW (tebuconazole, 250 g/l) Navu Forte (N, K, Ca, micorelements, 635,5 g/kg) Algamin (extracts of *Ascophyllum nodosum*, 150 g/l)	2 kg/ha 0.75 l/ha 4 kg/ha 2.5 l/ha	59 / (most flowers with petals forming a hollow ball)
5	Sercadis (fluxapiroxad, 300 g/l) Score 250 EC (difenoconazole, 250 g/l) Solar 10 -10 -10+ME (NPK + microelements, 302.25 g/kg) Kelom EDTA Calcium 140 (chelated CAO, 140 g/Kg) Citogen Fruit (auxins, cytokinins, gibberellic acid, chelated microelements, amino acids, 142.94 g/l) Proaqua Trio (adjuvants, 425 g/l) Trisilon (trisiloxane organosilicone copolymers, esterified vegetable oil, 400 g/l)	0.3 l/ha 0.15 l/ha 5 kg/ha 1 kg/ha 2 l/ha 1.5 l/ha 0.2 l/ha	62 / (about 20% of flowers open)
6	Signum (Boscalid + piraclostrobin, 267 + 67 g/kg) Syllit 400 SC (dodine, 400 g/l) Fertigofol Ultra (NPK + microelements, 195.83 g/l) Borocal (Ca 10%, B 0.3%, Mg 0.5%) Proaqua Trio (adjuvants, 425 g/l) Trisilon (trisiloxane organosilicone copolymers, esterified vegetable oil, 400 g/l)	0.5kg/ha 0.2 l/ha 4 l/ha 2 l/ha 1.5 l/ha 0.2 l/ha	65 / (full flowering, at least 50% of flowers open, first petals falling)
7	Merpan 80 WDG (captan, 800 g/kg) Luna Experience 400 SC (fluopiram + tebuconazol, 400 g/l) Algamin (extracts of *Ascophyllum nodosum*, 150 g/l) Cropmax (macro + microelements, auxins, citokinines, gibberelines, organic aminoacids,vegetal vitamins, vegetal enzimes)	2 kg/ha 0.5 l/ha 2.5 l/ha 2 l/ha	69 / (end of flowering, all petals fallen)
8	Xilato ZnMn (Zn 10% p/p + Mn 5% p/p) Proaqua Trio (adjuvants, 425 g/l) Trisilon (trisiloxane organosilicone copolymers, esterified vegetable oil, 400 g/l)	2.5 kg/ha 1.5 l/ha 0.2 l/ha	75 / (fruit about half final size)
9	Folicur Solo 250 EW (tebuconazole, 250 g/l) Chorus 50 (ciprodinil, 500 g/kg) Thiovit Jet 80 WG (sulphur, 800 g/kg) Cropmax (macro + microelements, auxins, citokinines, gibberelines, organic aminoacids,vegetal vitamins, vegetal enzimes) Proaqua Trio (adjuvants, 425 g/l) Trisilon (trisiloxane organosilicone copolymers, esterified vegetable oil, 400 g/l)	0.75 l/ha 0.6 kg/ha 6 kg/ha 2 l/ha 1.5 l/ha 0.2 l/ha	77 / (fruit about 70% of final size)
10	Score 250 EC (difenoconazole, 250 g/l) Kenja (isofetamid, 400 g/l) Kelom EDTA Calcium 140 (chelated CAO, 140 g/Kg)	0.15 l/ha 0.9 l/ha 1l/ha	81 / (beginning of the fruit colouring)
11	Proaqua Trio (adjuvants, 425 g/l) Trisilon (trisiloxane organosilicone copolymers, esterified vegetable oil, 400 g/l)	 1.5 l/ha 0.2 l/ha	85 / (colouring advanced)

RESULTS AND DISCUSSIONS

Within Ostrov fruitgrowing area, surrounded by Danube branches and Bulgarian border, apricot has many followers (small farms but even large farms), fact that makes possible the neverceasing existence of diseases inoculum. Under favorable conditions, infections may occur and can endanger apricot orchards. Infection with moniliosis is forwarded by the microclimate formed by the proximity of Danube, which brings extra

humidity, and by the temperature difference between day and night, as noted in the orchards. The evolution of the incidence of this pathogen is shown in Figure 2 and Figure 3.

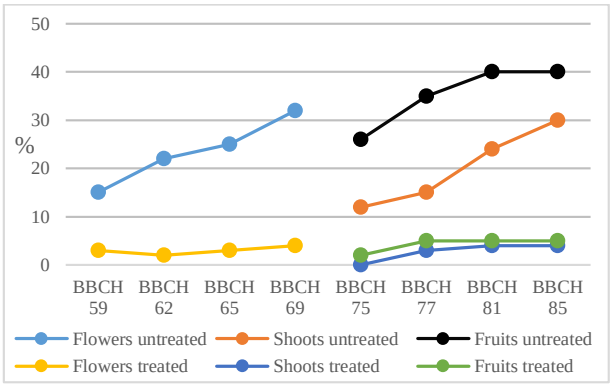

Figure 2. *Monilinia* Pesinc in Comandor variety
P-value = 0.000001

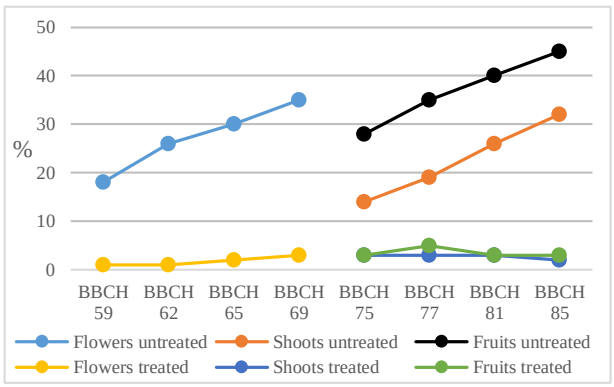

Figure 3. *Monilinia* Pesinc in Farbaly variety
P-value = 0.000004

Incidence In spring 2022, on some days, the temperature dropped below 15˚C and atmospheric humidity exceeded 75%. As a result, symptoms of brown rot have appeared and its incidence evolved in the untreated samples as follows: in Comandor, on flowers (Figure 4), from 15 (BBCH 59) to 32% (BBCH 69); in Farbaly, from 18 (BBCH 59) to 35% (BBCH 69). Infection on shoots (Figures 5 and 6) followed, from 15 (fruit about half final size) to 30% (colouring advanced) in Comandor and from 14 (BBCH 75) to 32% (colouring advanced) in Farbaly. Infection on fruit started in June, its incidence evolving from 26 (fruit about half final size) to 40% (BBCH 85) in Comandor and from 28% (BBCH 75) to 45% (BBCH 85) in Farbaly. It was noted that the Farbaly was slightly more susceptible to pathogen infection than Comandor on all parts investigated, despite the age difference between the plantations.

The assessments carried out at 7-10 days after treatments proved a limitated incidence of moniliosis on flowers, shoots and fruits in orchard where phytosanitary treatments along with fertilizers and adjuvants were applied. Incidence of brown rot in apricot at both varieties did not exceeded 5% at any time of assessments and demonstrated the utility of interventions. As pathogen can occur in 48 hours, we noted at 7 day after each treatment in Comandor sample the following values: on flowers, from 0 (BBCH 59) to 4% (end of flowering); at Farbaly: from 1 (BBCH 59) to 3% (end of flowering). On shoots, from 3 (BBCH 75) to 4% (BBCH 85) at Comandor and from 3 (fruit about half final size) to 2% (colouring advanced) at Farbaly. On fruits, from 2% (BBCH 75) to 5% (BBCH 85) at Comandor and from 3% (fruit about half final size) at 3% (colouring advanced) - Farbaly variety.

Figure 4. Moniliosis on flowers

Figure 5. Moniliosis on shoots

Figure 6. Flags shoots

The evolution of the pathogen *S. carpophila* is shown in Figure 7 and Figure 8. At the beginning of the summer period, specific shot - hole attack symptoms were observed, first on leaves and then on fruits. Thus, in the untreated check of Comandor variety, on leaves, the incidence evolved from 25 (fruit about half final size stage) to 35% (colouring advanced), and on fruits, from 20 to 33%. There was a progressive increase up to BBCH 81, after which the pathogen infection stops.

In the treated orchard there was a very low incidence of leaf spot, which was constant at 2% on leaves up to BBCH 85, and on fruits it increased by only one unit during fruit growing, from 0 at fruit about half final size to 1% at fruit colouring. The variety Comandor is recognised as a resistant cultivar to this pathogen, which does not develop itself at higher temperatures over 30˚C.

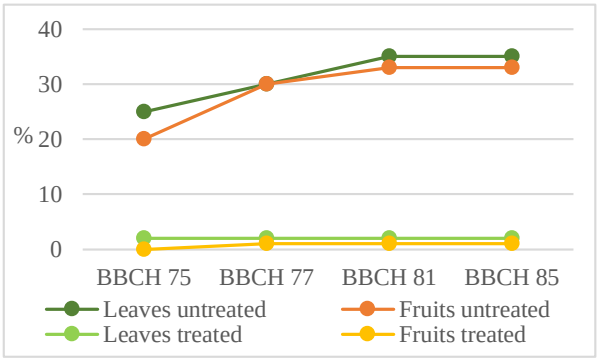

Figure 7. *S. carpophila* Pesinc in Comandor variety
P-value = 0.0000

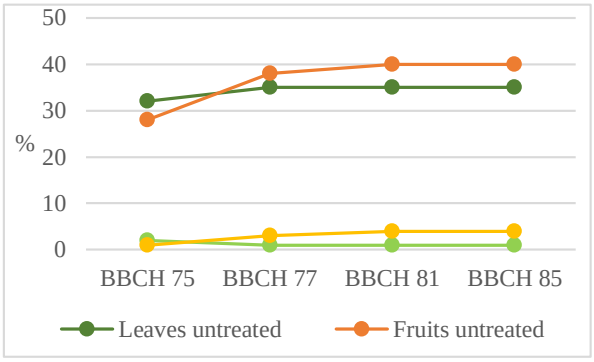

Figure 8. *S. carpophila* Pesinc in Farbaly variety
P-value = 0.00001

Infection by *S. carpophila* (Figure 9) was obvious in the Farbaly plantation as well, with symptoms also appearing from the beginning of summer. It should be noted that this plantation is flanked by 2 orchards planted with drupaceae species: plum (Angeleno variety) and cherry (Skeena variety). Under these conditions, in the Farbaly variety, the incidence evolved from 32 when fruits were about half final size to 35% (colouring advanced stage) on the leaves and from 28 to 40% on fruits in the untreated control. It was found that from BBCH 77, the infection incidence (35%) did not grow further on leaves. On fruits there was a sharp increase from BBCH 75 to BBCH 77 of 10%, after which infection stagnated at forty percents. Disease incidence in treated plot was 1% on leaves and 4% on fruits before harvest season. This fruit growing area is not so much humid but it almost always rains at the end of spring.

Figure 9. Symptoms of shot-hole of stone fruit

The rainfall during May-June helped the onset of apricot brown spot or apricot scab infection, which occurred in the Comandor variety on the leaves at an incidence of 19 (BBCH 75) and increased to 27% (BBCH 81 and 85) in the untreated control (Figure 10). A significant attack was recorded on fruit, reaching an incidence of 30 at BBCH 85, rising from 12% when fruits were about half final size. Attacked fruits had an unpleasant appearance, shrivelled skin and cracked, and the flesh had a bland, non-flavoured taste. In contrast, in treated plots protected by the fungicides included in the protection programme, the incidence of the pathogen at BBCH 85 was only 2% on both leaves and fruit. This proves the usefulness of copper treatments during dormancy and captan treatments during vegetation.

In Farbaly, an incidence of 21% (BBCH 75) was recorded on leaves, which increased to 30% (BBCH 81 and 85) in the untreated control (Figure 11). An even more intense attack was recorded on the fruits, reaching a Incidence of 45% at BBCH 85, starting at 15% at BBCH 75. This affected the appearance and therefore also the marketability of the fruits for the retail market.

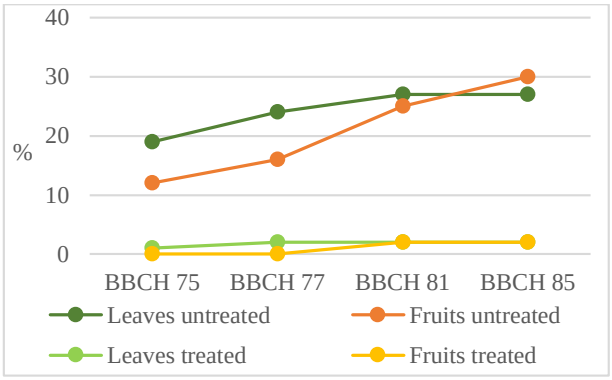

Figure 10. *V.carpophila* Pesinc in Comandor variety
P-value = 0.000000

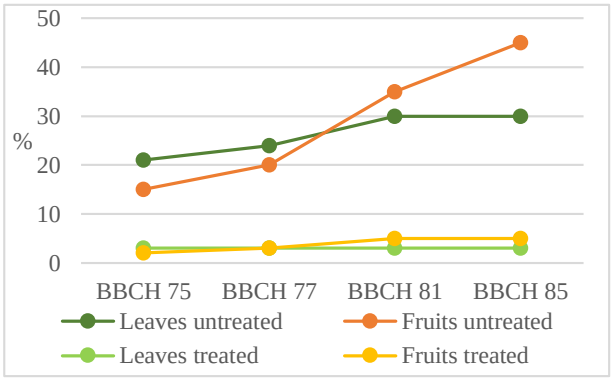

Figure 11. *V.carpophila* Pesinc in Farbaly variety
P-value = 0.000252

In the treated sample, the Incidence of the pathogen at each observation time (BBCH 75, 77, 81 and 85) was 3% on leaves, and on fruit starting at 2% at BBCH 75 and reaching up to 5% at BBCH 85. The slightly higher susceptibility of Farbaly to cryptogamic diseases compared to Comandor was noted again, even though there is a considerable age difference between the two orchards.

In the Ostrov fruit-growing area, apricot has been grown for a long time, so there is a high load of pathogenic inoculum. Due to climatic conditions similar to those in the Mediterranean area, the symptoms of powdery mildew were also found here on untreated leaves of the Comandor variety, with an incidence of 5 at BBCH 75, progressively increasing to 20% at BBCH 85. A fine cover formed by isolated pale-white spots with undefined outlines was identified on both leaf surfaces, but especially on the upper surface.

In the sample where phytosanitary treatments were applied, no symptoms of powdery mildew were noted, so the incidence was 0% at each observation time (Figure 12). The presence of this pathogen was not reported on fruits.

In Farbaly, an incidence of 3% was recorded on the leaves at BBCH 75, which increased to 25% at BBCH 85 in the untreated control (Figure 13). In the treated side, pathogen infection was not reported in the first two observation times (BBCH 75 and 77) and finally reached the threshold of only 2% at colouring advanced stage. Although it exists, lately having a more general spread, this pathogen was however not a disease that causes too much damage, the parasitic effect of the fungus that produced it being rather weak. It should however be controlled for the side effects it could induce in later years.

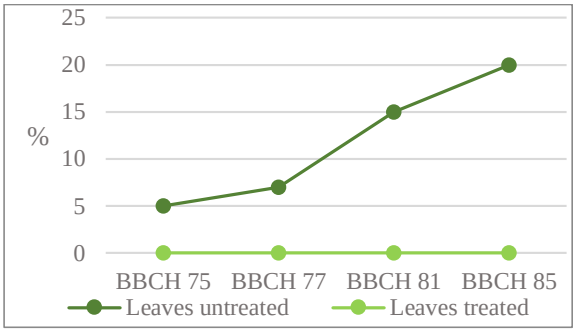

Figure 12. *P. tridactyla* Pesinc in Comandor variety
P-value = 0.015229

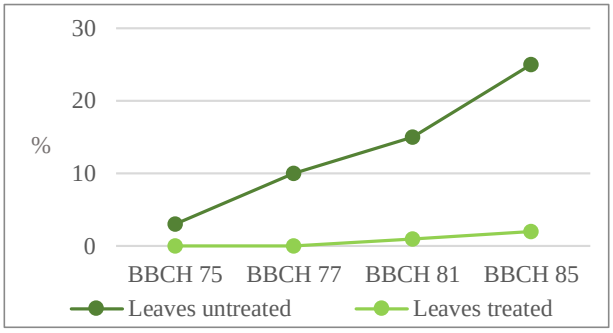

Figure 13. *P. trydactyla* Pesinc in Farbaly variety
P-value = 0.03615

Efficacy The most important disease of apricot has been controlled at all stages of growth because of the serious impact that moniliosis infection can have upon the yield and quality of fruits. Thus, in the variety Comandor (Figure 14), at BBCH 85, the effectiveness of phytosanitary treatments on flowers was 87.5% and in the variety Farbaly 91.43%, 10 days after the treatment carried out at BBCH 69. On shoots, an efficacy of 86.67% was obtained in Comandor and 93.75% in Farbaly, 10 days after BBCH 69. The most important results were obtained on fruits against the pathogen *M. fructigena*, where 87.60% efficacy was recorded on Comandor and 93.33% on Farbaly, after the last treatment at BBCH 85.

The higher efficacy of Farbaly is worth mentioning, although the Incidence of infection was slightly higher than in Comandor at the untreated control samples. The Farbaly plantation is established in 2012, so it is 22 years younger. In spite of being recognised as diseases resistant genetically, the Comandor variety reacted a little weakly to the phytosanitary treatments.

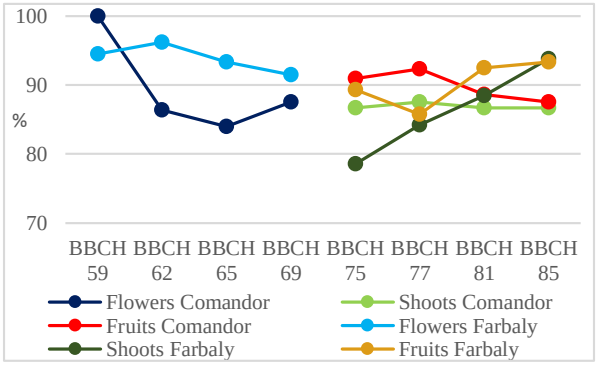

Figure 14. Effectiveness in *Monilinia* sp.
P-value = 1.55515

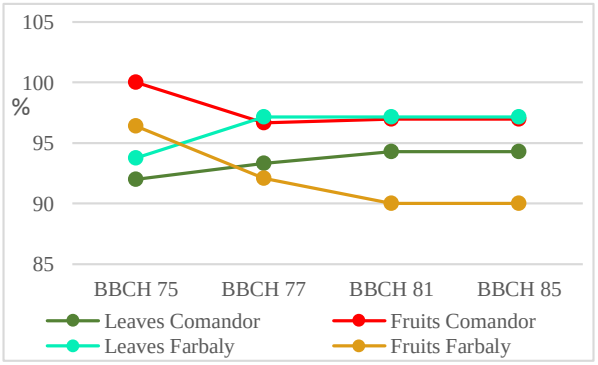

Figure 15. Effectiveness in *S. carpophila*
P-value = 0.07946

S. carpohila, leaf spotting and shot-hole of apricot fruits is another mycosis that needs to be controlled because it degrades the quality of the fruit and greatly reduces the assimilation capacity of the leaves. In the plantations studied, it was successfully controlled, the effectiveness being 94.29% on leaves and 96.97% on fruit in the Comandor variety. In Farbaly, the efficacy of the treatments applied was also at high parameters, with 97.14% on leaves and 90% on fruit, 10 days after treatment at BBCH 85 (Figure 15). This ensured a prodigious crop with a very high percentage of quality fruits, good - looking, which gave them a high degree of marketability.

The effectiveness of the disease control programme applied to apricot has also been demonstrated for the pathogen *V. carpophila* (Figure 16). The results were satisfactory, with

values of 92.59% on leaves and 93.33% on fruit for Comandor and 90.00% on leaves and 88.89% on fruit for Farbaly 10 days after treatment at BBCH 85.

However, there is a slight susceptibility of Farbaly to brown spot. The Comandor variety has behaved very well due to its qualities of genetic resistance to diseases obtained by the Romanian specialists following the breeding work.

For the pathogen *P. tridactyla* (Figure 17), the phytosanitary products included in the protection scheme applied to the apricot crop in the two varieties showed a very good efficacy, 100% in Comandor and 92% in Farbaly after the last treatment. Observations showed that no trees were affected by powdery mildew in the Comandor plot at each evaluation However, a percentage of 8% infected organs has been assessed in Farbaly orchard, in the form of curled leaves covered by white, powdery, small patches on the top side of foliar surface.

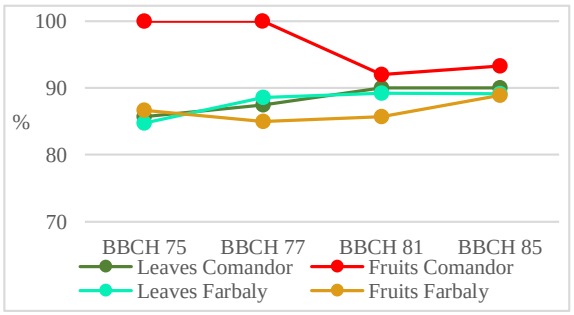

Figure 16. Effectiveness in *V. carpophila*
P-value = 0.982283

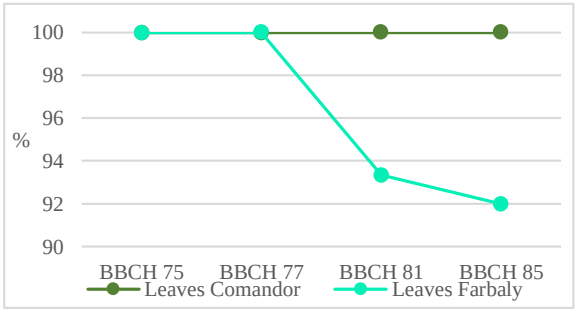

Figure 17. Effectiveness in *P. tridactyla*
P-value = 0.612492

CONCLUSIONS

The results obtained in this study showed a significant activity of the fungicide products in controlling pathogens that endanger this crop, with efficacy ranging from 86.67 to 100%. No phytotoxicity was observed.

The most dangerous pathogen, monilliosis, was successfully controlled, creating the conditions for a high yield, commercial appearance and increased marketability;

Leaf blight and fruit spot was successfully counteracted thanks to the judicious planning of the treatment schedule, which took into account the critical phases in the vegetation, but also the times of dormancy. Contact products should be combined with systemic products and active substances with different modes of action should be alternated.

Protection of apricot against mycorrhizal leaf spot and fruit blotch also includes treatments against brown spot (scab).

Powdery mildew has not posed particular problems, but it should be considered and controlled. Almost all products applied for brown rot proved to have had secondary effects for powdery mildew.

Correct assessment of the growth and development stages of the trees at the same time as the critical periods requiring phytosanitary interventions is of utmost importance.

In autumn, after harvesting and irrigating for revival, an antifungal treatment is mandatory to annihilate forms of resistance, improved with fertilizers containing microelements to increase resistance to negative temperatures over winter.

REFERENCES

BAICU, T., ȘESAN, T. E. (1996). Fitopatologie agricolă. Editura Ceres, București, 316.

BATRA, L.R. (1991). World species of *Monilinia.* Their biology, biosystematics and control. *Mycologia Memoiro*, 16, 246.
BĂLAN, V., STĂNICĂ, F., CHIRA, L., ASĂNICĂ, A., OPREA, M., TOPOR, E., HOZA, D., MARIN, I. D., CORNEANU, M., TUDOR, V., CHIRA, A., NISTOR, E., CHIRECEANU, C., ŞTEFAN, S. (2008). Caisul şi caisele. Editura Ceres, Bucureşti, 686.
BYRDE, R.J.W., WILLETS, H.J. (1977). The brown rot fungi of fruit. Their biology and control. *Pergamon Press*, Oxford, 171.
CHEN, C., BOCK, C.H., WOOD B.W. (2017). Draft genome sequence of *Venturia carpophila*, the causal agent of peach scab. *Standards in Genomic Sciences*, 12, 68.
CHIRA, L., CHEREJI, V., ROMAN, M. (2008). Caisul şi piersicul. Editura M.A.S.T., Bucureşti, 272.
COCIU, V., BOTU, I., SERBOIU, L. (1999). Progrese în ameliorarea plantelor horticole din România (Volumul I, Pomicultură). Editura Ceres, Bucureşti, 215.
DIEKMANN, M., PUTTER, C.A.J. (1996). Stone fruits. *FAO/IPGRI. Technical Guidelines for the Safe Movement of Germplasm.* No.16 collaboration with *Istituto Sperimentale per la Patologia Vegatale*, Roma, 109.
FIDEGHELLI, C., QUARTA, R., DELLA STRADA, G. (1978). Osservazioni in campo sulla sensibilità alla Monilia laxa (Aderh. et Ruhl.) Honey di cultivar di albicocco. *Rivista di ortoflorofrutticoltura italiana*, 62, 2, 177-190.
FISHER, E.E. (1961). *Venturia carpophila* sp. nov., the ascigerous state of the apricot freckle fungus. *Transactions of the British Mycological Society*, 44, 337-342.
GHENA, N., BRANIŞTE, N. (2003). Cultura specială a pomilor. Editura Matrix Rom, Bucureşti, 543.
GHEORGHIEŞ, C., GEAMĂN, I. (2003). Bolile plantelor horticole. Editura Universitas, Bucureşti, 330.
GONZÁLEZ-DOMÍNGUEZ, E., ARMENGOL, J., ROSSI, V. (2017). Biology and Epidemiology of *Venturia* Species Affecting Fruit Crops. *A Review. Frontiers in Plant Science*, 19 September 2017 *Sec. Plant Breeding*. https://doi.org/10.3389/fpls.2017.01496.
HOLB, I.J. (2004). The brown rot fungi of fruit crops (*Monilinia* spp.). II. Important features of their epidemiology. *International Journal of Horticultural Science*, 10, 4, 17-35.
MARI, M., CASALINI, L., BARALDI, E., BERTOLINI, P., PRATELLA, G.C. (2003). Susceptibility of apricot and peach fruit to *Monilinia laxa* during phenological stages. *Postharvest Biology and Technology*, 30, 1, 105-109.
PENROSE, L.J., TARRAN, J., WONG, A.L. (1976). First record of *Sclerotinia laxa* Aderh. & Ruhl. in New South Wales: differentiation from *S. fructicola* (Wint.) Rehm. by cultural characteristics and electrophoresis. *Australian Journal of Agricultural Research*, 27, 4, 547-556.
SEVERIN, V., CONSTANTINESCU, F., FRĂSIN, L. (2001). Fitopatologie. Editura Ceres, Bucureşti, 288.
SONODA, R.M., OGAWA, J.M., MANJI, B.T. (1982) Use of interactions of cultures to distinguish Monilinia laxa from M. fructicola. *Plant Disease*, 66, 325-326.
TOMŞA, M., TOMŞA, E. (2003). Protecţia integrată a pomilor şi arbuştilor fructiferi la începutul mileniului III. Editura Geea, Bucureşti, 164.
VLAD, F.F. (2020). Fitopatologie. *Lucrări practice pentru studenţii facultăţii de Horticultură*, Editura Ex Terra Aurum, Bucureşti, 200.
WORMALD, H. (1954). The brown rot disease of fruit trees. Ministry of Agricultures, Fisheries and Food, *Technical Bulletin* no. 3, London.