Scientific Papers. Series B, Horticulture. Vol. LXVI, No. 2, 2022
Print ISSN 2285-5653, CD-ROM ISSN 2285-5661, Online ISSN 2286-1580, ISSN-L 2285-5653

EDIBLE CLIMBING ROSE DISEASES MANAGEMENT IN THE ORGANIC SYSTEM

Alexandra Maria MARIN, Ana Cornelia BUTCARU, Beatrice Michaela IACOMI

University of Agronomic Sciences and Veterinary Medicine of Bucharest, 59 Mărăşti Blvd, District 1, Bucharest, Romania

Corresponding author's email: anabutcaru@gmail.com

Abstract

This study presents the results of the organic diseases management strategy applied to the climbing edible rose plantation. The research was carried out on the Experimental Field of the Faculty of Horticulture - USAMV Bucharest established in 2015 with three climbing cultivars from the David Austin collection: Crown Princess Margareta, Falstaff, and Brother Cadfael. Two main pathogens which affect susceptible rose cultivars worldwide were detected: Podosphaera pannosa var. rosae (powdery mildew) and Diplocarpon rosae (black spot). Our management protection scheme was based on environmentally friendly practices and organic products to prevent the pathogens severity and/or as natural resistance inducers. Both black spot and powdery mildew were present with a very low degree of attack (below 1%). These results could be explained by the efficacy of our organic scheme in preventing and limiting both pathogens incidence and severity. The influence of varieties and their position in the field on disease occurrence were analysed.

Key words*: organic edible climbing rose, powdery mildew, black spot, integrated management.*

INTRODUCTION

The rose has been cultivated for centuries, both for ornamental and therapeutic purposes, for its beauty and fragrance, or food purposes like the special product obtained from its petals, and also cosmetically for its essential oils and not only (Lambraki, 2001; Hessayon, 2005; Milică et al, 2010; Bojor & Răducanu, 2010; Lia et al, 2014; Park et al, 2016; Sengul et al, 2017; Dong et al, 2017; Fernandes et al, 2017; Pires et al, 2017).

Organic farming systems include production methods that combine traditional knowledge with scientific advances in agricultural fields. The main objectives of this culture system are both to obtain healthy and quality plants, respectively products, and to protect the biosphere and the planet's resources.

One of the principles of this system is based on the minimization of economic and ecological risks and the maximum utilization of local resources.

The organic production method differs from the conventional one by avoiding the use of chemical fertilizers and synthetic pesticides. The use of this production system determines a lower risk of contamination of horticultural products, which are healthier and safer for human consumption (Wagner, 2010; Wagner, 2012; Dinis et al., 2015; Tsanaktsidis et al., 2015; Commission Regulation (EC) No 889/2008; Regulation (EU) 2018/848; Boiu-Sicuia & Cornea, 2020; Ciotea et al., 2021; Stan et al., 2022).

Rose is susceptible to a large number of diseases, some of them being more severe and having an important negative impact on yield quantity and quality (Chalova et al., 2017).

Diplocarpon rosae (black spot) and *Podosphaera pannosa* (powdery mildew) are the most common and damaging fungal pathogens in roses (Debener & Byrne, 2014; Byrne et al., 2019), affecting cultivars worldwide (Gachomo et al., 2006; Munnenkhoff et al., 2017)

This study aimed to evaluate the effectiveness of the organic diseases management strategy applied to a climbing edible rose plantation in limiting the attack of the main pathogens. Special attention was paid to the influence of the plant position in the plantation correlated to the influence of the windbreak.

MATERIALS AND METHODS

Experiments were conducted on the climbing edible roses experimental plot of the Faculty of

Horticulture, in the Phytopathology Laboratory of the Faculty of Agriculture - Department of Plant Sciences, and in the Fruit Growing Laboratory from the Research Center for Studies of Food Quality and Agricultural Products, within the University of Agronomic Sciences and Veterinary Medicine of Bucharest.

The experimental plot, established in 2015, includes three edible climbing roses varieties: 'Falstaff', 'Brother Cadfael', and 'Crown Princess Margareta' (Figure 1). The plantation has a windbreak planted with *Populus balsamifera*.

Figure 1. Edible climbing roses ('Brother Cadfael', 'Crown Princess Margareta', 'Falstaff')

The plantation is in a super-intensive system, the planting distances being 2m between rows and 1 m per row (Figure 2) (Butcaru & Stănică, 2018).

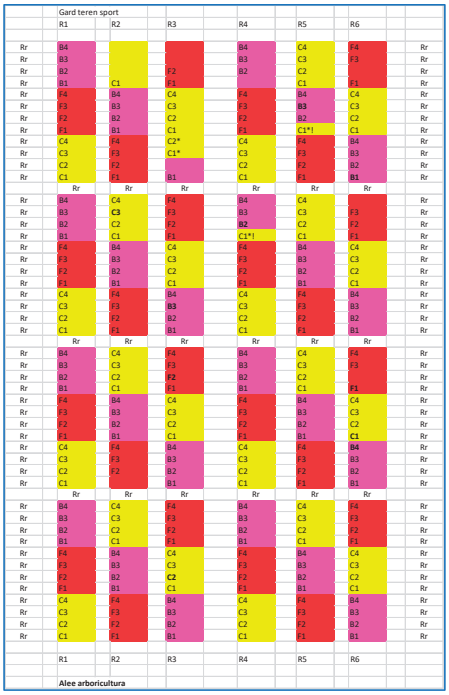

Figure 2. Rose planting scheme (B - 'Brother Cadfael', C - 'Crown Princess Margareta', F - 'Falstaff')

An organic technology was applied including pruning, trellising, weeds management, irrigation, harvesting, fertilization, and pest and disease scheme application.

During the experiment, fertilization applied consisted of an algae product, "Super fifty" (0.5%), and a new Romanian patented product, "Folarex" (0.45%), obtained from animal manure.

Pest and disease organic fertilization scheme consisted of cupric and sulphury based products, sodium bicarbonate, raw caw milk, neem oil, garlic extract, paraffin oil, chitosan, orange oil, propolis tincture-based products, home-made or commercial.

For disease monitoring and evaluation, field monitoring was carried out to determine the degree of black spot and powdery mildew infection in the plantation.

To estimate the attack of the black spot, three shoots per plant from each side of the plantation and a group inside it were analyzed. On the shoots taken under observation, 15 mature leaves, starting from the tip to the base were analyzed. To estimate the severity of the attack, a 6-class grading scale was used (Figure 3).

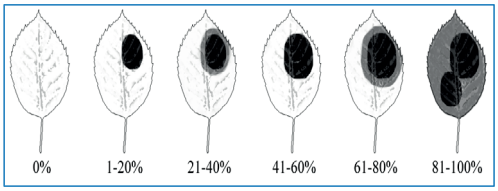

Figure 3. Illustrated scale for estimating the severity of black leaf spot attack in rose (Yasin et al., 2016)

To estimate the powdery mildew attack, three shoots from each side of the plantation and a group inside it, were analyzed. On the observed shoots, 10 mature leaves, starting from the tip to the base were analyzed. The 6-class scoring scale was used to estimate the severity of symptoms (Yan, 2006).

The first monitoring took place in July, and the second in October 2020. For each variety, its behavior to pathogen attack was analyzed, on each side of the lot, respectively North, South, West, and East. Groups of plants from inside the plot were also analyzed.

Based on primary data, disease incidence (DI, %), disease severity (DS, %), and attack degree (AD, %) were calculated.

Disease incidence, DI (%) = leaves with disease symptoms/total leaves observed x 100
Disease severity, DS (%) = black spot and powdery mildew severity were rated on 1 to 6 classes.
DS (%) = ∑(ixf)/n, where i = class or disease severity (%); f = number of leaves observed in this category; n = total number of leaves with symptoms.
The degree of attack, AD (%), was calculated according to the formula: AD (%) = DI x DS/100.
For the descriptive statistics of the data, Microsoft Excel 2016 and IBM SPSS v. 28.0.1.1 were used, for a significance level of p = 0.05.

RESULTS AND DISCUSSIONS

Following the monitoring of the plantation, the presence of powdery mildew and black spot attack was identified during the study period.
Black spot attack was observed, in the 'Brother Cadfael' variety, in both monitoring, the plants on the West side (0.21%) in July and the South, respectively inside parts (0.11%) in October, presented a higher degree of attack than those on the eastern side (0.03% in July and 0.02% in October) (Figure 4).

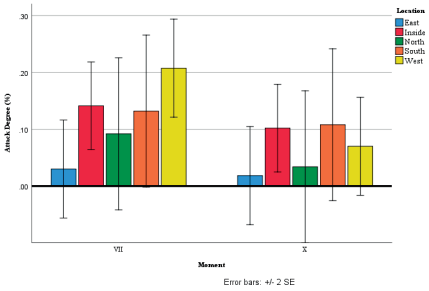

Figure 4. The influence of the location and moment on the black spot attack degree at 'Brother Cadfael' cultivar

At the 'Crown Princess Margareta' variety, a similar behavior to the 'Brother Cadfael' variety was observed regarding the black spot attack. A significant influence of the location was observed only at the second moment of the evaluation. For the attack degree, values ranged from 0.03% (North and East sides) to 0.16% (Southside) in July, respectively 0.11% (East side) to 0.07% (South and inside locations) in October (Figure 5). Combining the two experimental factors, location and moment, there was not a significant influence at this variety on the disease attack degree.

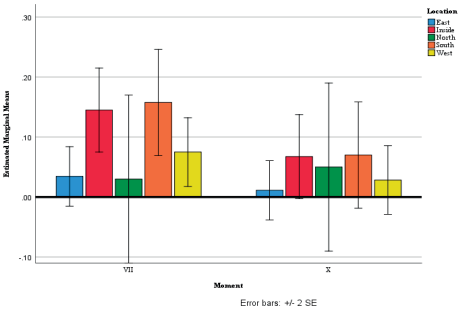

Figure 5. The influence of the location and moment on the black spot attack degree at 'Crown Princess Margareta' variety

Susceptibility to black spot attack was observed in the 'Falstaff' variety. The degree of attack increased at the second monitoring, compared to the first, but similar to the other varieties, a very small value was observed on the eastern side (0.03% July and 0.04% October) (Figure 6). An increased rate was observed inside the plantation, between the two moments, followed by the southern and western locations.

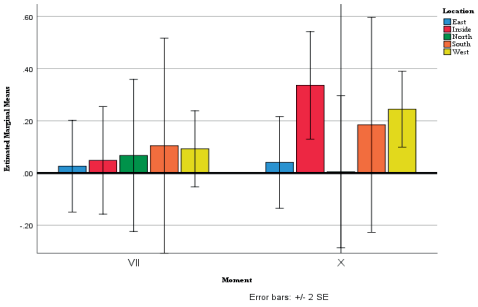

Figure 6. The influence of the location and moment on the black spot attack degree at 'Falstaff' cultivar

When all three cultivars were analysed, a significant influence of the location on the attack degree of the black spot was observed in July (figure 7). A slight decrease of the attach was observed to 'Brother Cadfael' and 'Falstaff' varieties, most caused by the summer pruning and protection scheme.

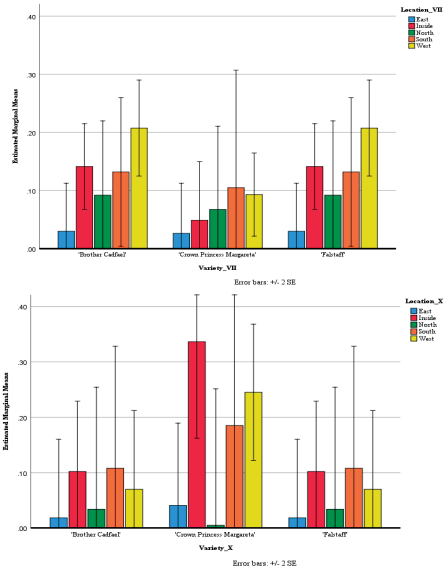

Figure 7. The influence of the variety, location, and moment on the black spot attack degree

Regarding the powdery mildew attack, in the first moment of evaluation, for all three varieties, only traces were identified. Due to favourable climatic conditions, specific for the *Podosphaera pannosa*, at the second evaluation plants affected were observed. In October, the powdery mildew attack registered a degree of attack between 0.06% in the 'Crown Princess Margareta' variety and 0.97% in the 'Falstaff variety'. The analysed varieties behaved similarly, with the values of the degree of attack being reduced.

At the 'Brother Cadfael' variety, the highest values were observed at the inside location (0.13%) and the lowest at the eastern part (0.01%) (Figure 8).

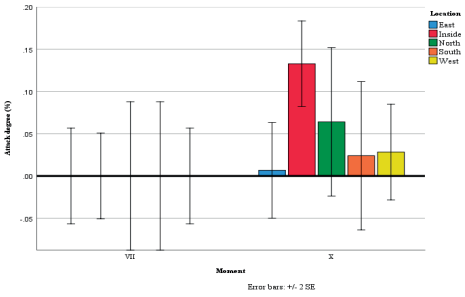

Figure 8. The influence of the location and moment on the powdery mildew attack degree at 'Brother Cadfael' variety

The 'Crown Princess Margareta' variety showed a higher degree of attack on the southern side (0.65%) while at the 'Falstaff' variety, the degree of attack varied between 0.03% (inside the plantation) and 1.91% (at the plants on the western side) (Figure 9).

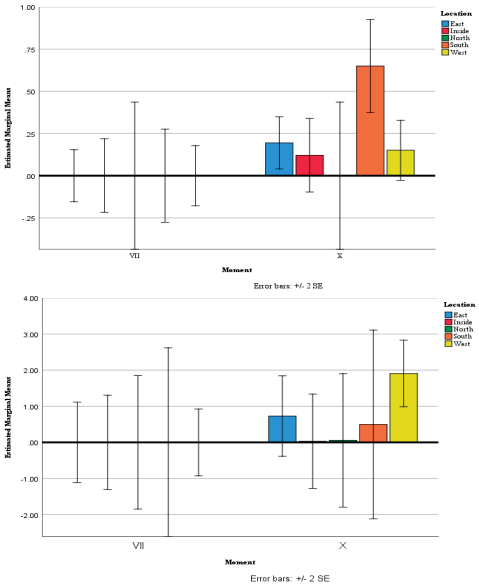

Figure 9. The influence of the location and moment on the powdery mildew attack degree at 'Crown Princess Margareta' (up) and 'Falstaff' (down) varieties

These reduced values of the degree of attack, both black spot and powdery mildew, can be considered the result of the application of organic technology, against the climatic background of the year in which the observations were made. They are similar to previous observations made (Butcaru & Stănică, 2018). The positive effect of neem, algae, or sodium bicarbonate is in accordance with Stangarlin et al. (2011), Plaza et al. (2004), Palou et al. (2002), Oliver et al. (1998), Palmer et al. (1997).

CONCLUSIONS

In the edible climbing rose plantation, managed in an organic system, the presence of the attack of black spot (*Diplocarpon rosae*) and powdery mildew (*Podosphaera pannosa*), two of the diseases known for the damage produced by this crop, was detected.

Black spot and powdery mildew infections occurred naturally. The protection treatment scheme reduced the attack to low levels (below 1%). Phytotoxicity, chlorosis, defoliation, discoloration, or stunting were not observed in any of the treated plants.

The products that have been integrated into the protection program ("Bouille bordelaise", "Prevam", "Garex", "Altosan") as well as for fertilization ("Folarex", "Super fifty") are known for their preventive action and have proven their efficacity.

The hypothesis regarding the significant influence of the location of plants on the disease attack degree, correlated to the effect of the windbreak was partially demonstrated, specific to some varieties and moments. Further and extended research can be valuable on this topic, important in the specificity of the newest climate change conditions and rose plant particularities.

REFERENCES

Byrne, D.H., Pemberton, H.B., Holeman, D.J., Debener, T., Waliczek, T.M., Palma, M. A. (2019). Survey of the rose community: desired rose traits and research issues. *Acta Hortic*. 1232: 189–192.

Boiu-Sicuia, O.A. & Cornea, C.P. (2020). Bacterial endophytes improving plant growth. AgroLife Scientific Journal, 9(2), 56-70.

Bojor O. & Răducanu D. (2007). *Plante şi miresme biblice, Hrană pentru suflet şi trup*, Bucharest:RO, Fiat Lux Publishing House.

Butcaru, A.C. & Stănică, F. (2018). Cultivation technology of organic roses for petal production. *Scientific Papers, Series Horticulture, LXII*, 203-210.

Chalova, V., Manolov I., Manolova V. (2017). Challenges for commercial organic production of oil-bearing rose in Bulgaria. *Biological Agriculture & Horticulture*, 1-13.

Ciotea, D., Shamtsyan, M. & Popa, M.E. (2021). Antibacterial activity of peppermint, basil and rosemary essential oils obtained by steam distillation. *Agrolife Scientific Journal, 10* (1), 75-82.

Commission Regulation (EC) No 889/2008 of 5 September 2008 laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 on organic production and labelling of organic products with regard to organic production, labelling and control

Debener, T., Byrne, D.H. (2014). Disease resistance breeding in rose: current status and potential of biotechnological tools. *Plant Sci*. *228*:107–117.

Dong, X., Jiang, X., Kuang, G., Wang, Q., Zhong, M., Jin, D. & Hu, J. (2017). Genetic control of flowering time in woody plants: Roses as an emerging model. *Plant Diversity 39*, 104-110.

Fernandes, L., Casal, S., Pereira, J.A., Saraiv, J.A. & Ramalhosa, E. (2017). Edible flowers: A review of the nutritional, antioxidant, antimicrobial properties and effects on human health, *Journal of Food Composition and Analysis 60*, 38–50.

Gachomo, E.W., Dehne, H.W., Steiner, U. (2006). Microscopic evidence for the hemibiotrophic nature of *Diplocarpon rosae*, cause of black spot disease of rose. *Physiological and Molecular Plant Pathology 69*, 86–92

Hessayon, D.G. (2005). *Expert în cultivarea trandafirilor*, Bucharest, RO: BIC ALL.

Lambraki, M. (2001). Plantes, herbees, Legumes verts, Fruits

Lia, A., Lia, S., Lia, H-B., Xua, D.P., Xub, X-R. & Chenc, F. (2014). Total phenolic contents and antioxidant capacities of 51 edible and wild flowers, *Journal of functional foods 6*, 319 –330.

Milică, C., Bavaru, A. & Bavaru, E. (2010). *Trandafirul: gingăşie, frumuseţe, sănătate*. *Monografia genului Rosa*, Iasi, RO: Pim.

Munnekhoff, A.K., Linde, M. & Debener, T. (2017). The gene diversity pattern of *Diplocarpon rosae* populations is shaped by the age, diversity and fungicide treatment of their host populations *Plant Pathology*, 1-11.

Oliver, C., Halseth, D.E., Mizubuti, S.G. & Loria, R. (1998). Post-harvest application of organic and inorganic salts to field-grown potato tubers can suppress silver scurf during potato storage. *Plant Dis. 83*, 814-818.

Palmer, C.L., Horst, R.K. & Langhans, R.W. (1997). Use of bicarbonates to inhibit in vitro colony growth of *Botrytis cinerea*. *Plant Dis. 81*, 1432-1438.

Palou, L., Usall, J., Munoz, J.A., Smilanick, J.L. & Vinas, J. (2002). Hot water, sodium carbonate and sodium bicarbonate for the control of postharvest green and blue moulds of Clementine mandarins. *Postharvest Biol. Technol. 24*, 93-96.

Park, D., Shin, K., Choi, Y., Guo, H, Cha, Y., Kim, S-H., Han, N.S., Joo, S.S., Choi, J.K., Lee, Y.B., Choi, E-K, Kim, J-B. & Kim Y-B. (2016). Antimicrobial activities of ethanol and butanol fractions of white rose petal extract. *Regulatory Toxicology and Pharmacology 76*, 57-62.

Pires, T.C.S.P., Dias, M.I., Barros, L. & Ferreira, I.C.F.R. (2017). Nutritional and chemical characterization of edible petals and corresponding infusions: Valorization as new food ingredients, *Food Chemistry 220*, 337–343.

Plaza, P., Usall, J., Torres, R., Abadias, M., Smilanick, J.L., Vinas, I. (2004). The use of sodium bicarbonate to improve curing treatments against green and blue molds on citrus fruit. *Pest Management Science, 60*, 815-821.

Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007

Sengul, M., Sener, D. & Ercisli, S. (2017). The determination of antioxidant capacities and chemical properties of rose (*Rosa damascena* Mill.) products.

Acta Sci. Pol. Hortorum Cultus, 16(4), 63–72, ISSN 1644-0692.

Stan (Tudora), C., Cardei, P., Muscalu, A., Boiu-Sicuia, O.A., Vladut, N.V. & Israel-Roming, F. (2022). Statistical analysis on the potential antifungal activity of some essential oils obtained from medicinal plants. *Agrolife Scientific Journal, 11*(1), 211-220.

Stangarlin, J.R., Kuhn, O.J., Assi, L. & Schwan-Estrada, K.R.F. (2011). Control of plant diseases using extracts from medicinal plants and fungi. In: *Science against microbial pathogens: communicating current research and technological advances*, A. Mendez Ed.

Tsanaktsidis, C.G., Tamoutsidis, E, Kasapidis, G, Itziou, A. & Ntina, E. (2012). Preliminary Results on Attributes of Distillation Products of the Rose Rosa damascena as a Dynamic and Friendly to the Environment Rural Crop. *APCBEE Procedia 1*, 66–73.

Yan, Z., Dolstra, O., Prins, T. W., Stam, P., & Visser, P. B. (2006). Assessment of partial resistance to powdery mildew (*Podosphaera pannosa*) in a tetraploid rose population using a spore-suspension inoculation method. *European Journal of Plant Pathology*, *114*(3), 301-308. https://doi.org/10.1007/s10658-005-5995-x

Yasin, N.A., Ahmed, S., Khan, W.U., & Ashraf, Y. (2016). Survey and pathogenicity of black spot disease of rose in Pakistan. *Journal of Horticulture 3*(4), 189. doi: 10.4172/2376-0354.1000189

Wagner, Ș. (2010). *Trandafiri cu parfum*. Cluj-Napoca, RO: Napoca Star.

Wagner, Ș. (2002). *Trandafirul - de la mit la mileniul trei*. Cluj-Napoca, RO: Napoca Star.

.