DOI: 10.22620/agrisci.2024.41.007

EFFICACY OF SOME INSECTICIDES AGAINST *RHODOCOCCUS PERORNATUS* (HEMIPTERA: COCCIDAE) ON THE OIL-BEARING ROSE (*ROSA DAMASCENA* MILLER)

Pavlin Vasilev*, Daniela Atanasova

Agricultural University – Plovdiv, Bulgaria
***Corresponding author's Email: p_vasilev@au-plovdiv.bg**

Abstract

The oil-bearing rose (*Rosa damascena* Miller) is the most important essential oil crop in Bulgaria. In May 2023 in rose plantations located in the region of Zelenikovo village the rose soft scale *Rhodococcus perornatus* (Hemiptera: Coccidae) was found in high density of 5% infested rose bushes (Cockerell & Parrott, 1899). The rose plantations are growing within the conventional farming. Two chemical (Closer – 0.02%, 0.04% and Sivanto prime – 0.05%, 0.1%) and one biological (Naturalis – 0.1%, 0.2%) insecticides were tested against the rose soft scale. All tested products showed better results in higher concentrations. Closer indicated the fastest initial action. In the concentration of 0.04% on the 1st day after the treatment its efficacy was 100%. Sivanto prime in the concentration of 0.1% on the 5th day after the treatment showed an efficacy of 100%. The biological insecticide Naturalis had a slower action and in the concentration of 0.2% on the 7th day after the treatment its efficacy was 90%.

Keywords: Rose soft-scale, *Rhodococcus perornatus*, *Rosa damascena*, damage, control

INTRODUCTION

The rose soft scale *Rhodococcus perornatus* (Hemiptera: Coccidae) is a serious pest of the oil rose that causes a significant reduction in the yield of rose flowers (Cockerell & Parrott, 1899). In Bulgaria the species was mentioned for first time by Chorbadjiev (1938) as the rose soft scale – *Physokermes bulgariensis*. Later Wünn (1939) reported this species as a new for science under the name *Eulecanium bulgariense*. Borchsenius (1953) determined the scale as *Rhodococcus rosophilus* (Borchsenius,1953). There are also other synonyms: *Rhodococcus bulgariensis* (Wunn, 1939) and *Eulecanium perornatum* (Fernald, 1903). The pest *R. perornatus* was formerly known as a rare, steppe-inhabiting, mesophilous species in the Palaeractic region; however, in recent years it is becoming a pest of cultivated roses in Hungary, mainly in the Budapest region. According to Tremblay (1991) the spherical rose scale was introduced into Italy in the 1970s, on roses from Bulgaria and Hungary. In Turkey (Demirözer et al., 2009), two species of scales, previously unreported on oil rose, were found. These are the species of the family Diaspididae - *Lepidosaphes ulmi* (L.) and *Parlatoria oleae* (Colvée), found in the region of Isparta, Turkey. Demirözer et al. (2011) indicated that over 70% of the rose oil production in Turkey is in the Isparta region. The authors published data on the species composition and population density of the main harmful and beneficial species of oil rose. The results of the study showed that the main pests in the oil rose plantations were *Rhodococcus perrornatus* (Hemiptera: Coccidae) and *Macrosiphum rosae* (L.) (Hemiptera: Aphididae). *Rhodococcus perornatus* (Cockerell & Parrott, 1899) was found for the first time in France, at 1,400 m in altitude, in a locality of the French Alps (Panis, 2011). The rose soft scale was found in high density of the cultivated rose in Hungary (Ördögh, 1995) and Bulgaria (Tsalev, 1966). The pest develops one

annual generation in Bulgaria and hibernates as second instar larvae. In the spring, the larvae become active and start causing harm. Males and young females appear in April, while oviposition begins in mid-May. Adult females lay their eggs under their bodies. One female lays an average of 1135 eggs (Capinera, 2008). The hatching of larvae begins in mid-June. The scale forms dense colonies of yellow-brown hemispherical shields 4.6 mm long on the shoots and stems from which it sucks sap. As a result of the damage, the rose bushes lag behind in their development, and after a strong attack over several consecutive years, they begin to dry out. A few larvae pass through the leaves, but the damage caused by them is insignificant. The rose soft scale mainly attacks the red and white oil-bearing rose (*Rosa damascena* Mill.), rarely ornamental roses and very rarely rosehip (*Rosa canina* L.).

The distribution of the pest is localized in the regions of Klisura, Kazanluk and Sofia. Tsalev (1966) reported on successful chemical control during the dormant season and also during the vegetation after the harvesting of rose flowers. The control was mainly done with chemical insecticides, but in recent years with the development of organic agriculture in Bulgaria there has been an increased interest in bioinsecticides as alternatives to chemical products.

The aim of our study was to establish the efficacy of two chemical (Closer – 0.02%, 0.04% and Sivanto prime – 0.05%, 0.1%) and one biological (Naturalis – 0.1%, 0.2%) insecticides against the rose soft scale *Rhodococcus perrornatus* under field conditions.

MATERIALS AND METHODS

During the growing season of 2023 in rose plantations in the region of Zelenikovo village the rose soft scale *Rhodococcus perornatus* (Hemiptera: Coccidae) was found in high density of 5% infested rose bushes (Cockerell & Parrott, 1899). The rose plantations are growing within the conventional farming. Two chemical (Closer – 0.02%, 0.04% and Sivanto prime – 0.05%, 0.1%) and one biological (Naturalis – 0.1%, 0.2%) insecticides were tested against the the rose soft scale under field conditions.

The treatment was carried out by spraying directly on the branches with colonies 2nd instar nymphs of the rose soft scale with tested concentrations of insecticides and the control was treated with water. Each variant was implemented with three replicates. The number of surviving individuals was recorded on the 1-st, 3-rd, 5-th and 7-th days after the treatment. The efficacy was estimated according to Henderson and Tilton (1955).

Flupyradifurone (Sivanto prime) is a systemic insecticide with a contact and stomach action for vegetative application, but it is also well absorbed by the roots. It penetrates translaminarly into the plant tissues through the leaves while simultaneously moving systemically (acropetal) along the xylem. It belongs to a new chemical class – butenolides. Its action is similar to neonicotinoids: activates the nicotinic acetylcholine receptors in the synapses. It causes tremors, paralysis, and death within 1 to 4 hours. It is effective against insects with piercing-sucking mouthparts. It could also be used for field and greenhouse crops. The standard and reduced doses were tested.

Sulfoxaflor (Closer 120 SC) is a new class insecticide (sulfoximine) with a contact and stomach action. In plants, it moves translaminarly and systemically along the xylem to the tips (acropetal). Its action on insects is similar to that of neonicotinoids and can be their substitute – agonist (activator) of acetylcholine receptors (nAChRs) in synapses, i.e. it functions in a manner different from the other insecticides acting on nAChRs. The insecticide effectively controls insects with piercing-sucking mouthparts, including those resistant to systemic insecticides of other chemical classes. Both registered doses were tested.

Naturalis is a microbial insecticide based on the living spores of a naturally occurring proprietary strain (ATCC 74040) of the entomopathogenic fungus *Beauveria bassiana*. The formulated product is a concentrated suspension ofat least 2.3 x 107 spores/ml. It is a suspension of conidiospores in vegetal oil, which improves spore germination and UV protection, enhancing the efficacy of the antagonist in the field. *B. bassiana* can affect a wide range of arthropod pests, such as whiteflies, thrips, mites, aphids, etc., infesting numerous crops (vegetables, cucurbits, solanaceous fruits, strawberry, flowers and ornamentals, grapevine, citrus, pome, stone fruits, etc.). The microbial insecticide Naturalis (*Beauveria bassiana*) is allowed for use in biological farming in Bulgaria, but there is no registration on the rose pests.

The registered concentrations for pests in vegetables, strawberries and orchards is between 0.1% - 0.2% according to the crop (Biogard, 2019).

Tozlu et al. (2017) established that the fungus *Beauveria bassiana* (Ascomycota: Hypocreales) showed a high efficacy against the larvae of the stem wasp *Syrista parreyssii* (Spinola, 1843) (Hymenoptera: Symphyta; Cephidae) on the oil-bearing rose.

Table 1. Tested products for control of *Rhodococcus perrornatus*

Active ingradient	**Trade name**	**Concentration**
Flupyradifurone	Sivanto prime i.a 200 g/L	0.05% and 0.1%
Sulfoxaflor	Closer 120SC i.a. 120 g/L	0.02% and 0.04%
***Beauveria bassiana*, Strain Атсс 74040, 2.3 X 10^7 Spores/Ml**	Naturalis	0.1% and 0.2%

Fig. 1. *Rhodococcus perrornatus* on oil-bearing rose branches

RESULTS AND DISCUSSION

The best action against *Rhodococcus perrornatus* by the tested chemical insecticides was shown by the product with the active substance sulfoxachlor (Closer). At the higher applied concentration (0,04%) the efficacy of the product reached 100% already on the 1st day, and in the lower concentration – on the seventh day (Fig. 2). The product with the active ingredient flupyradifuron (Sivanto Prime) also showed a very good effect, although its action was a bit slower. At the higher concentration (0.1%), its efficacy reached 100% on the 5th day. At the lower concentration (0.05%), the efficacy was weaker and reached 98% on the 7th day after

the treatment. The biological insecticide Naturalis had slower action and the higher concentration (0.2%) efficacy was 100% on 7th day after the treatment. In a lower concentration (0.1%) it also showed a very good effect against *Rhodococcus perrornatus*, and on the 7th day after treatment, the efficacy reached 97.6%.

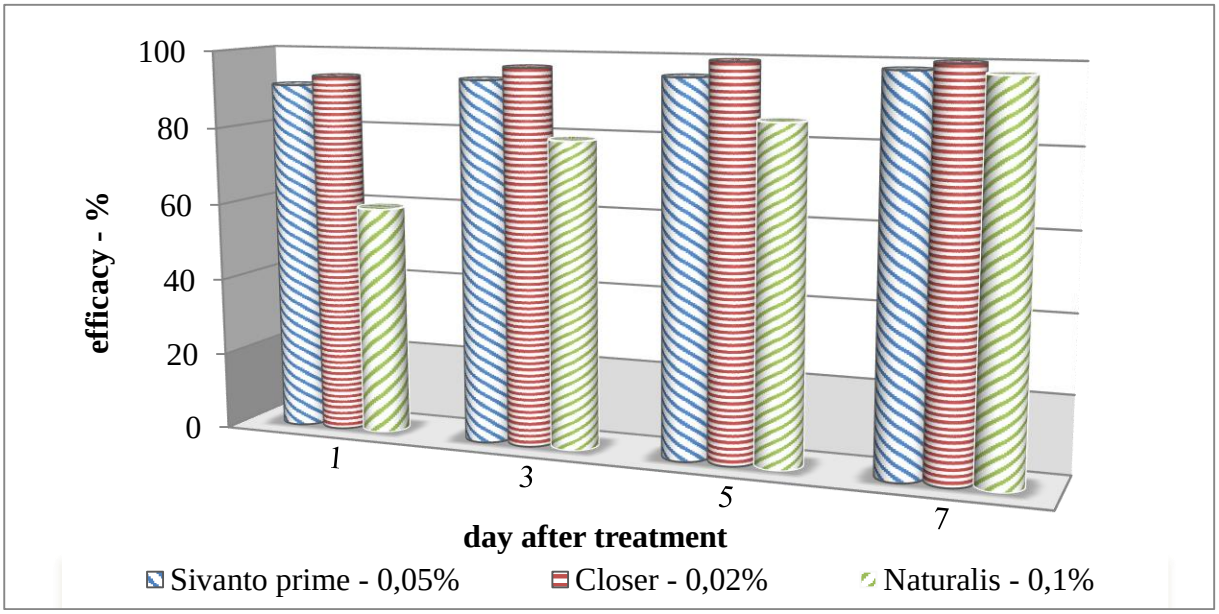

Fig. 2. Efficacy of insecticides against *Rhodococcus perrornatus* under field conditions

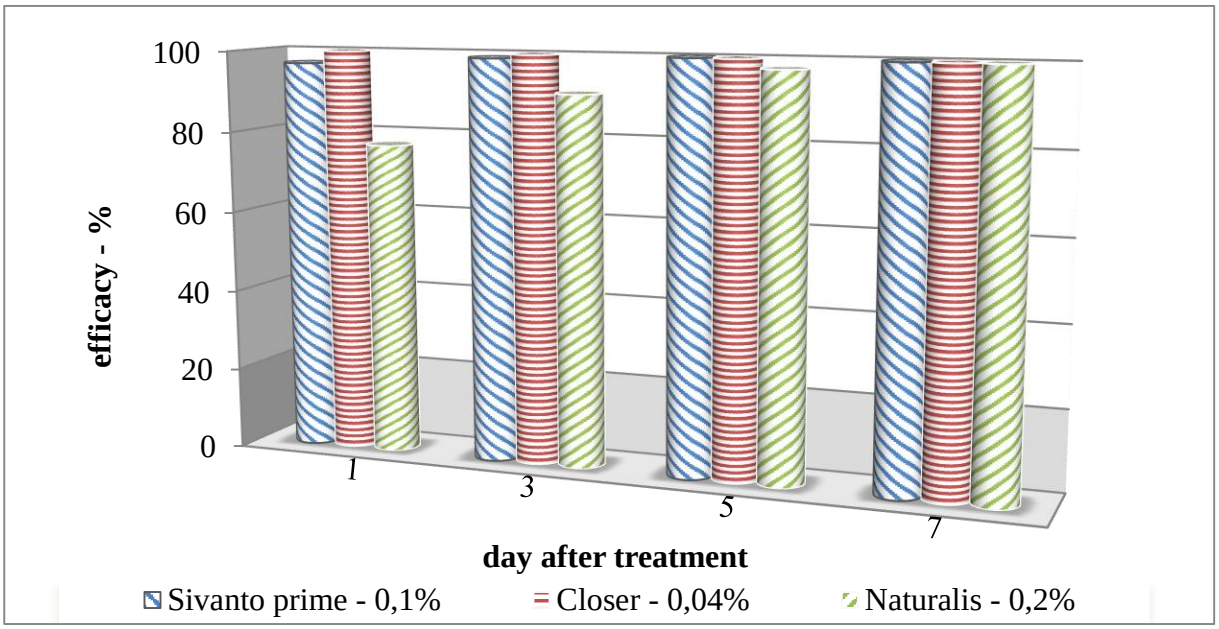

Fig. 3. Efficacy of insecticides against *Rhodococcus perrornatus* under field conditions

CONCLUSION

1. Clouser (sulfoxachlor), in a concentration of 0.04%, showed the fastest effect and reached 100% efficacy already on the 1st day after treatment.

2. Microbial insecticide Naturalis (*Beauveria bassiana*) also showed a very good action in its low (0.1%) and high concentration (0.2%) – the efficacy on the 7-th day after the treatment reached 97.6% and 100%, respectively.

3. Microbial insecticide Naturalis (*Beauveria bassiana*) could successfully be used to control the rose soft scale *Rhodococcus perrornatus* in the biological farming of the oil-bearing rose.

4. All tested insecticides are suitable for efficient control of the spherical rose scale *Rhodococcus perrornatus* on the oil-bearing rose, even at their lowest permitted concentration.

REFERENCES

Biogard, (2019). "Division for biological control." Available at: https://www.biogard.it/index.php/en/plantprotection/insecticides/273-naturalis-en.

Borchsenius, N.S. (1953). [New genera and species of scale insects of the family Coccidae (Homoptera, Coccoidea).], Entomologicheskoe Obozrenye.

Capinera, J. (2008). Encyclopedia of Entomology 2nd Edition. Eggs of insects, 1294.

Chorbadjiev, P. (1938). Kratuk spisuk na shtitonosnite vushki (Coccidae, Rhynchota) v Bulgaria. Izvestia na bulgarskoto entomologichno drujestvo, 10, 88-90.

Cockerell, T.D.A. & Parrott, P.J. (1899). Contribution to the knowledge of the Coccidae. The Industrialist, 25, 159-165, 227-237.

Henderson, C. F. & Tilton, E. W. (1955). "Tests with acaricides against the brown wheat mite." Journal of Economic Entomology, 48, 157-161. https://doi.org/10.1093/jee/48.2.157.

Demirözer, O., Kaydan, M. B., Karaca, I. & Ben-Dov, Y. (2009). First records of armoured scale insects (Hemiptera: Coccoidea: Diaspididae) from the oil-rose, *Rosa damascena*, in Turkey. Hellenic Plant Protection, 33.

Demirözer, O., Karaca, I., Karsavuran, Y. (2011). Population fluctuations of some important pests and natural enemies found in Oil-bearing rose (*Rosa damascena* Miller) production areas in Isparta province (Turkey). Türk. entomol. derg. 35 (4): 539-558.

Fernald, M. E. (1903). A catalogue of the Coccidae of the world. Bulletin of the Hatch Experiment Station of the Massachusetts Agricultural College.

Ördögh, G. (1995). Morphology of nymphs and biology of *Rhodococcus perornatus* (Cockerell and Parrott) (Homoptera: Coccidae) in Hungary. Israel Journal of Entomology 29, 93-96.

Panis, A. (2011). *Rhodococcus perornatus* (Cockerell & Parrott) new to France (Hemiptera, Coccidae). Nouvelle Revue d'Entomologie 26(4), 317-320.

Tozlu, E., Kotan, R. &Tozlu, G. (2017). The investigation of *Beauveria bassiana* (Ascomycota: Hypocreales) as a biocontrol agent of rose stem sawfly, *Syrista parreyssii* (Spinola, 1843) (Hymenoptera: Symphyta; Cephidae) larvae. Fresenius environ. Bull. Volume 26 – No. 12/2017, 7091-7100.

Tremblay, E. (1991). New entomological problems in the Mediterranean basin and possibilities of their confrontation. Proceedings of the 3rd National Entomological Congress, pp. 65-72. Thessaloniki, Greece. EPPO Reporting Service no. 01-1994 Num. article: 1994/03.

Tsalev, M. (1966). Contribution to the morphology, biology and control of *Rhodococcus bulgariensis* Wunn (Homoptera, Coccoidea) in Bulgaria. Plant Science. Sofia 3, 3-14.

Wünn, H. (1939). Eulecaniumbulgariense n. sp., ein Schädling der bulgarischen Olrosenkulturenaus der Familie der Cocciden. Zeitschriftfürangewandte Entomologie, Bd. XXV, 4.