

Viruses Causing Chlorotic Symptoms on Aromatic Plant *Nepeta racemosa*

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Abstract

Nepeta racemosa L. – or Persian catmint, is an aromatic plant species, used as a source for forming of perennial ornamental plantations. This plant is also useful for other reasons. It repels mosquitoes and cockroaches, because it contains nepetalactone, which has effects on some insects. Chlorotic spotting on the sprigs of the tufts of the perennial plantation of Persian catmint, originated from the trial field of the Institute of Rose, Essential and Medicinal Cultures near Kazanlak, was established in the period 2014-2017. The objective of the study was to establish the viral pathogen or several viral pathogens – agents of virus disease with chlorotic symptoms on the plants. The method used was ELISA, variant DAS- ELISA. Two plant viruses were proven. One of them was *Tomato spotted wilt virus* (TSWV) - *Bunyaviridae* family, *Tospovirus* genus. It was established on *N. racemosa* in a high percentage of the chlorotic plants in the period 2014-2017. Therefore, TSWV existed in 91 % of the tested chlorotic plants in 2017. The second viral pathogen was *Potato virus Y* (PVY) – *Potyviridae* family, *Potyvirus* genus. PVY was for the first time established as a viral agent of disease on *N. racemosa* plants in the present study in 2017 together with TSWV. PVY existed in 27 % of the tested chlorotic plants.

Key words: aromatic plant *Nepeta racemosa*, viral pathogens: TSWV, PVY.

Резюме

Nepeta racemosa L –Персийска котешка мента е вид етеричномаслено (ароматно) растение, което се използва за формиране на многогодишни цветни насаждения. Това растение е полезно и по друга причина. То отблъсква комари и хлебарки, защото съдържа непеталактон, който има ефект върху някой насекоми. В периода 2014 – 2017 години беше наблюдавано хлоротично напетняване на стръкчета в туйките от многогодишно насаждение на персийска котешка мента, произхождаща от опитното поле на института по розата, етеричномаслените и медицински култури в Казанлък. Целта на проучването беше установяването на вирусния патоген или няколко вирусни патогени – причинители на вирусната болест с хлоротичните симптоми по растенията. Използваният метод беше ELISA, вариант DAS- ELISA. Бяха доказани два растителни вируса. Единият беше *Tomato spotted wilt virus* (TSWV) – семейство *Bunyaviridae* family, род *Tospovirus*. Той беше установен във висок процент от хлоротичните растения на *N. racemosa* през всичките години за периода 2014-2017. Така TSWV присъстваше в 91 % от тестираните хлоротични растения през 2017 година. Вторият вирусен патоген беше *Potato virus Y* (PVY) – семейство *Potyviridae*, род *Potyvirus*. През 2017 година PVY беше установен за първи път като причинител на заболяване съвместно с TSWV по *N. racemosa*. PVY присъстваше в 27 % от тестираните хлоротични растения.

Introduction

The aromatic plant species *Nepeta racemosa* L – Persian catmint is used as a source for formation of perennial ornamental plantations. This plant is useful, because it repels mosquitoes and cock-

roaches due to its content of nepetalactone, which has effects on some insects.

Tomato spotted wilt virus (TSWV), family *Bunyaviridae* causes economically important diseases on tomatoes and peppers, decreasing their yield. Parella *et al.* (2003) have reported about large

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Fig. 1 Sprigs of *N. racemosa* with chlorotic leaves spotted by viruses.



Fig. 2 Symptoms of virus disease – chlorotic leaves and sprig of *N. racemosa* - on the left in comparison with symptomless (practically healthy) leaf and sprig – on the right.



Fig. 3 Two sprigs of *N. racemosa* with chlorotic and necrotic symptoms on the leaves and stems, caused by viruses - on the right; symptomless sprigs – on the left.



Fig. 4 One sprig of *N. racemosa* with chlorotic and necrotic symptoms on the leaves and especially on the stem, caused by viruses in comparison with a symptomless sprig.

ЦБ

host range of TSWV and significant losses in production of tomato and pepper caused by the same virus. Dikova (2010, 2011 and 2015) has established that TSWV host range includes different plant species of essential oil-bearing and medicinal plants. TSWV is efficiently transmitted by three widely distributed thrips species in Bulgaria: *Frankliniella occidentalis* (Pergande) (Western flower thrips); *Frankliniella intonsa* (Trybom) (Eurasian flower thrips) and *Thrips tabaci* Lindeman (Onion thrips) (Karadjova *et al.*, 2001).

Potato virus Y (PVY) – *Potyvirus* family, *Potyvirus* genus, is a pathogen for many agricultural crops with a major significance for potatoes. This virus has hosts among the aromatic and medicinal plants too. Dikova (2012) has established *Coriandrum sativum* L. and *Echinacea purpurea* (L.) Moench as hosts for PVY.

The objective of the research was to estab-

lish virus or viruses, causing chlorotic and necrotic symptoms on the aromatic plant *N. racemosa* L. and deteriorating the quality of the leaves (herba) and flowers from this aromatic species.

Material and Methods

The studies were carried out in the Division for Plant Protection of the Institute of Soil Science, Agrotechnologies and Plant Protection (ISSAPP) “Nikola Poushkarov”, Sofia, Bulgaria from 2014 to 2017. Samples of plants *N. racemosa* with symptoms of virus diseases were collected from a plantation in trial fields of the Institute of Roses, Essential and Medical cultures (IREMC) near Kazanlak, Bulgaria. Each sample from a single tuft of *N. racemosa* was analyzed by ELISA method (DAS-ELISA); (Clark and Adams, 1977) with kits for TSWV and PVY, purchased from the German company LOEWE, Biochemica. The extinction values were

measured using a spectrophotometer Multimode Detector DTX 880. All samples showing values two and a half times higher than the negative controls were assumed as virus positive namely virus carriers. Negative controls were samples of symptomless healthy plants *N. racemosa* and for positive controls indicator plants infected with TSWV and PVY were used.

Results and Discussion

N. racemosa L. – Persian catmint is an aromatic plant with attractive violet racemes, which forms thick shrubs. We observed large parts of these shrubs with chlorotic leaves and even entire chlorotic sprigs in a plantation of the Institute of IREMC near Kazanlak, Bulgaria (Fig. 1 and Fig. 2). We also observed chlorotic sprigs and bright yellow colored sprigs with partial necrosis on the stems or entire necrotic stems (Fig.3 and Fig. 4).

Viral pathogens were established as a cause of largely spread chlorotic symptoms (Fig. 5). Both viruses, TSWV and PVY, caused light yellow to bright yellow irregular spots on the middle and lower stages of leaves, that turned to necrotic spots, with frequent cases of wilting and premature dying of the entire sprigs or often the entire shrubs of *N. racemosa*.

Some tufts and shrubs of *N. racemosa* with chlorotic and necrotic, spotted by viruses, leaves and stems were generally infected by TSWV and sporadically by PVY, as was shown on chart of Fig. 5.

TSWV was proven in moderate viral concentration around 0.6 optical density (OD) in the majority of shrub samples with numbers: 2, 5, 6, 7, 9 and 11; high viral concentration over 1.4 OD only in sample 8 and comparatively low viral concentration in samples with numbers: 1, 3, 4, 10 - around 0.4 OD (Fig. 5). PVY was established in two shrub samples in moderate viral concentration – numbers 1 and 8, and in comparatively low viral concentration – number 2 (Fig. 5). Cut off the border for the diseased samples in comparison with symptomless (healthy) samples was 0.278 OD for TSWV and 0.338 OD for PVY. Therefore TSWV was established in 91 % of the tested chlorotic plants *N. racemosa* in 2017, and PVY – в 27 % (Fig. 5).

TSWV was established as a major viral pathogen, responsible for chlorotic and necrotic symptoms on *N. racemosa* in 2016, too (Dikova *et al.*, 2016). PVY was for the first time proven as a viral pathogen on the same aromatic species in this study for the first time. Apart on *N. racemosa* plants, TSWV was proven in the thrips bodies (*Thrips sp.*) (Dikova *et al.*, 2016). The wild plants (weeds) *Cirsium arvense* L. and *Convolvulus arvensis* L., collected in the Persian catmint plantations were with proven TSWV infection (Dikova *et al.*, 2016). Therefore, TSWV control must be carried out in three directions: against the virus, against its vector thrips, and against the weeds in the plantations – sources of viral infection.

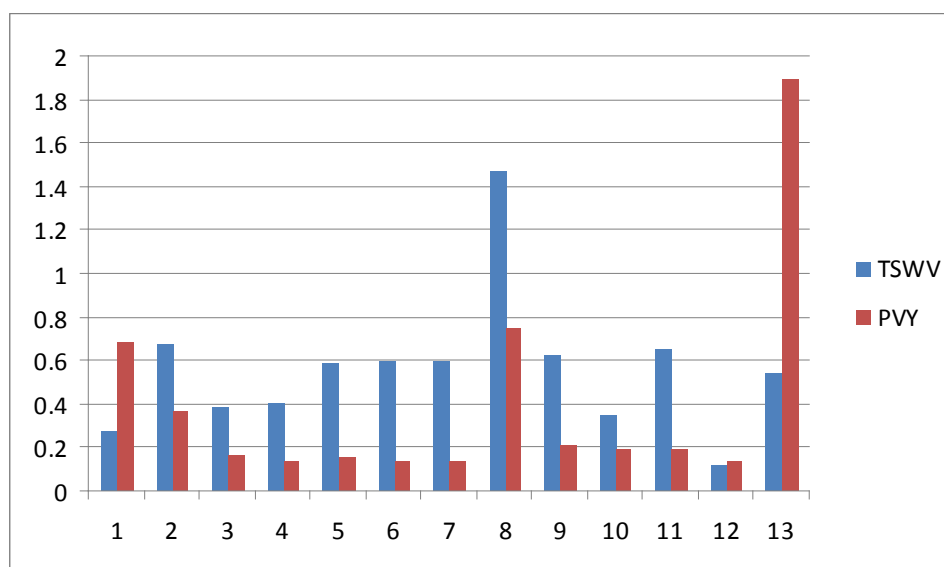


Fig. 5. Results from DAS-ELISA about establishment of TSWV and PVY on *N. racemosa* shrubs.

Conclusion

The viruses TSWV and PVY in mixed infection caused chlorotic and necrotic symptoms on the leaves and stems of the *N. racemosa* plants. These symptoms deteriorated the quality and decreased the yield of leaves (herba) and flowers from the plants. *N. racemosa* tufts with chlorotic, spotted by viruses; leaves were generally infected by TSWV and sporadically by PVY. This study has for the first time proved PVY as a viral pathogen on *N. racemosa* plants.

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