

FUSARIUM WILT RESISTANCE OF *Callistephus chinensis* L. (NEES) OF THE INTENSITY OF THE FLOWER COLORING

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Summary. The results of the study of the degree of damage to *Callistephus chinensis* (L.) Nees plants by *Fusarium wilt* from the collection of the Institute of Horticulture, depending on the intensity of coloration of inflorescences and weather conditions, are given. The development of *Fusarium wilt* on different varieties in the conditions of the Kyiv region is shown. It was established that resistance to the disease is a genetically fixed feature of the variety, the degree of manifestation of which does not depend on the intensity of the color of the inflorescences. It was found that the degree of damage is influenced by weather conditions during the growing season of plants. Among 30 varieties with a pink color of inflorescences, the highest level of resistance was in 2023 - 83.3%, with white color - observed in 2021 - 6.7%. Varieties "Waldersee", "Laplata", "Pomponna", "Dwarf Royal" were resistant to *Fusarium wilt*.

Keywords: vegetation period, weather conditions, genetic dependence, damage degree.

Introduction

The *Fusarium wilt* resistance is connected with the intraspecific differentiation of the species concerning the ornamental crops colouration was pointed out by many researchers [1]. In the special scientific literature on the *Callistephus chinensis* (L.) Nees inflorescences colouration intensity dependence the authors note that the degree of the plants affection by *Fusarium wilt* depends on this intensity [2, 3].

For example, A.A. Gorai considers that varieties plants with white and pink inflorescences colouration are affected by *Fusarium wilt* more severely than those with dark inflorescences. According to the author's observations, the plants with the red inflorescences are more *Fusarium wilt* resistant, and those with white and violet are the least resistant [4].

Studying the *Callistephus chinensis* (L.) Nees collection for many years (102 cvs of different origin) in the conditions of the Kyiv region we did not note the described dependence. Therefore the task of our explorations was to determine the resistance level of the varieties with different inflorescence colouration intensity on the provocative background.

The purpose of our researches is to study the resistance degree of the *Callistephus chinensis* (L.) Nees of the Institute of Horticulture collection to *Fusarium wilt* on the provocative background.

Materials and methods

The experiments to determine the dependence of the *Callistephus chinensis* (L.) Nees plants resistance to *Fusarium wilt* on their inflorescences colouration were conducted for three years (2021-2023) in the experimental field of the Institute of Horticulture (NAAS). The objects were 74 strains.

The sowing plots area was 25 m² (5 × 5 m), repetition three fold. The accounting plants were all in each plot.

The variants in the repetitions were placed systematically, the repetitions in one or two strips. In the factorial experiments treatments were established in the form of split plots, as a rule, randomized.

The plants of the studied varieties were grown in two ways: seedling and seedling less (direct sowing into ground). Seeds were sown into the sheltered ground at the optimum terms (early March).

The assessment of the affection degree by *Fusarium wilt* was carried out in the plots under the conditions of artificial infection of every investigated genotype separately in accordance with the corresponding methodical recommendations [5, 6].

Results and discussion

The highest level of the affection of the *Callistephus chinensis* (L.) Nees plants with the white inflorescences colouration was observed in 2021 - 6.7 %, while in the subsequent years (2022 and 2023) 15 cvs of the collections with such colouration displayed rather high level of the resistance to *Fusarium wilt* (table 1). Among 30 varieties of the experimental collection with the pink inflorescences colouration during three years of the investigations the high resistance level was fixed in 2021 - 83.3 %. This is the highest level for the explorations years among strains with different colouration intensity.

Table 1

Level of the affection of the *Callistephus chinensis* (L.) Nees varieties plants with different inflorescences in coloration by *Fusarium wilt*, 2021-2023

Inflorescence colouration	Number of cvs	The degree of fusarium wilt, %								
		2021			2022			2023		
		strong	weak	not affected	strong	weak	not affected	strong	weak	not affected
White	15	6,7	53,3	40,0	0	40,0	60,0	0	53,3	46,7
Pink	30	6,7	26,7	66,6	3,3	20,0	76,7	3,3	13,3	83,3
Blue	11	0	45,5	54,5	0	36,4	63,6	9,1	36,4	54,5
Dark blue	15	13,3	13,3	73,3	13,3	53,3	33,3	6,7	40,0	53,3
Red	31	9,7	32,3	58,1	6,5	19,4	74,2	3,2	32,3	64,5

The highest level of the *Fusarium wilt* affection was displayed on the plants with blue and red inflorescences in all the research years although the percentage of the non affected plants with such coloration was high too.

The uncharacteristic disease resistance during the investigations years with blue inflorescences colouration. If 2021 and 2022 were favourable for growing healthy plants with such colouration (the high disease level was not displayed), in the most favourable for the growth and development of the *Callistephus chinensis* (L.) Nees plants in 2023 the disease level with the described colouration achieved 9.1 %.

Thus studying the *Callistephus chinensis* (L.) Nees cultivars for three years did not detect to obvious the *Fusarium wilt* resistance between cvs with different colouration intensity. Most likely the disease resistance is a varietal genetically fixed trait, the degree of the display of which to a certain extent depends on the weather conditions of the growing season [7, 8].

Table 2 shows that the varieties with the similar white colouration (Teiza Star and Karpit White) within one variety - Edelweiss had different resistance degree: Teiza Star was resistant during all the investigation years whiles Karpit White was affected. Such trend was also observed among the strains with other, for instance, pink inflorescences colouration within the variety Khudozhnya. Its varieties: Umans'ka Svitlo Rozheva, Julia and Sonata Rozheva displayed a

medium *Fusarium wilt* resistance degree whilst 'Rozheve Chudo', 'Vesil'na', 'Yantarna' and 'Tsarivna' did high, cvs with the dark colouration of the same variety (Shokoladka, Syedaya Dama, Babushkin Sarafan) medium. Among the *Callistephus chinensis* (L.) Nees plants with the characteristic dark inflorescences coloration the level of the *Fusarium wilt* affection was different as well. For example the variety 'Rubinovyye Zvyozdy' plants with the red inflorescences colouration period during the explorations period displayed the medium *Fusarium wilt* resistance whereas the strain Yeva plants that belong to the same variety Unicum appeared high resistant.

Table 2

Characteristics of the *Callistephus chinensis* (L.) Nees cvs collection plants concerning the affection by *Fusarium wilt*, 2021–2023

Variety	Origin	Inflorescences colouration	<i>Fusarium wilt</i> resistance
Variety – Waldersee			
Amethyst	IH*	Dark Violet	Resistant
Serenada bila	Ukraine	White	Resistant
Serenada chervona	Ukraine	Red	Resistant
Variety – Edelweiss			
Edelweis	Western Europe**	Fiery -red	Resistant
Teiza Star	Germany	White	Resistant
CarpitWhite	USA	White	Not resistant
Variety – Laplata			
Laplata	Denmark	Silver-blue	Resistant
Snizhana	IH	White	Resistant
Variety – Pomponni			
Kirchwell	Western Europe	Red-purple	Resistant
Rita	Germany	Salmon pink	Resistant
Pompon Vellow	Western Europe	Lemon-yellow	Resistant
Variety – Princess			
Anyutochka	NBG NASU***	Soft cream-pink	Resistant
Prinzess Corinna	Germany	Whitish-yellow	Resistant
Serze France	France	Red	Resistant
Prinz	Western Europe	Red	Resistant
Pamina	Western Europe	Salmon - pink	Resistant
Bukett Crimson	Western Europe	Dark - red	Resistant
Angelina	IH	Dark-violet	Resistant
Prinzess Cristina	Western Europe	Lilac	Resistant
Anita	Germany	Pink	Resistant
Prinzess Cara	Western Europe	White	Resistant
Variety – Matador			
Matador	Germany	Yellow	Weak
Matador violett	Germany	Dark - blue	Weak
Variety – Chrysanthemum – like			
Goldschtral	Germany	Lemon-yellow	Medium
Nina	NBG NASU	Pink	Resistant
Samanta	IH	Lilac-pink	Resistant
Variety – Radio			
Florett	Germany	Crimson -red	Resistant
Variety – Unique			
Rubinovye Zvyozdy	IH	Ruby-red	Medium
Charme	Germany	Salmon - pink	Resistant
Yeva	NBG NASU	Pomegranate	Resistant

Variety – Khudozhnya			
Aelita	Uman'	Lemon-yellow	Resistant
Babushkin Sarafan	IH	Dark violet	Resistant
Veresen'	NBG NASU	Pink-lilak	Resistant
Golubyi Pavuchok	NBG NASU	Dark - blue	Resistant
Darunok Materi	Uman'	Soft- pink	Resistant
Zvyezda Polissya	IH	Creamy white	Medium
Carmen	IH	Dark red	Resistant
Lybid'	IH	Pale-blue	Resistant
Sophia	IH	Bright-violet	Resistant
Flamingo	IH	Yellow-lilak-pink	Resistant
Shokoladka	IH	Chocolate burgundy	Resistant
Leleka	NBG NASU	Snow-blue	Resistant
Natalka-Poltavka	Uman'	Carmine-red	Resistant
Nizhnist'	IH	Yellow- lilak-pink	Resistant
Lyudmyla	Uman'	Dark - crimson	Medium
Pavlina	IH	Raspberry	Resistant
Pamyat'	Uman'	Lemon-yellow	Medium
Polina	IH	Dark pink	Resistant
Sasha	IH	Silver-white	Resistant
Umans'ka Svitlo Rozheva	Uman'	Pale pink	Medium
Juliya	IH	Apricot-pink	Medium
Vesil'na	NBS NASU	Soft apricot	Resistant
Birma	Germany	Creamy white	Resistant
Sinderella	Germany	Violet	Resistant
Bile Chudo	IH	White	Resistant
Rozheve Chudo	IH	Pink	Resistant
Variety – Klyaksa			
Rosamunde	Germany	Bright-pink	Medium
Sonata	Uman'	Dark-pink	Medium
Raspberry gloss	NBG NASU	Bright crimson	Resistant
Oksamyt	IH	Dark-burgundy	Resistant
Krasunya	IH	Red	Resistant
Variety – Karlykovi			
Zwerg Aster Feur Kugtl	Germany	Fiery-red	Not resistant
Zwerg Aster Hellblau	Germany	Blue	Not resistant

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The other varieties of the collection had the same tendency. The plants of their varieties had different or similar inflorescences colouration.

Thus, the researches results have shown that the inflorescences colouration intensity of the *Callistephus chinensis* (L.) Nees does not influence the resistance of the plants to *Fusarium wilt*, but the damage degree depends considerably on the conditions. The dependence of the *Fusarium wilt* resistance of cvs of different origin has not been established.

Conclusions

The *Callistephus chinensis* (L.) Nees cvs did not display the obvious dependence of the *Fusarium wilt* resistance on the intensity of the coloration intensity. The varietal resistance to the disease is rather the hereditary genetically fixed trait, the extent of which some white depends on the weather conditions of the plants vegetation period. It is the varieties which belong to the varieties: 'Waldersee', 'Laplata', 'Pomponna' and 'Karlykovi Korolivs'ki' are *Fusarium wilt* resistant.

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