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THE CONTAGIOUS BACKGROUND FOR *POLYMYXA BETAE K.* FUNGUS HARMFULNESS ESTIMATION

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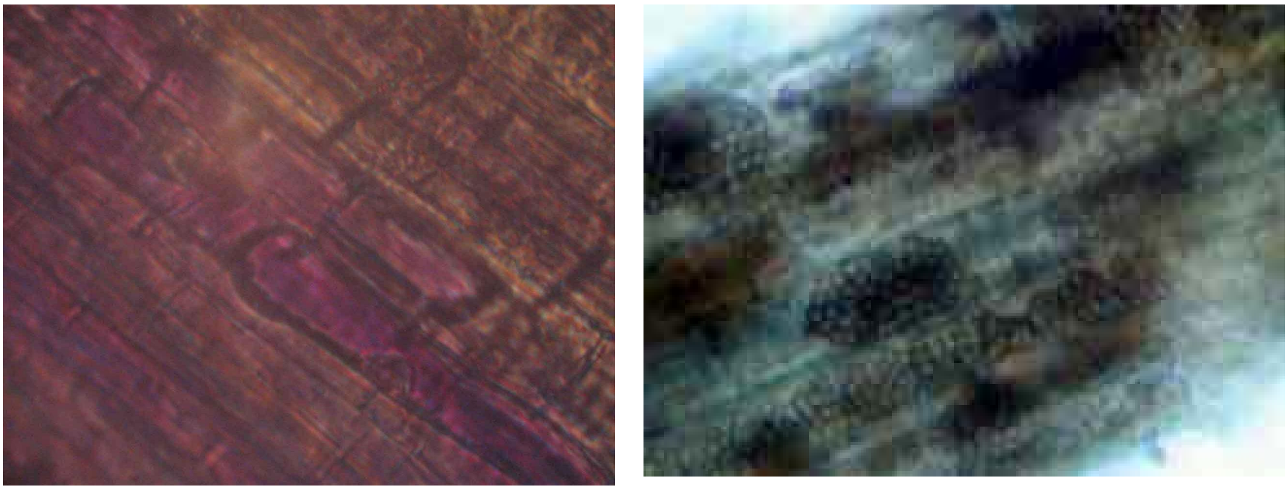
The research results on studying the harmfulness of Polymyxa betae K fungus are pointed out. The particularities of beet plants growth under fungus influence on different growth stages are examined. The system for contagious background creation was elaborated for laboratory research.

Key words*: rhizomania, Polymyxa betae K., beets, harmfulness, plasmodia, cyst soruses, contagious background*

The *Polymyxa betae K.* fungus is detected in soil worldwide where beet is cultivated. It is also detected in all areas of Ukraine where beet is planted, but general situation on infectious capacity in literature is absent. Detecting and defining the fungus infectious capacity on soil allows to predict epiphytotic situation on rhizomania development in particular household or in entire region [1,2,5].

The fungus is found in soil in the form of cyst soruses which are especially stable and can preserve their vital capacity up to 20-30 years. Cyst soruses are dark brown, during maturity period can be easily detected in sugar beet root hair contaminated by fungus. After plant penetration the polynuclear plasmodia is formed by synchronous cross-shaped nuclear division (Fig. 1).



a b

Fig. 5. *Polymyxa betae K.* fungus growth stages in sugar beet root hair (original) (400^x)

a — sporangial plasmodia;

b – cyst soruses.

The expanded data on Polymyxa betae K. fungus harmfulness in literature sources are not given. According to the literature analysis results *Polymyxa betae K.* fungus itself is a mild pathogen and does not cause significant contamination signs of crops growing wild. Although, its accumulation in new root hair can somewhat slow down beet shoots growth. However, according to data provided by number of authors, pathogen contaminating sugar beet plants causes growth weakening, leaves yellowing and root hair extending. The latter occurs under conditions of considerable root settlement by fungus [3,5,7].

The favourable conditions for beet seeds shooting are created at early sowing stages when there is sufficient moisture amount and reduced pathogen activity in soil [2]. In this connection, the vegetation period increases and plants make better use of solar energy. Though, early sowing leads to receiving thinned shoots, visible contamination and decrease of raw materials technical characteristics [2,3]. The *Polymyxa betae K.* fungus effect in given complex has not been studied.

It is worth to mention that natural contagious background is changing during the vegetation period, depending on crops cultivated on given soil. The mixed character of *Polymyxa betae K.* cyst soruses stress on soil of neighbouring fields within one farm is observed [4, 8]. However, laboratory research and studying the beet plant resistance to fungus can be conducted only if the steady contagious background is provided, by creating the necessary controlled quantity in certain period of time.

That is why the ***research goal*** was studying the *Polymyxa betae K.* fungus harmfulness, beet growth peculiarities under fungus effect on different development stages, as well as the optimal contagious background formation, which will provide the research carring out.

Research methods. An artificial contagious background was formed. In order to conduct the research 5 g, 2 g, 7 g and 10 g of root hair contaminated by *Polymyxa betae K.* fungus were applied into 50 g of sterile soil with average settlement of 8-10 cyst soruses in sight of microscope. The soil without contaminated roots served as control. Sterile soil was received by means of autoclave for 40 min. at 2 atm. and 120° C for microbe destruction.

The fungus harmfulness was examined on the example of sugar, red, and fodder beets. Sterile soil served as control. We sowed out up to 100 seeds into vegetation dishes and analyzed plants at the stages of shoots, first pair of leaves and second pair of leaves.

Research results. During the test on settling various roots quantity contaminated by fungus *Polymyxa betae K.*, at average settlement of 8-10 cyst soruses in sight of microscope at magnification of 400^x, certain regularities were pointed out (tab. 1). Thus, in the variant of settling more than 5 g of contaminated roots on 50 g of soil, the considerable falling out of plants was observed, starting from 10th day of shoots appearing. Meanwhile, shoots quantity as regards control on the 10-th day was less for 7,1 % at settling 2 g of contaminated roots, for 11,4 at 5 g, for 21,5% at 7 g and for 22,8 % at 10 g of shoots. On the 15th day there was less shoots for 2,7%, 18,4%, 24,5% and 24,7% correspondingly (table 1).

Providing that 2 g of contaminated roots were settled on 50 g of soil the considerable plant falling out was not observed and constituted 3,1%. Such infection quantity provided root hair contamination within 3,8 plasmodia in sight of microscope, which is insufficient for variety-resistance indices and trustworthiness of

1. Sugar beet roots settling by fungus Polymyxa betae K. at different contamination stages of soil (laboratory tests, Ukr SRSPQ IPP, Ukrainian variety CHS 75)

Shoots contaminated by fungus *Polymyxa betae K.*	Sugar beet plant condition on the day from their appearance							
	5- th, average		10-th , average		15-th , average		average	
	Shoots quantity, %	Plasmodia quantity, pcs.	Shoots quantity, %	Plasmodia quantity, pcs.	Shoots quantity, %	Plasmodia quantity, pcs.	Shoots quantity, %	Plasmodia quantity, pcs.
Control, without contaminated shoots applying	80,7	0	94,7	0	93,9	0	89,8	0
2 g of shoots on 50 g of soil	81,2	2,4	87,6	4,1	91,2	4,8	86,7	3,8
5 g of shoots on 50 g of soil	79,6	6,2	83,3	8,4	75,5	9,6	79,5	8,1
7 g of shoots on 50 g of soil	77,4	6,4	73,2	8,8	69,4	10,2	73,3	8,4
10 g of shoots on 50 g of soil	78,6	6,7	71,9	9,2	69,2	10,5	73,2	8,8

laboratory research.

The settling 5 g of roots contaminated by fungus *Polymyxa betae K.*, at average settlement of 8-10 cyst soruses in sight of microscope at magnification of 400^x on 50 g of soil turned to be the optimal quantity; provided sugar beet Ukrainian variety CHS 75 contamination within 8,1 plasmodia in sight of microscope, and resulted in mild plant falling out.

Using the research results we elaborated the system of contagious background creation for conducting tests under laboratory conditions and estimating beet resistance.

The conducted research in 2008, 2009 and 2010 years confirmed that *Polymyxa betae K.* fungus shows signs of harmfulness at early stages of plant growth. Soil, containing a large quantity of cyst soruses affects seeds resemblance and damps their growth [4,5,7].

The fungus harmfulness research showed that it mainly depends on the level the root hair is affected by plasmodia. In some way this index has distinct characteristic on various beet sorts. The research carried out during 2008-2010 years in Ukr SRSPQ IPP resulted into determining that the level of root hair settlement by *Polymyxa betae K.* fungus in sugar and red beets is larger than in fodder beets. Thus, the average number of plasmodia in sight of microscope at magnification of 400^x was 10,3 pcs., 8,9 pcs. and 11,9 pcs. – in sugar beet; 9,1 pcs., 7,7 pcs., 10,1 pcs. – in red beet; 8,4 pcs., 7,1 pcs. 8,9 pcs. – in fodder beet (table 1). The plasmodia quantity change at different stages of beet growth, during the research period, responds to the overall *Polymyxa betae K.* fungus growth (tab. 2).

The gathered data affirms that harmfulness manifestation as regards control preserves its characteristics in all variants. The plants of sugar, red and fodder beet had reduced shoots in contaminated soil and also slower growth, than at control, was observed. The fact that first leaves formation occurs for 5-7 days later confirms it.

Under conditions of soil contamination by *Polymyxa betae K.* fungus, the sugar beet plants falling out at early growth stages was on the average up to 22%, to 18% in red beet and to 14% in fodder beet.

2. Beet growth and root hair contamination by Polymyxa betae K. fungus (laboratory tests, Ukr SRSPQ IPP)

Culture	Soil	Plant growth phase							
		Fork (shoots)		First pair of leaves		Second pair of leaves		average	
		Shoots quantity, %	Plasmodia quantity, pcs.	Shoots quantity, %	Plasmodia quantity, pcs.	Shoots quantity, %	Plasmodia quantity, pcs.	Shoots quantity, %	Plasmodia quantity, pcs.
1	2	3	4	5	6	7	8	9	10
2008 year									
Red beet (Bordeaux 237)	sterile	95	0	93	0	91	0	93,0	0
	contaminated	81	5,8	73	8,8	69	12,8	74,3	9,1
Sugar beet (hybrid Shevchenkivskyi)	sterile	94	0	93	0	91	0	92,6	0
	contaminated	82	6,4	68	9,6	64	14,8	71,3	10,3
Fodder beet (hybrid Ursus poly)	sterile	96	0	94	0	94	0	94,6	0
	contaminated	87	6,1	79	7,6	77	11,6	81,0	8,4
2009 year									
Red beet (Bordeaux 237)	sterile	92	0	90	0	90	0	90,6	0
	contaminated	82	5,6	72	7,2	67	10,3	73,6	7,7

1	2	3	4	5	6	7	8	9	10
Sugar beet (hybrid Shevchenkivskyi)	sterile	91	0	90	0	89	0	90,0	0
	contaminated	86	5,9	72	8,4	68	12,6	75,3	8,9
Fodder beet (hybrid Ursus poly)	sterile	93	0	90	0	90	0	91,0	0
	contaminated	90	5,2	82	6,4	78	9,9	83,3	7,1
2010 year									
Red beet (Bordeaux 237)	sterile	89	0	88	0	87	0	88,0	0
	contaminated	78	6,6	70	9,8	66	13,9	71,3	10,1
Sugar beet (hybrid Shevchenkivskyi)	sterile	93	0	91	0	90	0	91,3	0
	contaminated	81	8,9	65	12,7	60	14,2	68,6	11,9
Fodder beet (hybrid Ursus poly)	sterile	92	0	92	0	90	0	91,3	0
	contaminated	86	4,8	75	8,8	71	13,2	77,3	8,9

It should be noted that plants falling out at different stages of beet growth (shoots, first pair of leaves) was somewhat bigger than at further plant growth. In this way, the quantity of plants falling out at the second pair of leaves stage, regardless of increased root hair contamination by *Polymyxa betae K*. fungus, didn't exceed 5 % in all beet sorts. Further plants falling out had individual character. This phenomenon can be explained by of their vital capacity increasing and enlarging of root hair not contaminated by fungus

Under favourable conditions and combined action with other pathogens such fungus parasitism, due to reduced shoots on contaminated fields, can lead to additional expenses on seeds.

Conclusion

Basing on the research results it was determined that in order to create *Polymyxa betae K* fungus contagious background under laboratory conditions it is relevant to apply 5 g of contaminated roots on 50 g of sterile soil. Larger dosages of contaminated roots settlement leads to considerable falling out of test plants, lower dosages do not give the necessary root hair contamination for trustworthy data receiving. Given measure provides sugar beet Ukrainian variety CHS 75 contamination within 8,1 plasmodia in sight of microscope, and results in mild plant falling out.

The *Polymyxa betae K.* fungus under conditions of western Forrest-steppe of Ukraine can cause considerable losses at early growth stages of beet, especially lead to shoots quantity decrease in sugar beet within 22%, in red beet —18%, in fodder beet — 14%.

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ИНФЕКЦИОННЫЙ ФОН ДЛЯ ОПРЕДЕЛЕНИЯ ВРЕДОНОСНОСТИ ГРИБА *POLYMYXA BETAE K.*

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Приведены результаты исследований по изучению вредоносности гриба Polytyxa betae K. Рассмотрены особенности развития растений свеклы под действием гриба на разных фазах развития свеклы. Разработана система создания инфекционного фона для лабораторных исследований.

Ключевые слова: *ризомания, Polymyxa betae K., буряки, вредоносность, плазмодии, цистосорусы, инфекционный фон*

ІНФЕКЦІЙНИЙ ФОН ДЛЯ ВИЗНАЧЕННЯ ШКІДЛИВОСТІ ГРИБА POLYMYXA BETAE K.

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Наведено результати досліджень з вивчення шкідливості гриба Polymyxa betae K. Розглянуто особливості розвитку рослин буряків під дією гриба в різні фази розвитку. Розроблена система створення інфекційного фону для лабораторних досліджень.

Ключові слова: *ризоманія, Polymyxa betae K., буряки, шкідливість, плазмодії, цистосоруси, інфекційний фон*