

# Effect of low-temperature exposure of the wild potato *Solanum commersonii* Dun. and its genotypes on infection by the potato cyst nematode *Globodera rostochiensis* Woll.

Elizaveta M. Matveeva<sup>1</sup>, Vyacheslav V. Gorbach<sup>2</sup> and Eugeny P. Ieshko<sup>1</sup>

<sup>1</sup>Institute of Biology, Karelian Research Centre, Russian Academy of Sciences, 185910, Petrozavodsk, Republic of Karelia, Russian Federation

<sup>2</sup>Department of Zoology and Ecology, Petrozavodsk State University, 185910, Petrozavodsk, Republic of Karelia, Russian Federation  
e-mail: matveeva@krc.karelia.ru

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**Summary.** In continuation of research to study the effect of low temperature treatments on the ability of plants to act as hosts for the potato cyst nematode *Globodera rostochiensis*, the reproduction of the nematode on roots of the tuber-bearing wild potato species, *Solanum commersonii*, and its genotypes were investigated. Two genotypes were chosen, differing in freezing tolerance: freezing tolerant genotype ‘FT 1020’ and susceptible genotype ‘FS 2022’, and two plant treatments with low temperature (5°C), applied prior to nematode infection. The temperature treatments differed in the duration of time the plants were subjected to low temperature, one treatment consisting of short-term daily temperature drops and the other of constant low temperature for 6 days. The infected *S. commersonii* plants had the highest mean and range of values of cyst numbers on their roots; the genotypes had similar cyst numbers on roots irrespective of their freezing tolerance level. Infection levels changed with the type of low temperature treatment. Plant treatment with short-term daily temperature drops consistently reduced the average cyst numbers and can be recommended for inducing *S. commersonii* resistance to *G. rostochiensis*; by contrast, low temperature for 6 days did not induce plant resistance. The genotype ‘FT 1020’ developed resistance after both low temperature treatments prior to infection, whereas the susceptible genotype ‘FS 2022’ became highly resistant only after the prolonged low temperature treatment.

**Key words:** freezing tolerance level, golden potato nematode, infection, low temperature treatments, potato genotypes, short-term daily temperature drops.

Potato is a convenient model for experimental research on the reproductive capacity, infection conditions, and aggregation dynamics of the potato cyst nematode (PCN), *Globodera rostochiensis* (Wollenweber, 1923) Behrens, 1975, which is an obligate root endoparasite of plants of the Solanaceae family, primarily of potato. *Globodera rostochiensis* is common in most (over 100) countries around the world, including Russia, and on all continents except the Antarctic (EPPO Bulletin, 2018), and is listed as subject to exterior and interior quarantine regulations.

The development of the PCN on cultivated potatoes (Trudgill & Cotes, 1983; Greco & Moreno, 1992; Renčo, 2007; Urek *et al.*, 2008; Ebrahimi *et al.*, 2014) has been studied for many years in search of the factors to inhibit the parasite. Wild tuber-bearing potato species are used in the research to

investigate the basis of the relationship between *Globodera* spp. and their host plants, and in studies designed to find new forms resistant to *G. rostochiensis*, or resistance to other biotic and abiotic factors that may influence the formation and progress of the host-parasite relationship. The best studied wild potato species with different degrees of resistance to *Globodera* are *S. tuberosum* ssp. *andigena*, *S. spegazzinii* and *S. vernei* (Jacobs *et al.*, 1996). Over the past few decades, several other species of the genus *Solanum* have been identified as valuable sources of resistance to the parasite (Rousselle-Bourgeois & Mugniery, 1995; Castelli *et al.*, 2005; Rogozina, 2012; Schultz *et al.*, 2012; Przetakiewicz & Milczarek, 2017; Park *et al.*, 2019).

The wild tuber-bearing species *Solanum commersonii* Dun. (Uruguayan potato) is interesting for the combination of cold resistance and

susceptibility to *G. rostochiensis*. First evidence of its suitability as host for PCN has been obtained (Lavrova & Matveeva, 2017); it is known to be resistant to some fungal, viral and bacterial pathogens (Valkonen, 1997; Narancio *et al.*, 2013). Despite the years of research, knowledge of the nematode development on wild potato species is still poor, and the search for new resistant forms and the factors influencing resistance to *G. rostochiensis* continues (Bethke *et al.*, 2017; Armstrong *et al.*, 2019; Park *et al.*, 2019; Gancheva *et al.*, 2021; Gartner *et al.*, 2021).

The genetic homogeneity of potato cultivars permits assessing the dependence of individual plant infection parameters on variation in the adaptive response of the host plant to abiotic impacts. The stability of population relations in host-parasite systems, as shown by many authors, is determined by the nature of the distribution of parasites in the host population (Crofton, 1971a, b; Anderson & May, 1978; Shaw & Dobson, 1995; Poulin, 2007, 2013). The aggregated distribution observed for almost all parasites suggests that, in the host population, most individuals have a weak infection, some are not infected, while a small part is infected with a large number of parasites.

Lavrova *et al.* (2015, 2017a) demonstrated induced resistance to PCN during low-temperature treatment of cultivated potato plants prior to infection. Based on the published data, Ieshko *et al.* (2018) hypothesised that low-temperature treatment of plants would also reduce nematode reproduction and, therefore, the intensity of PCN infection of wild potato plants.

The goal of this study was to investigate PCN reproduction on roots of the tuber-bearing wild potato species, *S. commersonii* and its genotypes, with different freezing tolerance after plant treatments with low temperature (5°C) prior to infection.

## MATERIAL AND METHODS

Experiments utilised: *i*) wild tuber-bearing freezing tolerant potato species, *S. commersonii*, from the Commersoniana family ('FT S.c'); *ii*) freezing tolerant genotype 1020 ('FT 1020'); and *iii*) freezing susceptible genotype 2022 ('FS 2022'). The latter two genotypes were S<sub>1</sub> genotypes (first-generation of the somatic hybrid SH9A – interspecies hybrid of *S. commersonii* Dun. PI243503 and potato cultivar *S. tuberosum* 'SPV11' genus *Solanum* L., series Tuberosa), and were kindly provided by M. Seppänen, Helsinki University, Finland (Seppänen & Coleman, 2003). Potato plants were obtained from the apical

meristems of etiolated tuber sprouts, followed by *in vitro* culturing for 3 weeks at a temperature of 20/18°C by microcutting on a modified Murashige-Skoog nutrient medium.

The experimental setup for studying the propagation of *G. rostochiensis* on the roots of *S. commersonii* and its genotypes was conducted in three years (in 2011, 2012 and 2013) and each included several stages. Meristem plants were propagated for 4 weeks to provide sufficient numbers for the experiment; after that plants were transferred to sand-filled pots (500 g) and grown in climate chamber in the optimal conditions for growth and development (temperature of 23°C, a photoperiod of 12 h at a PPFD of 122 µmol·s<sup>-1</sup>·m<sup>-2</sup>, with a complete Knop nutrient solution (based on 1 g l<sup>-1</sup> Ca(NO<sub>3</sub>)<sub>2</sub>, 0.25 g l<sup>-1</sup> KH<sub>2</sub>PO<sub>4</sub>, 0.25 g l<sup>-1</sup> MgSO<sub>4</sub> 7H<sub>2</sub>O, 0.25 g l<sup>-1</sup> KNO<sub>3</sub>, trace quantity of FeSO<sub>4</sub> and pH 5.5-5.6). After 2 weeks all plants were divided into three experimental groups: the first group was used as a control (without any additional temperature treatments) with 9, 10 and 10 replicates per genotype (*S. commersonii*, 'FT 1020' and 'FS 2022'), respectively; there were the same number of replicates for pre-treatment effects. The remaining two groups were subjected to two types of low temperature pre-treatment: *i*) short-term daily temperature drops from 23 to 5°C for 2 h at the end of the night during 6 days (DROP-treatment); and *ii*) constant (long-term) low temperature (5°C) for 6 days (CLT-treatment). The day after the end of temperature treatments non-treated (control) and treated (DROP- and CLT-treatment) plants were inoculated with *G. rostochiensis*, pathotype Ro1, by placing cysts into the soil nearby roots. Cysts were from 1-3-year old laboratory-reared populations obtained from local field populations (Republic of Karelia) and cultured on potatoes in sand. The inoculation dose was 20 cysts per plant; the mean cyst content was 270 eggs and juveniles with 89% viability; 68% of the viable J2 hatched in a hatching test of laboratory-reared PCN cysts. After infection the plants were kept under optimal growth conditions (23°C) for 7 weeks. Then, watering was stopped and the plants left for 3-4 weeks until completion of the nematode life cycle and formation of brown cysts, which detached from the roots into the soil. Cysts were isolated from the substrate by the floatation method (Seinhorst, 1967). The level of plant roots infection with the nematode was defined as cyst production per plant.

Comparing of triplicate repetitions by the frequency distributions of the number of nematode cysts per plant in control, DROP and CLT-treatments indicated the non-significant differences

of these variants within all investigated genotypes (Kolmogorov-Smirnov test:  $\lambda < 0.500$ ,  $P > 0.112$ ). The best reproducibility of the results was noted for control plants in all genotypes (Kolmogorov-Smirnov test:  $\lambda < 0.300$ ,  $P > 0.765$ ). The equivalent repetitions within genotype groups were pooled together for the subsequent analysis. Thus, the samples for comparisons were represented in each of the plant groups (*S. commersonii*, ‘FT 1020’ and ‘FS 2022’) 27, 30 and 30 replicates for control, DROP and CLT-treatments, respectively.

The hypothesis that empirical distributions conform to the Gamma law was tested and the frequencies obtained in the different experimental setups were compared by the Kolmogorov-Smirnov test ( $\lambda$ ). The key measures of infection used in the study were the arithmetic mean ( $M$ ), standard deviation ( $S$ ), and median ( $Me$ ). The range of parameter variation was determined by simple non-parametric bootstrapping with  $B = 1,000$  iterations, which was sufficient for the probability level  $P = 0.95$  (Shitikov & Rosenberg, 2013). Confidence intervals were constructed by the percentile method. The frequency distributions and the investigated parameters were compared by Monte Carlo Randomization (MCR) with the same number of iterations  $B$ . The significance of differences in  $P$  was represented by the proportion of null model combinations (the empirical difference not greater than the randomised difference,  $|d_{\text{obs}}| \leq |d_{\text{rand}}|$ ) in the total number of iterations  $B$ . The value adopted as critical for  $P$  was the standard value  $\alpha = 0.05$ .

The data were processed in the MS Excel and R 4.0.1 (R Core Team, 2021) environments using basic functions and functions of the packages composition (van den Boogaart *et al.*, 2022) and MASS 7.3-54 (Ripley *et al.*, 2022).

## RESULTS

**The response of the control plants of *S. commersonii*, freezing tolerant genotype ‘FT 1020’ and freezing susceptible genotype ‘FS 2022’ to PCN infection.** The frequency distribution of nematode cysts on control plants in all three potato genotypes was adequate by the gamma law (Table 1). Infection intensities in ‘FT 1020’ and ‘FS 2022’ genotype plants were similar in the distribution of frequencies (Kolmogorov-Smirnov test:  $\lambda = 0.200$ ,  $P = 0.599$ ) and in all the tested parameters (MCR test:  $P > 0.417$ ).

Compared to others, wild plants had a slightly higher infection by *G. rostochiensis*, but all statistical similarities and differences were recorded

at levels closer to the critical value of  $P$ . They did not differ from ‘FS 2022’ by frequencies of cyst infection (Kolmogorov-Smirnov test:  $\lambda = 0.296$ ,  $P = 0.188$ ) and parameters of the distribution (MCR test:  $P > 0.071$ ) but showed differences from ‘FT 1020’ in frequencies (Kolmogorov-Smirnov test:  $\lambda = 0.374$ ,  $P = 0.027$ ), arithmetic means and standard deviations (MCR test:  $P > 0.044$ ). The medians did not differ significantly (MCR test:  $P > 0.148$ ).

**Comparative analysis of the response of *S. commersonii*, genotypes ‘FT 1020’ and ‘FS 2022’ to PCN infection in the control and in the short-term low temperature (DROP) treatment.** DROP-treatment of the plants prior to infection by *G. rostochiensis* promoted the resistance of the treated *S. commersonii* (‘FT S.c’) and ‘FT 1020’ plants to *G. rostochiensis* as compared to the control (Table 1). Mean and median infection intensities in the treated plants decreased by a factor of 1.33-3.37. The range of variation in ‘FT 1020’ plants also declined significantly; the standard deviation for this genotype decreased 1.97 times. The overall effect from short-term low temperature exposure was a significant change in the frequency distribution pattern of the cysts on ‘FT S.c’ and ‘FT 1020’ plants compared to the control (Kolmogorov-Smirnov test:  $\lambda > 0.400$ ,  $P < 0.013$ ); the share of slightly infected plants increased notably in the treatment (Fig. 1). By comparison, freezing tolerant ‘FT S.c’ plants responded to the DROP-treatment differently from ‘FT 1020’ plants. The resulting infection level of ‘FT 1020’ genotype plants in the experiment did not exceed 100 cysts, while the variant with the wild species ‘FT S.c’ had quite a large group of plants infected at higher intensity. The significant deviation from the simple gamma distribution (Table 1) indicates a non-homogenous response of plants of the wild species to the treatment with low temperatures. This phenomenon is adequately explained by superposition of distributions; the closest approximation by the gamma law (Kolmogorov-Smirnov test:  $\lambda < 0.164$ ,  $P > 0.594$ ) yielded two transgressing series with variation ranges of plant infection by *G. rostochiensis* of 18-74 and 44-151 cysts. The first distribution has the arithmetic mean  $M = 31.7$  (26.5-37.7), standard deviation  $S = 13.2$  (6.2-18.6), and median  $Me = 29.5$  (25.0-32.5); the second distribution has  $M = 92.2$  (66.7-117.9),  $S = 41.0$  (22.6-50.1), and  $Me = 97.0$  (46.0-150). Thus, the DROP treatment appeared to differentiate *S. commersonii* plants into two groups differing in resistance to *G. rostochiensis*. The infection of plants of wild-growing species from the

first group was lower compared to the ‘FT 1020’ genotype; the differences between the arithmetic means and medians are statistically significant (MCR test:  $P > 0.002$ ), standard deviations are homogeneous (MCR test:  $P = 0.391$ ).

DROP-treatment of freezing susceptible ‘FS 2022’ genotype plants had no significant effect either on the distribution of frequencies (Kolmogorov-Smirnov test:  $\lambda = 0.300$ ,  $P = 0.116$ ) or on any of the tested infection parameters; there were no differences between experimental and control plants in means, medians, or standard deviations (Table 1).

#### Specific responses of *S. commersonii*, genotypes ‘FT 1020’ and ‘FS 2022’ to PCN infection in the control and in the constant low temperature (CLT) treatment prior to infection.

In the experiment, where potato plants were exposed to constant low temperature prior to infection by *G. rostochiensis*, a tangible decline in the number of cysts was demonstrated by the freezing tolerant genotype ‘FT 1020’ and the freezing susceptible genotype ‘FS 2022’. Mean and median values of the infection intensity decreased by a factor of 1.66-2.19 times (Table 1). Differences in the infection arithmetic means,

medians and standard deviations between plants of genotypes ‘FT 1020’ and ‘FS 2022’ were inconsistent (MCR test:  $P > 0.389$ ). In both variants empirical frequencies still conformed to the gamma distribution, but the distribution patterns changed notably compared to the control (Kolmogorov-Smirnov test:  $\lambda > 0.500$ ,  $P < 0.002$ ). Plants treated by constant low temperature exhibited a total shift towards a low number of *G. rostochiensis* cysts (Fig. 1). The differences between the distributions for ‘FT 1020’ and ‘FS 2022’, which were insignificant in the control, remained non-significant in the experiment (Kolmogorov-Smirnov test:  $\lambda = 0.200$ ,  $P = 0.508$ ).

CLT-treatment of wild potato plants ‘FT S.c’ did not altered any of the test parameters of infection levels significantly and the empirical distributions remained consistent with the gamma law (Table 1).

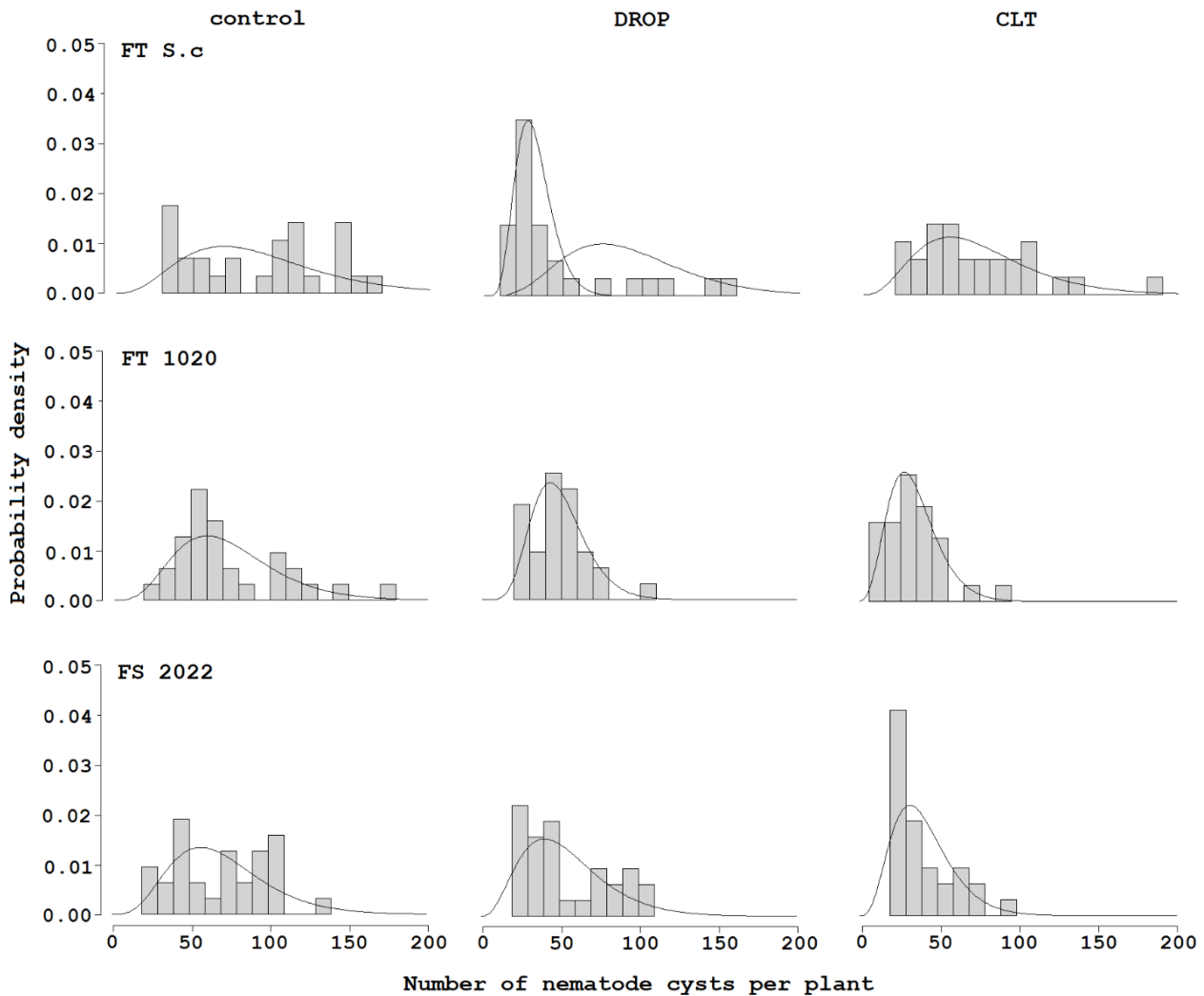
## DISCUSSION

The study has demonstrated that *S. commersonii* and its genotypes are susceptible to infection with *G. rostochiensis*. The possible reason for the susceptibility of *S. commersonii* to the nematode is the lack of natural genetic (R-gene-mediated) resistance to

**Table 1.** Statistical measures of infection by *Globodera rostochiensis* in plants of the freezing tolerant species *Solnum commersonii* (‘FT S.c’) and genotype ‘FT 1020’, and the freezing susceptible genotype ‘FS 2022’ in the control and after low temperature treatments.

Parameter	‘FT S.c’			‘FT 1020’			‘FS 2022’		
	Control	DROP	CLT	Control	DROP	CLT	Control	DROP	CLT
<i>n</i>	27	27	27	30	30	30	30	30	30
<i>lim</i>	33-162	18-151	22-189	28-177	20-100	16-92	25-137	21-109	20-97
$\lambda$	0.174 $P = 0.385$	0.263 $P = \mathbf{0.005}$	0.107 $P = 0.916$	0.152 $P = 0.496$	0.081 $P = 0.990$	0.091 $P = 0.964$	0.137 $P = 0.628$	0.122 $P = 0.762$	0.154 $P = 0.473$
<i>M</i>	91.6 76.0-107.5	48.5 34.7-63.9 $P < \mathbf{0.001}$	73.6 61.6-89.1 $P = 0.102$	74.0 61.9-87.1	49.0 43.1-55.2 $P < \mathbf{0.001}$	38.6 33.1-44.8 $P < \mathbf{0.001}$	70.7 59.2-81.5	54.5 45.5-64.4 $P = 0.055$	41.2 34.5-49.1 $P < \mathbf{0.001}$
<i>S</i>	42.9 34.2-47.9	39.1 21.7-49.9 $P = 0.537$	38.6 25.5-50.7 $P = 0.569$	34.8 22.9-44.4	17.7 12.1-22.3 $P = \mathbf{0.038}$	16.9 10.7-21.9 $P = \mathbf{0.034}$	29.8 23.8-34.8	28.1 22.0-31.8 $P = 0.708$	20.9 14.6-25.5 $P = 0.058$
<i>Me</i>	101.0 60.0-114.0	30.0 29.0-35.0 $P < \mathbf{0.001}$	61.0 53.0-90.0 $P = 0.090$	63.0 56.5-74.0	47.5 42.0-54.0 $P = \mathbf{0.011}$	38.0 31.0-43.5 $P < \mathbf{0.001}$	72.0 50.0-92.0	46.5 35.0-70.0 $P = 0.147$	32.5 29.0-43.0 $P < \mathbf{0.001}$

Note. ‘FT S.c’ – freezing tolerant potato species *S. commersonii*; ‘FT 1020’ – highly freezing tolerant genotype; ‘FS 2022’ – freezing susceptible genotype; control – infested plants without any low temperature pre-treatment; DROP – plant pre-treatment with daily short-term temperature drops (from 23 to 5°C) for 2 h at the end of the night during 6 days; CLT – plant pre-treatment with constant low temperature (5°C) during 6 days; *n* – sample size, *lim* – variation range,  $\lambda$  – conformance of empirical frequencies to the gamma distribution (Kolmogorov-Smirnov test and its significance  $P$ ), *M* – arithmetic mean, *S* – standard deviation, and *Me* – median; the variation range was determined by the percentile method (bootstrapping with  $B = 1,000$  iterations),  $P$  – significance of the difference from the control (MCR-test with 1,000 iterations). Bold type marks significant differences between variants.



**Fig. 1.** Distribution histograms of cysts of *Globodera rostochiensis* for the control and experimental plants of *Solanum commersonii*, genotypes ‘FT 1020’ and ‘FS 2022’. DROP – plant pre-treatment with daily short-term temperature drops (from 23 to 5°C) for 2 h at the end of the night during 6 days; CLT – plant pre-treatment with constant low temperature (5°C) during 6 days.

the parasite, since the potato species has not encountered the potato cyst nematode during its evolution and the two species have no host-parasite co-evolution history. Plants resistant to *G. rostochiensis* are mainly concentrated in the western and southern parts of South America, which coincides with the nematode’s provenance and distribution area (Evans & Stone, 1977; Castelli *et al.*, 2005, Subbotin *et al.*, 2020). The primary provenance and distribution region of *S. commersonii* on the other hand is Uruguay as well as eastern parts of Argentina and southern Brazil (Narancio *et al.*, 2013); this species grows outside the distribution range of cultivated potato species and is probably not among their ancestors (Gancheva *et al.*, 2021). A number of R-genes (resistant genes) have been

identified in the genome of *S. commersonii* plants, but their number is much lower than in *S. tuberosum* (Contaldi *et al.*, 2014; Aversano *et al.*, 2015), and no genes facilitating resistance to *G. rostochiensis* have yet been detected.

This research permitted new data to be obtained regarding the regulation of the host-parasite relationship by the thermal factor, which shaped the distribution of parasite numbers in the host population. The effect of low temperature pre-treatments on infection by *G. rostochiensis* in plants of the wild species and its freezing tolerant and freezing susceptible genotypes was described by frequency distributions of newly formed cysts. The study of the response of potato genetic lines obtained through selection for cold tolerance

revealed notable variation among individual plants in response to the thermal impact and infection by the biotrophic parasite. Analysis of the *G. rostochiensis* infection patterns in the control plants has demonstrated the wild species *S. commersonii* to be notably different from its genotypes, the freezing tolerant 'FT 1020' and the susceptible 'FS 2022', which were similar to each other in the pattern and parameters of the frequency distribution in the samples. The first thing to observe is the maximum level of the nematode infection in plants of the wild species and the bimodality of the empirical distribution, which indicates that the sample contained both infection-resistant and infection-susceptible plants. The variation in the infection by *G. rostochiensis* of *S. commersonii* plants maybe due largely to the plants' physiological and biochemical status: they feature a high content of sugars, carbohydrates, and glycoalkaloids (Vazquez *et al.*, 1997; Seppänen & Coleman, 2003) and a high level of some pathogenesis-related (PR) proteins (Folgado *et al.*, 2013), which are not only important actors in maintaining normal life function, but also contribute to the development of defence against stresses, including infection by plant-parasitic nematodes (Zinovieva *et al.*, 2004). A conclusion following from the above is that the physiological and biochemical status of *S. commersonii* plants is adverse to the development of nematode juveniles, generating a variation of infection parameters among individual plants. It appears that targeted selection of potato for cold tolerance simultaneously leads to resistance to the parasitic infection. Data on the numbers and viability of eggs and juveniles in new-generation nematode cysts indicated that *S. commersonii* is not an optimal host for *G. rostochiensis*. The viability of eggs and juveniles inside cysts was low due to the presence of a large number of blastomeric eggs containing only vitelline fluid, without a juvenile formed inside and empty eggs (Lavrova & Matveeva, 2017). Genotypes 'FT 1020' and 'FS 2022' were also characterised by a low total number of eggs inside cysts that were blastomeric or died. No juveniles were observed in the cysts (unpublished data).

Previous experimental studies on the effect of low temperature treatments on cultivated potato prior to infection by *G. rostochiensis* on the number of new-generation cysts, showed that the distribution of nematodes in the host population was always aggregated and modelled by the gamma distribution (Ieshko *et al.*, 2018). The highly aggregated distribution of cysts on the control plants not treated by low temperatures prior to infection

enables assessment of the initial (genetic) individual characteristics of plant resistance to the PCN achieved through selection. Individual differences in the resistance of cultivated potato plants may shape the degree of aggregation of nematodes in the host population. At the same time, the resistance of the plants to the nematode varies depending on the type of the low temperature exposure prior to infection. Exposure to constant low temperature caused potato plants to become more resistant compared to the control. Exposure to short-term temperature drops proved to be even more effective, the plants developing strong and more uniform resistance to *G. rostochiensis*. This can be explained by a modified functional state of the plants after low temperature treatments during the formation of the host-parasite relationship (Lavrova & Matveeva, 2015; Lavrova *et al.*, 2017a, b).

With the wild species, *S. commersonii*, short-term temperature treatment prior to infection promoted the plants' resistance to PCN; by contrast, constant low temperature treatment was not effective in promoting resistance. *Solanum commersonii* genotypes exhibited different adaptive reactions to temperature treatments. 'FT 1020' showed an increase in resistance to the nematode infection after both low temperature treatments, whereas 'FS 2022' became more resistant to infection only after CLT-treatment. The latter genotype has a fairly high cold acclimation capacity and it is possible that only a prolonged low temperature prior to infection can trigger augmentation of non-specific resistance in the plants. It should be noted here that freezing tolerance and cold acclimation capacity are controlled by different genes (Seppänen & Coleman, 2003). The differences demonstrated for the mean and the variance of nematode cyst numbers demonstrates that selection of potato for cold tolerance at the same time leads to enhanced resistance to infection by *G. rostochiensis*.

The results thus demonstrate that the expression of the adaptive response of potato plants to infection with the obligate parasite varied: its characteristics in the control were similar, being fully dependent on the characteristics of individual plants as evidenced by aggregation parameters and histograms of nematode cyst distribution in populations of different host plant groups. The situation in the DROP-treatment is different: the induction and vector of the adaptive reaction are modulated by the thermal factor (combination of the level and duration of the low- and optimal temperature impact) as exhibited by the differences in the cyst numbers and distribution aggregation between the freezing tolerant

*S. commersonii* and genotype 'FT 1020'. CLT-treatment induced differences between the freezing tolerant 'FT 1020' and the susceptible 'FS 2022' in the realisation of their adaptive potential. Thus, temperature, or more specifically the combination of low and optimal temperatures, is a factor regulating the host-parasite relationship, which results in the reduction of nematode reproduction on plant roots and increase in wild potato plant resistance to nematode infection.

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**Е.М. Матвеева, В.В. Горбач и Е.П. Иешко.** Влияние низкотемпературных обработок растений дикого клубненосного картофеля *Solanum commersonii* Dun. и его генотипов на их зараженность картофельной цистообразующей нематодой *Globodera rostochiensis* Woll.

**Резюме.** В продолжение исследований по изучению влияния низкотемпературных обработок на способность растений выступать в качестве хозяев для картофельной цистообразующей нематоды *Globodera rostochiensis* Woll. было изучено размножение нематоды на корнях клубненосного вида дикого картофеля *Solanum commersonii* Dun. и его генотипов при обработке растений низкими температурами различной продолжительности. Были выбраны два генотипа, обладающие различной устойчивостью к низким температурам: морозоустойчивый генотип 'FT 1020' и восприимчивый генотип 'FS 2022', и две обработки растений низкой температурой, примененные до заражения нематодой. Обработки различались по продолжительности воздействия низкой температуры на опытные растения: а) ежесуточное кратковременное снижение температуры (с 23 до 5°C) на 2 ч в конце ночного периода в течение 6 суток; б) постоянная низкая температура (5°C) в течение 6 суток. Показано, что все зараженные растения *S. commersonii* имели максимальные значения средней и дисперсии численности нематод; генотипы вне зависимости от их устойчивости к заморозкам показали близкие статистические показатели числа цист нематоды на корнях растений. Зараженность растений нематодой изменялась в зависимости от характера низкотемпературного воздействия. Кратковременная низкотемпературная предобработка растений достоверно снижала среднюю интенсивность заражения и дисперсию и рекомендована для повышения устойчивости *S. commersonii* к *G. rostochiensis*. Для устойчивого к заморозкам генотипа 'FT 1020' отмечено формирование устойчивости растений к заражению при обоих видах низкотемпературной обработки перед заражением. Для чувствительного генотипа 'FS 2022' выявлена высокая устойчивость к заражению только при продолжительной обработке низкой температурой.

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