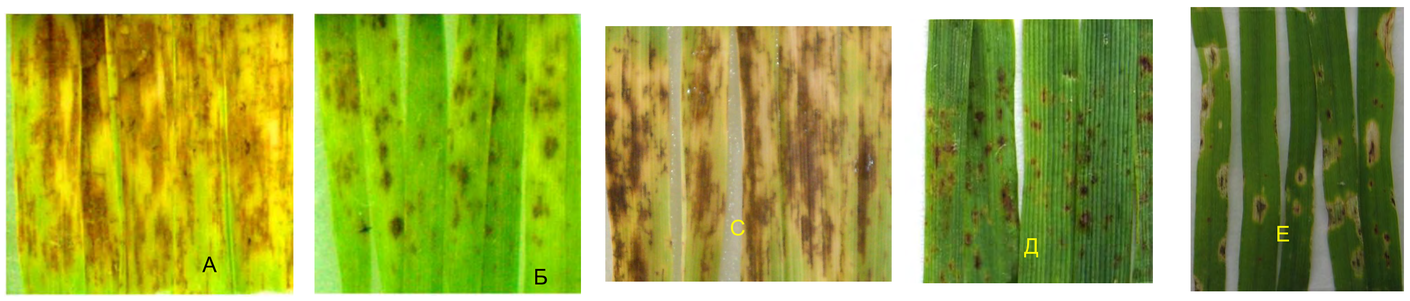
Genetic diversity of Pyrenophora teres f. teres populations on wheat and barley in North-West of Russian Federation

Nina Mironenko*, Ludmila Mikhailova, Irina Ternuk, Nadezhda Kovalenko

All Russian Research Institute for Plant Protection, Saint-Petersburg, Pushkin, Russia
*e-mail nina2601mir@mail.ru

P.tritici-repentis + P.teres on wheat



a – barley cv.Pirka, b – winter wheat cv.Tarasovskaya 29, c – barley cv.Pirkka, d, e – spring wheat cv.Svecha, a, b, – inoculated by P. teres originated from wheat, c, d – P. teres originated from barley, e – wheat inoculated by P. tritici-repentis

P.teres f.teres on barley

In 2005-2009 the species structure of genera Pyrenophora on wheat in territory of the North Caucasus (Krasnodar krai and Dagestan) and North-West Region (Novgorod, Pskov and Leningrad Region) of Russia was investigated. In 2005-2006 in all surveyed territory only *P. tritici-repentis* ***(Ptr)*** was found out. In 2007 *Pyrenophora teres* ***(Pt),*** the causal agent of barley net blotch was detected on spring wheat in Northwest Region. It was the first finding of this pathogen on wheat in Russia (Mikhailova et al., 2010).

Table 1. Frequency of occurrence *P. teres* (*Pt*) isolates on wheat

A

Year	Dagestan		Krasnodar krai		North-West	
	Number of isolates					
	Total	Pt (%)	Total	Pt (%)	Total	Pt (%)
2005	26	0	58	0	47	0
2006	35	0	38	0	36	0
2007	4	0	43	0	55	29
2008	32	0	62	0	77	13
2009	-	-	94	0	108	60

B

Year	Wheat	Number of isolates	
		Total	Pt
2007	Spring	30	**7**
	Winter	25	**0**
2008	Spring	22	**8**
	Winter	55	**2**
2009	Spring	62	**48**
	Winter	46	**17**

Table 2. Frequency of occurrence *P. teres*

Wheat cultivar	P. teres isolated from			P. tritici-repentis isolated from	
	Winter wheat	Spring wheat	Spring barley	Winter wheat	Spring wheat
Allies	59	60	80	69	46
Riley 67	41	20	0	34	15
Satsukei 86	41	28	7	69	85
Asiago	47	52	0	10	31
Clark	47	68	0	0	31
Hokkai 252	29	60	7	38	46
Komadi 3	29	60	7	52	38
Dartagnan	0	4	0	59	92
Glenlea	59	6	13	100	100
Katepwa	71	44	60	79	85
6B365	53	24	13	52	31
6B662	29	12	27	14	31
Salamouni	23	12	7	27	31
M3	0	0	0	3	0
Number of isolates	17	25	15	29	13

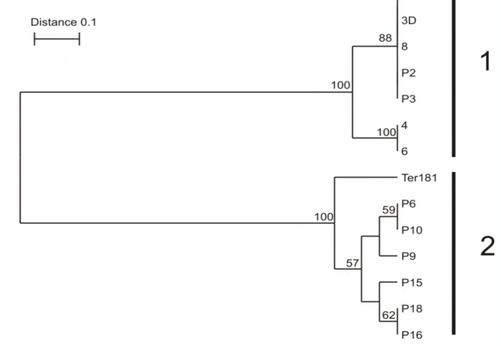
Frequency of occurrence isolates virulent to Allies, Katepwa, 6B662 was rather equal in all Pt and Ptr isolate samples. Pt isolates originated from barley were avirulent to the most part of wheat cultivars (Riley 67, Asiago, Clark Dartagnan), or their frequency was low (Satsukei 86, Hokkai 252, Komadi). However Pt isolates originated from wheat characterized by high frequency of occurrence of virulent ones. Their frequency practically not differing from frequency in samples of Ptr isolates.

In 2007-2009 frequency of occurrence *Pt* isolates has increased from 29% to 60% from the sum of *Pyrenophora* isolates (Table 1A). Basically *P. teres* originated from spring wheat cultivars (Tabl.1B).

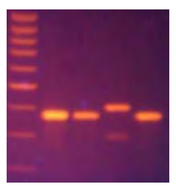
During all period of research in territory of North Caucasus *P. teres* was not found out.

Samples of isolates Pt and Ptr originated from spring and winter wheat, and Pt from barley were compared on frequencies of occurrence isolates virulent to wheat cultivars (Table 2). These cultivars were chosen on their ability to differentiate isolates Ptr on virulence (Mikhailova et. al., 2002). Virulence was estimated on size of necrotic spots on leaf segments for 5 - 6 days after their inoculation by conidia suspension of both fungi (3 - 4·10³ conidia/ml).

Species identification of new pathogen as *Pyrenophora teres* has been proved by Morphological traits and RAPD analysis. Genetic relationship between *Pyrenophora* isolates:
1 – *P. tritici-repentis*,
2 – *P. teres*

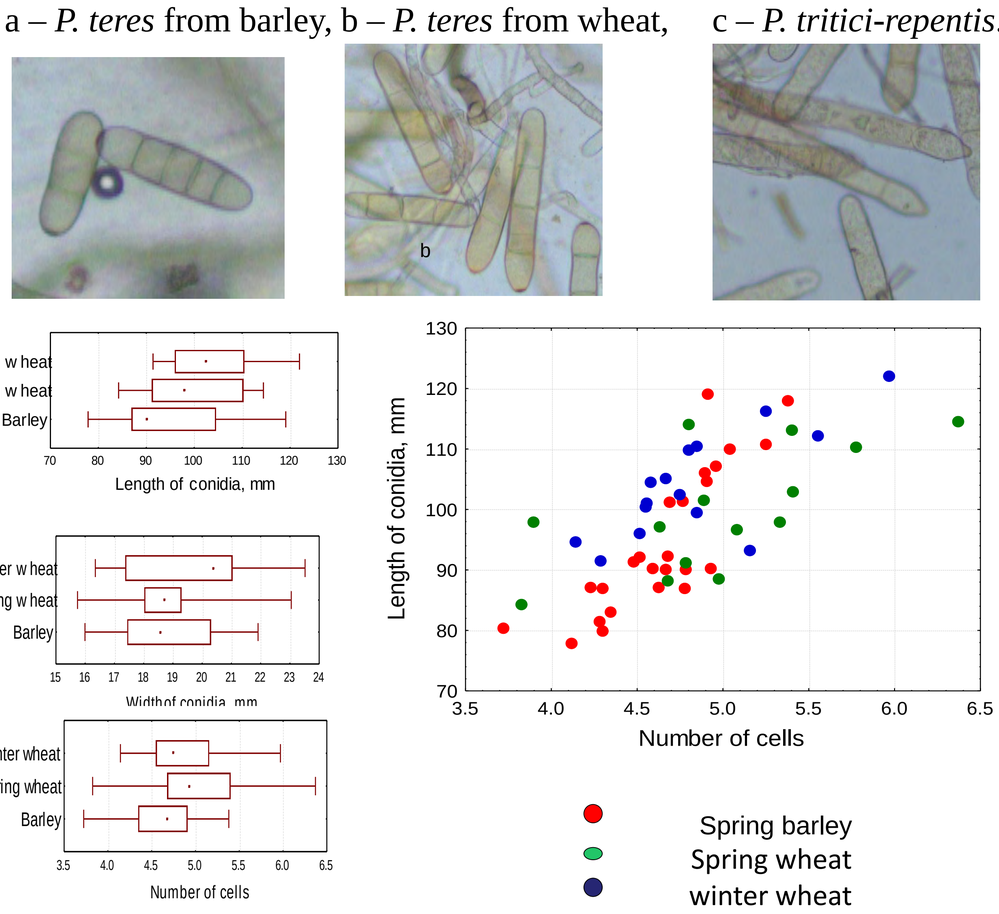


Using PCR with specific primers to spot and net forms (Williams et al., 2001) all P.teres isolates were identified as *P. teres* f. *teres*

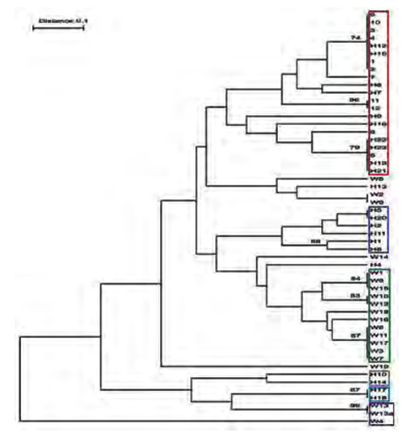


Isolates of *P. teres* f. *teres* originated from different hosts were distinguished by size of conidia. Variability of conidia originated from barley was wider than variability conidia originated from wheat.

a – *P. teres* from barley, b – *P. teres* from wheat, c – *P. tritici-repentis*.



P. teres isolates of the were isolated from spring and winter wheat (SW, WW), and from spring barley (SB). Using RAPD and UP-PCR methods, genetic differences were found out between SW and WW *P. teres* f. *teres* populations (F_{st} = 0,41), WW and SB (F_{st} = 0,21), and SW and SB (F_{st} = 0,18) on 16 polymorphic loci. Average gene diversity over loci was higher on barley (H=0,30) and spring wheat (H=0,26), than on winter wheat (H=0,12).



Genetic relationships between *P.teres* isolates, originated from winter (N and spring wheat (W) and barley (H from one region (Novgorod) of North West of RF

Conclusions

1. There is first report of detection of *P. teres* f. *teres* isolates on spring and winter wheat in Russia.
2. *P.teres* f.*teres* isolates originated from wheat are more adaptive to wheat, than to barley.
3. Among the studied cultivars of wheat distinctions on resistance to *P.teres* and *P.tritici-repentis* have been revealed only on cv. Dartagnan
4. Conidia of "wheat" P. teres isolates are longer and have more septa than conidia of "barley" isolates.
5. "Barley" and "spring wheat" *P. teres* isolates characterized by more genetic variability than "winter wheat" ones.
6. Genetic differences were found out for *P. teres* populations originated from different hosts: barley, winter and spring wheat.

P. teres is in process of genetic and physiological specialization to wheat.