**Report on *Puccinia striiformis* race analyses 2010, Global Rust Reference Center, Aarhus University, Flakkebjerg, DK- 4200 Slagelse, Denmark.**

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This is a preliminary report based on an agreement between Aarhus University, CIMMYT and ICARDA to facilitate race analyses of samples of *Puccinia striiformis,* causing yellow rust on wheat. In 2010, CIMMYT and ICARDA have each supported the research by a contribution of USD 20,000, whereas Aarhus University has contributed with facilities, consumables and substantial scientific and technical expertise. A summary of the results can be spread within relevant countries and organisations without delay, provided that the author of this report is acknowledged, along with funding institutions, i.e. "Hovmøller 2010: Global Rust Reference Center – Yellow rust (Research funded by: Aarhus University, Denmark; CIMMYT; ICARDA)".

**Sample submission and preparation**
Sample sites in 2010 were selected by staff at ICARDA, CIMMYT and NARCs in Africa and Asia, with a focus on high risk epidemic areas. The sampling procedure was suggested as follows.

Four to five leaves were collected from each plot where a sample was required. Younger (upper) leaves are usually better than older leaves (more viable and green), if possible with clearly separated lesions. Each of such five leaves was folded to avoid curling (pustules inside the folded leaf), after which they were put into a SINGLE paper envelope, i.e., one envelope per plot /field sampled. After collection, the samples were dried at room temperature for about one day. Additional two layers of envelopes (increasing in size) were used to seal samples to avoid contamination during transportation.

Samples were preferably collected from different locations and varieties (e.g., some heavily infected and some light infected), max of 20-25 sites/varieties (i.e., 25 envelopes with individual leaves). GRRC did not guarantee to process all samples received. The risk of unintentional spread arising from sending the package like this should effectively be 0

A total of 187 samples were received from 6 countries. These entered recovery processing on susceptible seedlings and resulted in 71 viable isolates (38%). This rate is overall considered OK, but varying considerably from case to case. The lowest recovery rate in 2010 (Uzbekistan) was ascribed to a relative long time between sampling and arrival at GRRC (approx. 3 weeks). In general, three leaves from each field/plot entered recovery. Successful samples were often multiplied more than once to achieve sufficient amount of spores to allow for race analyses, which were made according to the procedure described by Hovmøller & Justesen (Aust. J. Agr. Research 58, 518-524 (2007).

**Table 1. Number of yellow rust samples submitted to GRRC in 2010**

| Number of samples | | | | |
|---|---|---|---|---|
| Country | Failed | Recovered | Total | **Provided by** |
| Afghanistan | 3 | 3 | 6 | Rajiv Sharma, CIMMYT, Afghanistan |
| Azerbaijan | 32 | 18 | 50 | Kumarse Nazari, ICARDA |
| Iraq | 22 | 12 | 34 | Emad M. Al-Maaroof, Ministry of Science & Technology, Iraq |
| Kenya | 14 | 14 | 28 | Ruth Wanyera, KARI, Kenya |
| Tajikistan | 12 | 20 | 32 | Mahbubjon Rahmatov, Plant Breeding Specialist, Tajikistan & Sweden |
| Uzbekistan | 33 | 4 | 37 | Ram C Sharma, ICARDA |
| Total | 116 | 71 | 187 | |
| In per cent | 62% | 38% | 100% | |

A subset of 52 recovered isolates were analysed for race ID (Table 2). The figures correspond to virulence matching YR resistance genes, a parenthesis designate 'partial virulence', either due to heterozygosity of the

isolate or unknown R-genes in the differentials. Yr-genes corresponding to a virulent race are considered ineffective for yellow rust control. In 2010 we did not observe virulence for Yr5, 10, 15, 17, 24 among the isolates tested from areas listed in Table 1. Despite that some pathotypes may remain undetected in some areas due to a relative low sample size, the results were quite consistent across the different sampling areas.

Virulence for Yr10 was common among European samples from Triticale and virulence for Yr17 was common for European wheat samples (data not shown). For European results, see www.eurowheat.org under the heading "pathogens" and "yellow rust".

**Table 2. Race analyses of Puccinia striiformis from wheat 2010.**

| Number of isolates of different races | | | |
|---|---|---|---|
| Country | Pathotype code | number | Comment |
| Afghanistan | -(2)---6789----25.-.-- | 3 | aggressive |
| Afghanistan Total | | 3 | |
| Azerbaijan | -(2)---6789----25.-.-- | 2 | aggressive |
| | -(2)---6789----25.27.-- | 7 | aggressive |
| | -----678------.-.-- | 2 | |
| Azerbaijan Total | | 11 | |
| Iraq | -(2)---6789----25.27.-- | 6 | aggressive |
| Iraq Total | | 7 | |
| Kenya | 1(2)---6789----25.27.-- | 13 | aggressive |
| Kenya Total | | 13 | |
| Tajikistan | 1234-6--9----25.-.32- | 9 | |
| | 1234-6--9----25.27.32- | 2 | |
| | 1234-6--9----25.27.32(sp) | 1 | |
| | 12---678------.27.-- | 1 | |
| | 12---678-----25.27.-- | 1 | |
| Tajikistan Total | | 14 | |
| Uzbekistan | 1234-6--9----25.-.32- | 4 | |
| Uzbekistan Total | | 4 | |
| Total number of isolates | | 52 | |

Based on race and previous studies of aggressiveness (Milus et al. 2009: Phytopathology 99, 89-94) a high frequency of isolates were considered aggressive. This suggests that the aggressive strains of yellow rust are spreading further in Africa and Western Asia, including Iraq and Afghanistan. The combination of virulence for *Yr27* and aggressiveness may be a dangerous cocktail, which cam initiate devastating yellow rust epidemics, including areas where *Yr27*-resistant varieties are commonly grown. In Kenya, the aggressive strain has evolved further and acquired virulence for Yr1. However, final conclusions concerning ongoing spread of aggressive yellow rust must await DNA-fingerprint analyses, which are in progress at Aarhus University (Walter et al., unpublished).

Yellow rust isolates from Tajikistan and Uzbekistan had similar virulence characteristics, not unlike typical races from China (data not shown). Despite that these are not at present classified as "aggressive", i.e., not part of the aggressive lineage defined by Hovmøller et al. 2008: Molecular Ecology 17, 3818-3826, they may possess an aggressive feature not yet detected.