Training and Surveillance Support for Wheat Rust Diseases in Central Asia and Near East

Activity 1: In-country rust surveillance

Cereal rust pathogens undergo continuous pathogenic changes for virulence factors. This phenomenon is resulting in the breakdown of the effective resistance genes being deployed in resistant cultivars. Understanding the population structure and distribution of the rust pathogens at national, regional and international levels would enable better understanding of the pathogenic variability and assist breeding programs to plan for development of durable rust resistant cultivars.

Monitoring occurrence and movement of the rust pathogens and study of the pathogens variation among and between the rust populations is a major objective of the rust surveys. Surveillance of wheat rust pathogens, including assessments of rust incidence and virulence characterization via either trap plots or race (pathotype) surveys provides important information also for the countries. This assists them in formulating and adopting appropriate national and international policies, investments and strategies in research, seed systems and management efforts in general. Thus, the Global Cereal Rust Monitoring System plays an important role in collecting and sharing this information internationally. Through these international collaborations, a rust surveillance protocol was developed and adopted by national rust surveillance teams. With the development of the new web-based data-base system significant data has been collected over the last decade and publically shared with users.

Through this current collaborative Letter of Agreement (LoA), technical backstopping, guidelines and financial support were provided to facilitate national in-country rust surveillance in 10 countries in Central Asia, North Africa, and the Middle East. During the rust training course held in Izmir, the standard rust surveillance protocol were presented to participants and practical lessons were provided. This was followed by field practicals and assessments of the rust using survey formats.

Rust surveillance was conducted in Iran, Morocco, Azerbaijan, Eritrea, Turkey, Uzbekistan, and Iraq. To facilitate these activities, USD 3,000 was disbursed to each country. Among the 10 target countries, Egypt, Iran, and Pakistan could not accept the provided financial support through this project because of administrational procedures. However, in-country rust surveillance was conducted in Iran and Pakistan while disease status could be assessed through the trap nursery in Egypt through the use of national and other resources. The rust-surveillance coordinator in Tajikistan was not able to follow the full surveillance program because he had other responsibilities towards his PhD thesis. In addition, Dr. Nazari (ICARDA Scientist) could not visit Tajikistan as it was planned because of formal difficulties in obtaining an entry visa. However, evaluation of the trap nurseries and breeding program germplasms provided information on the occurrence of stripe rust in the country. The sample collection in rust infections of barberries (alternative host) is very important in understanding the dynamics of pathogens virulence structure.

The rust surveys were conducted in major wheat growing areas following the rust survey protocol (Annex 3) and data was collected for rust incidence and disease severity. Spore samples were collected for race analysis at national or international rust laboratories. Using GPS tools, the collected information has been used to update the distribution map of the rust diseases and races in survey countries using RustTracker (http://rusttracker.cimmyt.org) and WheatRust Tool Box

(http://130.226.173.136/ProjectNET/WheatRustToolbox). The collected data from 2016 rust surveillance in Iraq, Azerbaijan, and Pakistan are currently presented in the Rust tracker website (http://rusttracker.cimmyt.org/) where other data will appear following scientific confirmation. An example of collected yellow and stem rust survey data in Azerbaijan in 2016 is presented in Figure 4.

The survey activities indicated that the most common rust was yellow rust in the countries where the activities took place (Table 1, Figure 1). Yellow rust was widely present and prevalent in Azerbaijan, Pakistan and in northern Iraq. Stem rust occurred widely in northern Iraq and Iran and it was sporadically severe in Azerbaijan. Surveys showed an increased pressure from stem rust in these countries. Trap Nursery data and race typing at Global Rust Reference Centre (GRRC) and at national rust laboratories indicated occurrence of a local race mainly known as TKTTF, which is avirulent on *Sr31* in most of the infected areas in these countries. Considering the field responses of the key diagnostic genes for detection of Ug99 lineages (*Sr31*, *Sr24*), the Ug99 and its derivatives has not been confirmed to date in the listed 10 countries in 2016.

Among the 10 countries, Egypt, Iran, and Pakistan could not accept the provided financial support through this project, but survey data from Iran and Pakistan and Trap Nursery data from Iran, Pakistan, and Egypt are available and presented in this report. Using other resources, extensive rust survey were conducted in Pakistan in 2016. Data was uploaded into the WheatRust ToolBox (Figure 3). These indicate that the leaf rust has occurred in large areas of wheat production in Pakistan and yellow rust was present in the south and north but more severe in the north and northwest of the country. Occasional stem rust infections were observed and collected samples have been used in race typing at the Pakistan National Rust laboratory and parts of the samples have been shared with GRRC for further race analysis.

Table 1. Summary of survey findings: Number of fields in incidence categories *

Country	Number of fields surveyed	Yellow Rust			Leaf Rust			Stem rust		
		High (>40%)	Moderate (20-40%)	Low or no (<20%)	High (>40%)	Moderate (20-40%)	Low or no (<20%)	High (>40%)	Moderate (20-40%)	Low or no (<20%)
Azerbaijan	36	13	0	23	0	0	36	20	0	16
Turkey- North	26	8	0	18	0		26	17	1	8
Turkey- West	303	0	4	299	0	6	297	0	0	303
Uzbekistan	25	17	2	6	0	2	23	0	0	25
Tajikistan	4	4	0	0	0	0	4	0	0	4
Pakistan	413	8	53	352	80	48	285	1	0	412
Iran	519	26	19	474	19	12	488	18	14	487
Iraq	90	8	10	72	0	7	83	16	17	57
Egypt	6	5	1	0	6	0	0	4	1	1
Morocco	96	66	11	19	0	1	95	0	0	96
Eritrea	10	6	1	3	4	1	5	2	1	7
Total	1528	161	101	1266	109	77	1342	78	34	1416

* Data for Egypt and Tajikistan originate from trap nurseries and for Pakistan from the rust tool box.

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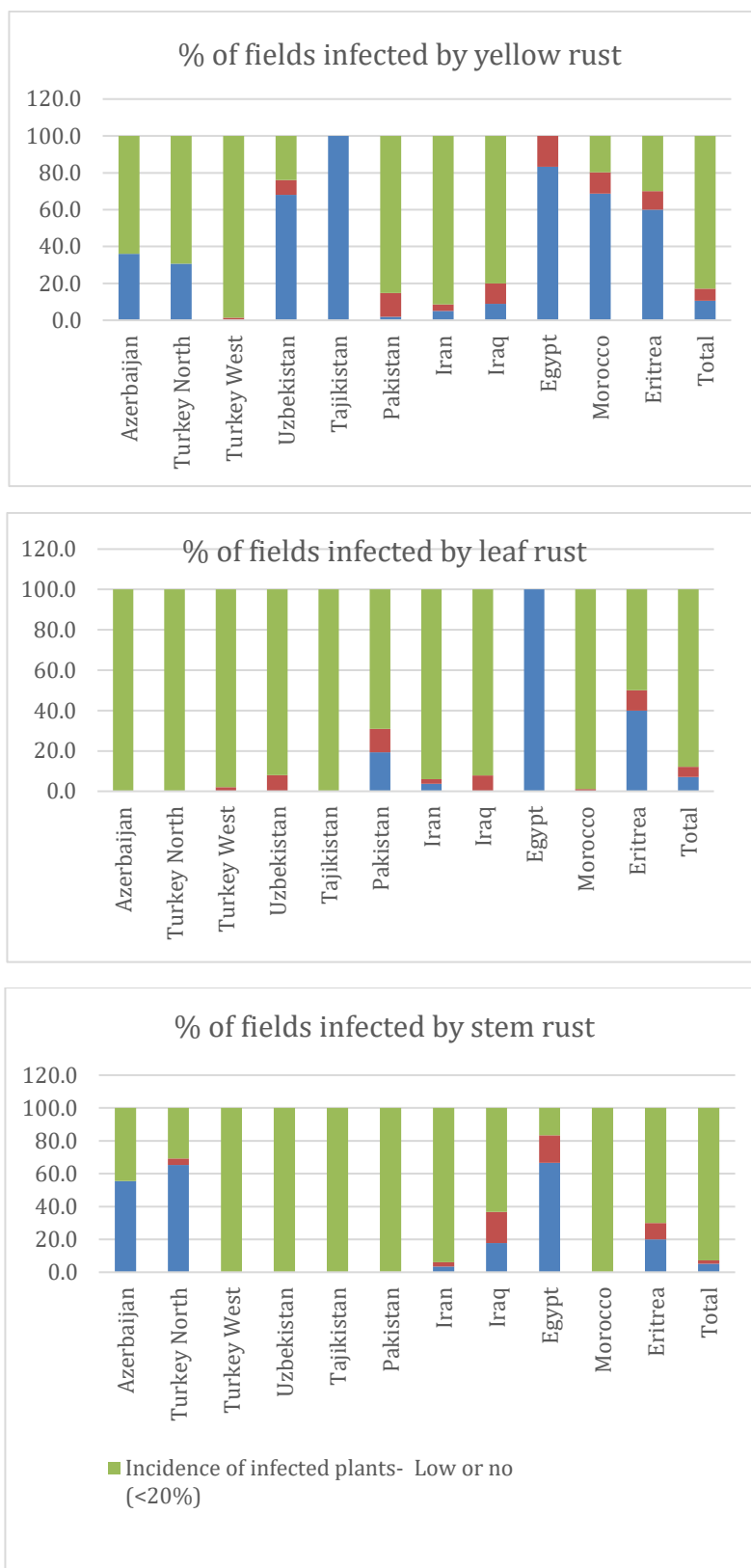MINISTRY OF FOOD, AGRICULTURE
AND LIVESTOCK

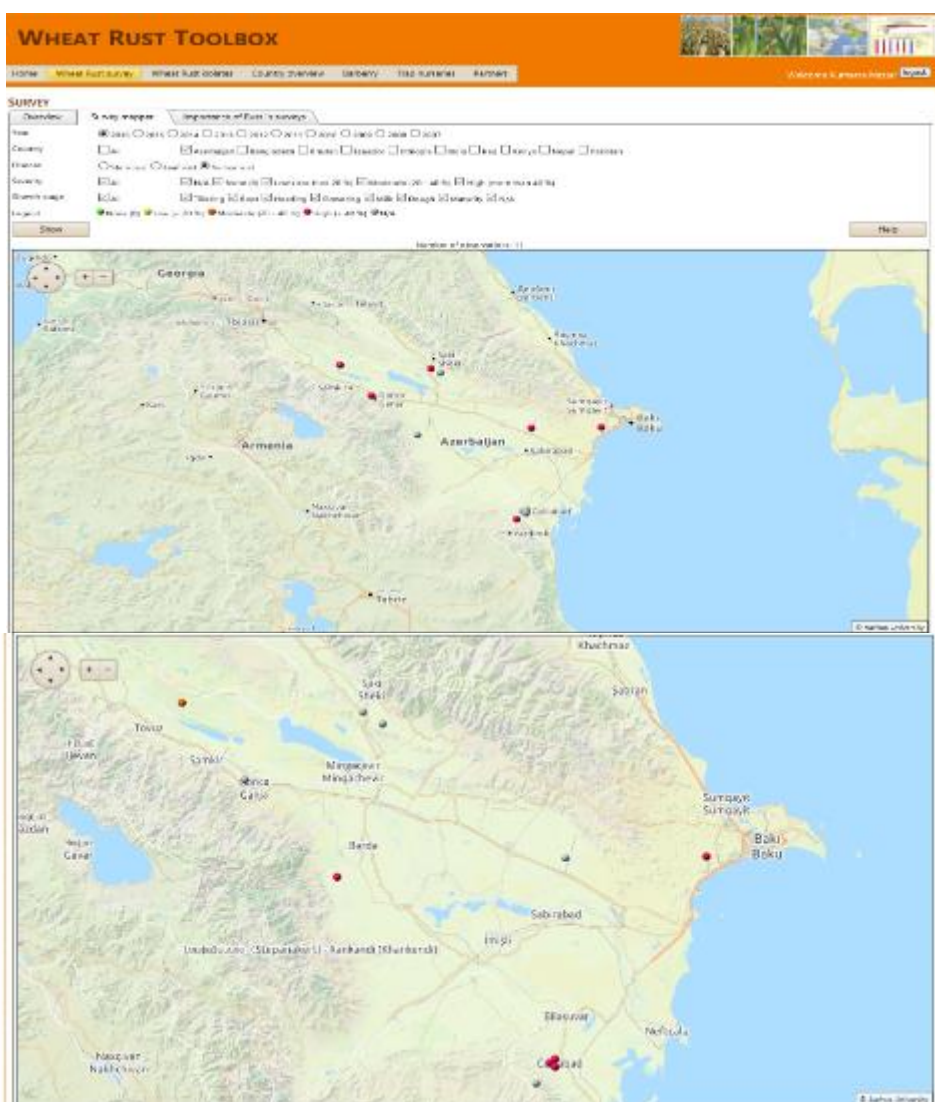Figure 1. Occurrence of wheat rusts in different countries in 2016.

Figure 2. Distribution and rust incidence map of the wheat yellow (top) and stem rust (lower) in Azerbaijan 2016, GRRC-Denmark, WheatRsut ToolBox.
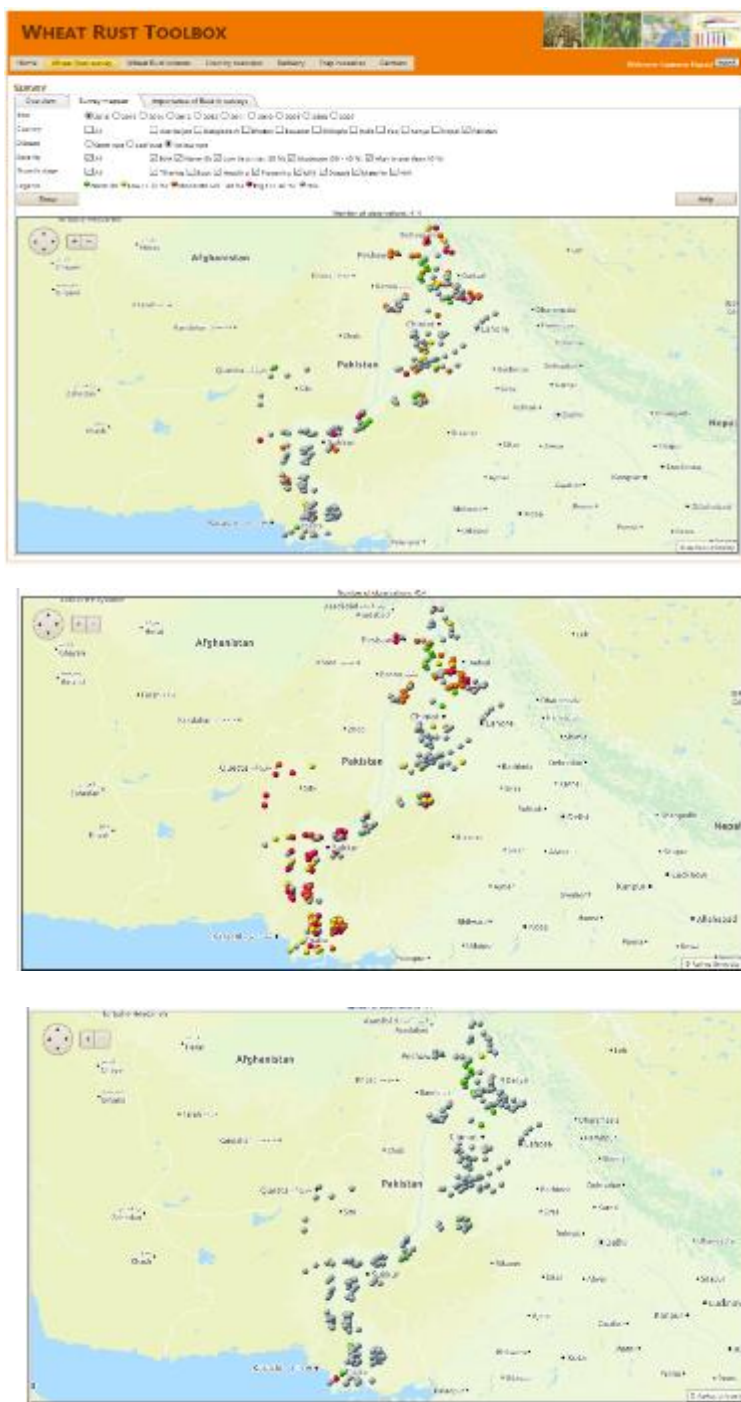
Figure 3. Distribution and rust incidence map of the wheat yellow (top), leaf (middle) and stem (lower) rust in Pakistan 2016, GRRC- Aarhus University, WheatRust ToolBox.