



## Surveillance and monitoring the cereal rust diseases in Lebanon, Morocco, and Tunisia in 2023

Plant Health Initiative WP1-OP4

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### Summary

The key components for achieving long-lasting resistance to wheat rust disease and effectively managing the wheat rust disease relies on constantly tracking the movement of the pathogens and studying their pathogenic variabilities. Despite the severe drought conditions in wheat-growing regions of CWANA in 2023, the Regional Cereal Rust Research Center-Turkey in collaboration with national rust surveillance teams conducted rust surveillance in Lebanon, Morocco, and Tunisia, following to the BGRI rust surveillance procedures.

The national rust surveillance teams at the Lebanese Agricultural Research Institute, Institut National de la Recherche Agronomique (Morocco), and INSTITUT NATIONAL DES GRANDES CULTURES-TUNISIA (Tunisia) conducted the rust surveys in wheat growing areas. The GPS coordinates of survey sites, the status of rust diseases, and crop phenology were collected and shared with the online Global Cereal Rust Surveillance and Monitoring System (<https://rusttracker.cimmyt.org>) following the BGRI standard rust surveillance protocol (<https://rusttracker.cimmyt.org/wp-content/uploads/2011/11/2013-Updated-BGRI-protocols-v2-web.pdf>).

### Materials and Methods

Rust surveillance was carried out in farmer's fields and research stations using the BGRI rust surveillance form (<https://rusttracker.cimmyt.org/wp-content/uploads/2011/11/2013-Global-Cereal-Rust-Survey-Form-v2.pdf>) by national rust survey teams at LARI-Lebanon, INRA-Morocco, and INGC Tunisia. The IPM group of ICARDA in Morocco were also participated into the rust survey. Geo-referenced information, crop phenology, disease status during rust severity, and disease incidence were recorded in provided survey forms. Data were shared as excel files with the Global Cereal Rust Monitoring System and RustTracker (<https://rusttracker.cimmyt.org>).

### Results

In 2023, wheat rust surveillance took place in Morocco, Lebanon, and Tunisia, following the BGRI's protocol. Surveillance data were collected from both farmer's fields and experimental sites at 104 locations. The data were shared on RustTracker.org and distribution maps were developed for survey sites. Unfavorable environmental conditions hindered rust occurrence in 2023. Despite the historical predominance of wheat yellow rust, adverse drought conditions led to its low occurrence. Mild winters increased the likelihood of stem

and leaf rust development. In Morocco, where overall drought prevailed, 30% of surveyed fields exhibited low level of stem and leaf rust. Lebanon and Tunisia also had low occurrences of the three rust diseases due to drought. Stem and leaf rust incidences were moderate to high at surveyed trial sites in all three countries, indicating more favorable conditions under irrigated conditions. Rust samples were collected and sent to the RCRRRC for race typing. Continuous monitoring provides valuable insights for disease preparedness and control.

## Lebanon

### The Status of wheat rusts for the growing season 2022-2023

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Wheat rusts are the most biotic and devastating diseases that affect cereal production in our region. Our region witnessed many recurrent epidemics; there have been several outbreaks since the 1980s of both wheat yellow (stripe) rust, caused by the fungal pathogen *Puccinia striiformis* f. sp. *tritici* (Pst) and *Puccinia graminis* f. sp. *tritici* (PGT) causing serious economic losses.

Surveillance, monitoring, efficient tracking, and new virulence identification are prerequisites for future race prediction and for effective breeding programs for generating tolerant genotypes.

#### Surveillance

Rust surveillance was initiated in the Northern coastal areas, where rust outbreaks were a historical recurring issue, typically manifesting early in the season. However, due to a mild and dry winter, the three rust varieties did not manifest in April, contrary to previous years. The diseases emerged in early May with a low frequency and severity. Surveillance activities adhered to the BGRI form, involving the detachment of leaves for sampling and preservation in glassine bags. To prevent germination and enhance spore viability, detached leaves were tapped and dried at the end of each day.

The surveillance scope extended to other regions, including research stations and farmers' fields. Unfortunately, rust establishment was not observed in the latter, attributed to unfavorable climatic conditions. March experienced heavy snowfall and extreme cold, while April was excessively dry and hot, rendering the plants unhealthy and susceptible to drought and heat waves. In total 12 farmers' fields and the research station in Tel Amara were surveyed.

At research stations, where supplemental irrigation mitigated the situation, rust incidence was minimal. Collected samples underwent drying and were shipped to the Regional Cereal Rust Reference Center (RCRRRC)-Izmir through DHL, adhering to Turkish laws regarding the transfer of hazardous materials.

## Morocco

### The wheat production and the status of wheat rust diseases in Morocco 2022-23

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#### Wheat production

In Morocco, wheat faces various biotic constraints, particularly rusts. Stem rust, once not a concern for wheat production in Morocco, is now emerging as a potential threat due to the appearance of new virulent races. The objective of this survey was to evaluate the prevalence, incidence, and severity of wheat rust diseases throughout Morocco to create a comprehensive map with various layers. The survey spanned from April 2023, covering the growth stage from grain filling to physiological maturity. Recorded data included site coordinates, host species and growth stage, visual assessment of grain yield, field size, water regime (rainfed or irrigated), and incidence and severity of rust diseases. Subsequently, the prevalence was computed. A total of 50 bread wheat fields and 14 durum wheat fields were inspected. The survey revealed that Stem rust, previously undetected in 2013-2014, was found on 38% and 86% of bread wheat and durum wheat fields, respectively. Stem rust severity on bread wheat ranged from 1S to 60S (Table 1), observed in 19 fields (38%) (Figure 1), while on durum wheat, it ranged from 1S to 50S, scored on 12 fields (86%). Additionally, leaf rust showed the highest severity (80S) on one bread wheat and 60S on two bread wheat fields. Its severity on bread wheat ranged from 1S to 80S. In contrast, durum wheat was mostly free from leaf rust, except for one field with a severity of 5S and another with a severity of 60S (Figure 1 & Table 1).

The highest severity of yellow rust on bread wheat was observed in one field (40S), with a range from 1S to 40S. Notably, it was entirely absent on durum wheat (Figure 3). The imminent threat posed by stem rust to national and regional wheat production underscores the importance of implementing an anticipatory breeding strategy to address this emerging fungus in our breeding programs. Furthermore, a total of 8, 7, and 14 samples of yellow rust, leaf rust, and stem rust were collected and sent to the Regional Cereal Rust Research center in Izmir for race analysis.

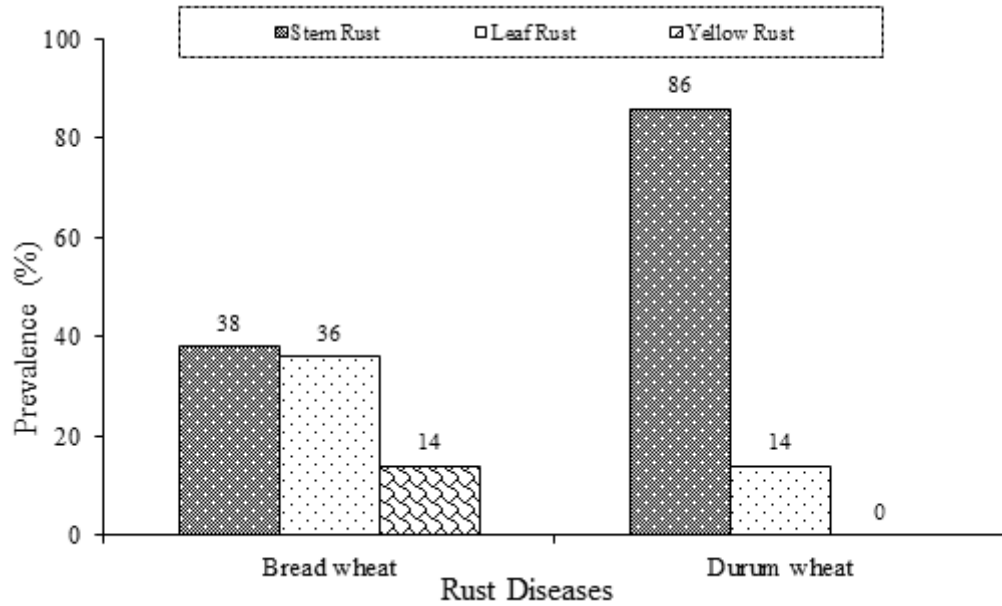


Figure 1. Prevalence of wheat rust diseases in Morocco during 2022-2023 cropping season

Table 1. The magnitude of rusts severity on bread (BW, 50 fields) and durum (DW, 14 fields) wheats in Morocco during 2022-23 cropping season

Severity	Stem Rust		Leaf Rust		Yellow Rust	
	Bead Wheat	Durum Wheat	Bead Wheat	Durum Wheat	Bead Wheat	Durum Wheat
<b>Zero</b>	31	12	39	12	43	14
<b>1</b>	13	0	9	0	4	0
<b>5</b>	2	1	2	1	0	0
<b>10</b>	1	0	1	0	1	0
<b>20</b>	1	0	1	0	1	0
<b>30</b>	0	0	0	0	0	0
<b>40</b>	1	0	2	0	1	0
<b>50</b>	0	1	0	0	0	0
<b>60</b>	1	0	2	1	0	0
<b>80</b>	0	0	1	0	0	0

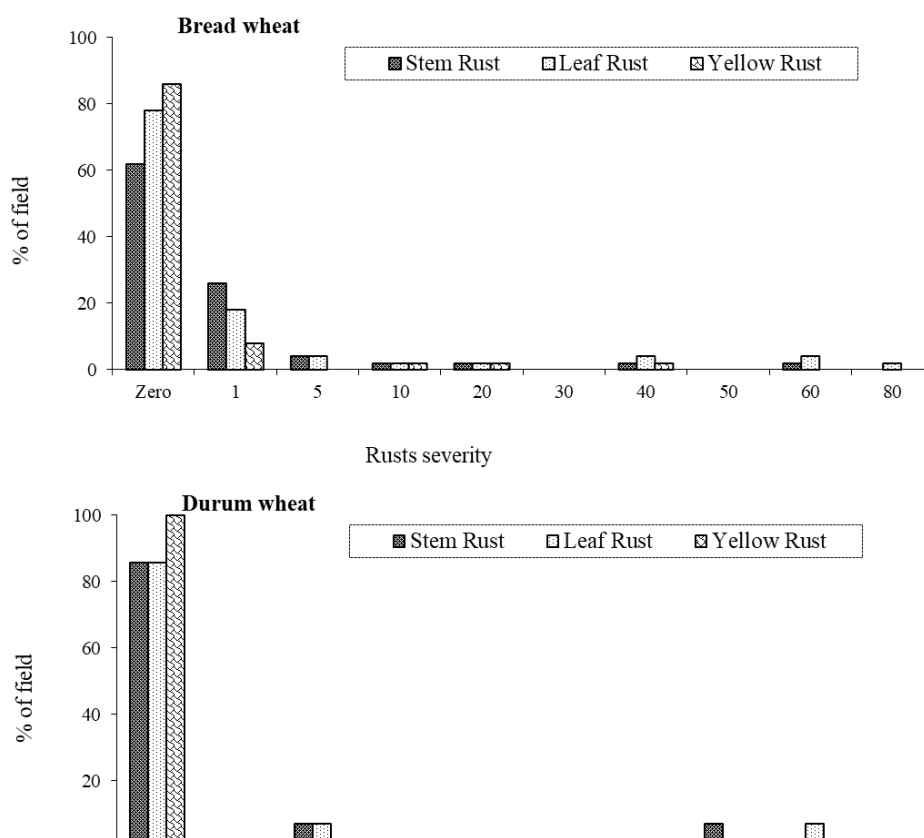


Figure 2. Magnitude of rusts severity on bread (BW) (Top) and durum (DW) (bottom) wheats in Morocco during 2022-2023 cropping season

**Wheat Rust Survey Report, Tunisia 2023**

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Historically, wheat rusts have been prominent diseases affecting wheat crops in Tunisia, leading to significant yield losses in Tunisia. The commencement of the wheat growing season in 2023 in Tunisia was characterized by temperatures considerably higher than the average for the period from December to mid-February. Elevated temperatures, coupled with a lack of precipitation throughout January, February, and March, contributed to a low incidence and limited spread of rust infections.

In 2023, surveillance efforts were undertaken in key wheat-growing areas to monitor rust prevalence. Yellow rust infections at low to moderate levels were primarily observed on susceptible durum and triticale cultivars. The incidence of stem rust was minimal, except for a notable high infection on a bread wheat cultivar. A total of 28 locations were surveyed, and rust samples were collected from Triticale, durum, and bread wheat cultivars at various stages of growth, ranging from flowering to the dough stage. The rust samples were sent to the Regional Cereal Rust Research Center in Izmir, Türkiye for race analysis. The surveillance data were shared with the Wheat Rust Tracker online rust monitoring data system.