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# Tracking Virulence Shifts in Wheat Yellow Rust via International Trap Nurseries

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## Abstract

Wheat is one of the oldest cultivated crops in Georgia. From ancient times to the present day, rust diseases have remained a serious threat to wheat production due to the exceptionally rapid variability of rust pathogens. The International Rust Trap Nursery (IRTN) serves as a critical tool for the early detection of pathogenic shifts within rust populations, particularly across key wheat-growing regions. Historically, yellow rust has frequently dominated over other rust species in Georgia. Three IRTN sets for wheat yellow rust were evaluated under natural infection across three distinct agroecological zones of Georgia - Shida Kartli, Kolkhis Lowland, and Meskheti- during the 2025 and 2026 growing seasons. The nursery comprised 16 isogenic lines, 19 differential cultivars, 18 foreign varieties with known yellow rust resistance genes, and 18 commercial varieties currently cultivated in Georgia. The distribution of yellow rust was higher in 2026 than in 2025. Specifically, disease severity on the Morocco (susceptible variety) varied between 40% and 100%. Based on the consolidated disease evaluation data, 51.4% of the entries exhibited resistant (R) to moderately resistant (MR) reactions, 15.4% showed an intermediate or mixed reaction (MR-MS), and the remaining entries were moderately susceptible (MS) to susceptible (S) to the pathogen. Notably, lines carrying the genes *Yr2*, *Yr3a*, *Yr4*, *Yr5*, *Yr15*, *Yr17* and *Yr CV* demonstrated high resistance across most locations. Furthermore, the varieties Compare, Sleipner, Cortez, VPN1 39, Brigadier, Pastor, Cartago, TP 981, *Triticum spelta*, Shavpkha, Amicus, Premio, Asano and Balitus remained highly effective against the disease at all evaluation sites.

**Keywords:** *Wheat, Differential Lines, yellow rust, resistance.*

## INTRODUCTION

Wheat is one of the oldest cultivated crops in Georgia. From ancient times to the present day, rust diseases have remained a serious threat to wheat production due to the exceptionally rapid variability of rust pathogens. Three species of rusts: Yellow Rust (*Puccinia striiformis f.sp. tritici*),

Stem Rust (*Puccinia graminis f.sp. tritici*) and Brown Rust (*Puccinia triticina f.sp. tritici*) have a serious impact worldwide on yield losses in bread wheat. Yellow rust has frequently dominated over other rust species in Georgia during the past 20 years. International research, supported by data from the FAO and CIMMYT, categorizes Georgia as a high to very high-risk region for both stem and yellow rust epidemics (Sinha and Chen, 2021). Over the past 15 years, Georgia has experienced recurring wheat yellow rust epidemics. During severe outbreak seasons, the disease has caused devastating yield losses of up to 70% (Natsarishvili et al., 2017). Each year, it obliterates approximately 5.5 million tons of wheat on a global scale. During severe epidemic years, this loss can account for up to 8.5% of the world's total output. Lately, shifting climate patterns have fueled the emergence of more virulent strains. Among these, yellow rust has recently wiped out 40% of wheat harvests across Central Asia, the Middle East, and Africa (Beddow et al., 2015). Traditionally viewed as a disease of cool and damp temperate climates, stripe rust has emerged in warmer, more arid regions since 2000. This geographic expansion underscores the ability of *Puccinia striiformis* to swiftly adapt to environmental stress, illustrating climate-driven evolution. The virulence of both stem and yellow rust has intensified following the emergence of the Ug99 race variants between 1999 and 2007, and the Warrior races in 2011, respectively (Aslam et al., 2026, Hovmoller et al., 2016). Crucially, these environmental shifts alter not only the biological traits of the pathogen but also compromise the longevity of crop resistance and the efficacy of control measures.

The development and realization of yellow rust-resistant varieties are considered the principal and environmentally reliable means of controlling rust diseases. The development of resistant varieties is a complex, long-term, and continuous process. Success in this field requires continuous monitoring of virulence changes in the population of the fungal pathogen causing wheat rusts, alongside timely communication with breeders regarding newly emerging virulent races that threaten cultivated varieties.

As a critical early-warning tool, the International Rust Trap Nurseries (IRTN) is a global network coordinated by CIMMYT and ICARDA and operating under the Borlaug Global Rust Initiative. It monitors pathogenic shifts within rust populations while identifying and measuring the virulence of wheat rust pathogens, particularly across key wheat-producing regions (FAO-ICARDA, 2015).

The objective of this study was to monitor the yellow rust population and detect virulence changes under field conditions using a yellow rust trap nursery (YRTN).

## MATERIALS AND METHODS

**Field trials.** The YRTN sets were sown in autumn on 15 October, 2024 and 18 October, 2025 at three yellow rust hotspots representing three distinct agroecological zones of Georgia: the Shida Kartli zone of eastern Georgia (Mtskheta, Tsilkani Research Station), the Kolkhis Lowland zone of western Georgia (Kobuleti - PB Institute's research plot), and the Meskheti zone of southern

Georgia (Borjomi, Tsagveri Research Station). Each nursery comprised 16 isogenic lines, 19 differential cultivars, 18 foreign varieties carrying known yellow rust resistance genes, and 18 commercial varieties currently cultivated in Georgia. The susceptible check Morocco was planted after every 20th entry (five rows in total) to increase inoculum pressure and promote uniform disease development.

Wheat entries were sown manually in two rows, each 1-m long, with 20cm spacing between rows at a rate of 100 seeds per meter. Phosphorus fertilizer was applied before planting, followed by an early- spring application of ammonium nitrate at a rate of 90 kg/ha. Weeds were controlled manually. Disease severity and infection type were assessed between 10 and 15 June under natural yellow rust infection. The YRTN set was provided by ICARDA.

**Site climate.** The Tsilkani research station is located on the Shida Kartli plain at 560 meters above sea level (41.941335$^0$ N, 044.689289$^0$E). The region experiences a moderately humid continental climate with mildly cold winters and warm summers. The average two-year air temperature and precipitation were 12.7 °C and 11.3 mm per month of growing season, respectively. The region experienced a steady drop into near-freezing winter conditions before rebounding into hot, clear early-summer weather. Unlike coastal regions, Mtskheta gets much lower total precipitation, peaking heavily in late spring. May acts as the wettest month of the timeline (https://weatherspark.com/y/103481/Average-Weather-in-Mtskheta-Georgia).

The Kobuleti research station is situated at latitude 41.80993$^0$ N and longitude 041.79047$^0$ E at an elevation of 3 meters above sea level. Kobuleti features a humid subtropical climate typical of Western Georgia, characterized by mild, warm winters, where the absolute maximum temperatures peaking near 30°C during July and August, and minimum temperatures dropping to 3°C during the coldest month of February (https://weatherspark.com/y/102080/Average-Weather-in-Kobuleti-Georgia). **High overall humidity** and **frequent rainfall** throughout the first half of 2026, typical of its lush subtropical climate. Rain falls regularly across all six months, with April offering the driest conditions before late-spring and early-summer storms pick up.

The Tsagveri research station is located on the Borjomi Municipality at an altitude 41.94380N and longitude 043.50707E at of 1,082m above sea level. Tsagveri features a moderately continental, mid-mountain climate with relatively cold, snowy winters and moderately warm, dry summers. During this period, temperatures range from an average high of 27°C in late spring down to a nighttime low of -7°C in mid-winter. Humidity typically stays moderate. The average annual precipitation ranges between **300 mm and 550 mm (**https://www.worldweatheronline.com/ **Tsagveri-weather-averages/borjomis-raioni/ge.aspx).**

**Assessment of Host Plant Response to Disease.** To determine adult plant resistance (APR), field assessments were conducted three times at 7–8-day intervals during the flowering to soft dough growth stages (Zadoks et al., 1974.). Host infection types were scored using a 0–4 scale based on pustule type and size (Gassner and Straib, 1932). Host responses—reflecting the efficacy of the resistance genes—were categorized as follows: Resistant (**R**: chlorosis or necrosis present, no uredia), moderately Resistant (MR: small uredia surrounded by chlorosis or necrosis), moderately

Susceptible (MS: medium-sized uredia with minimal chlorosis), and Susceptible (**S**: large, fully formed uredia with no necrosis (Roelfs et al., 1992). Disease severity was evaluated visually on the flag leaves as the percentage of plant tissue surface area covered by rust pustules (uredia) according to the modified Cobb's scale (Peterson et al., 1948), ranging from 0% (completely healthy) to 100% (maximum infection). Following the classification framework of Hodson et al. (2009), severity data were grouped into three distinct categories: : Low (<20%): ranging from 0% (completely clean plant) and 1% (trace/scattered pustules) up to less than 20%; Moderate (20%–40%): Low-to-moderate infection levels; High (>40%): Infection levels where both incidence and severity exceeded 40%, extending up to 100% (maximum infection). To characterize the degree of variety resistance, the Coefficient of Infection (C.I.) was used, which combines the reaction type of the wheat genotype and disease severity. It is calculated by multiplying the disease severity and a constant value for host response. This constant value for each individual host reaction type is as follows: for immune genotypes it equals '0', R=0.2, MR=0.4, MS=0.8, MR-MS=0.6, and S=1.0 (Pretorius et al., 2007; Stubbs et al., 1986).

## RESULTS AND DISCUSSION

Wheat yellow rust was prevalent across all three surveyed agroecological zones (Meskheti, Shida Kartli, and the Kolkhis Lowland) during 2025–2026. Disease incidence and severity ranged from 50–100% and 5–100%, respectively, depending on the survey location and the wheat genotype. On the susceptible cultivar Morocco, disease severity varied from 40% to 100%. Natural infection of yellow rust was significantly more severe in 2026 than in 2025. While heavy disease pressure developed at the Tsilkani and Kobuleti stations, both incidence and severity remained lower at the Tsagveri station. This variation indicates that climatic conditions were highly conducive to disease development in the lowland and coastal regions, but less favorable in the higher-altitude zone. As it is known, the presence of a susceptible host and *P. striiformis* inoculum alone does not guarantee a yellow rust outbreak; environmental factors such as moisture, temperature, and wind are the ultimate drivers. Also, moisture, in particular, acts as a vital abiotic determinant that directly governs spore germination, infection, dispersal, and survival (Khushboo et al., 2023; Chen, 2005). The experimental entries included in the trap nursery exhibited different responses (severity and resistance type) to natural infection by yellow rust (Table 1).

Table 1. Host response (severity, RT) to natural infection of yellow rust in wheat trap nursery

| N | Host isogenic line/differentials/ cultivars | Yr gene Resistance gene/gene source | Host response/CI | | |
|---|---|---|---|---|---|
| | | | Mtskheta research station | Kobuleti research station | Tsagveri research station |
| 1 | **Morocco** | | 90S | 100S | 40MS |
| 2 | Yr1/6*Avocet S | Yr1 | 80MS/64 | 5MS/4 | 10MR/4 |
| 3 | Chinese166 (W; Yr1) | W;Yr1 | 70MS/56 | 5MS/ 4 | 1MS/0.8 |
| 4 | Kalyansona (S) | Yr2 | R | R | R |
| 5 | Heines VII (W; Yr2+?) | (W; Yr2+?) | 5MR/2 | R | R |
| 6 | Vilmorin 23(W;Yr3a,4a) | (W; r3a,4a+other) | R | R | R |
| 7 | Hybrid 46 | (W;Yr4) | 10MR/4 | 10MR/4 | R |
| 8 | Yr 5/6* Avocet S | Yr 5 | MR | R | R |
| 9 | Triticum Spelta (Inter, Yr5) | Yr 5 | R | R | R |
| 10 | Yr 6/6* Avocet S | Yr 6 | 100S/80 | 30MS/24 | 5MS/4 |
| 11 | Heine's Kolben | (S; Yr6+1) | 90MS/72 | 80MS/64 | 10MS/8 |
| 12 | Heine's Peko | (S; Yr6+?) | 60MS/48 | 40MS/32 | 10MS/8 |
| 13 | Fielder | Yr6,Yr20 | 40MS/32 | 30MS/24 | 10MS/8 |
| 14 | Yr 7/6* Avocet S | Yr 7 | 90MS/72 | 80MS/64 | 25MS/20 |
| 15 | Lee(S;Yr7) | S; Yr 7 | 60MS/48 | 30MS/24 | 1MS/0.8 |
| 16 | Reichersberg 42 | (W; Yr7+? ) | 5MR/2 | 5MR/2 | R |
| 17 | Yr 8/6* Avocet S | Yr 8 | 90MS/72 | 60S/48 | 20MS/16 |
| 18 | Compair (S; Yr8) | (S; Yr8) | 10MR/4 | 20MR/8 | R |

| | | | | | |
|---|---|---|---|---|---|
| 19 | Yr 9/6* Avocet S | Yr9 | 50MS/40 | 60MS/48 | 5MS-MR/3 |
| 20 | **Morocco** | | 100S | 100S | 40S |
| 21 | Clement (W; Yr9+Yr2+?) | Yr9 | R | R | R |
| 22 | Sleipner | Yr9 | R | 0 | 0 |
| 23 | Federation | W; Yr9+Yr2+? | 60MS/48 | 60MS/48 | 20MS/16 |
| 24 | Fed.4/Kavkaz (Yr9) | Yr9 | 5MR/2 | 5MS-5MR./3 | 20MR/8 |
| 25 | Yr 10/6* Avocet S | Yr10 | 10MS/8 | 5MS/4 | 5 MS MR/3 |
| 26 | Moro (W; Yr10) | (W; Yr10) | 25MS/20 | 10MS/8 | 5MS/4 |
| 27 | Yr 15/6* Avocet S | Yr 15 | R | R | R |
| 28 | Cortez | Yr15 | 0 | 0 | 0 |
| 29 | Yr 17/6* AOC | Yr 17 | MR/0.4 | MR/0.4 | R |
| 30 | Brigadier | Yr17+9 | R | 0 | 0 |
| 31 | VPM1 39.2 | Yr17+ | R | R | 0 |
| 32 | Yr 18/3* Avocet S | Yr18 | 50S/40 | 10S/8 | 5MS/4 |
| 33 | Anza | YrA, Yr18 | 5MS MR/3 | 1MS/0.8 | MR/0.4 |
| 34 | Avocet S | Yr18 | 50MS/40 | 40MS/32 | 20MS/16 |
| 35 | Jupateco'R' (S) | Yr18+ | 10 MS/8 | 10MS/8 | 5MS/4 |
| 36 | Yr24/6* Avocet St | Yr24 | 50MS/40 | 70MS/56 | 30MS/24 |
| 37 | Lemhi | Yr21 | 70S/70 | 60S/60 | 5MS/4 |
| 38 | TP 981 Dark Green | Yr25 | R | R | R |
| 39 | TP1295 | Yr25 | R | R-10MR/4 | MR |
| 40 | **Morocco** | | 80S | 80S | 50S |
| 41 | Yr 27/6* Avocet S | Yr27 | 10MS/8 | 10MS/8 | 5MS/4 |

| | | | | | |
|---|---|---|---|---|---|
| 42 | Ciano 79 | Yr27 | 1MS-MR/0.6 | 5MS MR/3 | MR/0.4 |
| 43 | ATTILA CM8536-50Y<br>-OM-OY-3M-0Y | Yr27+? | 5MR/3 | 1MR/0.4 | 1MR/0.4 |
| 44 | Opata 85 | Yr27+Yr18 | 10MS MR/6 | 20MR-1MS/12 | 1MS MR/0.6 |
| 45 | AVOCET-YRA*3/3ALTAR84/AE.SQ//OPATA<br>CGSS00Y00204T-099M-20Y | Yr28 | 5MS/4 | 10MS/8 | 5MS/4 |
| 46 | Lal Bahadur/Pavon 1B L | Yr29 | 10MS/8 | 50MS/40 | 5MS/4 |
| 47 | AVOCET-YRA*3/PASTOR<br>CGSS00Y00207T-099M-1Y | Yr31 | 10MS/8 | 5MS/4 | 1MS/0.8 |
| 48 | PASTOR | Yr31+APR | 5MS -MR/3 | 30MR-MS/18 | 5MS -MR/3 |
| 49 | Yr32/6* Avocet S | Yr32 | 25MS-MR/15 | 30MS-MR/18 | 10MS-MR/6 |
| 50 | Carstens V | W, Yr32 | 5MS MR/3 | 10MS-MR/6 | R |
| 51 | Yr SP / 6* Avocet S | Yr SP | 80MS/64 | 40MS/32 | 10MS/8 |
| 52 | YRCV/6*AOC | YrCV | R | R | R |
| 53 | Strubes Dickkopf (W;2-more) | W;2-more? | R | R | R |
| 54 | Suwon92 x Omar(W) | W; | 5MS/4 | 5MS/4 | 5MS/4 |

| | | | | | |
|---|---|---|---|---|---|
| 55 | Nord Desprez(W; YrND) | W; YrND | R | R | R |
| 56 | Ambition | | 5MR-MS/3 | 20MS/16 | MR/0.4 |
| 57 | Akhaltsikhis tsiteli dolis puri | | 40MS/32 | 10MS/8 | 1MS/0.8 |
| 58 | Moklegeroiani tsiteli Dolis Puri | | 5MS/4 | 1MS/0.8 | 1MS/0.8 |
| 59 | Korboulis dolis puri | | 10MS/8 | 25MS /20 | 5MS/4 |
| 60 | **Morocco** | | 90S | 80S | 40S |
| 61 | Adgilobrivi Dolis Puri | | 10MS/8 | 40MS/32 | 40MS/32 |
| 62 | Dolura | | 15MS/12 | 25MS /20 | 5MS/4 |
| 63 | Shavpkha *(Triticum durum)* | | 30MR/12 | 10MR/4 | 10MR/4 |
| 64 | Tetri dika | | 5MS /4 | 5MS/4 | 1MS/0.8 |
| 65 | Tsiteli dika | | 40MS/32 | 40MS/32 | 40MS /32 |
| 66 | Vardzia | | 30MS/24 | 30MS/24 | 50MR-MS/30 |
| 67 | Tbilisuri15 | | 50MS/40 | 40MS/32 | 5MS/4 |
| 68 | Sauili 9 | | 50MS/40 | 30MS/24 | 20MS/16 |
| 69 | Lomtagora 126 (local Check) | | 40MS/32 | 40MS/32 | 10MS/8 |
| 70 | Lomtagora 123 | | 30MS/24 | 20MS/16 | 20MS/16 |
| 71 | Tanya | | 80S/80 | 50S/50 | 30S/30 |
| 72 | Amicus | | R | R | R |
| 73 | Premio | | R | R | R |
| 74 | Balitus | | R | R | R |

| | | | | | |
|---|---|---|---|---|---|
| 75 | Gallus | | R | R | R |
| 76 | **Morocco** | | 70S | 100S | 50S |

As shown in Table 1, the isogenic lines carrying resistance genes *Yr5*, *Yr15*, *Yr17*, and *YrCV*, as well as the differential cultivars Kalyansona and Heines VII (*Yr2*), Vilmorin 23 (*Yr3a*), Hybrid 46 (*Yr4*), *Triticum spelta* (*Yr5*), Clement (W; *Yr9*+ *Yr2*+?), TP1295 and TP981 Dark Green (*Yr25*), Reichersberg 42 (W; *Yr7*+?), Nord Desprez (*YrND*), Strubes Dickkopf (W; 2 or more genes), Brigadier (*Yr17*+ *Yr9*), VPM1 39.2 (*Yr17*+), Sleipner (*Yr9*), Cortez (*Yr15*), and ATTILA-CM8536-50Y-OM-OY-3M-0Y (*Yr27*+?), exhibited resistant to moderately resistant reactions across all testing sites. Consistent with observations made 20 years ago, the line carrying the *Yr1* resistance gene and the differential cultivar Chinese 166, which also carries *Yr1*, had remained effective at the Kobuleti and Tsagveri stations in subsequent years (Natsarishvili et al., 2016). However, during the present study, both genotypes were found to be susceptible for the first time at all three locations. A moderately susceptible reaction with low disease severity (1MS–5MS) was observed at the Kobuleti and Tsagveri stations, whereas a highly susceptible reaction with high disease severity (70MS–80MS) was recorded at the Tsilkani station. It is highly probable that this observation represents the first detection of the 'Warrior' race in Georgia. The 'Warrior' race, first confirmed in Turkey in 2015 and characterized by virulence to the *Yr1* resistance gene (Mert et al., 2015), may have reached Georgia through the windborne dispersal of urediniospores. This hypothesis is consistent with observations from numerous wheat-growing regions over the past decade, where the effectiveness of *Yr1* has progressively declined in response to evolving populations of *P. striiformis*. The 'Warrior' race, which is considered to have originated in the Himalayan region, has been reported from numerous countries since its emergence in 2011 and has become widely distributed in wheat-growing regions of Europe, North Africa, South America, China, and Central Asia, including neighboring Turkey (Hovmøller et al., 2016; Khushboo et al., 2021; Shaydayuk and Gultyaeva, 2023; Riella et al., 2024). However, the occurrence of the 'Warrior' race in Georgia requires confirmation through standard race analysis using the international wheat stripe rust differential set at the seedling stage.

The resistance reaction of the line Avocet S*6/Yr10 (carrying the *Yr10* gene) has been stable over the long term; the sole exception occurred in 2015, when a 10MS (moderately susceptible) reaction was sporadically recorded. Virulence toward this gene has not been increased in the following years. The virulence of the cultivar 'Moro', which carries the *Yr10* gene, also remains low (5-10 MS). The isogenic line carrying the resistance gene *Yr32* and the differential cultivar 'Carstens V' (also carrying *Yr32*) were resistant to natural yellow rust infection at the adult plant stage prior to 2015. However, in 2015, high susceptibility levels of 100S, 100MS, and 30S were recorded in Kobuleti, Tsagveri, and Tsilkani, respectively (Natsarishvili et al., 2015). Around this time, the resistance of the *Yr32* gene was also broken in the UK, Turkey, and several other

countries (Chen et al., 2021). In the present study, the *Yr32* isogenic line and 'Carstens V' exhibited a mixed response reaction (10MS-MR).

The lines carrying genes *Yr6*, *Yr7*, *Yr8*, *Yr18*, *Yr24*, *Yr27*, and *YrSP*/6*Avocet S, as well as the differential cultivars Spaldings Prolific (*YrSP*), Heine's Kolben (S; *Yr6*+1), Heine's Peko (S; *Yr6*+?), Fielder (*Yr6*, *Yr20*), Lee (S; *Yr7*), Jupateco 'R', Lal Bahadur/Pavon (*Yr29*), Lemhi (*Yr21*), AVOCET-YRA*3/3ALTAR84/AE.SQ//OPATA (*Yr28*), AVOCET-YRA*3/PASTOR CGSS00Y00207T-099M-1Y (*Yr31*), and Federation (W; *Yr9*+ *Yr2*+?), were moderately susceptible with moderate to high severity across all three research locations in both years.

A mixed MS-MR infection response was observed in several entries previously noted for their resistance, specifically: the 'Federation'/'Kavkaz' line (carrying the *Yr9* gene), the cultivar 'Anza' (*Yr18*), 'Ciano 79' (*Yr27*), 'Opata 85' (*Yr27* + *Yr18*), the cultivar Ambition and 'Pastor' (which carries *Yr31* in combination with an APR gene).

Trap nursery data obtained in this study largely aligned with the yellow rust virulence data identified in China in 2020 and Ethiopia (Huang et. al., 2025; Abebele et al., 2022).

Nearly all Georgian varieties—including Vardzia, Akhaltsikhis tsiteli doli, Moklegeroiani tsiteli doli, Korboulis dolis puri, Adgilobrivi dolis puri, Dolura, Tbilisuri 15, Tetri dika, and Tsiteli dika—were moderately susceptible, with disease severity ranging from 5MS to 40MS. The single exception was the durum variety Shavpkha, which consistently showed an MR reaction across all locations many years. Conversely, the varieties Sauli 9, Lomtagora 123, and Lomtagora 126 (a local check)—which were selected from CIMMYT international nurseries and released in Georgia ten years ago as resistant varieties (Sikharulidze et al., 2022)—exhibited a susceptible reaction with a moderate level of severity in the current study.

Meanwhile, the introduced Austrian wheat varieties (Amicus, Premio, Gallus, and Balitus) currently cultivated in eastern Georgia demonstrated excellent disease resistance, proving resilient even under high moisture and temperature stress many years (Natsarishvili et al., 2016a).

Compared to previous years, there have been minor changes in the virulence structure of the yellow rust Georgian population, which can be primarily attributed to climate change. The resistance genes *Yr5, Yr10, Yr15* and *Yr17*, which have demonstrated high resistance across most locations in Georgia over many years, still hold great importance and are currently the most reliable and widely effective race-specific resistance genes used in global breeding programs against *Puccinia striiformis* f. sp. *tritici* (Tekin et al., 2022; Gultyaeva and Shaydayuk, 2023).

## CONCLUSION

Thus, no significant shifts in virulence were observed in the pathogen population relative to prior years. Of the nursery accessions evaluated, 51.4% demonstrated a highly effective defense response. The isogenic lines carrying resistance genes *Yr5*, *Yr15* and *Yr17*, as well as the differential cultivars Kalyansona, Heines VII (*Yr2*), Vilmorin 23 (*Yr3a*), Hybrid 46 (*Yr4*), *Triticum spelta* (*Yr5*), Clement (*Yr9*+ *Yr2*), TP1295 and TP981 Dark Green (*Yr25*), Reichersberg

42 (*Yr7*+?), Nord Desprez, Strubes Dickkopf, Brigadier (*Yr17*+*Yr9*), VPM1 39.2 (*Yr17*+), Sleipner (*Yr9*), Cortez (*Yr15*) have maintained their effectiveness over the years. It is noteworthy that Austrian cultivars currently cultivated in eastern Georgia demonstrated excellent disease resistance since 2013. The *Yr1* resistance gene, which had remained effective in Georgia over many years, was overcome for the first time during the present study, with the *Yr1*-carrying line exhibiting a susceptible reaction.


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