Escalating Threat of Wheat Rusts

LAST MONTH, NEARLY 600 SCIENTISTS FROM MORE THAN 80 COUNTRIES CONVENED IN ST. PETERSBURG, Russia, at the International Wheat Conference to discuss the world’s most widely planted crop. This came on the heels of a Borlaug Global Rust Initiative (BGRI) workshop that focused on the rapidly spreading fungal diseases known as wheat rusts, which are causing epidemics that require urgent action. If we are to prevent devastating crop losses, nations must coordinate to enact short-term solutions; they must also expand long-term efforts in research, plant breeding, and surveillance.

In the 1940s, American agronomist Norman Borlaug led the charge against wheat stem rust that threatened farmers in Mexico. By breeding new plant varieties to resist the causative pathogens, he spurred a Green Revolution that has held this worldwide threat in check since the 1970s. But in 1999, a virulent fungal strain (Ug99) was detected in Africa, making most commercial wheat varieties around the world vulnerable to stem rust once again.* While the world remains in fear of stem rust, large-scale epidemics caused by new virulent and aggressive strains of yellow rust fungus (also known as stripe rust) now pose a severe threat to the world’s wheat supply. Since 2000, the United States and Australia have faced severe yellow rust epidemics. Even more alarming, last year yellow rust devastated major wheat-producing areas in China, northern and eastern Africa, western and central Asia, and the Middle East. The presence of two virulent and highly aggressive yellow rust strains (PstS1 and PstS2) at high frequencies at epidemic sites on five continents (including Europe) may represent the most rapid and expansive spread ever of an important crop pathogen. This epidemic trend may continue because the aggressive strains, which can tolerate higher temperatures, are still evolving.

Short-term responses to ongoing rust epidemics are limited to fungicide sprays, which may be unaffordable or unavailable in poor countries. Rapid replacement of the wheat most susceptible to rust with locally adapted, resistant, or less susceptible varieties is needed to slow down future spread. Any sustainable solution must involve political commitment; increased and coordinated international surveillance and monitoring; breeding for durable rust resistance; seed multiplication; and training of pathologists, breeders, and new young scientists. Fundamental research covering rust biology and epidemiology, evolutionary genetics, and rust-wheat interactions will also be required. For stem rust, such coordinated efforts have been successfully established by the BGRI and the Food and Agriculture Organization of the United Nations, which last month launched the Rust SPORE Web portal to track the advance of Ug99.† However, similar combined efforts are lacking for yellow rust, and the creation of an analogous reaction force will require substantial financial support.

The recent agreement by the BGRI Executive Committee and international experts at the St. Petersburg meeting to establish a Global Rust Reference Center (GRRC) that targets all wheat rust fungi would unify and intensify wheat rust surveillance and training. A first step was taken last year, when the International Center for Agricultural Research in Dry Areas (ICARDA), the International Maize and Wheat Improvement Center (CIMMYT), and Aarhus University (Denmark) launched a facility to target yellow rust. The GRRC will complement existing surveillance efforts by CIMMYT, ICARDA, and national rust diagnostic laboratories and maintain a wheat rust gene bank to support resistance breeding and research. The burning question, however, is whether policy-makers in wheat-growing countries will provide the sustained support needed for national and international institutions to prepare for future challenges by the wheat rusts. Borlaug used to say, “Rust never sleeps.” Events of recent years show how right he was.

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