

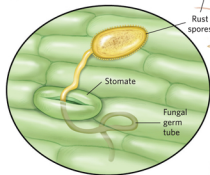
WHEAT ASSASSIN

Stem rust can take out a healthy wheat crop within weeks to months of infection. The offending fungus, *Puccinia graminis* f. sp. *tritici*, weakens its host by hijacking sugars and other nutrients. Eventually, the plant falls to the ground, and combine harvesters can no longer gather the crop.

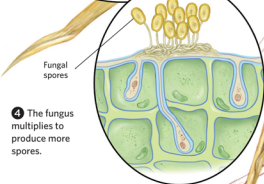
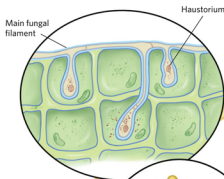
To protect the world's wheat crop from this devastating pathogen, researchers aim to develop varieties with multiple forms of rust resistance by taking genes from strains of wheat, wild grasses, and other plants that can resist the disease.

1 Wind carries rust fungal spores to a wheat plant.

2 The spore lands on a leaf or stem and sends a germ tube down into a respiration pore called a stomate.



3 The germ tube branches out to form a structure called a haustorium, which pushes through the cell walls of the plant, but does not penetrate the cell membrane. Through the haustorium, the fungus saps the plant of nutrients.



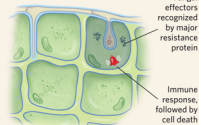
4 The fungus multiplies to produce more spores.

5 The infected plant "lodges" and falls over.

PLANT ARMOR

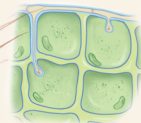
To fend off pathogens, plants call upon resistance genes that fall into two main categories: major and adult resistance. Combining several resistance genes into one wheat variety is a strategy for providing long-lasting protection against stem rust.

MAJOR RESISTANCE



Major, or seedling, resistance involves immune responses that stop fungal infection by sounding the immune alarm, ultimately resulting in the sacrificial death of the infected cell. Major resistance genes offer immunity only to specific races of stem rust.

MINOR RESISTANCE



Minor, or adult, resistance stunts the fungal infection, reducing its nutrient intake and spore production. Adult resistance genes are partially protective against multiple rust species.