

Advances in Phytophthora Resistance Breeding at Cornell University

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Phytophthora capsici in New York State

- The soilborne oomycete pathogen *Phytophthora capsici* causes root, stem, and fruit rot on peppers, among several other vegetable crops.
- The presence of both mating types in a single field results in thick-walled sexual oospores (bottom right image) which can overwinter and persist for many years.
- Flooding events in recent years have resulted in the introduction of *P. capsici* to previously disease-free farms.

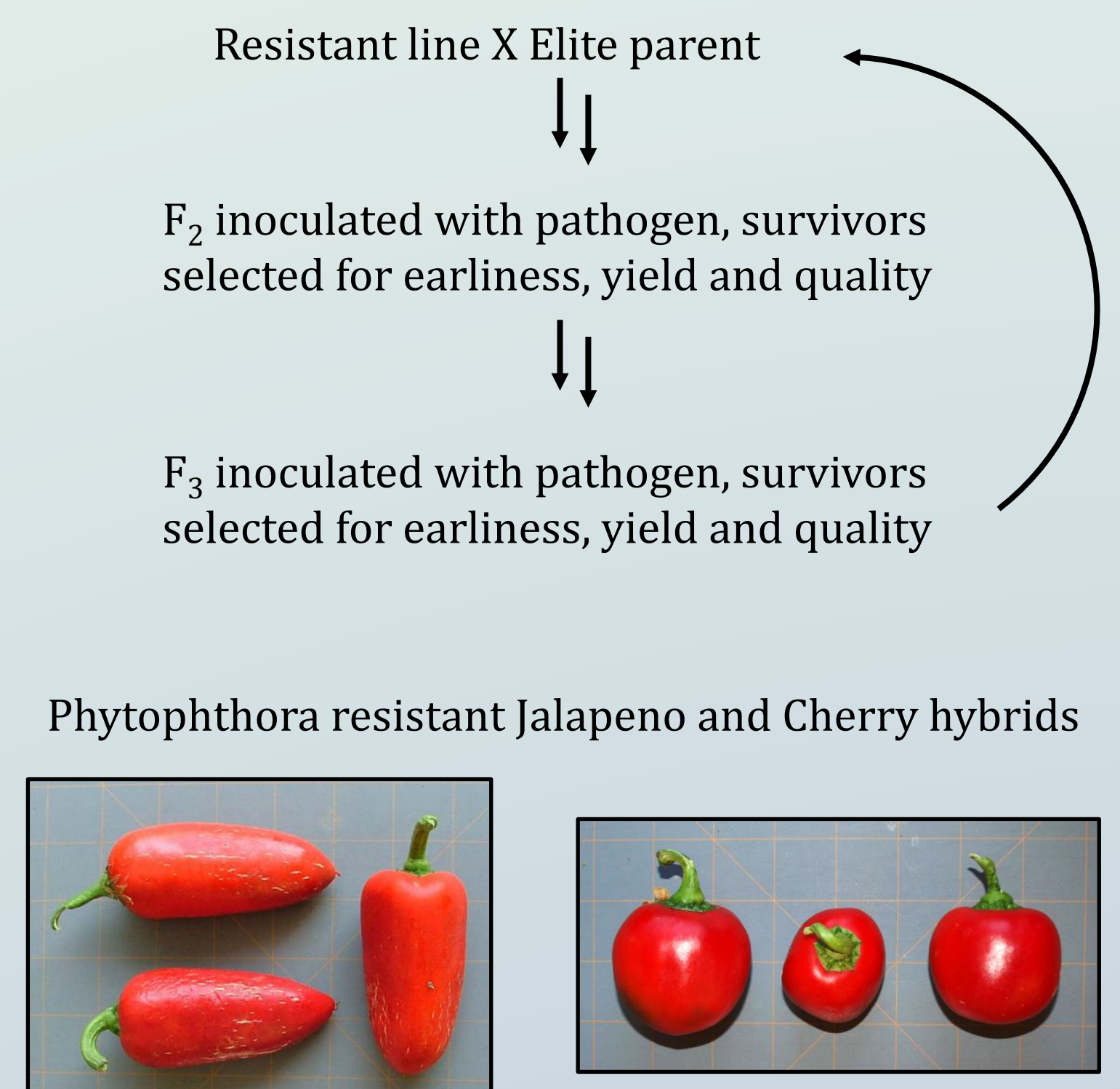


Pepper lines in development

Improved architecture and fruit shape. Initial breeding lines (left) were prolific but with irregular fruit shape and crowded crown set. Subsequent selections (right) featured blockier fruit with a more distributed fruit set.



Breeding cycle used to develop new resistant pepper lines. Critically, multiple strains of *P. capsici* are utilized to drench the seedling from leaves into soil, enabling selection for all all vegetative components of disease resistance.



NY pepper grower needs

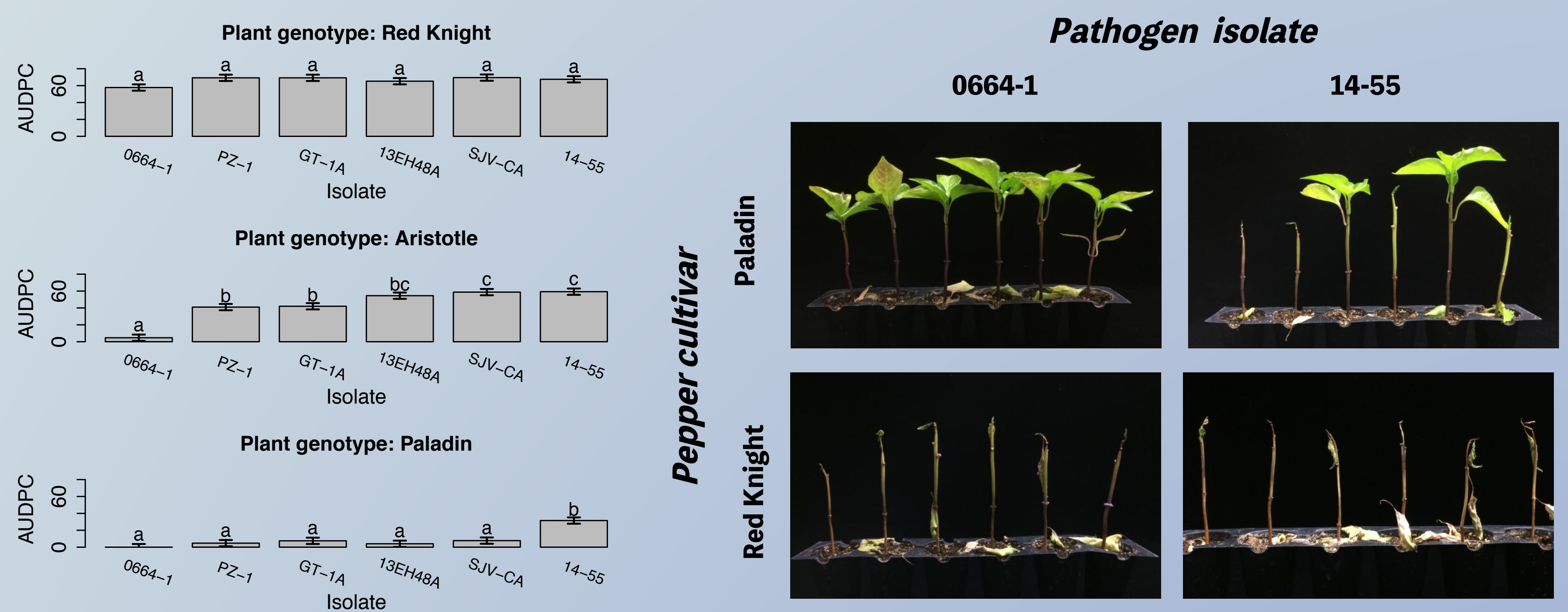


In 2017, New York ranked 9th in the United States in total acres planted to bell peppers¹. Grower priorities for NY and the northeastern US are:

- Durable resistance to diverse *P. capsici* isolates
- Bacterial leaf spot resistance
- Early maturity with good plant architecture
- Large, blocky, bells with four lobes, thick walls, and low incidence of silvering
- Diversification into hot and mild market classes such as poblanos, jalapeños, and wax peppers

Evaluating virulence of pathogen isolates

Isolates of *P. capsici* vary in their ability to cause disease on different pepper cultivars². We have screened several dozen samples from our culture collection to identify highly aggressive isolates that have an increased ability to cause disease on pepper cultivars with intermediate or high resistance, compared to our reference isolate 0664-1 (figures below). We are beginning to use these isolates to challenge breeding material in the greenhouse and field. An additional objective is to discover the genetic basis of avirulence in *P. capsici*, with the ultimate goal of developing molecular markers to race-type isolates. We intend to use an association mapping approach to identify pathogen genes associated with variation for virulence on different cultivars.



Cornell blight farm



The Cornell blight farm, in Geneva, NY, is an enclosed nine-acre farm dedicated exclusively to research on *Phytophthora* blight. At the blight farm, we conduct field trials of our breeding material and collaborate with other public and private breeders to evaluate their germplasm. We also use this facility to perform long-term studies on sexual pathogen populations.

Acknowledgements

This project is supported by a grant from the New York State Department of Agriculture and Markets. We would like to thank Molly Jahn, Matthew Falise, Emily Rodekoher, Maryann Fink, Amara Dunn, and Lindsay Wyatt for their contributions to this work.

References

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