Resistance to soybean aphid in eight wild soybean lines

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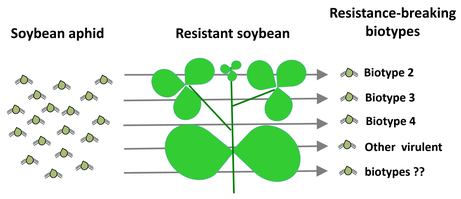
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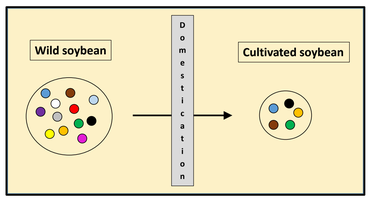
Background

The development of resistant soybean cultivars is a promising way to manage infestations of soybean aphid (SA, *Aphis glycines*). However, SA biotypes that overcome some SA-resistance (*Rag*) genes have been found.



Viable plant resistance to SA may depend on finding enough resistance genes to place within cultivars to protect against virulent biotypes.

Because of genetic bottlenecks that occurred during crop domestication, wild relatives have a greater genetic diversity than cultivated soybean.[1]



Objectives

1) Screen a large number of wild soybean (*Glycine soja*) lines for resistance to soybean aphid.

2) Follow-up with putatively resistant lines to confirm their resistance to soybean aphid

Materials

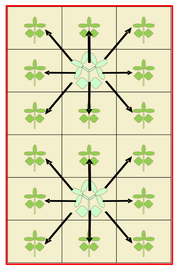
Avirulent SA biotype 1 was used in the tests. It was collected in 2009 from soybean fields near Brookings, SD, and maintained in growth chambers at the USDA-ARS Laboratory in Brookings.

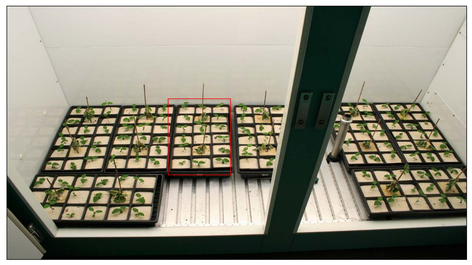
Test lines were obtained from the USDA-ARS Soybean Germplasm Collection, National Soybean Research Center, Urbana, IL.

Tests were conducted in environmental chambers (16:8 L: D, 24:18°C) at the USDA-ARS Lab in Brookings.

I. Screening: 337 wild soybean lines screened in 25 free-choice tests

SA were free to disperse from two inoculant plants among 14 test lines, a resistant check (*Rag1* gene), and a susceptible check per replicate tray.[2]





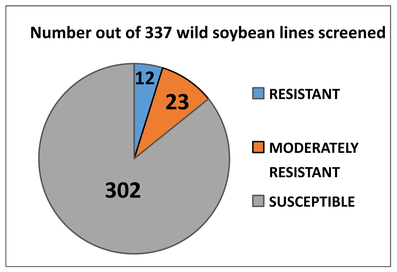
Free choice screening test. Above left: Single replicate indicating SA were able to freely disperse from focal plants to test lines. Above right: Screening test with 8 replicate trays in a growth chamber. Individual rep outlined in red.

After 2 wks, SA infestations on test lines were rated on a 1-to-6 rating scale.[2]

Rating	SA per plant	Classification
1	≤ 50	Resistant
2	51 - 100	
3	101 - 150	Moderately resistant
4	151 - 200	
5	201 - 250	Susceptible
6	≥ 250	

Results

The vast majority of the 337 test lines screened was susceptible to SA; only 12 lines were resistant, and 23 were moderately resistant.[1] The proportion resistant (3.3%) was more than 2x higher than a similar screening of domesticated soybean (1.3%).[3]



II. Follow up: No-choice cage tests

Two no-choice cage tests were used to confirm resistance with 8 of the 12 wild soybean lines identified as resistant during screening. Soybean test lines in the 2-leaf stage were inoculated with 6 SA each, which were confined within tubular cages (see figure right). The number of SA per test plant was determined 20 d later.



Results

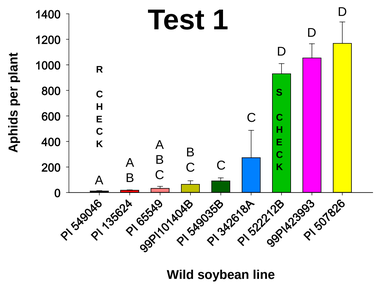
Test 1

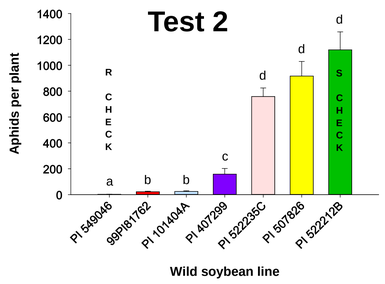
PI 135624 and PI 65549 did not differ from the R check in mean SA levels. Lines 99PI101404B, PI 549035B and PI 342618A had SA levels lower than the level on the S check but higher than that on the R check.

Test 2

Lines 99PI81672, PI 101404A and PI 407299 had SA levels lower than the level on the S check but higher than that on the R check.

SA levels on 99PI81672 and PI 101404A were lower than the level on PI 407299.





Conclusions

Twelve wild soybean lines were identified as aphid resistant in our screening tests.

Resistance was confirmed to varying degrees among 8 lines in follow-up tests.
- PI 65549 and PI 135624 had particularly strong resistance.

All 8 lines should be advanced for genetic characterization to...
- ID associated genetic markers for breeding SA-resistant soybean cultivars
- Understand patterns of inheritance

Follow-up tests should be conducted...
- Against SA biotype 4 using resistant lines identified in this study.
- In no-choice tests for the 4 remaining lines screened as putatively resistant.

Acknowledgments

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Literature cited

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[2] Hesler, LS & KJ Tilmon. 2017. Infestation ratings database for soybean aphid on early-maturity wild soybean lines. Data in Brief 15: 138-141. https://doi.org/10.1016/j.dib.2017.09.012.

[3] Hesler LS, BM Van De Stroet, NR Schultz, EA Beckendorf & KJ Tilmon. In Press. Laboratory evaluation of soybean plant introductions for resistance to *Aphis glycines* (Hemiptera: Aphididae). J. Agric. Urban Entomol.