

Introduction

Soybean aphid (SA), *Aphis glycines* Matsumura, is a newer pest of soybean [*Glycine max* (L.) Merr.] in North America and has been established in the northern United States [8]. SA sucks plant sap, resulting stunted plant growth and reduced seed yield and quality; transmits viral pathogens; and facilitates sooty-mold development. On severe infestations, it causes over 50% of yield loss [6].

Rag1, *Rag2*, *Rag3*, *rag4* and *rag1c*, *rag1b*, *rag3b*, and *Rag5* are identified resistant genes against SA in Dowling, PI 243540, PI 567543C, PI 567541B, PI 567598B, PI 567543B, and PI 567301B, respectively [2, 3, 4, 5, 7, 9]. However, SA resistance is limited in early maturing soybeans.

Objective

➤ To identify new sources of soybean aphid resistance in soybean germplasm accessions of maturity group (MG) I.

Materials and Methods

Greenhouse Screening

SA resistance was evaluated in a total of 330 soybean germplasm accessions of MG I along with eight resistant, and three susceptible checks in greenhouse by caged (no-choice) and non-caged test in thrice-replicated RCBD.

➤ Three seedlings of each germplasm accessions were inoculated with three adult soybean aphids per plant at unifoliate (VC) stage.

➤ In caged (no-choice) test, inoculated plants were covered with clear plastic cup cages, and the aphids multiplied per plant were counted two weeks after inoculation (Figure 1).



Figure 1. Inoculated plants covered by cup-cages and infested plant in greenhouse, 2013.

➤ In non-caged test, the infestation was scored after two weeks of inoculation by using a 1 to 5 point scale where 1 = <25 aphids, 2 = 26 – 100 aphids, 3 = 101 – 200 aphids, 4 = 201 – 500 aphids, and 5 = >500 aphids per plant [1].

Field Screening

Selected germplasm accessions from greenhouse tests were evaluated by thrice-replicated RCBD in the field, Brookings, SD in 2013 with artificial SA supplementation at V2 stage. SA per plant were counted at peak infestation during R4 – R6 stage in 5 plants of each plot.

Data Analysis

Square-root transformed SA counts and SA scores were analyzed by PROC GLM and PROC GLIMMIX, respectively in SAS 9.2. Resistant, mostly resistant, and susceptible accessions were categorized by comparing with standard resistant and susceptible checks [1].

Results and Discussion

➤ Significantly different ($p < 0.0001$) infestation of soybean aphid among different germplasm accessions was observed both in greenhouse and field experiments. (Figure 2 and 3).

➤ PI 567250A and PI 603339A from MG I were resistant in the field which were also resistant in caged greenhouse test but mostly resistant in non-caged greenhouse test.

➤ PI 153214 and PI 437075 were mostly resistant in the field which were resistant in both of the greenhouse tests.

➤ PI 189946 was resistant both of the greenhouse test but it was found susceptible in the field test.

➤ PI 243540 carrying resistant gene *Rag2* was resistant in non-caged greenhouse test but susceptible in caged (no-choice) greenhouse test. It was susceptible in the field test in choice situation that indicates the presence of different soybean aphid biotypes in the field.

■ PI 567250A (New, 'I') ■ PI 603339A (New, 'I') ■ PI 603712 (Res. Ck., '0')
 ■ PI 567541B (*rag4*, 'III') ■ PI 567543C (*Rag3*, 'III') ■ PI 548663 (*Rag1*, 'VIII')
 ■ PI 243540 (*Rag2*, 'IV') ■ PI 597386 (Sus. Ck., 'II') ■ PI 532438 (Sus. Ck., '00')

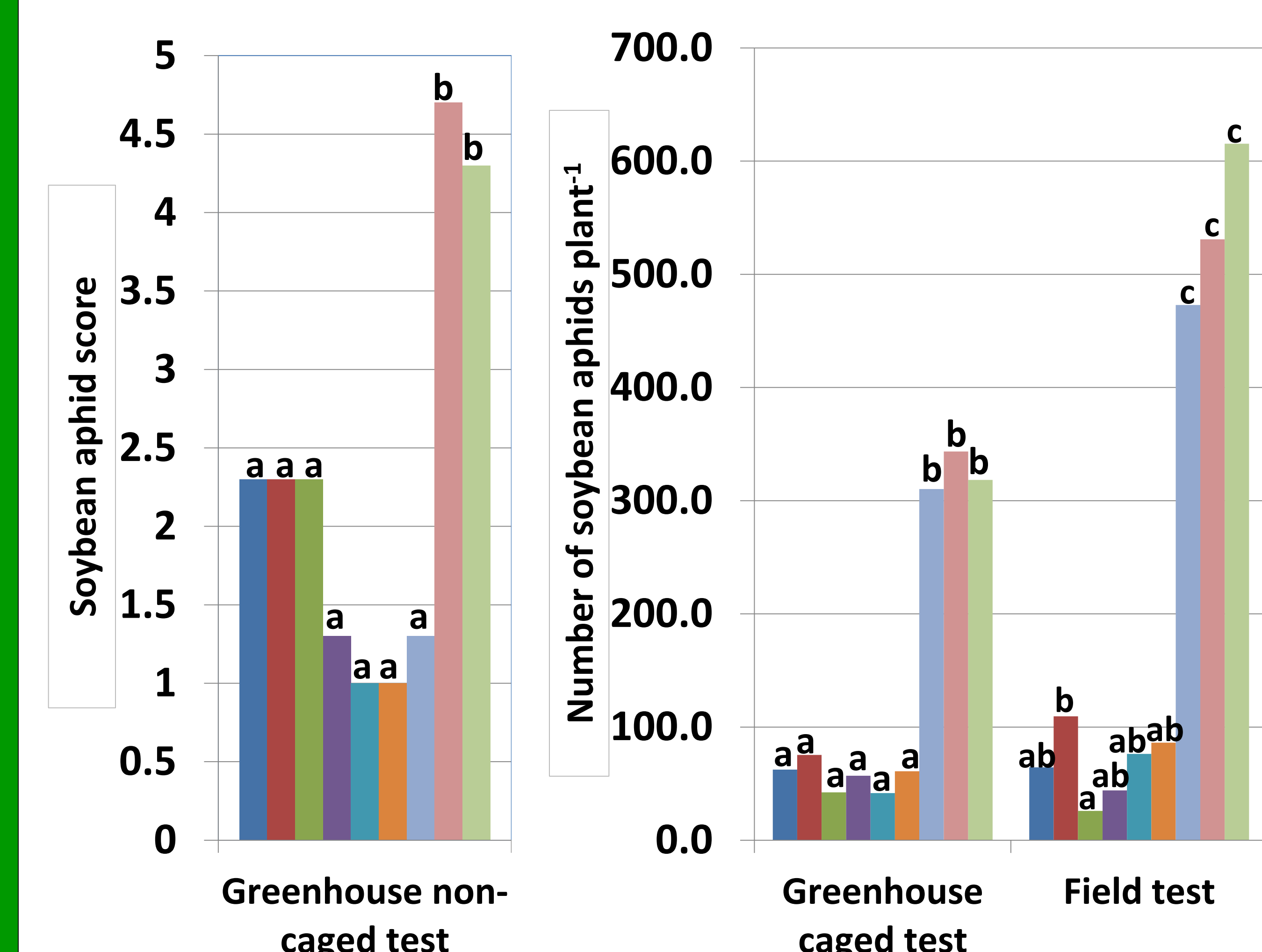


Figure 2. Soybean aphid score in greenhouse non-caged test and soybean aphid counts per plant in greenhouse caged and field tests in different soybean germplasm accessions (within parenthesis: resistance trait and maturity group); accessions with same letter are not significantly different by LSD ($p < 0.05$).

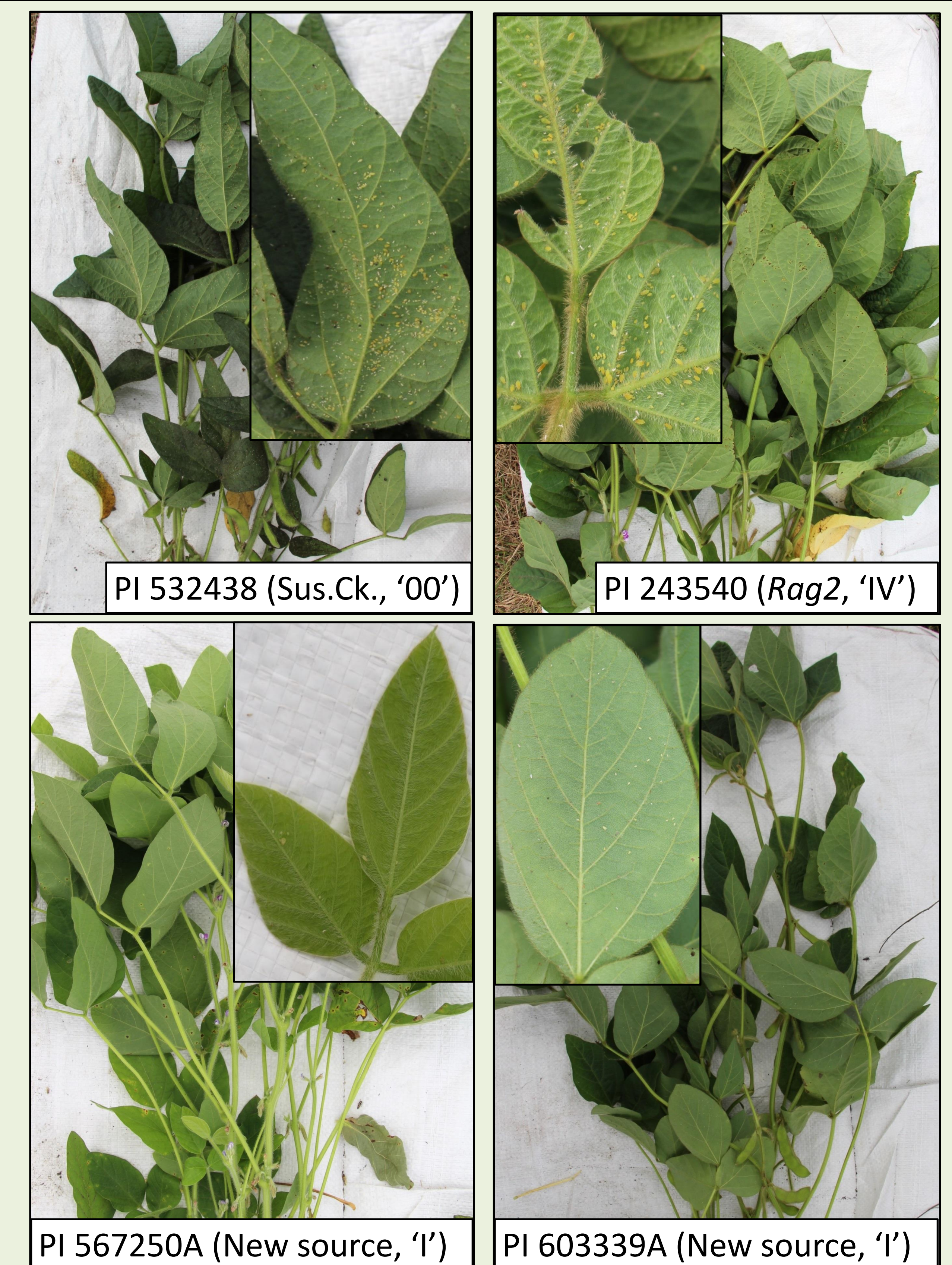


Figure 3. Soybean aphid infestation in different soybean germplasm accessions (with resistance source and maturity group in parenthesis) in Brookings, 2013.

Conclusion

➤ Two new soybean aphid resistant sources are identified in soybean germplasm accessions of MG I which can aid easy access of genetic resource for the development of soybean aphid resistant cultivars in this region.

Acknowledgements

➤ United Soybean Board and the USDA-NIFA/CSREES Hatch project for financial support.
 ➤ USDA National Soybean Research Center for test seeds.

References

- Bhusal et al. 2013. *Crop Sci.* 53:491-499.
- Hill et al. 2006. *Crop Sci.* 46: 1601-1605.
- Jun et al. 2012. *Theor. Appl. Genet.* 124:13-22.
- Mensah et al. 2008. *Crop Sci* 48:1759–1763.
- Mian et al. 2008. *Theor. Appl. Genet.* 117:955-962.
- Ostlie, K. 2002. University of Minnesota Extension Service. http://www.soybeans.umn.edu/pdfs/SBAMgmtFact_2.pdf.
- SGC Minutes, 2009: <http://www.soygenetics.org/previewMinutes.php?autoID=12>
- Venette, R. C. and D. W. Ragsdale. 2004. *Ann. Entomol. Soc. Am.* 97(2): 219-226.
- Zhang et al. 2010. *Theor. Appl. Genet.* 120:1183-1191.