Finding Sorghum Varieties Resistant to Sugarcane Aphid

by George Kuepper
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The second edition of ***Sweet Sorghum: Production and Processing*** includes a discussion of the sugarcane aphid (*Melanaphis sacchari*) - formerly, a minor pest that became a major one in 2013.[1] We address several means for controlling, or *attempting* to control it. Notably missing is any mention of resistant or tolerant varieties. At that time - spring 2019 - there weren't any available.

More recently, however, we've reason for optimism. USDA plant breeding research has released new sweet sorghum lines that carry resistance to sugarcane aphid.[2] Labeled GTS 1903, GTS1904, and GTS 1905, they are "sister" selections with resistance genes obtained from an African landrace cultivar called No. 5 Gambela, so-named for the city and region in western Ethiopia.

Landraces are local varieties that have distinctive characteristics derived from indigenous farmer selection and adaptation to geographic conditions. They are more genetically diverse than those developed through modern breeding methods.[3] (The discovery of sugarcane aphid resistance in No. 5 Gambela is an outstanding argument for preserving and conserving heritage crops and varieties.)

A high concentration of the natural substance trans-aconitic acid in No. 5 Gambela appears to be the factor that confers sugarcane aphid resistance.[4] Trans-aconitic acid has been associated with a number of plants used in herbal healing.[5] However, it has also been identified as a possible contributor to grass tetany and other nutritional disorders in early-spring cattle grazing.[6] Its precise mode-of-action in providing aphid resistance has yet to be established.

The newly released lines - GTS 1903, GTS1904, and GTS 1905 - will certainly be of interest to plant breeders, as is the source of resistance, No. 5 Gambela. While all carry the genetics of sugarcane aphid resistance, they may have undesirable characteristics as well, like disease and lodging susceptibility, poor juice quality, and excessive tillering (the production of additional thinner stems from the plant base[7]). Plant breeders commonly begin with commercially desirable cultivars and crossbreed them with lines

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1. Kuepper, George. 2019. Sugarcane Aphids, Appendix 3, p. 97-104. *In:* Kuepper, George. 2019. Sweet Sorghum: Production and Processing, 2nd Edition. The Kerr Center for Sustainable Agriculture, Poteau, Oklahoma. 122 p.
2. Bhatnagar, Deepak. 2022. Notice of Release of GTS1903, GTS1904, and GTS1905 Sweet Sorghum. USDA-ARS. Mar 3. 2 p.
3. Merriam-Webster, 2022. https://www.merriam-webster.com/dictionary/landrace
4. Knoll, Joseph E., Minori Uchimiya, and Karen Harris-Shultz. 2021. Juice chemical properties of 24 sorghum cultivars under varying levels of sugarcane aphid (*Melanaphis sacchari*) infestation. *Arthropod-Plant Interactions*. September.
5. de Oliveira, Diego P., et al. 2021. Medicinal plants and their potential use in the treatment of rheumatic diseases. Inflammation and Natural Products. Published on-line in ScienceDirect. https://www.sciencedirect.com/topics/chemistry/trans-aconitic-acid
6. Burau, R, and P.R. Stout. 1965. Trans-Aconitic Acid in Range Grasses in Early Spring. *Science* 150(3697): 766-767. Nov. 5.
7. This is also known as "stooling."

that have desirable characteristics such as, in this case, sugarcane aphid resistance. They then select, from among the resulting offspring, those individuals most like the commercial parent, but which also show aphid resistance. This selection process is repeated for several generations until the desirable trait becomes a fixture of the plant's genetics.[8]

While plant breeders are expected to use the GTS varieties in this manner, USDA research geneticist Dr. Joe Knoll suggests that growers might want give them a try "as is." It appears that the three lines all performed well in early field trials - maturing earlier and producing higher juice brix than Top 76-6. According to Dr. Knoll, No. 5 Gambela might *also* work well for some growers. Gambela, however, is somewhat photosensitive and might not mature in more northern states. In all locations, No. 5 Gambela is likely late-season and would need to be planted early.[9]

Growers and plant breeders seeking small quantities of the newly-released sweet sorghum lines or No 5 Gambela should contact Dr. Joseph Knoll, USDA-ARS Crop Genetics and Breeding Research Unit, 115 Coastal Way, Tifton, GA 31793; Joe.Knoll@usda.gov [10]

8. Musico, Josie. 2016. Pest control without pesticides: organic sorghum v. sugarcane aphids. *Lubbock Avalanche Journal*. Oct. 10. https://www.lubbockonline.com/local-news/2016-10-10/pest-control-without-pesticides-organic-sorghum-v-sugarcane-aphids
9. Knoll, Joseph. 2022. Personal communication. July 1.
10. Bhatnagar, Deepak. *op. cit.*