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ENY-480

Screening Methods for Southern Chinch Bug Resistance in St. Augustinegrass[1]

Huangjun Lu and Ronald Cherry[2]

St. Augustinegrass is the primary turfgrass for lawns and is probably the most widely used plant species in landscapes in Florida. The southern chinch bug is the plant's most damaging insect pest. Insecticidal application has been the primary control for southern chinch bugs. However, relying on insecticides for southern chinch bug control raises turfgrass maintenance costs, increases the risk that insects will develop resistance to insecticides, and may damage the environment. Host-plant resistance is a relatively sustainable and environmentally sound option for management of this damaging insect pest.

Three St. Augustinegrass varieties with resistance to the southern chinch bug have been released for commercial use for lawns. 'Floratam' is the first improved St. Augustinegrass resisitant to southern chinch bugs that was released jointly in 1973 by the University of Florida and Texas A & M University. 'Floratam' is the most widely produced and used St. Augustinegrass in Florida. But its resistance to southern chinch bug has been lost since 1985 when southern chinch bug damage on 'Floratam' was reported in Florida (Busey and Center 1987) and later confirmed by Cherry and Nagata (1997). This cultivar is now highly susceptible to the southern chinch bug. The second variety resistant to sourthern chinch bugs is 'FX-10' St. Augustinegrass (Busey 1993). 'FX-10' was never extensively grown due to several negative characteristics including a very course appearance and tough texture (Busey 1993). The third St. Augustinegrass variety that is resistant to southern chinch bugs and used for sod production and lawns is 'Captiva,' which was tested as 'NUF-76' St. Augustinegrass (Nagata and Cherry 2003). 'Captiva' is unique because, for the first time, resistance to southern chinch bug was identified within a diploid (containing 2 sets of genome) line of St. Augustinegrass, unlike polyploids (containing more than 2 sets of genome) such as 'Floratam' and 'FX-10'. Currently, 'Captiva' is the only chinch-bug-resistant St. Augustinegrass grown on sod farms in Florida. However, based on past experience with 'Floratam', it is highly probable that the chinch bugs will also overcome resistance in 'Captiva' in the future. Therefore, new resistant varieties of St. Augustinegrass need to be developed.

To develop new resistant varieties, plant materials must be screened for new sources of southern chinch bug resistance. Screening methods to measure host plant resistance of St. Augustinegrass to southern chinch bugs have measured nymphal and/or adult survival in so-called no-choice tests in which only the experimental plant materials were provided. There are four types of screening methods.

Bag Test

This method was used first by Reinert and Dudeck (1974). Terminal stolons (runners) were cut from the plants and wrapped with a wet cotton ball at the cut end, and each stolon was placed into a clear plastic bag (Figure 1).

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2. Huangjun Lu, assistant professor, Department of Horticultural Sciences; and Ronald Cherry, professor, Department of Entomology and Nematology; UF/IFAS Everglades Research and Education Center, Belle Glade, Florida 33430

Thereafter, nymphal and/or adult chinch bugs were placed into each bag, and the bag was sealed.

Figure 1. Bag test.
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Jar Test

The jar test was first described by Crocker et al. (1982). Terminal stolons were cut from the plants and inserted into vials of water, which were then sealed with parafilm. Each vial was placed into a wide-mouthed, clear glass jar along with nymphal and/or adult chinch bugs. The jars were covered with insect screen cloth secured by a screw-on ring (Figure 2).

Figure 2. Jar test.
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Box Test

The box test was initially used by Nagata and Cherry (2003). Polypropylene opaque food storage containers (28 × 16 × 11 cm) were used in this test. The central part of each lid was removed leaving approximately 3cm around the sealing edge. A 6-mm diameter hole was drilled halfway up on one of the 16-cm sides. A channel was then cut from the top of the box to the hole. A potted plant was placed beside the box. Strips of parafilm were wrapped around the stolon where it would pass through the channel. Flaps were bent on each side of the channel to help with the passing and positioning of the stolon within the hole. A 15-cm stolon attached to the plant was placed in each box. Tape was used to cover the channel from both inside and outside (Figure 3). Nymphal and/or adult chinch bugs were placed into each box. An insect screen cloth was placed on top of the box stabilized by the lid. Plants were watered as needed.

Figure 3. Box test.
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Tube Test

The tube test was established by Cherry et al. (2011). A 15-cm stolon attached to a plant was placed in a 22-cm-long, 4-cm-diameter, clear plastic tube. A sponge was wrapped around the stolon and wedged into the tube end next to the potted plant. Nymphal and/or adult chinch bugs were placed into the tube. The other end of the tube was covered with insect screen cloth held in place by a rubber band (Figure 4).

Figure 4. Tube test.
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Comparison of the Screening Methods

A recent research study determined the efficacy of these four procedures in determining St. Augustinegrass resistance to southern chinch bug at 7-, 14-, 21-, and 28-day intervals (Ma et al. 2013). In that study, St. Augustinegrass varieties used were 'Captiva', 'FX-10', 'NUF-216', and 'Floratam'. 'NUF-216' is a resistant breeding line that is not released as a commercial variety of St. Augustinegrass. The tube test distinguished the three resistant St. Augustinegrasses from the susceptible 'Floratam' St. Augustinegrass at 7, 14, 21, and 28 days (Table 1). Similarly, the jar test showed differences between the three resistant St. Augustinegrasses and 'Floratam' at 7, 14, 21, and 28 days (Table 2). The box test showed differences between the susceptible 'Floratam' and the three resistant St. Augustinegrasses at 21 and 28 days but did not show differences between 'Floratam' and 'Captiva' nor between 'Floratam' and 'NUF-216' at 7 and 14 days (Table 1). The bag test method was unable to distinguish the resistant cultivar 'Captiva' from the susceptible cultivar 'Floratam' at any intervals and failed to show difference between 'Floratam' and 'NUF-216' at 7, 21, and 28 days (Table 2).

The bag test gave the most erratic results of the 4 methods and never showed 'Captiva' to be resistant, which the other three methods demonstrated. The insects feeding on the susceptible variety 'Floratam' died quickly. Results were highly inconsistent from one run to another. Therefore, the bag test is not a really useful method for screening St. Augustinegrass for southern chinch bug resistance. Among the remaining three methods, the jar test is simple, easy to perform and requires much smaller spaces than the tube test or the box test and thus should be the first choice for screening St. Augustinegrass for resistance to southern chinch bug in a breeding program. The jar test can also be used in other types of studies such as investigating behavior or biology of the southern chinch bug on the resistant St. Augustinegrass in a restricted environment. In addition, sod farmers can use the jar test to monitor change of the southern chinch bug populations in the field. For instance, if chinch bugs are seen on a resistant variety of St. Augustinegrass, the sod farmer can conduct a simple jar test to compare the chinch bugs on the resistant variety with those on a susceptible variety such as 'Floratam' to determine whether a new chinch bug biotype that overcomes the resistant variety has appeared. Based on the test results, the farmer can adjust the management strategy.

References

Busey, P. and B. J. Center. 1987. "Southern chinch bug (Hemiptera: Heteroptera: Lygaeidae) overcomes resistance in St. Augustinegrass". *J. Econ. Entomol*. 80:608–611.

Busey, P. 1993. "Registration of FX-10 St. Augustinegrass". *Crop Sci*. 33:214–215.

Cherry, R. H. and R. T. Nagata.1997. "Ovipositional preference and survival of southern chinch bugs (Blissus insularis Barber) on different grasses". *Int. Turfgrass Soc. J*. 8: 981–986.

Cherry, R., A. Wright, R. Raid and Y. Luo. 2011. "St. Augustinegrass to southern chinch bugs (Hemiptera: Blissidae) and grey leaf spot disease". *J. Entomol. Sci*. 46:96–101.

Crocker, R. L., R. W. Toler and C. L. Simpson. 1982. "Bioassay of St. Augustinegrass lines for resistance to southern chinch bug (Hemiptera:Lygaeidae) and to St. Augustine decline virus". *J. Econ. Entomol*. 75:515–516.

Ma, L., H. Lu, R. Cherry, H. McAuslane and K. Kenworthy. 2013. "Effect of time and methodologies in determining St. Augustinegrass resistance to southern chinch bugs (Hemiptera: Blissidae)". *J. Entomol. Sci*. 48:161–165.

Nagata, R. and R. Cherry. 2003. "New source of chinch bug (Hemiptera:Lygaeidae) resistance in a diploid selection of St. Augustinegrass" . *J. Entomol. Sci*. 38:654–659.

Reinert, J. A. and A. E. Dudeck. 1974. "Southern chinch bug resistance in St. Augustinegrass". *J. Econ. Entomol*. 67:275–277.

Table 1. Numbers of adult southern chinch bugs that survived after different intervals (days) using whole plants (10 adult southern chinch bugs were tested for each variety).

	Tube test				Box test			
Variety	**7**	**14**	**21**	**28**	**7**	**14**	**21**	**28**
Floratam	8.1a*	6.8a	5.3a	4.1a	6.8a	5.0a	4.1a	3.2a
Captiva	5.1b	3.1b	1.1b	0.6b	7.0a	3.0a	1.3b	1.1b
NUF-216	4.8b	3.1b	1.1b	0.0b	6.5a	3.1a	1.6b	0.9b
FX-10	3.5b	0.4b	0.0b	0.0b	2.5b	0.3b	0.1b	0.0b

*Means within each column followed by the same letter were not significantly different from each other (α=0.05) when evaluated with a least significant difference (LSD) test. (Ma et al. 2013).

Table 2. Numbers of adult southern chinch bugs that survived after different intervals (days) using excised stolons (10 adult southern chinch bugs were tested for each variety).

	Jar test				Bag test			
Variety	**7**	**14**	**21**	**28**	**7**	**14**	**21**	**28**
Floratam	6.0a*	5.0a	3.4a	2.6a	5.1a	3.0a	1.9a	0.3a
Captiva	2.8b	1.3b	0.8b	0.4b	6.0a	2.1ab	1.6a	0.9ab
NUF-216	3.3b	0.8b	0.3b	0.3b	4.0a	0.9b	0.6ab	0.3ab
FX-10	2.1b	0.5b	0.1b	0.0b	4.0a	0.5b	0.0b	0.0b

*Means within each column followed by the same letter were not significantly different from each other (α=0.05) when evaluated with a LSD test. (Ma et al. 2013).