# N O T E

## Seed Preferences of the Red Imported Fire Ant (Hymenoptera: Formicidae) in Oklahoma[1,2]

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Since their introduction near Mobile, AL, around 1930, red imported fire ants, *Solenopsis invicta* Buren, have spread throughout the southern United States including California (Jetter et al. 2002, Calif. Agric. 56: 26-34). While most of the food foraged by these ants is derived from arthropods, seeds may constitute between 4 and 17% of the foraged items in Oklahoma (Vogt et al. 2002, Environ. Entomol. 31: 47-53). Fire ants damage or consume some seeds, including agricultural seeds such as wheat, maize, cotton, sorghum, and soybean (Morrison et al. 1997, J. Econ. Entomol. 90: 218-222) and peanuts (Vogt and Rice, unpubl.). Water content can influence the rate at which seeds are damaged by fire ants (Morrison et al. 1999, J. Econ. Entomol. 92: 215-219). Fire ants prefer some types of seeds over others (Ready and Vinson 1995, Environ. Entomol. 24: 1422-1431) and may significantly affect seed dispersal and species composition in a plant community (Barr 1997, Ph.D. Dissertation, Texas A&M Univ. 169 pp.).

The objective of our study was to investigate preferences of red imported fire ants for seeds of eight species of forbs native to Oklahoma. The Oklahoma Department of Transportation uses these seeds, among others, for roadside reclamation. Therefore, our results have relevance not only to understanding the ecology of fire ants but also to assessing their impact on reclamation activities.

We conducted this study on the shore of Lake Texoma (Bryan Co., OK), in an area designated for research by Southeastern Oklahoma State Univ. The vegetation was a mixture of native and introduced forbs and grasses and disturbed cross-timbers

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[2]Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U. S. Department of Agriculture, Southeastern Oklahoma State University, or the U. S. Army Corps of Engineers.

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forest [dominated by post oak (*Quercus stellata* Wangenh)], with some areas of bushes and lianas. There are also small plots of milo, corn, foxtail millet, and winter wheat for wildlife management. The area is heavily infested with fire ants; some overnight pitfall traps captured almost 900 fire ants in the summer this study was conducted (Vogt et al., unpubl.). Conditions were hot and dry, with soil surface temperatures approaching or exceeding 50°C.

We obtained seeds of the following species of forbs native to southern Oklahoma from a commercial seed distributor: six composite species (Asteraceae) including black-eyed susan (*Rudbeckia hirta* L.), clasping-leaved coneflower (*Rudbeckia amplexicaulis* Vahl), Indian blanket (*Gaillardia pulchella* Fougeroux de Bondaroy), plains coreopsis (*Coreopsis tinctoria* Nuttall), purple coneflower [*Echinacea purpurea* (L.)], and lance coreopsis (Asteraceae: *Coreopsis lanceolata* L.); and two other species, lemon beebalm (Lamiaceae: *Monarda citriodora* Lagasca) and bluebonnet (Fabaceae: *Lupinus texensis* Hooker).

Preliminary work indicated that foraging fire ants ignored dry seeds under our experimental conditions, so seeds were allowed to imbibe water for 48 h prior to beginning the experiment. This was determined to be the point at which maximum water uptake had taken place. Our experimental design was a randomized complete block replicated six times. Seeds were exposed to foraging fire ants in pie plate foraging arenas, similar to the arena used by Hooper and Rust (1997, Ann. Entomol. Soc. Am. 90: 246-253). An aluminum pie plate contained eight small plastic weighboats of seeds (preweighed, about 0.25 g each), one for each species, near the circumference. Four holes equidistant around the circumference allowed ants to enter through drinking straws which conducted them to the middle of the pie plate, from which they had equal access to all eight seed species. We covered each plate with plexiglass, and a paper plate for shade. Each arena (N = 6) remained in the field until one of the species of seeds had been completely removed. Plates were observed 11 times over a 22 h period at intervals ranging from 0.25 to 8 h. Two control plates, placed in the study area but isolated from foraging ants, allowed an estimate of water loss from seeds of each type. Initial seed weights and final seed weights corrected for mean water loss allowed calculation of percent seed weight loss due to ant foraging for each species. Data were analyzed using Proc Mixed (Littell et al. 1996, SAS System for Mixed Models, SAS Institute, Cary, NC. 633 p.) with block as a random factor. Differences among seed species were detected using Least Squares Means; means were considered different at the $\alpha < 0.05$ level.

Imported fire ants were the only ants observed in and around the foraging arenas during all observation periods. Mean corrected seed mass loss after exposure to foraging fire ants differed between seed species ($F = 186.6$; df = 7, 35; $P < 0.0001$). Foraging fire ants preferred *E. purpurea* over other species included in the study (Table 1). The ants had a secondary preference for *M. citriodora,* and collected similar percentages of seeds of *R. hirta* and *G. pulchella.*

Barr (1997) found that red imported fire ants preferred *M. citriodora* to other species he investigated in Texas. He did not include *E. purpurea,* and found that the ants did not consume all of the seeds, but dispersed some, resulting in patches of lemon beebalm in the vicinity of ant mounds. Ready and Vinson (1995, Environ. Entomol. 24: 1422-1431) found that ants tended to transport seeds of *R. amplexicaulis,* rarely damaging them. Seed dispersal by ants can, therefore, have a significant effect on success of reproduction by seeds, and distribution patterns of dominant forb species in grasslands.

**Table 1. Removal of seeds presented to *S. invicta* in the field**

| Species | Mean % removed* |
|---|---|
| *Echinacea purpurea* | 100a |
| *Monarda citriodora* | 23.0 ± 2.8b |
| *Rudbeckia hirta* | 10.0 ± 2.8c |
| *Gaillardia pulchella* | 9.5 ± 2.8c |
| *Coreopsis tinctoria* | 3.7 ± 2.8cd |
| *Coreopsis lanceolata* | 0.6 ± 2.8d |
| *Rudbeckia amplexicaulis* | 0.4 ± 2.8d |
| *Lupinus texensis* | 0.3 ± 2.8d |

* All seeds allowed to imbibe water for 48 h. Means followed by the same letter are not significantly different (Least Squares Means, $P > 0.05$) and are reported as estimated mean ± SE.

While imported fire ants may not disturb dry seeds in summer, they may forage upon wildflower seeds in spring and fall, thus interfering with efforts by some agencies to use wildflowers for erosion control and roadside beautification. Such reclamation efforts might prove more successful if the species that ants prefer (especially *E. purpurea*) are not heavily used. Alternatively, broadcasting a bait product for fire ant control prior to sowing might benefit reclamation efforts, as one bait product (Amdro®) (0.73% Hydramethylnon) can halve foraging activity in the broadcast area within 24 h, and almost totally suppress it within 1 wk (C. Barr, pers. comm.). Much attention has focused recently on echinacea as a dietary supplement, and increased cultivation may be necessary to prevent overharvesting of wild stands (Kindscher 1989, Econ. Bot. 43: 498-507). As mechanisms of the commercial production of echinacea, perhaps from seedlings, are developed, the effect of imported fire ants on the seeds of *E. purpurea* needs to be considered. Finally, as studies continue on prairie restoration and the sexual reproduction of rare and endangered prairie species (e.g., Oklahoma Grass-pink, *Calopogon oklahomaensis* Goldman), the effects of imported fire ants on these seeds should be investigated.

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