BioOne COMPLETE

A Device and a Protocol for Collecting Brood of the Red Imported Fire Ant (Hymenoptera: Formicidae) in the Field

Authors: Zheng, Jihuan, Guo, Yangyang, Mao, Runqian, Xiao, Yingfang, and Huang, Mingdu

Source: Florida Entomologist, 96(4) : 1489-1491

Published By: Florida Entomological Society

URL: https://doi.org/10.1653/024.096.0429

BioOne Complete (complete.BioOne.org) is a full-text database of 200 subscribed and open-access titles in the biological, ecological, and environmental sciences published by nonprofit societies, associations, museums, institutions, and presses.

Your use of this PDF, the BioOne Complete website, and all posted and associated content indicates your acceptance of BioOne's Terms of Use, available at www.bioone.org/terms-of-use.

Usage of BioOne Complete content is strictly limited to personal, educational, and non - commercial use. Commercial inquiries or rights and permissions requests should be directed to the individual publisher as copyright holder.

BioOne sees sustainable scholarly publishing as an inherently collaborative enterprise connecting authors, nonprofit publishers, academic institutions, research libraries, and research funders in the common goal of maximizing access to critical research.

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

A DEVICE AND A PROTOCOL FOR COLLECTING BROOD OF THE RED IMPORTED FIRE ANT (HYMENOPTERA: FORMICIDAE) IN THE FIELD

JIHUAN ZHENG[1], YANGYANG GUO[1,2], RUNQIAN MAO[1*], YINGFANG XIAO[3] AND MINGDU HUANG[1]
[1]Guangdong Entomological Institute and Guangdong Provincial Public Laboratory on Wild Animal Conservation and Management, Guangzhou 510260, China

[2]South China Botanical Garden, Chinese Academy of Sciences, Guangzhou 510650, China

[3]Mid-Florida REC, University of Florida, Apopka, FL, 32703, USA

*Corresponding author; E-mail:g.dr@163.com

ABSTRACT

The red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), is an invasive ant of serious public health significance. In this study, a device and a protocol were developed for collecting brood of the red imported fire ant in the field. Field trials showed that within 30 min about 700 larvae and pupae plus about one half this number of workers were collected per device. This collection procedure takes advantage of the innate brood rescue behavior of alarmed workers, which involves strong negative phototaxis. This brood collection device is not useful for collecting queens, but it provides a practical means to separate the brood from the mound soil.

Key Words: innate brood rescue behavior, *Solenopsis invicta*, negative phototaxis

RESUMEN

La hormiga de fuego roja importada, *Solenopsis invicta* Buren (Hymenoptera: Formicidae), es una hormiga invasora de suma importancia para la salud pública. En este estudio, un instrumento y un protocolo fueron desarrollados para recolectar la cría de la hormiga de fuego roja importada en el campo. Los ensayos de campo mostraron que dentro de 30 minutos, en cada dispositivo se colectaron alrededor de 700 larvas y pupas, además de aproximadamente la mitad de este número de trabajadores. Este procedimiento para recolectar se aprovecha del comportamiento innato de los trabajadores alarmados para rescatar la cría, que implica un fuerte fototaxis negativo. Este instrumento de recolectar la cría no es útil para recoger las reinas, pero provee un medio práctico para separar la cría de los montículos del suelo.

Palabras Clave: comportamiento innato de rescatar cría, *Solenopsis invicta*, fototaxis negativo

The red imported fire ant, *Solenopsis invicta* Buren (Hymenoptera: Formicidae) is one of the most notorious invasive ant species, because of its significant impact on human health, agriculture, livestock and wildlife (Vinson 1997; Chen 2007). Techniques have been developed for the separation and maintenance of red imported fire ant colonies in laboratories (Khan et al. 1967; Markin 1968; Banks et al. 1981; Chen, 2007) because they are crucially needed for research. *Solenopsis invicta* colonies usually have been collected by shoveling mound soil into a container, such as a plastic bucket (Banks et al. 1981). Various laboratory studies require the separation of a colony from is mound soil. In the laboratory, the water-drip method was developed for colony separation (Jouvenaz et al. 1977; Banks et al. 1981). However, few studies have focused on techniques for collecting brood of the fire ants in the field. In current study, devices and methods were developed for collecting brood of red imported fire ant in the field.

MATERIALS AND METHODS

Device for Collecting *Solenopsis invicta* Brood

The device developed in this study consists of an opaque light-tight covered column and a circular base (Fig. 1), which henceforth is referred to as the cover. The cover was 5 cm high with a diam of 20 cm. Three gaps were made in the cover, and the cover was fixed on the base with 3 plugs. The purpose of the gaps was to serve as

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

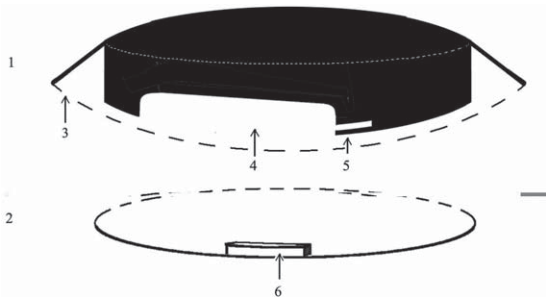


Fig. 1. Schematic diagram of the device for collecting *Solenopsis invicta* brood in the field. 1. Light-tight cover; 2. Base; 3. Shade; 4. Gap; 5. and 6. Plugs to attach the removable bottom.

entrances through which workers could deliver rescued brood into the device. The innate brood rescue behavior of the workers results from their negative phototaxis.

Procedures for Collecting *Solenopsis invicta* Brood

Thirty-two colonies were scooped by shovel for brood collection in the field. The procedure to separate the brood from mound soil by the device included the following 3 steps:

1. Several shovel scoops of mound soil were scattered thinly over a sorting sheet as described by Porter (1993);
2. The inside surface of the wall of the cover of the brood collector was coated either with vaseline or Teflon®. Two or 3 brood collectors were placed on the sheet at its edge and immediately adjacent to the scattered mound soil. Care was taken to assure complete contact of the base of the brood collector with the sorting sheet to prevent workers from moving brood underneath the base;
3. After 30 min the workers had transferred almost all the brood into the device, then the device was turned upside down and the brood collection with brood and workers was transported to the laboratory, where the brood and the workers were counted.

Results

The device successfully provided a shelter for brood rescue. Usually the brood was moved from the sorting sheet into only 1 or 2 of the devices on the sheet. The device(s) nearest to the brood on the sorting sheet were chosen by the workers as the shelter for the brood. An average of 745 ± 358 individuals of larva and pupa were collected per collector, depended on the quantity of brood on the sorting sheet. Accordingly, the workers were also caught in the device as 32 ± 5% of the combined catch of workers plus brood individuals; but only 1 queen was transferred into a collection device while collecting brood from 32 colonies.

Discussion

The brood collection device was designed on the basis of the worker rescue behavior, and especially on their strong negative phototaxis. The brood rescue behavior of workers was also previously used for colony collection, especially for searching out the queen (Tschinkel & Howard 1978). In addition the negative phototaxis of alarmed fire ants was also recognized and used in laboratory by Porter & Tschinkel (1985). We were successful in developing a device for red imported fire ant brood collection based on the brood rescue behavior of workers.

The workers were also caught in the device in a ratio to brood individuals of about 50: 100, and therefore the brood cannot be separated from the workers by this device. Moreover, the device is not useful for collecting queens because only one queen was transferred into a collecting device in this study. Nevertheless, rescue behavior was successfully used to collect queens by Tschinkel & Howard (1978).

Brood can be separated from the soil in about 30 min by the device used in this study. By the water drip method a colony could be separated overnight (Banks et al. 1981), and within 2-3 h at the increased drip rate developed by Chen & Wei (2005). However the water drip method cannot be used to collect brood in the field. Accordingly, this study has provided a practical method of brood collection.

Acknowledgments

This work was supported by the National Natural Science Foundation of China (Grant No. 31100316) and Science and Technology Program of Guangdong province (2012B061800091), and we express deep gratitude to the Foundation.

References Cited

Banks, W. A., Lofgren, C. S., Jouvenaz, D. P., Stringer, C. E., Bishop, P. M., Williams, D. F., Wojcik, D. P., and Glancey, B. M. 1981:Techniques for collecting, rearing, and handling imported fire ants. USDA SEA AATS-S-21.

Chen, J., and Wei, X. 2005: An improved method for fast and efficient fire ant colony separation, pp. 173-175 *In* Proc. Annu. Red Imported Fire Ant Conf., Gulfport, Mississippi, 22-24 March 2005.

Chen, J. 2007: Advancement on techniques for the separation and maintenance of the red imported fire ant colonies. Insect Science 14: 1-4. DOI: 10.1111/j.1744-7917.2007.00120.x.

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use

JOUVENAZ, D. P., ALLEN, G. E., BANKS, W. A., AND WOJCIK, D. P. 1977: A survey for pathogens of fire ants, *Solenopsis* spp. in the southeastern United States. Florida Entomol. 60: 275-279.

KHAN, A. R., GREEN, H. B., AND BRAZZEL, J. R. 1967: Laboratory rearing of the imported fire ant. J. Econ. Entomol. 60: 915-917.

MARKIN, G. P. 1968: Handling techniques for large quantities of ants. J. Econ. Entomol. 61: 1744-1745.

PORTER, S. D., AND TSCHINKEL, W. R. 1985: Fire ant polymorphism: the ergonomics of brood production. Behav. Ecol. Sociobiol. 16: 323-336.

PORTER, S. D. 1993: Stability of polygyne and monogyne fire ant populations (Hymenoptera: Formicidae: *Solenopsis invicta*) in the United States. J. Econ. Entomol. 86: 1344-1347.

TSCHINKEL, W. R., AND HOWARD, D. F. 1978. Queen replacement in orphaned colonies of the fire ant, *Solenopsis invicta*. Behav. Ecol. Sociobiol. 3: 297-310.

VINSON, S. B. 1997: Invasion of the red imported fire ant (Hymenoptera: Formicidae): Spread, biology, and impact. American Entomol. 43(1): 23-39.

Downloaded From: https://bioone.org/journals/Florida-Entomologist on 28 Mar 2024
Terms of Use: https://bioone.org/terms-of-use