SCIENTIFIC NOTE

Attraction of Gravid Females of *Culex quinquefasciatus* and *Aedes nocturnus* (Diptera: Culicidae) to New Jersey Light Traps on the Island of Kauai, Hawaii

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Abstract. Gravid females of *Culex quinquefasciatus* (Say) and *Aedes nocturnus* (Theobald) were collected in New Jersey light traps from March 2002 to February 2003 on the Island of Kauai. The monthly gravid rate (proportion of gravid females to all females) and average number of undeposited eggs per gravid female were obtained from the third week collections in the month. *Culex quinquefasciatus* had much higher gravid rates (0.56–0.98) than *A. nocturnus* (0–0.24). The monthly average number of undeposited eggs per gravid female was significantly different between these two species. The range was from 80.9 to 163.1 eggs for *C. quinquefasciatus*, and 29.8 to 71.7 eggs for *A. nocturnus*. For both species, no significant peaks were found for monthly gravid rate and monthly average number of undeposited eggs per gravid female. This study demonstrates a means of collecting gravid females of *C. quinquefasciatus* and *A. nocturnus* and also provides a method of collecting information of the fecundity from wild mosquito populations.

Key words: Gravid mosquitoes, New Jersey light trap

Introduction

The New Jersey light trap, developed in the 1930s, has been widely used for obtaining information for mosquito research and control (Reinert 1989). In Hawaii, New Jersey light traps have been used for monitoring the populations of night biting mosquitoes for many years and have provided valuable information for planning the mosquito control operation. There are two species of night biting mosquitoes in Hawaii, the Southern house mosquito, *Culex quinquefasciatus* (Say), an important filariasis vector in the tropics (but not Polynesia) (Service 1996), and the flood water mosquito, *Aedes nocturnus* (Theobald), a common pest in many areas of the western and southern Pacific (Joyce 1963). These species were accidentally introduced into Hawaii in 1826 and 1962, respectively.

The *West Nile virus* (WNV) has become established in 46 states of the US mainland (Hawaii State Department of Health: Unpublished report). Hawaii now faces a public health risk from the disease because of the presence of potential vectors including *C. quinquefasciatus* and *A. nocturnus* (Turell et al. 2001; Hawaii Department of Health: Unpublished report). Detecting the WNV in gravid mosquitoes is one way of determining whether the virus has entered the mosquito population. In addition, the proportion of gravid females to all females (gravid rate) indicates not only how successful the individual females attack their hosts, as a result of the chance to translate diseases, but also the strong influence to the population fecundity because of egg production depending on blood meal.

In recent years, we realized that there were gravid females of both night biting species in the light trap collections. In order to provide a method of obtaining gravid females and to

collect information on the fecundity of wild mosquito populations, from March 2002 to February 2003 we examined the female mosquitoes from 16 New Jersey light traps on the island of Kauai.

Materials and Methods

A total of 16 New Jersey light traps were located in residential areas in the coastal towns Kekaha, Waimea, Hanapepe, Koloa, Lihue, Wailua, Kapaa, Anahola, Kilauea, and Hanalei on Kauai. The light traps were operated daily from sunset to sunrise, and the trapped mosquitoes were collected weekly. All of the female mosquitoes collected from the light traps during the third week of each month were placed into a petri dish and examined to determine the gravid rate of females, which is defined as the proportion of gravid females. The total number of females in each collection for each species during a one year period ranged from 42 to 119 for *C. quinquefasciatus* and 21 to 122 for *A. nocturnus*. In this study, blood-fed and half-gravid females were considered gravid.

To determine the average number of undeposited eggs per individual, ten gravid females of each species were chosen randomly. These females were placed in petri dishes containing water. When the bodies softened, the abdomens of the gravid females were dissected and the undeposited eggs were counted with a dissecting microscope.

Results and Discussion

The gravid rates of *C. quinquefasciatus* and *A. nocturnus* throughout a one-year period are shown in Fig. 1. There were no clear peaks but some fluctuations for both species. *Culex quinquefasciatus* consistently had much higher values (0.56–0.98), than *A. nocturnus* (0–0.24). Therefore, the chance of obtaining gravid females of *C. quinquefasciatus* is high. The New Jersey light traps also caught gravid females of *A. nocturnes*, albeit in low numbers.

According to Reinert (1989), the New Jersey light trap can accurately monitor the populations of *C. quinquefasciatus* and *A. vexans*, a species closely related to *A. nocturnus*. The results of this study may indicate that *C. quinquefasciatus* is a more aggressive species than *A. nocturnus* because more individuals in the population successfully obtain blood meals. Although *A. nocturnus* prefers animal blood to human (Hawaii Department of Health, Vector Control Training Manual, 1991) the females bite humans readily (Joyce 1963). The population abundance is also believed to be playing an important role in causing disease translation and nuisances. But obviously the population abundance depends on the population fecundity, which is closely related to the gravid rate of females. More studies are needed to reveal the relationship between gravid rate and the factors that may influence the gravid rate, such as rainfall, host, etc.

The average number of undeposited eggs per gravid female during a one-year period is shown in Fig. 2. There were no clear peaks for either of the species. It may also indicate that conditions of hosts, breeding habitats of both mosquito species, and other environmental factors are quite stable. The range was 80.9 to 163.1 eggs for *C. quinquefasciatus* and 29.8 to 71.7 eggs for *A. nocturnus*. Chadee and Haeger (1986) reported that *C. quinquefasciatus* from a wild population laid 30–350 eggs per raft. Zharov (1980) reported that *A. vexans* Meigen laid a range of 156–198 eggs per female. The fecundity was from a laboratory colony and lifetime production. Compared to *A. vexans*, the egg count of A. *nocturnus* in this study was low because it is from a wild population and also not a lifetime production. There are very few studies on the fecundity of wild mosquito populations, even for some medically important species. The average undeposited egg number per gravid female or the combination of this number with the gravid rate may provide some important information

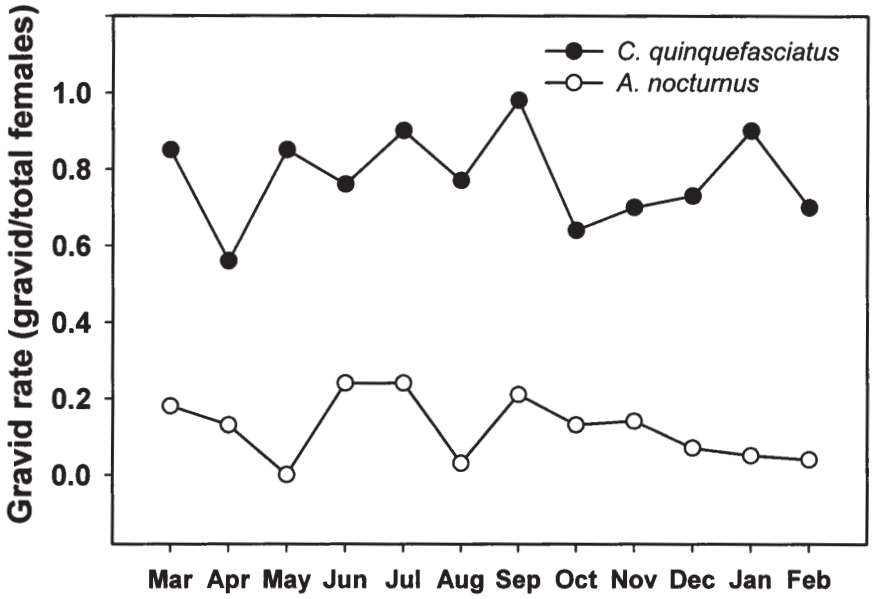

Figure 1. Gravid rate of *Culex quinquefasciatus* and *Aedes nocturnus* collected from New Jersey light traps from March 2002 to February 2003 on Kauai.

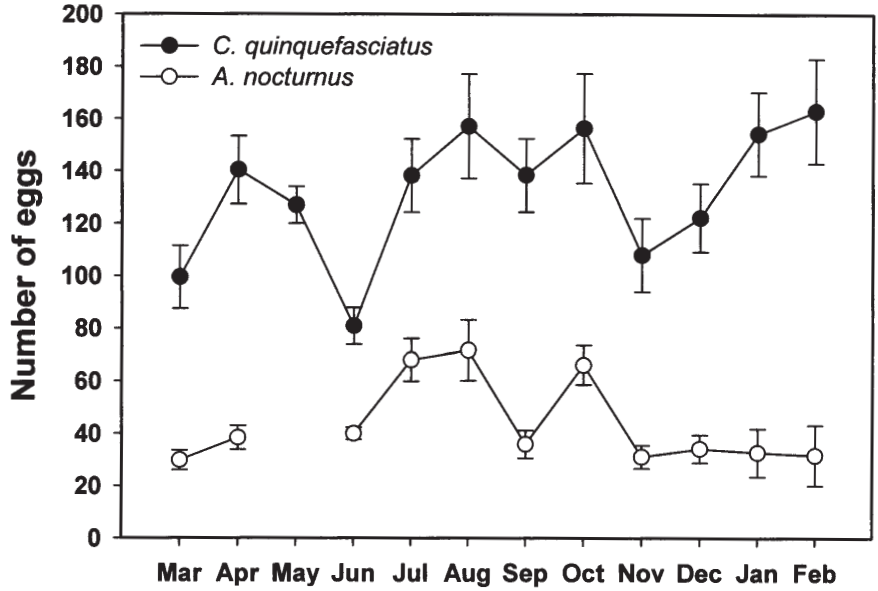

Figure 2. Average number of eggs per female of *Culex quinquefasciatus* and *Aedes nocturnus* collected from New Jersey light traps from March 2002 to February 2003 on Kauai. Vertical bars represent standard error.

useful in monitoring the fecundity of a wild mosquito population.

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