SCIENTIFIC NOTE

USING BG LURE VERSUS NON-ATTRACTANT IN STICKY TRAPS TO EVALUATE EFFECTIVENESS OF COLLECTING EYE GNATS (DIPTERA: CHLOROPIDAE: *LIOHIPPELATES* SPP.)

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ABSTRACT

Increased number of eye gnats often cause a nuisance problem in St. Johns County, Florida, during spring and summer. Anastasia Mosquito Control District, St. Augustine often receives service requests and complaints about the eye gnat problem. Evaluation of traps is critically important for surveillance and control of nuisance eye gnats. This study was conducted to determine if sticky traps (RESCUE!® TrapStik for Flies) baited with BG Lure were more attractive to eye gnats than sticky traps without bait in Elkton, northeastern Florida. The results showed that sticky traps baited with BG Lure were more attractive to eye gnats than unbaited traps, which could be considered as a tool for surveillance and control of eye gnats.

Key Words: sticky trap, BG Lure, eye gnats, Liohippelates, Diptera, Hymenoptera, Coleoptera, Hemiptera, Homoptera, Thysanoptera, spiders

INTRODUCTION

The two most common species of eye gnats in the southeastern United States are *Liohippelates pusio* (Loew) and *L. bishoppi* (Sabrosky) (Klepzig et al. 2022). These non-biting flies are attracted to fluids secreted from the eyes, nose, ears, and open wounds of both humans and animals (Mulla 1965). As flies feed on these fluids they can transmit pathogens such as bacteria and viruses between and among humans and livestock. Where eye gnats are abundant, they become a nuisance to humans in rural towns and tourist and agricultural areas. Eye gnats have been implicated in the mechanical transmission of several disease-causing pathogens including the bacteria that cause human acute conjunctivitis (pink eye) (Machtinger and Kaufman 2011). Increased number of eye gnats often cause a nuisance problem in St. Johns County, Florida, during spring and summer, leading to Anastasia Mosquito Control District, St. Augustine receiving service requests and complaints. For eye gnat control, applications of insecticides have shown various degrees of success. Unfortunately, many of the effective chemicals are not labeled for eye gnat control in the U.S. The use of removal trapping (Day and Sjogren 1994) and attractants (Hwang et al. 1976) might be a promising alternative for the management of eye gnat populations.

During the Florida summer, the complete life cycle from egg to adult takes approximately three weeks (Klepzig et al. 2022). Primary breeding sites are freshly disturbed soil with cut grass or hay and moisture (Bigham 1941). This study was conducted to determine if a commercial sticky trap baited with an attractant was more productive for collecting eye gnats than traps without an attractant.

Sticky traps (RESCUE!® TrapsStik for Flies, Manufactured by Sterling International, Inc., Spokane, WA; Figure 1A) were used to assess the attractiveness of eye gnats (Chloropidae: *Liohippelates* spp.). This sticky trap uses a combination of appealing colors, patterns, and contrast to attract nuisance flies (Zhang et al. 2015). For this study, BG Lure (consisting of ammonia, lactic acid and fatty acids, BioGents, Regensburg, Germany; Figure 1B) was added as an attractant to the sticky traps to see if the lure improved trap performance at collecting eye gnats compared to an unbaited sticky trap. Also, all insects and spiders caught by the traps were identified and evaluated to determine the impact of baited and unbaited traps on non-target organisms.

The entire trapping study was repeated three times during the last week in August and the first two weeks in September 2019, each consisting of 3 pairs of sticky traps with BG lures vs. sticky traps without BG lures. All six traps in each test were deployed in the field for 24 hours

and then collected. A total of 18 traps, nine traps baited with BG Lures (n=9) vs. nine unbaited traps (n=9), were deployed during this study. The study area was in Elkton (Latitude: 29° 46'44.96" N; Longitude: -81° 26' 12.24" W), St. Johns County, Florida.

All insects and spiders (Araneae) collected on the sticky traps were identified to order. Where possible, some taxa were identified to the lower taxonomic ranks of family or genus (Table 1). Only the most abundant orders were compared between the baited and un-baited traps (Table 2) using a *t*-test at $\alpha = 0.05$.

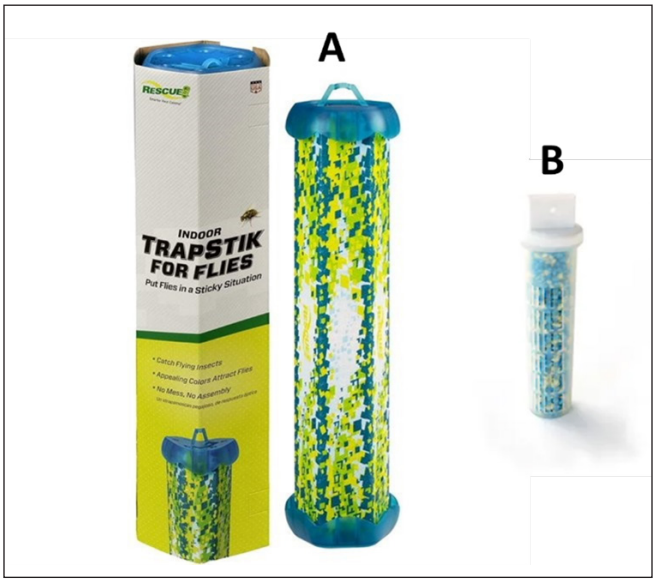

Figure 1. RESCUE!® TrapStik for Flies (A) and BG Lure (B) used in the field trapping experiment

A total of 2,408 specimens were collected during this study (Table 1). The BG Lure baited traps collected 1,318 specimens and the unbaited traps collected 1,067 specimens (Table 2). Figure 2 shows the difference in the numbers of *Liohippelates* spp. and the specimens from most common orders collected between the BG Lure baited and non-baited sticky traps during this study. The BG Lure traps were significantly more efficient at collecting *Liohippelates* spp. than the non-attractant traps ($t = 2.615$, $df = 8$, $p < 0.05$). Other dipterans were weakly but not significantly attracted to the BG Lure ($t = 1.438$, $df = 8$, $p > 0.05$). There were no significant differences in trap catch for all other orders between the BG Lure-baited traps and the unbaited traps, even though both traps caught substantial numbers of specimens (100-300 individuals) of these orders.

The BG Lure, consisting of ammonia, lactic acid, and fatty acids, was designed and marketed for BG traps to attract container-inhabiting *Aedes* mosquitoes (Geier et al. 2004). In the current study, the combination of this lure with the commercial sticky trap (RESCUE!® TrapStik for Flies) attracted significantly more *Liohippelates* spp. than did the unbaited sticky traps. BG lures did not show significant attraction to other filth flies nor to other orders of insects or spiders when compared to the catch in unbaited traps. However, both sticky traps (baited and unbaited) caught a great number of other dipterans, coleopterans, hymenopterans, thysanopterans, and spiders among others. This is probably due to the strong visual attraction of these insects to the blue/green color

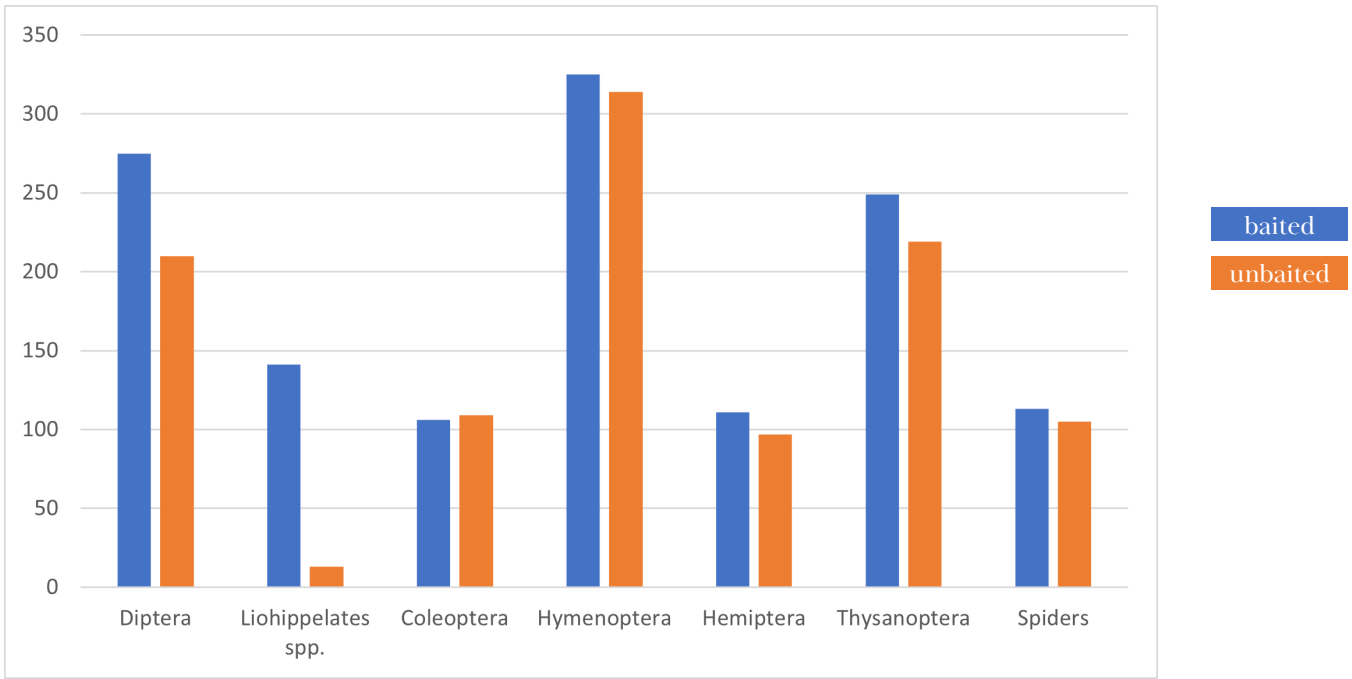

Figure 2. Total number of specimens captured by sticky traps baited with BG lure vs. without lure.

combinations, clustering pixel patterns and strong color contrasts of the RESCUE!® TrapStik for Flies (Zhang et al, 2015).

As with most sticky traps a large number of non-target insects were collected. Non-target species accounted for 93.8% of the total trap catch. Future studies could consider using different (and more selective) types of traps such as Biogents Sentinel Traps baited with dry ice and/or BG Lure. This approach would take advantage of eye gnat behavior if they are attracted by CO2 first (Defoliart and Morris 1967) and then to host odors as they search for tears and other moist areas of the host. Nevertheless, discovery and development of more powerful attractants and traps are needed for optimal monitoring/surveillance and control of these important nuisance eye gnats.

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Table 1. Identified taxa and number of specimens collected. For each order, the first number in the last column refers to the number of specimens only identifiable at that taxonomic rank, while the number in parentheses refers to the total number of specimens identified at all levels within the order.

Taxonomic Rank				No. of Specimens
Class	**Order**	**Family**	**Genus**	
Insecta				
	Blattodea			0 (2)
		Blattidae		2
	Coleoptera			172 (215)
		Carabidae		22
		Curculionidae		5
		Elateridae		2
		Scarabaeidae		2
		Scolytidae		1
		Staphylinidae		11
	Diptera			474 (637)
		Bombyliidae		3
		Chloropidae	*Liohippelates*	149
		Culicidae		1
		Platystomatidae		3
		Syrphidae		6
		Tabanidae		1
	Hemiptera			42 (208)
		Aphididae		1
		Cercopidae		1
		Cicadellidae		63
		Cydnidae		90
		Reduviidae		8
		Scutelleridae		3
	Hymenoptera			605 (639)
		Apidae	*Apis*	2
		Formicidae		28
		Sphecidae		1
		Vespidae		3
	Lepidoptera			6 (14)
		Hesperiidae	*Urbanus*	1
		Papilionidae	*Papilio*	5
		Pyralidae		1
		Tortricidae		1
	Megaloptera			1 (1)
	Orthoptera			0 (2)
		Acrididae		1
		Tettigoniidae		1
	Psocodea			3 (3)
	Thysanoptera			468 (468)
Arachnida				
	Araneae (spiders)			217 (218)
		Salticidae		1
Collembola				
	Collembola (springtails)			1 (1)

Table 2. Total number of specimens for traps with and without BG Lure for the most common arthropod orders and the eye gnat genus *Liohippelates*. Numbers for the Diptera row do not include eye gnats

Taxonomic Rank			
Order	**Genus**	**BG Lure**	**Without BG Lure**
_Coleoptera		106	109
Diptera		278	210
	Liohippelates	136	13
Hemiptera		111	97
Hymenoptera		325	314
Thysanoptera		249	219
Aranae (spiders)		113	105
Total Specimens		1318	1067