A Comparison of Efficacies of Pitfall Trapping to Netting of Tiger Beetles

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ABSTRACT

As part of the DOE/ACTS program myself and three other teachers took part in a population study of tiger beetles at Brookhaven National Laboratory. Jonathan Mawdsley, PhD in entomology, had surveyed the laboratory property and identified five adult species of tiger beetles all of the genus Cincindela. Mawsdley's survey took place in the spring of 2007. We decided to survey and capture tiger beetles during the summer of 2007 with the hopes of determining what species are on site and active at this time as well as to determine population estimates at the particular sites. The team employed two different methods of capture, netting and pit fall trapping. As field work progressed it became apparent that the capture methods used had different efficacies. As a result of this learning we decided to examine trapping methods in more detail.

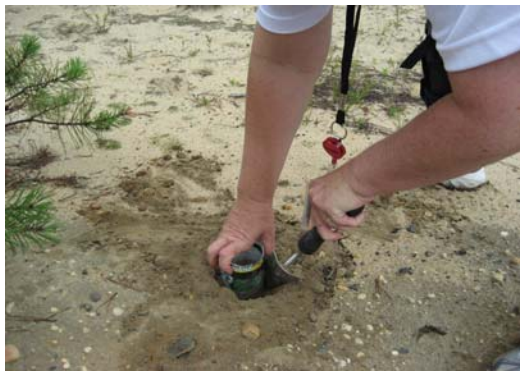
INTRODUCTION

Tiger beetles are an easily distinguishable group that is classified in the order Coleoptera and family Cinindelidae. Four genera occur in the North America: Omus, Amblycheila, Tetracha and Cincindela. Traits common to adult tiger beetles include long sickle shaped mandibles, teeth arrangement on the mandible, antennae width and segment number, position of antennae, and long, thin, running legs. Adult tiger beetles are similar in body shape, proportions and behavior. The head is generally larger than the thorax as to allow for the large eyes that help them in predation. Adults have transparent hind wings that are folded under the elytra, the front wings. The hind wings allow for flight and most species can fly for short distances at a low height. Characteristics used in identification of tiger beetles at the species level include the color of the elytra, the luster of the body, especially the abdomen and the pattern on the elytra referred as the maculation. Some maculations appear to be no more than a series of dots, some maybe absent and others entirely fused so to make the elytra entirely white. The normal maculation pattern includes an attractive band of light colored markings found at the front, middle and rear of the elytra. It is often helpful to look and see if the maculations are fully attached to a white line running along the outer edge of the elytra. (Pearson, Knisley/Kazile 2006)

The tiger beetles are so named for their predatory skills. Although they are fast sprinters they must be remain stationary in order to see their prey. Then and only then can they run down their prey and seize it with their mandibles. The tiger beetles need to chew the prey into a puree and nature has given them digestive juices from mandibular glands that help them in feeding as well as defense. (Pearson, Knisley/ Kazilek 2,006)

Tiger beetles are attractive insects that are often beautifully colored and marked and often times display a metallic sheen. Tiger beetles are found world wide in various habitats. Because of this tiger beetle collections by amateur hobbyists have been adding to the body of knowledge of this beetle for many generations. Tiger beetle studies date back to 1758 with a study from Linne. The vast wealth of tiger beetle information has allowed conservation biologists to use them as indicators of habitat health and biodiversity. Their distributions throughout time are well documented and are used in evaluating and authenticating historic declines as well as correlating some declines with long term environmental changes. Tiger beetle populations can be used as a bioindicator to make inferences about butterfly and bird populations. (Pearson, Cassola 2,005)

Collecting of adult tiger beetles can be attained by a variety of methods including netting, pit fall traps, nocturnal "sheeting" and sticky traps. The netting of tiger beetles involves a standard insect net, skill and patience. Movements by the collector must be slow or the tiger beetle will react suddenly. The net is to be slapped over the beetle and then can be removed from the net. Pitfall traps are containers that are buried flush to the ground. There are many variations and sizes that researchers have used but the concept is always the same: the insect inadvertently falls in the trap and can't go out. Sheeting of nocturnal insects involves luring insects at night with a light source to a sheet where they will be picked off by hand and sticky traps capture insects by causing them to adhere to vegetation or a plastic strips that have a sticky material applied. The team decided to employ pi fall trapping and then shortly later added netting to the sampling procedure.



METHOD

Five sites located at Brookhaven National Laboratory were used in the sampling of Tiger Beetles. The sites are: North Fire Break (NF), New Burn A and New Burn B (NBA, NBB), Treatment Plant (TP), Fire Break and Fire Break B (FB, FBB), Balloon Launch (BL). Traps were set at NF, NBA and NBB, TP and netting when tiger beetles were seen. FB and BL were sites for netting only. NF had twenty-four traps set at approximately twenty meters apart. NBA had thirteen traps at approximately twenty meters apart. NBB had fifteen traps at twenty meters apart. TP had nine traps twenty meters apart. GPS readings were taken at all trap and netting locations. Maps were created reflecting these areas. Traps were made by using twenty ounce water bottles. The tops of the water bottles were cut about 4-5 cm in length so that they resemble funnels and the caps removed and discarded. The top was inverted in to the body of the bottle and taped. Traps were planted flush to the ground and no bait was used. Traps were visited daily and the funnel was closed with a stone when left over the weekend.

RESULTS

TIGER BEETLE CAPTURES THROUGH TRAPS AND NETS

DATES OF SITE VISITS

SITES	7/10	7/11	7/12	7/13	7/16	7/17	7/19	7/20	7/24	7/25	7/26	7/30
NF	-	1N	2T	0	-	0	1N	4N	-	0	0	1T
NBA/NBB	0	0	1T	1T/1N	-	2T	0	-	-	0	0	1T
TP	0	0	0	0	0	0	0	0	0	0	0	0
FB/FBB	-	-	-	0	8N	11N	6N	2N	7N	9N	8N	7N
BL	-	1N	1N	1N	-	4N	3N	3N	-	7N	3N	2N
TOTALS	0N/0T	2N/0T	1N/3T	2N/1T	8N/0T	15N/2T	10N/0T	9N/0T	7N/0T	16N/0T	11N/0T	9N/2T

Legend:
- not visited
0 no captures
N net capture
T trap capture
NF: North Fire Break
NBA/NBB: New Burn A and New Burn B
TP: Treatment Plan
FB: Fire Break and Fire Break B
BL: Balloon Launch

RESULTS/DISCUSSION

Early in the research it was quickly determined that trapping was not an efficient means of capturing an adequate amount of tiger beetles to help the team estimate population. The collection period was twelve days over three weeks and in that time eight tiger beetles were trapped compared to the ninety that were netted. Although pitfall traps is a commonly employed method of invertebrate collection it is not without drawbacks in terms of its use in population estimates. Researcher G.G.E. Scudder warns that population studies using pitfall trapping for sampling needs to be correlated with independent measures. This sentiment is also echoed by researcher Kimberly Ogden for both pitfall and sweep netting. Pitfall trapping of course is only useful in surveying ground invertebrates and flying insects would need a different method of capture. Even though netting was a more successful method in beetle capture it is not without drawbacks. Nets require more on site time by the team and limits the range in which capture can occur where as traps allow for a practical survey of a large area without the constant supervision of the researcher. Considering all the obstacles in collecting insects for population studies it becomes important to give careful consideration to pitfall design. Further research suggests the following improvements to trap design:

1 – "Nesting of traps", the placement of traps of one into another is beneficial in two ways. The inner container is suspended to the outer and makes it easy to remove without disturbing the environment. (Scudder 2000) and it also increases capture number. Tiger beetles are very active and can sometimes escape a single funnel fitted trap. The nested trap will help capture rates by increasing the probability that an escaping tiger beetle will literally falling in the crack between the traps. (Young Entomologists Society)

2 – Trap layout, traps are more effective when planted in arrangement that will collect the most beetles in a specific area. Traps can be laid out in an x design with plastic lawn edging acting as barriers between the traps. This edging helps to catch beetles running in any direction. Traps placed near the edge of water and by boulders helps beetle capture rates. (Pearson/Knisley/Kazilek) Researcher Kimberly Ogden laid out 120 pitfall traps covering two different sites. Each set of sixty was set up in rows of five at one meter apart. (Ogden 2,004) A "trap circle" was a layout used by Scudder. The circle was ten meters in diameter with three to five traps placed on the circle perimeter. Scudder cites a similar design by van den Bergh that is suitable for any habitat. The traps are doubly nested and with three to five trap circles placed fifty to seventy five meters apart. (Scudder 2,000)

Future attempts by this researcher to trap tiger beetles will include closer placement of nested traps in a more limited site. More research into effective trapping so as to make reliable population estimates is needed.

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