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Sex-ratio of Miridae (Hemiptera) taken via UV light-traps in Arkansas, USA.

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Sex-ratio of Miridae (Hemiptera) taken via UV light-traps in Arkansas, USA.

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Running Title: Sex-ratio of Miridae from light-traps.

Abstract

We determined the sex-ratio of 1,095 plant bugs (Hemiptera: Miridae) taken from 60 individual UV light-trap samples in Clark County, Arkansas, over a two-year period. We found that of the 21 taxa in which a sex-ratio determination could be made, 61.9% of them (13 of 21) contained a majority (over 50%) of males. Three taxa were exclusively represented by males, while two taxa were exclusively represented by females. Although taxa dependent, our data indicate that male mirids are, in general, more frequently encountered in UV light-traps. However, contrary to the notion that sparked this study (see herein) light-trap content was not represented vastly to exclusively by male individuals as the sex-ratio of the cumulative data was 62.47% males (684) and 37.53% females (411).

Introduction

A reviewer of some of our previous research sparked our investigation into this subject. The comment (paraphrased) was that we should exclude breakdown of number of male vs female plant bugs (Miridae) we found via UV light-traps in our paper as it was well known that males were mostly to exclusively collected in light-traps. This struck us as somewhat odd as while indeed the *Reuteria* species we had collected were by far majority male (86%) (Chordas *et al*. 2013), the samples from which we sorted those specimens seemed to also have an ample proportion of female mirids. However, we had no quantification of proportions at the time. We assumed that since this skewed collection of males via light-trap was well known, we could quickly find a reference. A cursory literature search using multiple key words in BIOSIS and other database research engines failed to find literature corroborating this assertion.

Our purposes herein were to quantify the mirid sex-ratio, to at least the genus level, from a large series of light-trap samples, report the ratios in the literature and evaluate the resultant ratios. We hypothesized that the overall sex-ratio of all species would be significantly skewed to the males; aligned with the comments we received previously.

Methods

During 2009 and 2010, a UV light-trapping project was conducted in the Ross Foundation Demonstration Area Forest (Clark County, Arkansas). The Ross Foundation forest was an old growth *Quercus* sp (Oak species) dominated forest with various levels of managed understory (Chordas *et al*. 2013). Although moths were the target of the study, many true bugs were captured. We use bugs from these samples for this study. The collection locality for all taxa reported herein is: **Arkansas**, *Clark County* : ~25km south west of Arkadelphia, Arkansas; forest (Ross Foundation Demonstration Area) off south side of I-30: UV light-trap [N33.937 : W-93.237], K. Benjamin collector. We sorted mirids from 60 individual UV-traps set at 19 stations within the forest between April and September of 2009 and 2010 (Table 1).

Mirids were identified to the lowest taxonomic level possible by the authors using Blatchley (1926), Henry (1976, 2015) and Knight (1941) with numbers of males and females recorded for each taxa. Taxa were grouped to at least the genus level (even if some

Table 1. UV light-traps: grouped by year, month (as a Roman numeral), date and total.

	2009		2010		
Month	Date	#UV Traps	Date	#UV traps	Total
IV			11th	1	**1**
V	27th	2	21st	4	**6**
VI	17th	10	11th & 27th	11	**21**
VII	15th	3	23rd	5	**8**
VIII	6th & 26th	16	14th	6	**22**
IX	20th	2			**2**
		= 33		= 27	**60**

Sex-ratio of Miridae from light-traps.

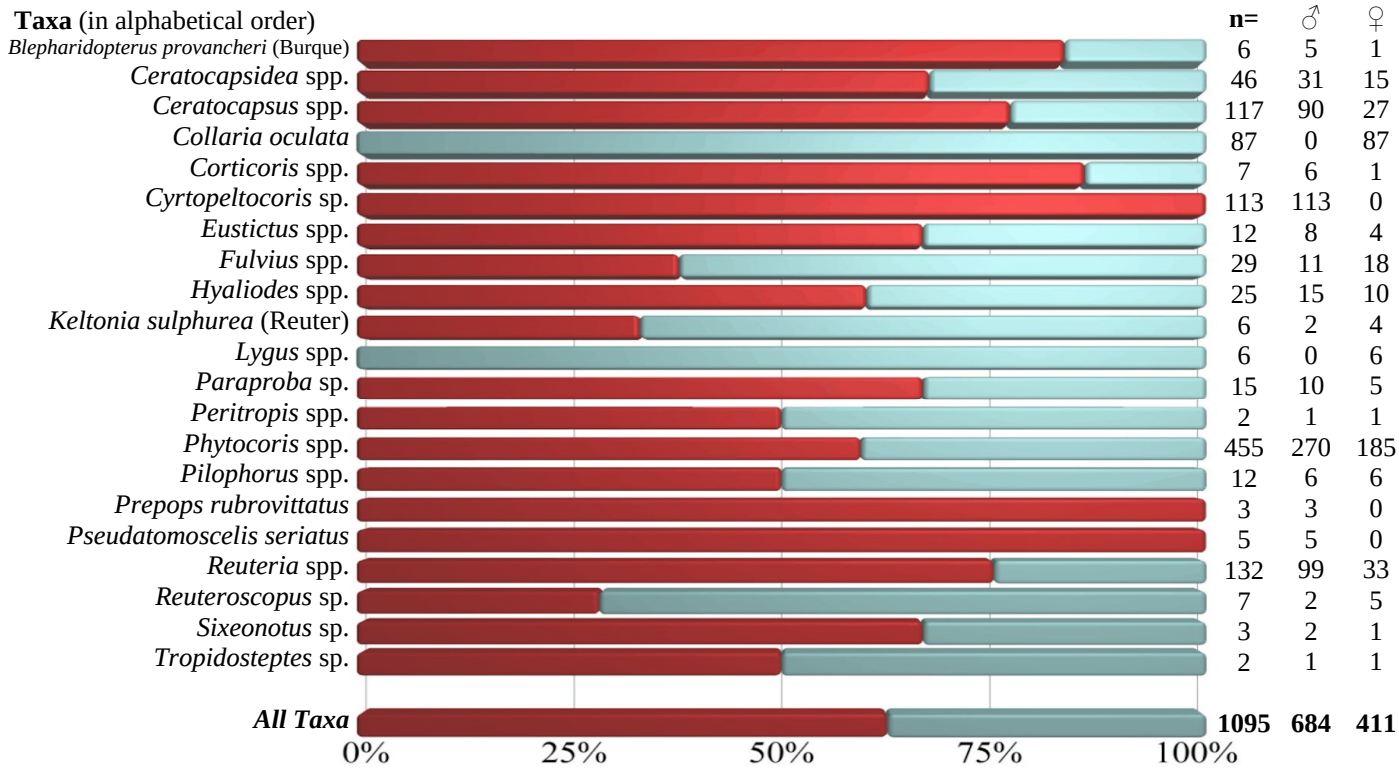

Figure 1. Stacked bar graph depicting sex-ratio for 21 taxa of mirids identified from 60 UV light-traps; dark shade = proportion (%) of males, light shade = proportion (%) of females; n= total number of individuals of that taxa identified from all 60 traps; ♂ and ♀ fraction of each total given in far right columns.

individuals of that genus group were determined to species) for male : female ratio tabulations.

Results

A total of 1,095 mirids, representing 26 genera were identified. Five taxa were represented by singletons and thus, no sex-ratio determinations were made for those taxa (they are, however, included in the "all taxa" data). Singleton taxa were: *Deraeocoris* sp. ♂, *Diphleps unica* Bergroth ♀, *Metriorrhynchromiris* sp. ♂, *Plagiognathus* sp. ♂ and *Spanagonicus albofasciatus* (Reuter) ♂. Thus, 1,090 mirids representing 21 taxa were utilized to determine sex-ratio percentages by taxa (Fig. 1).

The resultant sex-ratio for all taxa was 62.47% males and 37.53% females (Fig. 1). Of the 21 taxa, 13 (61.9%) were represented by majority males (i.e. greater than 50%), while five (23.8%) were represented by majority females and three (14.3%) had an equal 50-50 sex-ratio. The three taxa with 50-50 ratios were represented by small sample sizes; *Peritropis* sp. (n=2), *Pilophorus* spp. (n=12), *Tropidosteptes* sp. (n=2) (Fig. 1). Three taxa were represented by males only; *Cyrtopeltocoris* sp. (n=113), *Prepops rubrovittatus* (Stål) (n=3) and *Pseudatomoscelis seriatus* (Reuter) (n=5). Conversely, two taxa were represented by females only; *Collaria oculata* (Reuter) (n=87) and *Lygus* spp. (n=6) (Fig. 1).

Phytocoris was by far the dominant taxon with 455 individuals (representing 41.55% of the total number of mirids examined) with a sex ratio (male : female) of 59.34% : 40.66%. The next closest taxa in abundance, all with over 100 individuals, were *Ceratocapsus* spp. (n=117), *Cyrtopeltocoris* sp. (n=113) and *Reuteria* spp. (n=132). These four taxa accounted for approximately ¾ of the study material (74.61% of the total mirids examined) (Fig. 1) and, when combined, basically mirrored the all taxa sex-ratio with 70% : 30% (slightly male skewed being influenced by *Cyrtopeltocoris*, which were 100% males). While it was not surprising to capture only males of *Cyrtopeltocoris* sp. in light-traps, because females of the genus are brachypterous, the large number of individuals collected (n=113) was unanticipated.

Discussion

These data support the notion that overall male plant bugs are indeed more frequently attracted to and

encountered in UV light-traps over their female counterparts. However, the notion that males are exclusively or almost exclusively the representative fraction of mirids taken in UV light-traps was not supported as the male fraction of 62.47% was merely a majority. Further, that a few taxa were represented exclusively by females (*Collaria oculata*), signifies that UV light-trap sex-ratio composition in the Miridae was taxa dependent.

Given that over half of the taxa (12 out of 21 = ~57%) were represented by smaller sample sizes of 12 specimens or less, and we sorted from 60 trap samples taken over a two-year period, indicated we were less likely to take those taxa with any given single trap. Further, since the majority of these (9 of the 12) were majority male or 50:50 split, any trapping, less than the volume we examined, may very well likely, vastly or exclusively encounter the male fraction of the ultimate catch in a given light-trap. Thus, there is significantly more chance that isolated, single, or smaller trap volume will encounter a male specimen. We note that the 86% male fraction of *Reuteria* species reported by Chordas *et al*. (2013) was data from a smaller sample size than we examined for this study. Once the sample size was increased to the volume for this study, the male fraction dropped and the *Reuteria* sex-ratio herein (70% : 30%) was much closer to the all taxa ratio of 62.47% : 37.53%. We suspect that excluding the species represented by a single sex (Fig. 1), the majority of the taxa would fall close to the all taxa sex-ratio range given ample sample size.

Male mirids are frequently used for specific identifications or to confirm species identifications because they often have very distinctive parameres (claspers) and other genital components that allow for a confident identification to be made (see Knight 1941 and Henry 2015). We certainly relied on the males for species confirmations with our work on the report of five species of *Reuteria* for Arkansas (Chordas *et al.* 2013). We did not attempt to even identify any female *Reuteria* until we were comfortable with our determinations of the males using Henry's (1976) excellent key. The reliance on male specimens for identifications, especially by the authors of this paper, may tend to skew our perception that we encounter males significantly more often.

Since the data were taken from light-traps set over a six-month period with ample representation of summer and periods with favorable weather to support mirid mobility (Table 1), we did not consider temporal influences to be a factor in the resultant sex-ratio for this study. We did notice, however, that while collections of nearly all mirids spanned multiple months, a few were encountered during narrower time frames and only present during certain months (e.g. all 113 *Cyrtopeltocoris* were sorted from June samples).

Although outside the scope of this project, we noticed that a few of the genera identified in this study have no representative taxa reported in the literature for Arkansas (e.g., *Corticoris* sp., *Paraproba* sp., etc; see true bug checklist in this journal volume; Chordas (in press)). We further recognized a few species within the genera reported herein that appear to be currently unreported from Arkansas. A future plan of action will be to identify, deposit vouchers, and report any unrecorded mirid species in the literature for Arkansas.

Acknowledgments

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