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# SURVIVORSHIP, MATING AND ACTIVITY PATTERN OF ADULT *TELEBASIS SALVA* (HAGEN) (ZYGOPTERA: COENAGRIONIDAE)

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A mark-recapture study of *T. salva* produced an estimate of daily survivorship of 0.91. Males were more prone to abandon a habitat if they did not obtain females during their first day's visit to the site. The average time between marking and last recapture of recaptured males was 7.06 days. Young males mated with higher frequency than older males, but no individual male obtained more females than would be expected if matings were random.

## INTRODUCTION

*Telebasis salva* (Hag.) is a coenagrionid damselfly (body length 25-28 mm) common in the southwestern United States from California to Texas; its range extends between Kansas on the North, and Colombia and Venezuela on the South (JOHNSON, 1972; SMITH & PRITCHARD, 1956; Dr M.J. Westfall Jr, pers. comm.). Males are bright red, while females are reddish-brown. Individuals of this species are common amongst emergent vegetation (e.g., *Ludwigia peploides* and *Sagittaria platyphylla*) in the lentic environments of Tarrant Co., Texas. Little has been reported concerning the ecology (Westfall, 1984) or behavior (NEEDHAM & HEYWOOD, 1929; SMITH & PRITCHARD, 1956; PAULSON, 1974) of this species.

A demographic study of this species was undertaken during July and August of 1983 at Trading House Creek, Arlington, Texas, USA. This site has been described elsewhere (ROBINSON, DICKERSON & BIBLE, 1983) but has been significantly modified as an odonate habitat due to a very dense accumulation of *Sagittaria platyphylla* and *Typha* sp. in the western section of the study site. The heavy cover of vegetation seemed to make this portion of the creek more attractive to *Telebasis salva* and *Ischnura posita* (Hag.), while *Enallagma civile* (Hag.), *E. basidens* Calv., and *Argia sedula* (Hag.) tended to avoid it and utilize more open sites on the creek.

While considerable work has been performed with regard to the demographics of species in species rich genera of zygopterans found in the United States e.g. *Enallagma* (BICK and BICK, 1963; JOHNSON, 1964; GARRISON, 1978; FINCKE, 1982); *Argia* (BORROR, 1934; BICK & BICK, 1965; GARRISON, 1978; ROBINSON, DICKERSON & BIBLE, 1983); *Ischnura* (GARRISON, 1981; ROBINSON, 1983); and *Lestes* (BICK & BICK, 1961) little has been documented concerning species in genera which are represented by few species, such as *Telebasis* which has two species within this country (BICK, BICK & HORNUFF, 1976). Information about such genera is necessary for a more complete picture of life history patterns of North American zygopterans.

## METHODS AND RESULTS

Both male and female *T. salva* were captured and uniquely marked on their wings with indelible ink using a Pilot marking pen. The capture-recapture study lasted from 9 July 1983 to 11 August 1983; during this time daily collections were made on all days which imaginal *T. salva* were active. Rain or cloudy weather drastically reduced activity. Collections were made primarily from a 30 m section of the creek in which emergent *Sagittaria platyphylla* formed a dense cover over the water. This region was preferentially utilized by *T. salva* (Fig. 1). *T. salva* use this habitat as a rendezvous site for mating and oviposition and was most active around noon (Fig. 2). Our collecting activity reflected the species activity and was confined to the times 1030 hr to 1410 hr.

A total of 475 individuals were captured, marked and released at the site of their capture; 383 of these individuals were males. While these numbers indicate a high bias toward males at the site they inadequately reflect the true activity bias because only 18 recaptures were females while 618 recaptures were males. The average number of recaptures per female was 0.196 while the corresponding average for males was 1.614. Females were rarely observed without a male and usually were captured while in tandem, in copula, or ovipositing. The majority

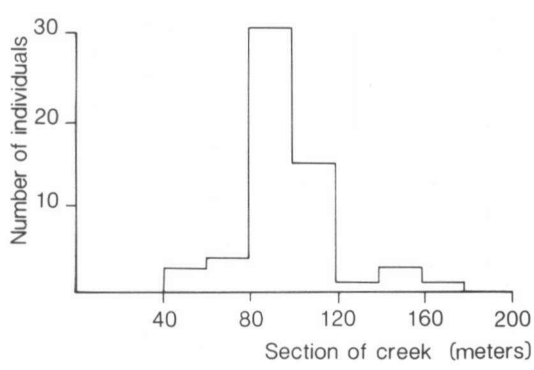


Fig. 1. Localization of males along the section of Trading House Creek used as a study site. Frequencies were determined by line transects taken hourly throughout a day during the study. Arrowheads delineate the most heavily sampled region.

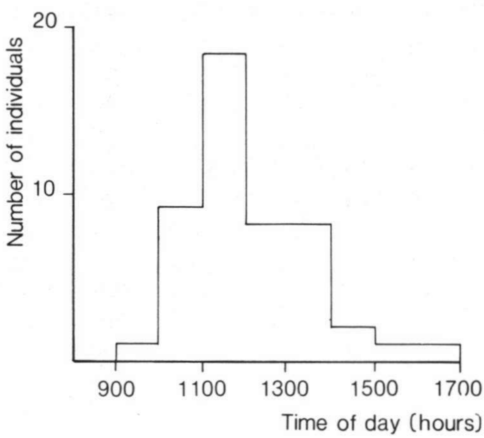


Fig. 2. Temporal pattern of occurrence of males. Frequencies were determined by line transects taken hourly throughout a day during the study.

of females were never observed to visit this site on multiple dates, and these females probably represent the normal behavior of this species.

Reproductive behavior generally took place on the stems or leaves of *Sagittaria*, however occasional pairs were observed on the well cut grass bordering the creek. Sperm translocation occurred following the clasping of the female by the male and had an observed duration ranging from 11-23 seconds (n=5). Copulation immediately followed sperm translocation and was characterized by repeated shifting of perching locations while the pair remained in copula. During copulation, a pair was likely to be tested by solitary males which were usually present in high density. These aggressive attempts were repelled via wing spreading signals by the female. A copulation from sperm translocation to oviposition was timed to last 1 hr 20 min. Oviposition took place near the site of copulation. During oviposition the male and female remained in tandem, with the male assuming the Agrion position. Eggs were deposited below the water surface in the stems of *Sagittaria*. When depositing eggs the female would back down a stem, progressively submerging more and more of her abdomen, until finally all but her thorax and head were underwater. Females were never observed to completely submerge as has been described for other species. Several stems are descended in this manner during an oviposition episode and often the female ascends, pivots approximately 90° on a stem, and descends again. An ovipositioning sequence timed from the end of copulation to the separation of the individuals lasted 25 min 30 sec. Separation of the sexes seems to be initiated by the female. Immediately prior to separation the female straightens her body, making her head, thorax and abdomen form a linear line with the tip of the abdomen raised so that her body makes approximately a 45° angle to the surface. During this maneuvering the male releases her and flies to a nearby perch. Both individuals remain perched for a short period of time, and then the female flies away from the water at a relatively high speed.

The analysis of the mark-recapture data was limited to males due to the low recapture frequency of females. The Jolly-Seber stochastic procedure (JOLLY, 1965; SOUTHWOOD, 1978) was employed. During our study an appreciable variation existed in the daily values for the total number of animals released on a given date and subsequently recaptured; these values are key to estimating most important demographic parameters. This led to considerable variation in our daily estimates of these demographic parameters. Therefore, we will present only an average daily survivorship rate which was obtained by including only data contained within the semi-interquartile range of daily survivorship estimates (SOKAL & ROHLF, 1981). This was determined to be 0.91.

The average length of time between the first and last recapture for the recaptured males is 7.06 days. The males of *T. salva* have life expectancies within the range of those reported for other zygopteran species (ROBINSON, DICKERSON & BIBLE, 1983). The maximum age determined for *T. salva* males, 22 days, is greater than that reported for two other species of zygopterans studied in the environments of Arlington, Texas i.e. *Ischnura posita:* 9 d (ROBINSON, 1983) and *Argia sedula:* 16 d (ROBINSON, DICKERSON & BIBLE, 1983). Sixty-two percent of the nonreproducing males are never recaptured on a day following their initial date of capture, while only 37 percent of reproducing males are not so recaptured (Fig. 3). When the survivorship curves of reproducing and nonreproducing males are compared using a Kolmogorov-Smirnov two-sample test the curves are shown to be significantly different ($P < 0.05$). When those individuals which were never recaptured on any date following their date of initial capture are removed from the analysis, the survivorship curves cannot be shown to differ from each other using the same statistical procedure.

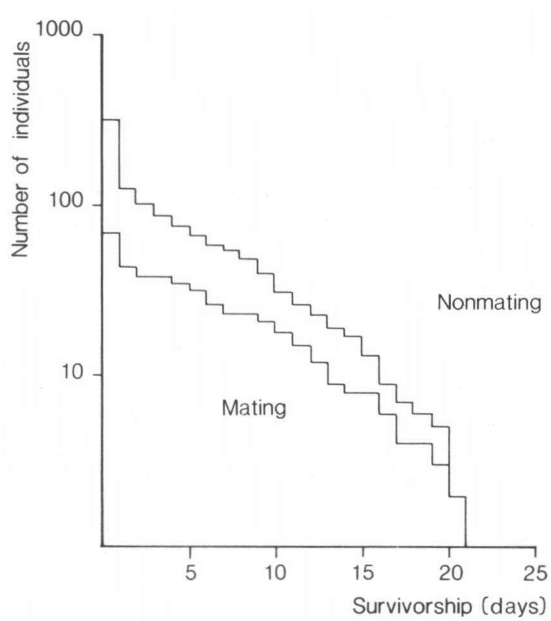


Fig. 3. The number of males observed reproducing and those males not observed reproducing versus the minimum time they must have survived as determined by recapture data.

Most male reproduction occurs early in a male's reproductive lifetime. This can be demonstrated through either of two contingency table analyses. Table I

Table I
Contingency table analysis comparing the number of males observed with females on the males' first day at the site versus subsequent visitation dates

| | First visitation date | Subsequent visitation dates |
|---|---|---|
| Observed reproducing | 55 | 27 |
| Not observed reproducing | 453 | 466 |

G = 9.72**

Table II
Contingency table analysis comparing the number of unmarked males observed with females versus marked males observed with females

| | New captured males | Recaptured males |
|---|---|---|
| Reproducing | 47 | 35 |
| Not reproducing | 336 | 583 |

G = 13.28**

represents the number of males observed reproducing versus those not reproducing on their first date of capture, and the same categories are compared for all later capture dates. Younger males are engaged in reproduction with a frequency of 0.108 per capture compared to 0.055 for older males. This difference is significant at $P < 0.01$ ($G = 9.715$). The preceding analysis groups newly captured males with those recaptured on the same day of their being marked. When a comparison is made between only newly captured males and recaptured males (Tab. II), there is once again a significant difference when reproduction occurs ($P < 0.01$, $G = 13.284$); 12.3% of newly captured males are engaged in reproduction but only 6.4% of recaptured males are so engaged.

Table III
The number of reproduction episodes per males compared with expected frequencies obtained from a Poisson distribution with mean equal to 0.214. (To prelude any category having an expected frequency < 5 the categories ≥ 2 copulations were grouped together for analysis)

| Number of copulations | Observed number of males | Expected number of males |
|---|---|---|
| 0 | 312 | 310.0 |
| 1 | 64 | 66.3 |
| 2 | 4 | 7.1 |
| 3 | 2 | 0.5 |
| 4 | 1 | 0.0 |

Each male on the average was observed mating 0.214 times. To determine whether some males were excessively successful in obtaining females, the observed distribution of the number of matings was compared to a theoretical distribution derived from a Poisson distribution having a mean equal to 0.214. The closeness of the observed and expected frequencies supports the null hypothesis that males randomly obtain females. (Tab. III).

## DISCUSSION

The local abundance of *T. salva* in the dense patch of *Sagittaria* in Trading House Creek indicates that males and females are visually attracted to such habitats for reproductive activity. The pattern of visitation by these individuals through time suggests that individual judgements are made concerning further use of a site in a way which transcends the habitat's physical appearance.

Females were rarely recaptured at this site after their first appearance. When females leave this habitat they probably disperse to other sites for future reproduction. An evolutionary explanation for this would be that females by ovipositing in different environments ensure that their fitness would be less susceptible to local habitat variation.

Males returned to the site more frequently than females, but their return was influenced by whether or not they successfully obtained a female during their first visit. Those males that did were less likely to abandon the site than those that did not. We interpret the lack of recapture of these nonreproducing males as evidence of site abandonment rather than higher mortality for them. This interpretation is supported by the fact that survivorship curves for reproducing males were not significantly different from each other when the date of initial capture was removed from the analysis.

Young males obtained more females than older males (Tabs I, II). Similar patterns have been reported previously for *Argia sedula* (ROBINSON, DICKERSON & BIBLE, 1983) and *Enallagma hageni* (FINCKE, 1982) and warrant further investigation in future studies. Since ability to obtain females is higher for the young males there would be additional pressure not to invest too much youth in an environment that was unproductive in terms of obtaining females. This might partially explain the site abandonment patterns portrayed in Figure 3.

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