AGE EFFECTS ON DRUMMING BEHAVIOR OF *PTERONARCELLA BADIA* (PLECOPTERA) MALES[1]

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ABSTRACT: Drumming behavior was compared between two age groups (1-2 and 4-5 days of age since emergence) of *Pteronarcella badia* males. Six males of each age group were monitored separately for two hour periods. The two age groups showed a significant difference (Mann-Whitney U-test) in drumming tendency (drumming signals per hour) but not in signal structure. The noted difference seems to be age related, however differences in nutritional state could have had an effect.

Age effects on various reproductive-related behaviors have been uncovered in many insects, including female attractiveness to males in *Drosophila melanogaster* (Cook and Cook 1975), mating behavior of the pink bollworm moth (Henneberry and Leal 1979), and courtship and copulation duration in *Drosophila melanogaster* (Long et al. 1980). No work to date has dealt quantitatively with possible age-related effects on the drumming signals and/or drumming tendencies of stoneflies. Drumming behavior in the Plecoptera is an intersexual calling behavior for mate location and identification. Drumming signals of most species are produced by tapping the substratum with the posteroventral surface of the abdomen. The number and spacing of the resultant pulses provide the necessary information for species and sex indentification. In most species the male initiates an exchange by calling. Nearby virgin females usually answer with their own drumming signal. Many variations and complexities have been uncovered since quantification of drumming behavior began in the late sixties (Rupprecht 1967, 1969, 1972, 1977, 1981, 1982; Zeigler & Stewart 1977; Snellen & Stewart 1979; Szczytko & Stewart 1979; Stewart et al. 1982a,b; Maketon & Stewart 1984a,b; Stewart & Zeigler 1984a,b). This experiment was designed to examine potential age effects in the drumming behavior of male *Pteronarcella badia* (Hagen). The relatively simple signal exchanges of this species (Fig. 1) have been previously described and characterized (Zeigler & Stewart 1977; Stewart et al. 1982a).

MATERIALS

Pre-emergent nymphs of *P. badia* were collected from the Conejos River, Conejos Co., Colorado in May, 1983. Nymphs were transported to

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the laboratory in chilled styrofoam ice chests and reared to adulthood in a Frigid Unit LSW-700 living stream where light and temperature simulated natural habitat conditions. Virgin adults were collected shortly after emergence and housed individually in clean shell vials with cotton plugs which were wetted every 24 h. The vials were kept in an environmental chamber at 16±1°C with light and dark periods approximating natural conditions.

Six males from each of two age groups (1-2 and 4-5 days of age since emergence) were selected randomly for analysis. Males were allowed 1-2 h to adjust to laboratory lighting and temperature (60-80 fc and 23-24°C) before being monitored for a 2-h period. The period of monitoring was done from two to four P.M. on separate days for each of the 12 males involved. Three drumming signals were recorded from each male using a Sony ECM-250D electret condenser microphone and a Superscope C-202LP cassette recorder for later analysis of signal characters. The number of beats per signal and beat interval lengths were measured by playing the recorded signals into a Tektronix 5111 storage oscilloscope for analysis. Comparisons (Mann-Whitney U-test) were made between the two age groups for drumming tendency (calls per hour), number of beats per signal, and length of beat intervals. Longevity data were also collected and compared for both males (n=46) and females (n=50).

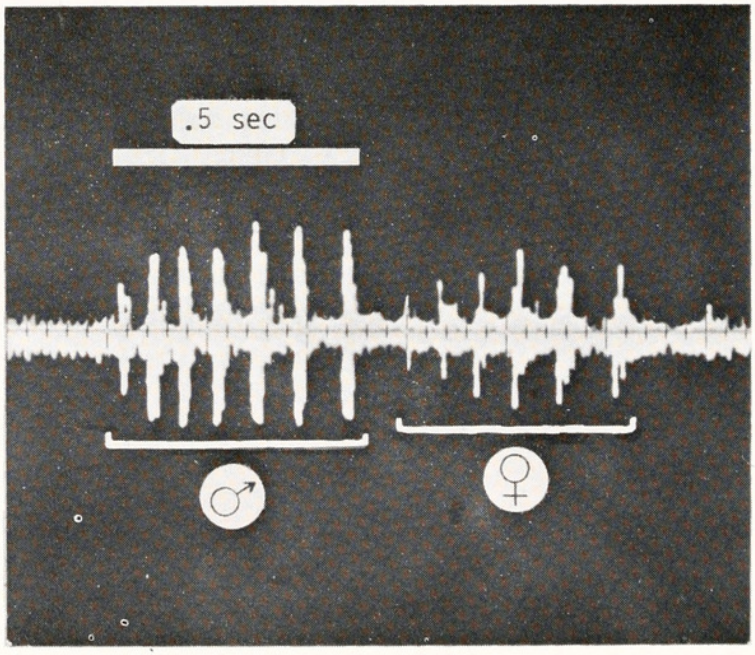

Fig. 1. *Pteronarcella badia* male-female exchange at 25 C.

RESULTS AND DISCUSSION

No significant difference was found between the two age groups for number of beats per signal (1-2 days of age—6.8±0.9 beats, 4-5 days of age—5.8±0.6 beats) or beat interval length. These results are not surprising since females, who mate only once (supported hypothesis), choose which calls to answer and thus establish communication contact. The call is presumably her only means of evaluating the male's fitness before tactile contact is made. Females may therefore choose to answer only those calls which fall within a narrow range of variation which is characteristic for her species.

A significant decrease was found between the two groups in drumming tendency, with the 1-2 day-old males producing 63.3±26.1 signals per hour and the 4-5 day old males producing only 14.2±16.5 signals per hour. This difference probably means that younger males have a greater chance for locating females since more "exploratory" calls are sent out per unit time than for older individuals.

This difference in drumming tendency could result from a direct aging effect or from a difference in energy stores. Adult stoneflies in general are thought to feed little or not at all in nature. If this is the case for *P. badia,* then energy stores in the emergent adult must decrease steadily with age. It is unknown whether *P. badia* adults do feed in nature. If they normally do, the noted difference in drumming tendency could be due to a difference in nutritional state rather than to a direct age effect, since the experimental groups were not fed. However, Finni (1975) reported that in *Allocapnia granulata* (Claassen), a winter emerging stonefly, adults supplied with only water lived just as long as those given both food and water, which was significantly longer than those given nothing. The *P. badia* in this study were observed resting with their mouthparts in contact with the wet cotton plugs as if drinking, especially so after each wetting of the plugs. The plugs remained moist for several hours after each wetting, so at least water was available to the individuals used in this study. The males lived 7.2±3.1 days which was significantly shorter (Mann-Whitney U-test) than for females who lived for 8.6±2.1 days.

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