EFFECTS OF METHOD AND TIME OF PRESERVATION ON VOLUMETRIC MASS ESTIMATES OF SPIDERS (ARANEAE)

Various techniques have been used to back-estimate the live masses (i.e. the masses prior to killing and preservation) of preserved spiders (see Hagstrum 1971, Rogers et al. 1977, and Greenstone et al. 1985a, for literature reviews). We have recently described a technique in which live masses were regressed on an estimate of volume derived by treating the specimen as a cylindrical solid of uniform density having height equal to total length and diameter equal to the mean of greatest widths of the carapace and abdomen. A regression containing such data for 101 animals of the families Lycosidae, Salticidae, Araneidae, Oxyopidae, and Thomisidae explained 95.7% of the variation in mass and was superior to traditional methods using total length or carapace width rather than volume as the estimator (Greenstone et al. 1985a).

Although the technique employed spiders which were preserved directly in 70% ethanol, it was intended for estimating live masses of spiders which had been sticky-trapped using the adhesive Tack Trap™(Animal Repellents Inc., Griffin, Georgia). Such specimens must be soaked for four days each in paint thinner and toluene before final preservation in 70% ethanol. This series of solvent changes could conceivably affect their shape and size and, hence, volume estimate. In order to determine whether the volume-mass regression would be different using animals trapped in this fashion, and also to determine whether the time since preservation affects the regression of mass on the volume estimate, we performed the following experiment.

On June 12, 1984, we collected spiders by sweeping in native tall grass prairie at the Tucker Prairie Preserve, 27 km east of Columbia in Callaway Co., Missouri. In order to minimize variability only araneids were used. The animals were returned alive to the laboratory and weighed on a Mettler AE 160 electronic balance. Following this they were ranked from lowest to highest mass and then assigned serially and alternately to either of two treatment groups to ensure that both groups covered approximately the same range in masses. The first group (hereinafter referred to as "direct-ethanol") was preserved directly in 70% ethanol. The second (hereinafter "sticky-trapped") was placed on a previously prepared 12.7 mm (½″) mesh hardware cloth sticky trap (Greenstone 1985b) with the exact location of each animal on the trap recorded. The trap was then placed in the field for a week as per our normal protocol. Following this the animals were removed from the trap and placed for four days each in paint thinner and toluene before final preservation in 70% ethanol.

To determine the effect of preservation time on the volume estimate the animals in each set were measured five times at set intervals. We anticipated that the most rapid changes would happen in the early phases of preservation and therefore made our first two measurements at weekly intervals. To minimize the possible adverse effects of excessive handling of the specimens we made the remaining three measurements at bi-weekly intervals. Overall, then, the measurement period covered a total of eight weeks following preservation.

Sign tests (Siegel 1956) were performed on the volume estimates at the beginning and end of each interval to determine whether significant increases or
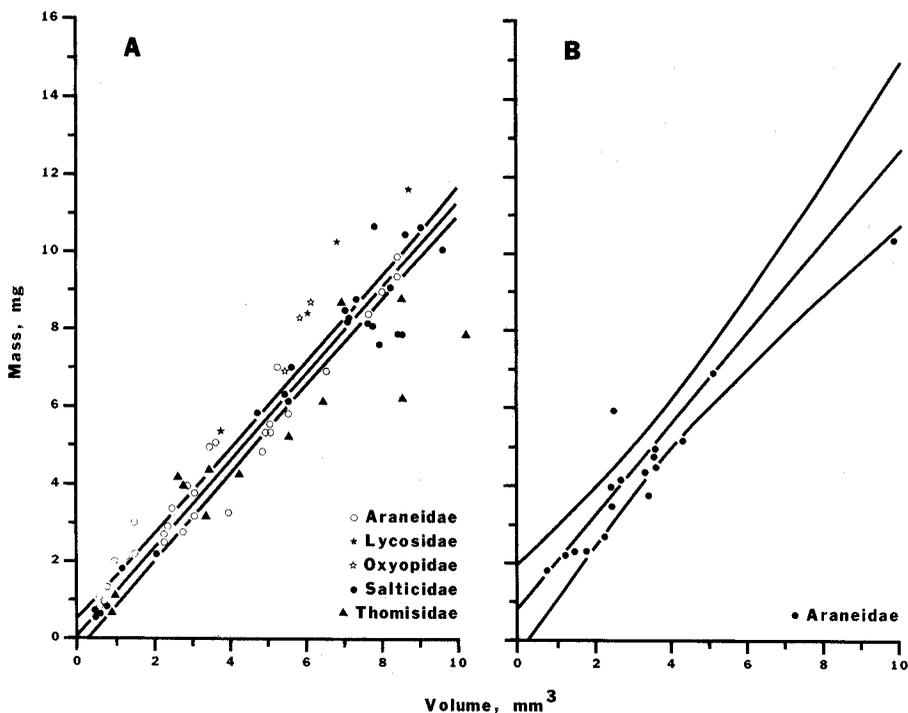
Fig. 1.—Regression lines, 95% confidence bands, and data for volume-mass regressions for original direct-ethanol data set (Greenstone et al. 1985a) (Fig. 1A) and for sticky-trapped set (Fig. 1B). Fig. 1A shows only that portion of the original data set covering the same volume range as the sticky-trapped set.

decreases had occurred during the interval. Sample sizes for each comparison were fifteen for the direct-ethanol set and eighteen for the sticky-trapped set. In the direct-ethanol there was a significant (P <0.025) decrease amounting to 19% (arcsin transformation of original data) in the volume estimate in the first week of preservation. None of the succeeding intervals showed significant change although there was an almost-significant (P <0.10) increase of 22% between the first and fourth week estimates. The sticky-trapped set showed a significant (P <0.02) increase of 9.5% during the first week interval and a significant (P <0.02) decrease of 6.0% during the second; all subsequent intervals were non-significant (P >0.60). In both samples, then, following one or two weeks of alternating increases or decreases in volume estimate there were no significant differences between the initial (one week) estimate and subsequent estimates following not more than six weeks preservation. This appears to be ample time to wait before making measurements to be sure that further changes will not occur.

To determine whether the regressions of live mass on that of direct-ethanol preserved and of previously sticky-trapped spiders differ, the sticky-trapped sample may be compared with either the simultaneously preserved direct-ethanol fifteen animal set of araneids or the original 101 animal direct-ethanol set (Greenstone et al. 1985a). Figure 1 shows the data for the sticky-trapped set (Fig. 1B) and that portion of the 101 animal set which covers the same range in volume (Fig. 1A), and the 95% confidence bands for the complete data sets. The

variances of these two samples are significantly different (P <0.01, Bartlett's Test for Homogeneity of Variances, Sokal and Rohlf 1969). Therefore t-tests on slopes and intercepts with unequal variance were performed (Snedecor and Cochran 1967). Both of these were non-significant (t = 0.690 and t = 2.880, respectively, P >0.50 in both cases). Failure to reject is not due to the added variance in the 101-animal set due to inclusion of non-araneids, because comparison of the sticky-trapped set with the simultaneously direct-ethanol preserved araneid set is not significant (t = 1.1223, P >0.20, t = 0.1002, P >0.50, slope and intercept, respectively).

There is therefore no evidence that prior sticky-trapping followed by passage through paint thinner and toluene alters the relationship between estimated volume and live mass for ethanol preserved spiders.

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