

FIG. 1. Map showing approximate localities of collection of *T. lineatus* and *T. garipeensis* in the southern part of the Kalahari Desert. They are sympatric on at least eight sites within the dune region (outlined by line and stippling). Tsane and Mabua Sefubi Pan are just off the map to the northeast. Study areas indicated by letters.

single functional (right) oviduct (Coe and Kunkel 1905, 1906).

Ecological Morphology and Character Shifts

Typhlosaurus lineatus and *T. garipeensis* are partially sympatric in the Kalahari Desert (Fig. 1 and *Macrogeographic Distribution*, below). They differ considerably in snout-vent length (Fig. 2). Sympatric *T. lineatus* of both sexes are significantly longer (*t*-tests, *P*'s < .001) than adult *T. garipeensis*. In maximum SVL *T. lineatus* is also longer (167 mm vs. 140 mm).

Data on allopatric *T. lineatus* were divided into two populations (Fig. 1 and 2): one is far from sympatry (Tsane and Mabua Sefubi Pan) while the other (T + D + R) is near sympatry. Sympatric *T. lineatus* were divided into two populations: deep sympatry (M + B + A + others) and near allopatry (K + L + X + others). Paired comparisons within sex classes show no significant differences (*t*-tests, *P*'s > .60) in SVL among either allopatric or sympatric populations. However, paired comparisons within sex classes show that both sympatric populations are significantly longer in SVL than any of the allopatric populations (*P*'s < .01) (Fig. 2). Thus *T. lineatus* exhibit a step-wise character shift (rather than a clinal shift) in SVL where sympatric with *T. garipeensis*. (Whether or not this and other morphological shifts described below can properly be

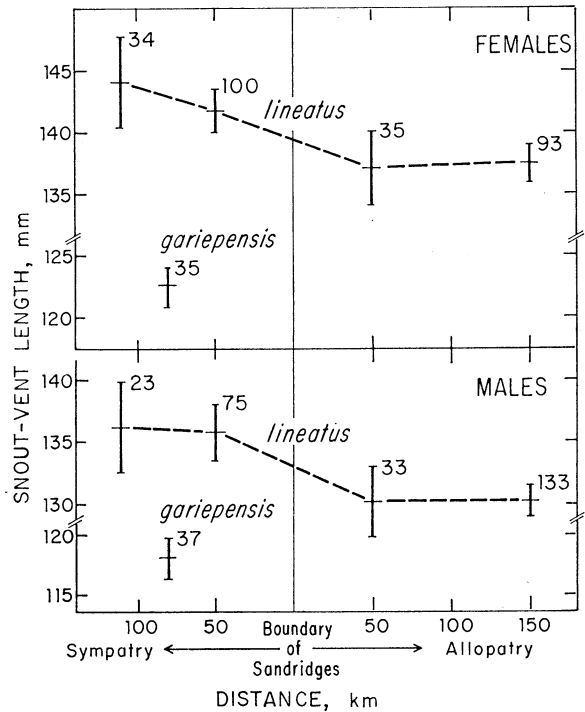


FIG. 2. Snout-vent lengths of male (below) and female (above) *Typhlosaurus* vs. approximate average distance of populations from boundary of sandridges. Means shown as horizontal lines; two SE of the mean on either side by vertical lines. Numbers inside graph are sample sizes (number of lizards).

called character displacement is considered in the Discussion). Because *T. garipeensis* are always sympatric with *T. lineatus*, reciprocity cannot be directly observed. However, *T. garipeensis* is the smallest of the eight species of *Typhlosaurus*, suggesting that its small size might reflect historical interaction with *T. lineatus* (Broadley 1968).

Statistics in Table 1 show that sympatric *T. lineatus* (both populations combined) have significantly longer and wider heads than do *T. garipeensis* (*t*-tests, *P*'s < .001). Sympatric *T. lineatus* also have significantly (*t*-tests, *P*'s < .001) longer and wider heads

TABLE 1. Head length and width statistics for *Typhlosaurus*. \bar{x} = mean, SE = standard error of mean, SD = standard deviation, and N = sample size. Text gives tests of significance

Species	Head length				Head width			
	\bar{x}	SE	SD	N	\bar{x}	SE	SD	N
Allopatric								
<i>T. lineatus</i>	4.39	.021	.203	94	3.25	.015	.142	94
Sympatric								
<i>T. lineatus</i>	4.65	.022	.215	93	3.40	.013	.129	93
<i>T. garipeensis</i>	3.75	.017	.147	76	2.77	.010	.089	76