THE EFFECTS OF PERCH HEIGHT ON TERRITORY SIZE AND FEMALE ATTRACTION BY *DENDROBATES PUMILIO* MALES

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Abstract. *Dendrobates pumilio* use vocalizations and physical combat to maintain territories. Calls may travel farther from higher perches, helping to maintain a larger territory and attract more females. Males may compete for higher perches to obtain these potential advantages. I hypothesized (1) that perch height would correlate positively with distance to nearest calling neighbor, (2) that males with high perches would have females in their territory more often than males with low perches and (3) that larger males would occupy higher perches. I found that distance to nearest neighbor and male weight correlated positively with perch height, and that males were perched higher when females were present as opposed to absent. Perch height may be an important factor contributing to male reproductive success.

INTRODUCTION

The "insect-like" chirp of the poison dart frog (*Dendrobates pumilio*) is a common sound in the Caribbean lowland forest of La Selva, Costa Rica. These vocalizations are important in maintaining male territory (Crump 1983). Presumably, high perches would allow calls to travel further, which would help maintain larger distances between males. Therefore, I hypothesized that perch height would correlate positively with territory size as estimated by distance to nearest calling neighbor.

If range of call increased with perch height, then mating success might also increase because males at high perches might attract more females. Consequently, I hypothesized that males at high perches would have females in their territory more often than males at low perches.

The potential advantages of high perches may cause male-male competition for territories with taller vegetation suitable for perching. The average distance between males is only 2-3 m (Crump 1983), so even in the dense understory of a secondary forest, there may be small territories with no high perches. Presumably, larger frogs would prevail in fights for better territory (*i.e.*, territory with high perches). Therefore, I hypothesized that larger males would occupy higher perches than smaller males.

METHODS

Frogs were sampled on 12-14 February 1995 at La Selva Biological Station, Costa Rica, along three trails through secondary forest. At 15 sample points (five on Sendero Tres Rios, five on Sendero Oriental and five on Sendero Sura), spaced 20 m apart on the trails, I listened to calling males for five minutes, sketched a map of their relative positions in the forest, and randomly chose one male as the focal frog. I measured the height of the focal frog's perch and the distance to its nearest calling neighbor (DNN). I captured six of 15 focal frogs and measured their snout-to-vent length and weight.

To investigate whether males at higher perches have higher success at attracting mates, I recorded the presence or absence of females within a 16 cm radius of the focal male at each of the last seven points. I chose the 16 cm radius based on the assumptions that territories are roughly circular, and that the boundary between two males exists at about one-half the distance between them. Half of the shortest DNN from the first eight points was 33.5 cm. I chose less than one-half of this length (16 cm) as my sample radius to ensure that any discovered females were in the focal male's territory.

RESULTS

There was a positive correlation between perch height and DNN ($r=0.844$, $n=15$, $P<0.0001$, Fig. 1). The average (± SE) perch height was 25.4±4.3 cm, and the average DNN was 346.0±48.0 cm ($n_{\text{perch height, DNN}}=15$).

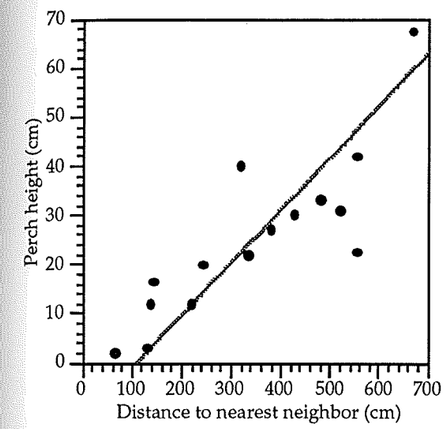

FIG. 1. Correlation between perch height of focal frog and distance to nearest calling neighbor , DNN ($r=0.844$, $n=15$).

There was a positive correlation between perch height and weight of the focal frog ($r=0.838$, $n=6$, $P=0.037$, Fig. 2). Frog length was not significantly correlated with perch height ($P=0.258$). There was no significant correlation between weight or length and DNN ($P_{\text{weight}}=0.149$, $P_{\text{length}}=0.947$). The average weight was 0.70 ± 0.03 g, and the average snout-to-vent length was 18.9±0.2 mm. The coefficient of variation was higher for the weights than the lengths, implying greater variation in body mass ($CV_{\text{weight}}=0.09$, $CV_{\text{length}}=0.026$).

Males were perched higher when females were present as opposed to absent ($t=-3.626$, $df=5$, $P=0.015$). The average perch height when females were present was 33.5±4.5 cm ($n=4$). The average perch height when females were absent was 13.8±9.8 cm ($n=3$).

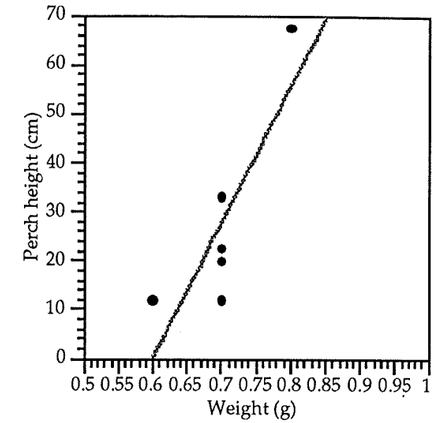

FIG. 2. Correlation between perch height and weight of the focal frog ($r=0.838$, $n=6$).

DISCUSSION

As predicted, males on high perches weighed more and had more females in their territories than males on low perches. The higher frequency of female presence near high perches suggests an advantage in terms of mating success. If high perches are a limiting resource, then male-male competition should result in larger males occupying more of the high perches. Captured males were similar in length, but varied in weight, so heavier males were presumably stronger.

Males on high perches had larger territories than those on low perches. Bunnell (1973) found that vocalization helps to maintain the distance between males. If calls from high perches travel farther, then the distance to nearest calling neighbor should increase with perch height. I expected territory size to increase also with male size, but found no correlation between DNN and frog length or weight. Since perch height correlated positively with DNN, and weight correlated positively with perch height, I believe a larger sample size might reveal a positive correlation between weight and DNN. Larger and presumably stronger frogs should be able to maintain larger territories.

Non-calling males were not measured in this study, but their effect on the mating success of calling males is probably small. Non-calling males might sneak into another male's territory and mate with local females. No non-calling males were found within 16 cm of a focal male, so this sneak-mating appears to be uncommon.

Future studies should investigate the importance of perches as a potentially limiting resource. Males in habitats with few high perches might have generally lower reproductive success than males in habitats with many high perches. Perch availability may, therefore, limit the range of habitats in which *D. pumilio* can successfully reproduce.

LITERATURE CITED

Crump, M. L. 1983. *Dendrobates granuliferus* and *Dendrobates pumilio* (Ranita Roja, Rana Venenosa, Poison Dart Frogs). Pages 396-398 *in* D. H. Janzen, editor. Costa Rican Natural History. University of Chicago Press, Chicago, USA.