

CLIMBING HABITS OF LEPTOTYPHLOPIDAE (SERPENTES) AND WALLS'S THEORY OF THE EVOLUTION OF THE OPHIDIAN EYE

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ABSTRACT

A specimen of Leptotyphlops tenella, a species belonging to a normally subterranean group, was found at noontime climbing a tree in the Amazonian forest. Two other instances of climbing in South American and one in Asiatic leptotyphlopids were found in the literature, and an unpublished case of climbing in North American L. dulcis was communicated to me. It is proposed that climbing and diurnal habits in leptotyphlopids represent a broadening of their ecological niche, made possible by the capability of following pheromone trails. Such a broadening might readily lead later to a resumption of life above the ground. This sort of transition is exactly that needed by Walls's theory of the evolution of the ophidian eye through a subterranean phase.

On September 10, 1968, in the "terra firme" (never flooded) forest around the town of Itapiranga, state of Amazonas, Brasil, (ca 2°45'S, 58°01'W), at about noontime, I found a leptotyphloid snake on the trunk of a tree, at a height of almost 2 meters above ground. The diameter of the trunk at that height was about 60 cm, and the bark very rough; the snake, 17.5 cm long, was traveling horizontally over the surface of an abandoned termite nest built against the tree.

The specimen belongs to the widespread form usually called *Leptotyphlops tenella* Klauber. As Thomas (1965) and Orejas-Miranda (1967) have remarked, this is very probably a synonym of *L. albifrons* Wagler, but, as the type of this form has been destroyed in the war (Smith & List, 1950), the matter can only be settled by collecting around Belém, Pará, the type locality.

When I saw the snake, its movements, apparently exploratory, seemed quite normal. I have no doubt that it was pursuing a habitual course of behavior, as there was no way for it to have gotten there but by climbing, and there was at the time no flood, or any other kind of disturbance that might have chased it up the tree.

Leptotyphlopids are usually said (*e.g.*, Mertens, 1966) to be one of the few snake families without climbing habits. I searched

the Zoological Record (1864-1963) and the usual herpetological bibliographic indices for explicit mentions of arboreal habits in the family, and found none. Additionally, I checked the general literature on South American leptotyphlopids, looking for incidental references to locomotor habits, and found two unequivocal cases of climbing, plus a possible one.

Beebe's (1946: 13) specimen n.º 2 of *Leptotyphlops albifrons* from Kartabo, Guyana (most probably the same species as the present one), was found "coiled around a live bamboo twig close to the ground and the laboratory door". His specimen n.º 5 (*loc. cit.*) exhibited the same behavior as mine: "Watched the snake for half an hour, during which time it climbed eighteen inches up the rough bark of a half dead tree, winding in and out of crevices toward the damaged termite nest".

Dunn (1944: 52) took a specimen of *L. macrolepis* in Mariquita, Colombia, "at night, as it was climbing two feet above ground on the vertical concrete wall of a building".

A less clear cut case is that of Schmidt & Walker (1943: 304); one of their specimens of *L. tessellatus* was found "in the wall of an old adobe house in Lima".

Dr. Frederick R. Gehlbach, to whom I was already indebted for valuable information on the behavior of *Leptotyphlops*, has recently communicated an observation of Mr. Robert Plsek, made at Waco, McLennan County, Texas:

"Mr. Robert Plsek, a member of our research group, was introducing captive *L. dulcis* into natural raid columns of *Neivamyrmex nigrescens* (common local army ant) when he made the climbing observation. Many of the releases of *L. dulcis* resulted in its typical defensive behavior in response to any attacks (cf. Gehlbach *et al.*, 1968) and were followed by the snake entering a raid column and traveling with it. On the specific occasion of climbing (11 August 1968, 11:06 P.M. C.D.T., ground temperature 27°C.), the ants were raiding up a 40° inclined sycamore tree, 35 cm. d.b.h. The blind snake followed the ground surface raid column for 51 cm. and then ascended the inclined tree; it climbed along with the army ants between the wood and loose bark and over the rough bark surface to about one meter above ground. Then it was recovered for other field experiments."

Minton (1966) reports specimens of *L. macrorhynchus* taken on and below the surface of the ground in Pakistan, but also two that dropped from crevices in the mud and thatch roof of a house.

COMMENTS

I believe we are witnessing a process of broadening of the ecological niche of the leptotyphlopids. It should be noted initially that the climbing seen is not a fully arboreal type of locomotion, but involves crawling over rough broad surfaces which differ from the ground mostly by their steepness. Besides, climbing, although seemingly more common than currently believed, is probably not the usual method of locomotion of these snakes. Bailey & Carvalho (1946) report 2 specimens of *L. tenella* "within a much-perforated mos-covered rock in humid forest", this clearly indicates that the

case is not one of shift of ecological preferences, but of an increase in the range of environments exploited. The richness of the Amazonian forest in arboreal termites and ants makes the selective advantage quite obvious.

Before knowing of Plsek's observation I was inclined to believe that two major factors would be responsible for the acquisition of climbing habits of leptotyphlopids: the seasonal flooding of Amazonian "varzea" (back-swamp) forests and the capability of these snakes of following scent trails left by ants and (probably) termites (Watkins, Gehlbach & Baldrige, 1967). The presence of climbing in *L. dulcis*, definitely not a forest species, places the emphasis squarely on the trail-following habits, although seasonal flooding may still be relevant in the Amazonian environment.

The importance of the chemical sense may explain also another facet of the broadening of the ecological niche of *Leptotyphlops*: my specimen and several of Beebe's were found active at day time, although leptotyphlopids are usually found wandering at night. Although the closely canopied rain forest is probably the environment in which illumination differences between day and night are minimal, the increased span of activity is certainly meaningful.

This broadening of the ecological niche of leptotyphlopids seems to me especially important in one respect: the broadened niche encompasses two very different, even contrasting, modes of life. On one side we have the subterranean, or at least sub-fossorial "normal" leptotyphloid ecology, with nocturnal excursions to the surface; on the other hand, diurnal, arboreal or semi-arboreal activity.

It is quite probable that selective pressures could result into a new narrowing of the broad niche, with some forms pushed toward diurnal, above-ground life.

This seems to be exactly the ecological mechanism advocated by Walls to explain the morphological peculiarities of the snake eye: "The pattern of the whole snake eye is consistent only with the hypothesis that the first snakes lived underground or originated there from lizards which had become fossorial." (Walls, 1942: 634).

The present observation makes seem clear that an ecological shift such as postulated by Walls may be happening before our eyes, and that it is explainable through a very simple mechanism. One specialization (pheromone trail following), developed in connection with a mode of life for which vision is of little importance, makes itself possible the change to a mode of life for which vision regains its relevance. If degeneration of the eye consequent to subterranean life has not gone too far, the new phase of surface life will tend to an elaboration of the remaining structures into a new fully functional organ.

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