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ANURAN SUCCESSION IN A TEMPORARY POND
IN COLIMA, MEXICO

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INTRODUCTION

While studying the herpetofauna of the Nevado de Colima, Jalisco, we were able to study anuran succession in a temporary pond in a tropical deciduous forest (Fig. 1). The pond is in the State of Colima on the road from Colima to Tecoman, 2.4 km E. and 9.6 km S. of Colima at 520 m elevation. The dominant plants of the area are legumes (*Acacia* and *Prosopis*), with an occasional larger tree (*Crescentia*) and giant organ cacti (*Lemaireocereus*).

Our first visit to the pond was daytime, of July 11, 1967. We were attracted to the dry bed of the pond by male *Leptodactylus labialis* calling from hidden burrows in the cracked soil beneath rocks, logs, and debris. Rain began to fall at approximately 0100 hours on July 12 and continued until 0500. By 0800 about 20 cm of water had collected in the pond. *Bufo marmoratus* and *Hypopachus variolosus* were calling. We returned the same night and recorded calls of three additional species: *Agalychnis dacnicolor*, *Diaglena spatulata*, and *Smilisca baudinii*. We revisited the site on several days and nights through July 24, to collect tadpoles, adults and to record calls and new anuran visitors to the pond.

MATERIALS AND METHODS

Samples of the adult anuran fauna were taken 8 times in the period from July 11-24. Larval samples were taken at 3-4 day intervals. At-

tempts were made to sample microhabitats and morphologically distinct larvae. Larvae were returned to the laboratory for identification, staged (Gosner, 1960), and gut analyses were made on one or two larvae of three of the species. Only a few gut analyses were made because we were primarily interested in gross differences in feeding habits and had only a small sample of some species.

All specimens of adults and larvae have been deposited in the Los Angeles County Museum of Natural History.

RESULTS

A summary of the visits made to the pond, time of day, choruses, larval stages at time of collecting, and anurans present but not chorusing, are given in Table 1.

Species Accounts

Bufo marmoratus — Most of the breeding activity took place during the day of July 12. Several amplexing pairs were observed and mating calls were recorded. A few calling males were observed on the night of July 12, but none were seen or heard during the remainder of the study.

Agalychnis dacnicolor — Adults were found calling from vegetation in the pond and some distance from the shore on the night of July 12, and individuals continued to call throughout the study period. Several individuals were seen on the retaining wall of the pond on the night of July 12, but none were calling from these positions. Neither amplexus or eggs were observed, nor were tadpoles collected of this species. However, during the study period, egg masses were seen in other areas.

Diaglena spatulata — Adults were calling from rock walls, vegetation, and shoreline only on the night of July 12. Several amplexing pairs were found in the water. One individual was found on the night of July 13, crossing the road near the pond, but heading away from the water. Neither eggs nor tadpoles were collected.

Smilisca baudinii — This species was the most common, both in terms of adults present and number of larvae observed in the water. Adults called on every nightly visit and sometimes during the day. Tadpoles were observed in large swarms at times. Tadpoles were also observed feeding on vegetation on or near the surface of the pond. The anterior portion of the gut of the larvae has a manicotho (stomach-like, thickened walls). The total length of the gut is 12 times body length. The gut of one tadpole (stage 35), was filled with a mucoid-appearing matrix consisting of filamentous algae and diatoms. The larvae appeared to be scraping the algae and diatoms off of vegetation in the water. Adults were breeding throughout the study period. The last sam-



Figure 1. Photograph of the study site at the termination of the study.

ples of larvae taken from the pond contained three or more temporal lots.

Leptodactylus labialis — Adult males were calling from terrestrial “incubating chambers” both night and day during the entire study. These chambers were found in clay soil, usually beneath rocks, logs, or other debris. Some chambers contained either calling males, foam nests, or were empty. The chambers were usually 30-40 mm in depth, with an entrance 20-30 mm in diameter. (Fig. 2). The main chamber was approximately 50 mm wide and 65 mm long. Some of the chambers contained another opening (probably an escape exit) 90-100 mm in a direction opposite the main entrance, connecting with the chamber by a tunnel about 10 mm below the soil surface.

On one occasion two chambers were found under the same rock, one with foam and eggs, the other empty. The foam was about 20 mm below the surface of the entrance. Yellowish eggs lacking melanophores were located in the lower half of the foam.

Apparently males attract females to the chambers, where the eggs are laid. The eggs hatch in the enclosed foam nest and the larvae remain within the foam until the first rain, at which time they float or swim from the nest to the pond. One preserved nest contained 247 larvae at devel-

opmental stage 25. It is possible more advanced stages may be reached before flooding releases the larvae from the nest. A second preserved nest contained 190 eggs. When one nest was uncovered, it flooded with water, and the larvae swam into the pond.

The majority of the tadpoles were observed in very shallow water near the edge of the pond. Three larval guts were examined. The gut is 8-10 times the body length. The largest example (stage 38) has a manicotto; this is not evident in smaller stages (25). The gut contents consist of a mud-silt matrix, with a few plant fibers and seeds, and unidentified debris. The larvae apparently ingest bottom material indiscriminately.

Leptodactylus melanonotus — Adult males and females were first observed on July 17, but none were calling. A large number were seen on July 24, again none were calling. The adults may have moved in for feeding and perhaps establishment of a breeding site. Actual reproduction may have been delayed because rain had not fallen at the pond since July 12, and the water level was receding.

Hypopachus variolosus — Adults were observed calling and in amplexus on July 12. Males were observed calling on July 13 but amplexus was not observed. Adults were not present at any other time during the study. Tadpoles of this species were relatively scarce. Improper sampling techniques or low larval survival rates may have accounted for their scarcity.

One tadpole gut was examined. The gut is 11 times the body length, and contains a homogeneous, silty-appearing matrix. These tadpoles seemingly vacuum the pond bottom, selecting small particles, and pass them to the gut via a mucus cord, as reported by Savage (1955).

Rana pipiens — This ubiquitous frog appeared at the pond on July 20, and was present during the remainder of the study. Never were they observed calling or in amplexus. This species was commonly encountered on the road following every rain, even though permanent water was several miles away.

DISCUSSION

There are definite differences in breeding periods and appearance of larvae. *Bufo marmoratus*, *Diaglena spatulata*, and *Hypopachus variolosus* are early breeders. They called for only a short period of time (24-36 hours), and left the pond by the second day following the first rain. Apparently these three species were less successful in egg laying and had a lower larval survival than the other species. Eggs of *B. marmoratus* were observed on July 11, larvae on July 14, but larvae were



Figure 2. Photograph of a foam nest of *Leptodactylus labialis*. Arrow indicates opening of the nest which was beneath a rock.

never collected again. *D. spatulata* eggs and larvae were never found and the adults had the shortest activity period at the site of all the anurans. *H. variolosus* eggs were observed on July 12. Larvae were taken first on July 17, and occasionally in later larval samples, but never in abundance.

Leptodactylus labialis and *Smilisca baudinii* are early breeders. Eggs and larvae were present on July 11 for *L. labialis*; eggs of *S. baudinii* were present on July 12 and larvae on July 14 and later. Adult males of the latter species continued to call throughout the study, and amplexing pairs were observed on at least three different nights. The larvae of these two species made up the bulk of larvae present at any one time in the pond.

Agalychnis dacnicolor appeared on the night of July 12 and called both night and day during the entire period of the study. However, amplexing pairs, eggs, and larvae were not observed. Nest sites may not have been available for this species. *A. dacnicolor* often lays its eggs in trees or branches overhanging the water. The large shrubs at the side of the pond (Fig. 1) could have provided adequate nesting sites,

