LACK OF GENETIC VARIATION IN *LACANDONIA SCHISMATICA* (*LACANDONIACEAE: TRIURIDALES*) IN ITS ONLY KNOWN LOCALITY[1]

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ABSTRACT

Lacandonia schismatica has only one known population in a small patch of tropical rain forest. Using electrophoretic techniques, we assessed its genetic variation in eight loci; no variation was found. We discuss this result and its implications for the conservation prospects of this threatened species.

Lacandonia schismatica (Martínez & Ramos, 1989; Márquez-Guzmán et al., 1989), the only species of Lacandoniaceae, is unique in having a central androecium surrounded by an apocarpous gynoecium. A series of studies of the plant is underway to determine its relationships and taxonomic status, which is still under debate (Stevens, 1991).

The unusual morphology and restricted distribution of *Lacandonia schismatica* suggest that it is an interesting model to study macroevolutionary mechanisms. In this paper we report results on the genetic variation of *L. schismatica* as estimated by enzyme electrophoresis.

METHODS

The only known locality for *L. schismatica* is the type locality (Fig. 1), which is a ca. 15-ha tropical rainforest patch a few miles north of the Montes Azules Biosphere Reserve in Mexico. The climatological station at Bonampak, close by and at a similar altitude, has a mean annual temperature of 24.6°C and precipitation of 2,609 mm per year (Meave, 1990). The type locality is almost completely surrounded by secondary growth vegetation and cattle pastures. The plants are found within the forest, but only 10–100 m from the edge with a natural savanna. This edge has wet soil, almost a marsh, with an underground water level at about 60 cm below the surface during the dry season. During the dry season, the plants are inconspicuous and can only be found under the litter. During the rains, however, rotting logs are often covered with carpets of *L. schismatica* (E. Martínez, pers. comm.).

Individuals of *L. schismatica* were collected in a 0.5-ha plot (Fig. 1) on three dates, all during the dry season: (A), 10 individuals, April 1988; (B), 72, April 1989; and (C), 27, July 1989. The sample size changed between sites depending on the abundance of the plant. Plants from sample A were collected along a 100-m transect. Plants from samples B and C come from 10–20-m^2 high-density patches not more than 50 m away from each other. Live specimens were transported to Mexico City and maintained in growth chambers at 25°C and 80% humidity until prepared for electrophoresis.

Starch gel (12%) enzyme electrophoresis (Vallejos, 1983) was carried out on fresh stem tissue homogenized with gel buffer and absorbed in filter paper wicks (Whatman 17). Eighteen enzymes were assayed, but only eight resolved well in two buffer systems. The enzymes analyzed and the stain references are shown in Table 1.

System I consisted of tris-citrate pH 7 electrode buffer and L-histidine pH 7 gel buffer and system

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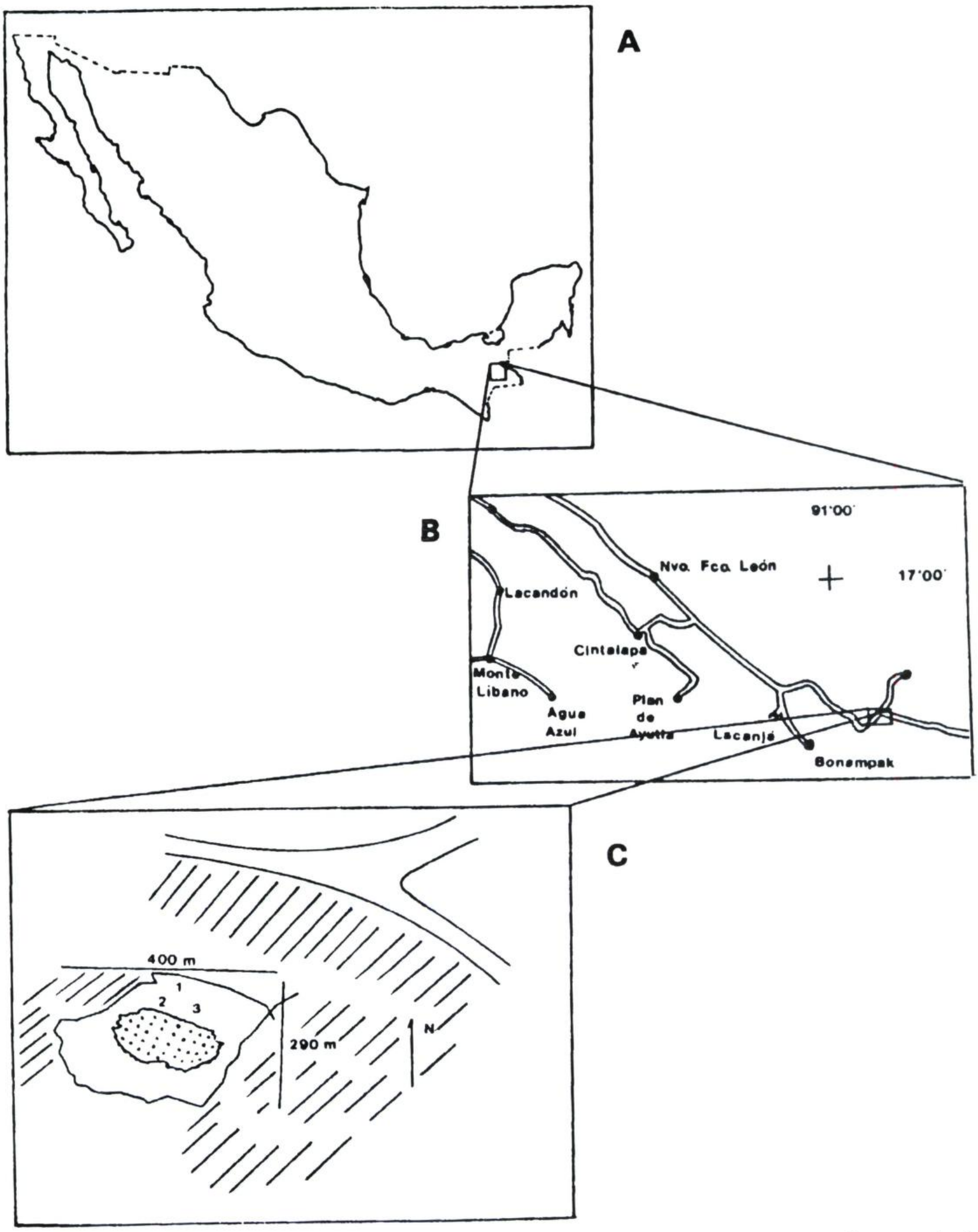

FIGURE 1. Location of the site of *Lacandonia schismatica*. The striped area in C represents cattle pasture land and the dotted area a natural savanna community. Numbers 1, 2, and 3 in C represent collection sites. The polygon around the dotted area is the plot reserved by the Chole Indians to protect the plant.

II of lithium-borate pH 8 electrode buffer and tris-borate pH 8.6 gel buffer (Soltis et al., 1983). Electrophoresis was conducted at 55 mA for system I and 45 mA for system II until the front migrated 10 cm.

RESULTS

No electrophoretic variation was detected among any of the plants or sites in the 14 loci examined. Stems of 109 individuals were assayed and the

TABLE 1. Enzymes assayed in *Lacandonia schismatica* and stain recipes references.

Enzyme	Code	Stain reference
Acid phosphatase (ACP)	E.C. 3.1.3.2	Soltis et al. (1983)
Aconitase (ACO)	E.C. 4.2.1.3	Wyatt (1989)
Alcohol dehydrogenase (ADH)	E.C. 1.1.1.1	Vallejos (1983)
Diaphorase (DIA)	E.C. 1.6.4.3	Wyatt (1989)
Glutamate oxaloacetate transaminase (GOT)	E.C. 2.6.1.1	Wyatt (1989)
Leucine-amino peptidase (LAP)	E.C. 3.4.1.1	Wyatt (1989)
Peroxidase (PER)	E.C. 1.11.1.7	Vallejos (1983)
6-Phosphogluconate dehydrogenase (6-PGD)	E.C. 1.1.1.44	Soltis et al. (1983)

same alleles were expressed in all of them. Table 2 shows the number of loci that resolved for each enzyme analyzed, and the zymogram of Figure 2 shows the activity zone of each loci.

Assuming that the specimens represent a random sample of 218 alleles at each locus, we would have detected any variant allele that existed at an overall frequency of 1.4% or greater with a probability of 95% ($P = 0.986^{218} = 0.05$). Thus, genetic variation is not apparent in our sample.

Lack of genetic variation has also been reported for other endemic species (Hamrick et al., 1979; Waller et al., 1987) and has implications for a conservation program (Holsinger & Gottlieb, 1989).

DISCUSSION

Lack of genetic variation can be explained by a number of mechanisms, including random drift, genetic bottlenecks (Waller, et al., 1987), and apomixis (Marshall & Brown, 1981). In the case of *Lacandonia schismatica*, the lack of genetic variation can be explained by the autogamic fertilization system reported by Márquez-Guzmán et al. (1993, this issue).

Since *Lacandonia schismatica* is apparently restricted to a small area, the existence of several subpopulations cannot be rejected at this time. The small size of the plant, its location under the litter, and its cleistogamous pollination system (Márquez-Guzmán et al., 1993, this issue) suggest very low levels of gene flow, which may lead to several subpopulations within a small area. The samples used in this study were collected in roughly the same site, and it may be that other subpopulations could have the same low genetic variation but for different sets of alleles. This still has to be tested.

The low genetic variation has contradictory im-

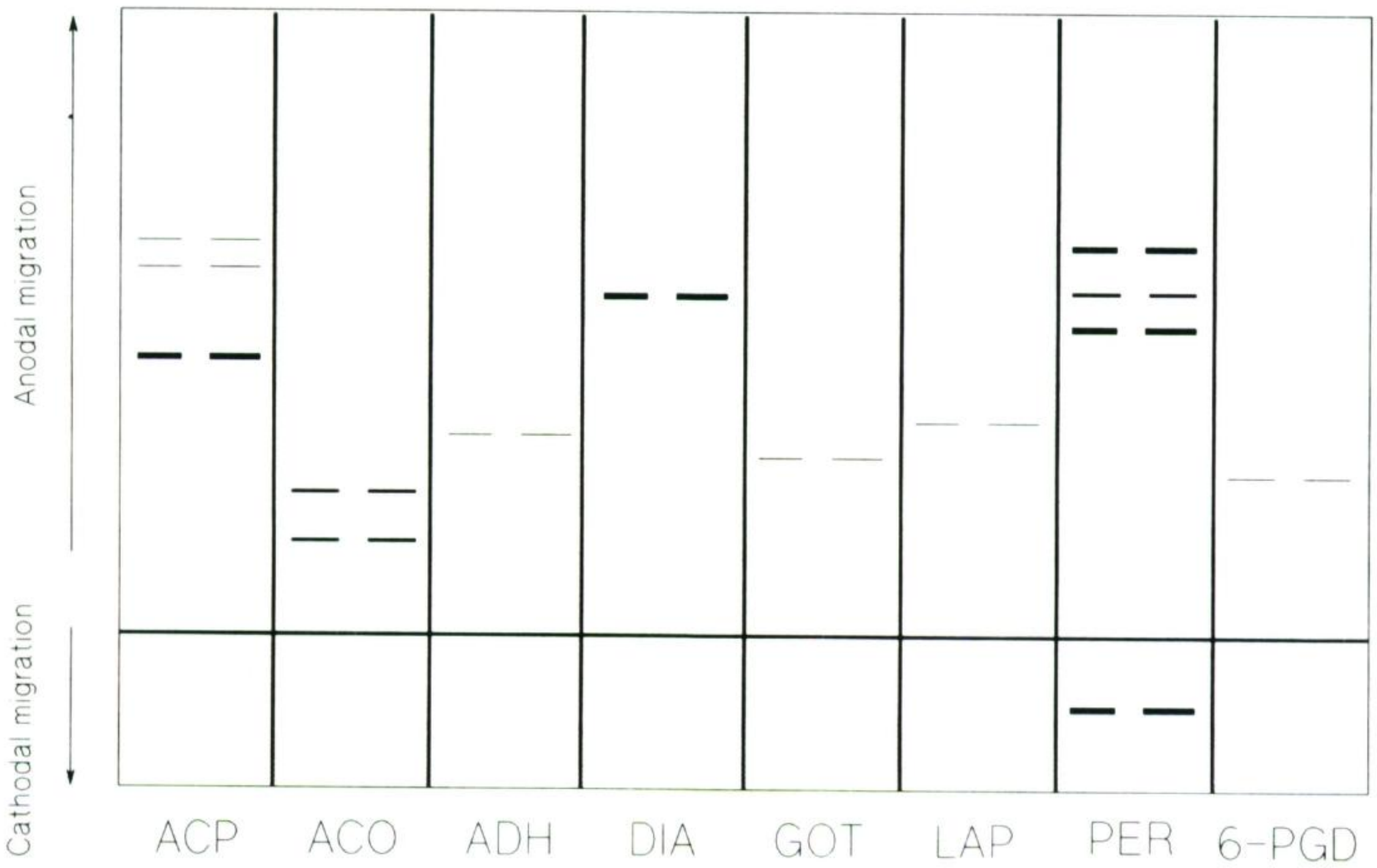

FIGURE 2. Zymogram showing the activity regions for the eight enzymes tested in *Lacandonia schismatica*.

TABLE 2. Enzymes analyzed on each buffer system and the number of loci detected for each one in *Lacandonia schismatica* from Mexico.

System	Enzyme	Number of loci
I	ACP	3
	ACO	2
	ADH	1
	PER	4
	6-PGD	1
II	DIA	1
	GOT	1
	LAP	1

plications for the conservation of the plant. On one hand, obtaining representative variation for preservation in the greenhouse may be feasible using only a small number of specimens. Unfortunately, to date all attempts to preserve living specimens in growth chambers for more than two or three months have failed. Failure may be due to death of the associated root fungi. On the other hand, the forest patch in which the only known population of *L. schismatica* is located will soon be completely surrounded by secondary vegetation and natural and artificial grasslands. It is likely that microenvironmental conditions in its habitat will change, and it may be the case that *L. schismatica* lacks the genetic variability to adapt to the new situation. Although it now appears that the locality of *L. schismatica* will not be cleared and will be kept as a sanctuary by the owners, the Chole Indian community of Corozal, it is important to begin intensive ecological and genetic studies of the species in order to insure its conservation. It is unlikely that the area in which the plant is located will be able to support a viable population without some degree of management. Given the situation of the habitat, and what is known about the plant's genetics and biology, it is clear that an immediate effort is required to preserve the plant in laboratory conditions and to understand its ecological requirements and genetic structure in order to propose sound management strategies.

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