

activity in infiltration anaesthesia (column b). The onset of anaesthesia of pyrimidinoacetyl-2-amino-benzimidazole in conduction anaesthesia (compound 6) is noteworthy as shown in Table IV (column c).

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1. Srivastava, P. K. and Srivastava, P. N., *J. Med. Chem.*, 1970, 13, 304 and 977.
2. —, Sharma, R. D. and Rai, S. K., *Acta Chim.*, 1977, 94, 229
3. —, — and Upadhyaya, J. S., *Ind. J. Pharmacy*, 1977, 39, 56.
4. Bhargava, P. N. and Singh, G. C., *J. Ind. Chem. Soc.*, 1961, 38, 77.
5. Sollmann, T., *J. Pharmacol.*, 1918, 11, 17.
6. Bulbring, E. and Wajda, I., *J. Pharmacol. Exp. Ther.*, 1945, 85, 78.

### PHENOLICS, PEROXIDASE AND PHENOLASE AS RELATED TO GALL FORMATION IN SOME ARID ZONE PLANTS\*

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#### ABSTRACT

Increased phenolics and protein contents were recorded in *Prosopis cineraria* leaf gall and *Zizyphus mauritiana* stem gall. Phenolics and protein contents were low in *P. cineraria* stem gall. Activity of phenolase was inversely proportional to the phenolics concentration in all the tissues. Peroxidase activity was higher in the leaf gall and stem gall of *P. cineraria* than in normal tissues. Peroxidase activity was low in *Z. mauritiana* gall. Phenolics may act as enzyme inhibitor/protector or activator.

**P**ROSOPIS CINERARIA (Linn.) Druce. and *Zizyphus mauritiana* Lamk. are severely infected by leaf and stem galls caused by *Eriophyes prosopidis* Saksena and unknown Chalcidoidea (Hymenoptera), respectively. *Zizyphus* galls are induced by *Eriophyes cernuus* Masee (Acarina)<sup>1</sup>. The present paper reports the biochemical changes in leaf and stem gall tissues of *P. cineraria* and *Z. mauritiana*. The possible role of phenolics, phenolase and peroxidase have been discussed in relation to gall formation.

#### MATERIALS AND METHODS

All the experimentations were done in three replicates and the superimposable results presented.

##### *Prosopis cineraria* :

Healthy leaves, stem, leaf gall (0.5 to 1.0 mm) and stem gall (2.0 to 4.0 mm) were carefully removed, washed with chilled distilled water and homogenised in phosphate buffer (pH 6.0 at 0°C).

##### *Z. mauritiana* :

Healthy stem and gall (0.5 to 1.5 cm) tissues were washed and homogenised in phosphate buffer (pH 6.0 at 0°C).

Homogenates were centrifuged (5000 g) in a refrigerated centrifuge (0°C) and supernatants were used for polyphenol oxidase (PPO), peroxidase (PRO) activities<sup>2</sup> and protein content<sup>3</sup>. The activity of enzyme is presented as O.D./min./3 mg fresh wt. as recorded on an automatic recorder. All the six samples were dried in lyophiliser (Toshniwal) and extracted in ethanol (80%) for total phenols and O-dihydroxy phenols<sup>2</sup>.

#### RESULTS AND DISCUSSION

The results obtained with protein, total phenols and O-dihydroxy phenols are presented in Figs. 1 and 2. Increased protein contents were recorded in *P. cineraria* leaf gall and *Z. mauritiana* stem gall, and these decreased in *P. cineraria* stem gall. In the case of *P. cineraria* stem gall, low protein contents were registered. The increased protein contents degrade to aromatic aminoacids and ultimately converted to transcinamic acid by phenylalanine ammonia lyase<sup>4</sup>.

In the leaf gall of *P. cineraria* and stem gall of *Z. mauritiana*, high amounts of total and O-dihydroxy phenols were recorded. Phenolics can change considerably the activity as enzyme inhibitor or activator<sup>5,6</sup>. These phenols also inactivate the phenolase<sup>4</sup> and thus result in the accumulation of phenolics. The results obtained with phenolase (Fig. 3) and peroxidase

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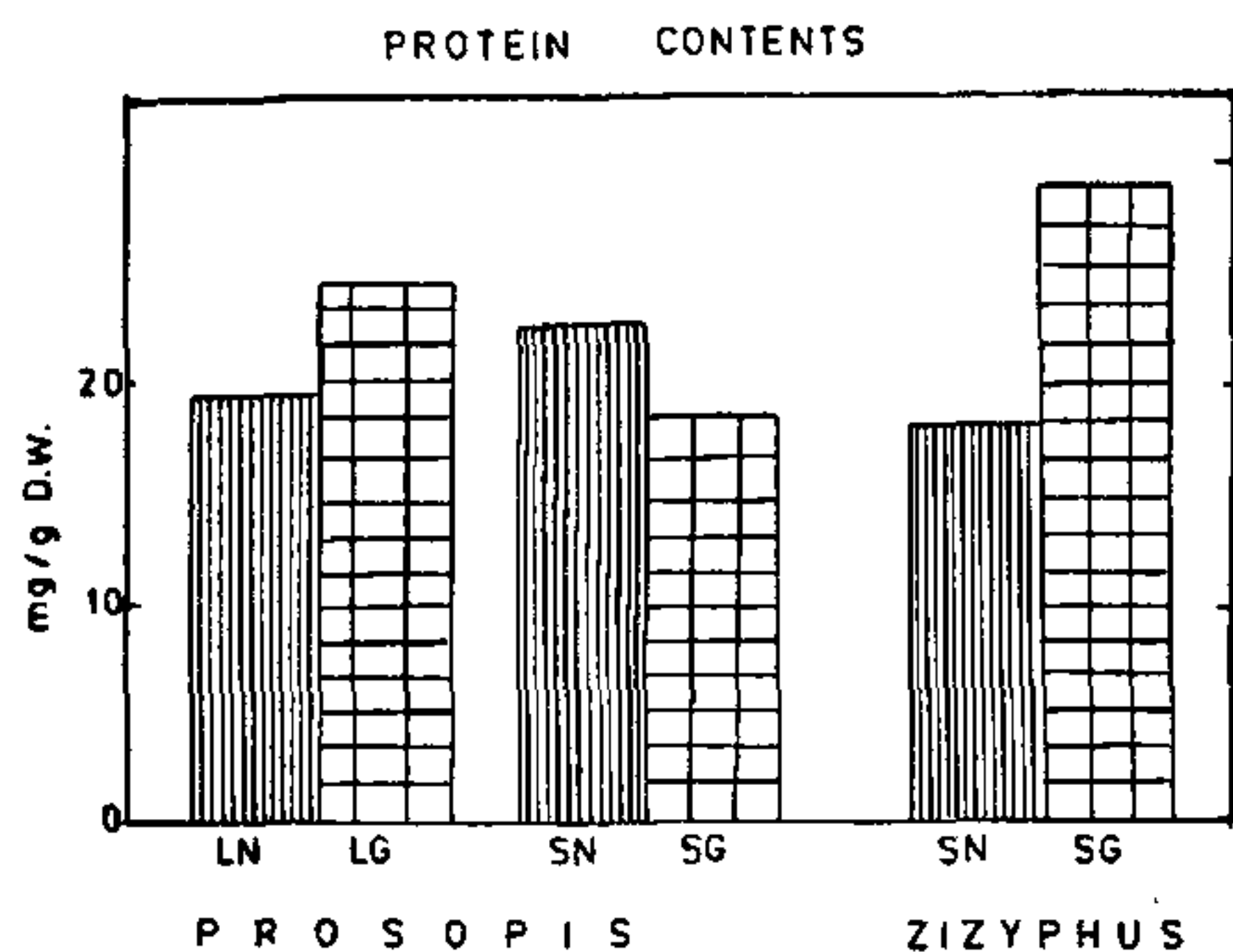


FIG. 1. Histogram showing protein contents in gall and normal tissues of *P. cineraria* and *Z. mauritiana*. (LN, leaf normal; LG, Leaf gall; SN, Stem normal; SG, Stem gall.)

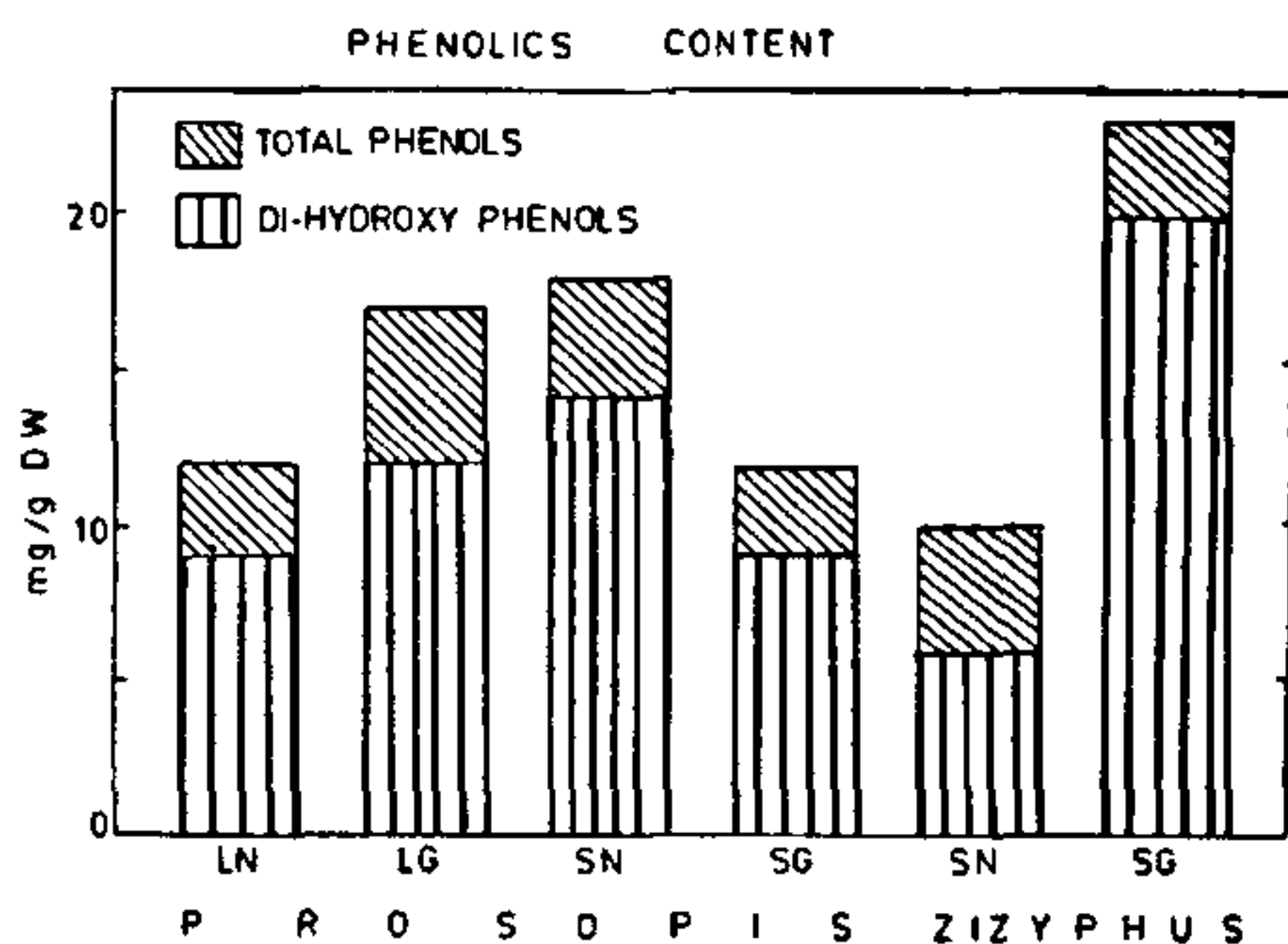


FIG. 2. Histogram showing total and O-dihydroxy phenol contents in normal and gall tissues of *P. cineraria* and *Z. mauritiana*. (Abbreviations similar to Fig. 1.)

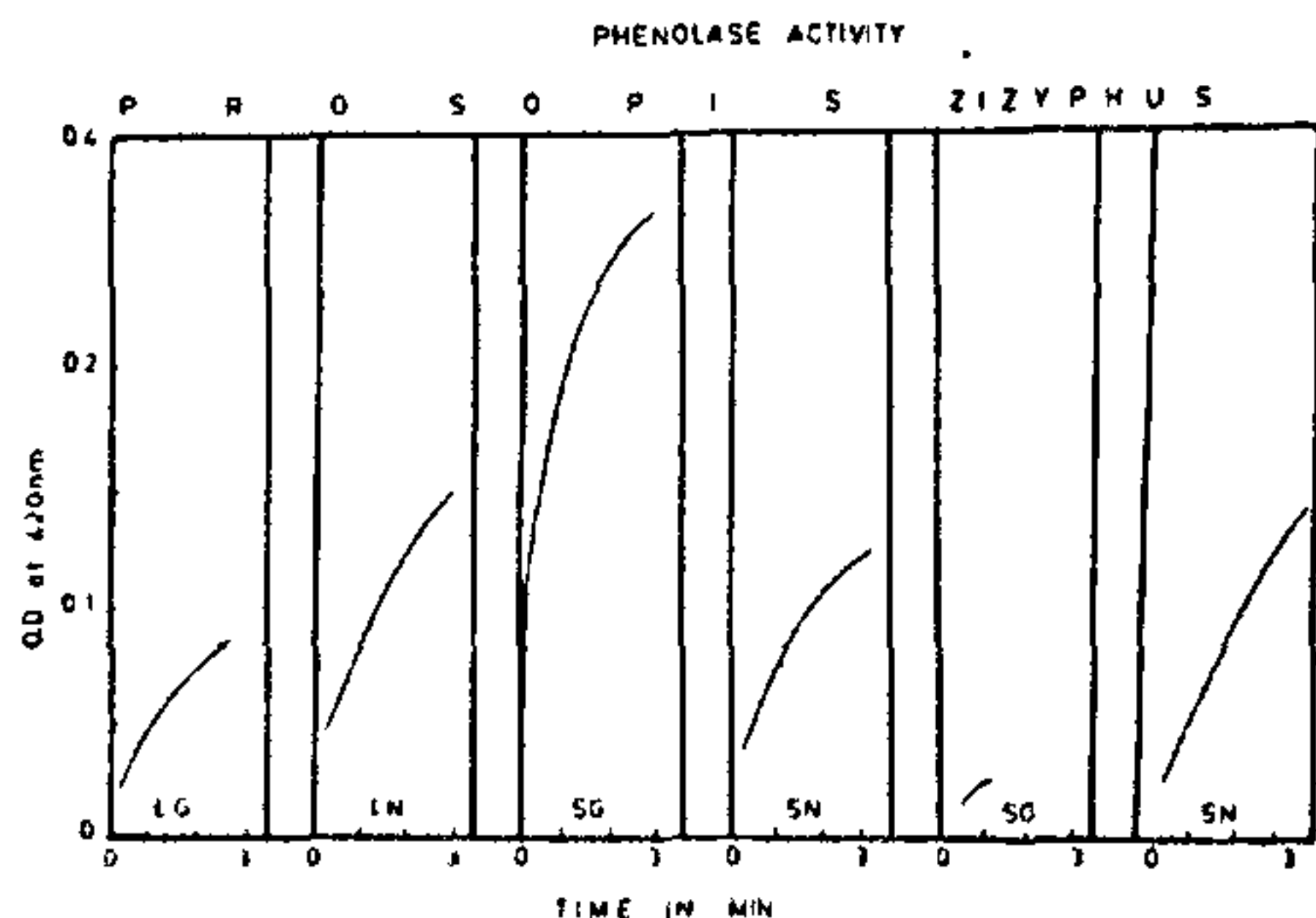


FIG. 3. Phenolase activity in normal and gall tissues of *P. cineraria* and *Z. mauritiana*. (Abbreviations similar to Fig. 1.)

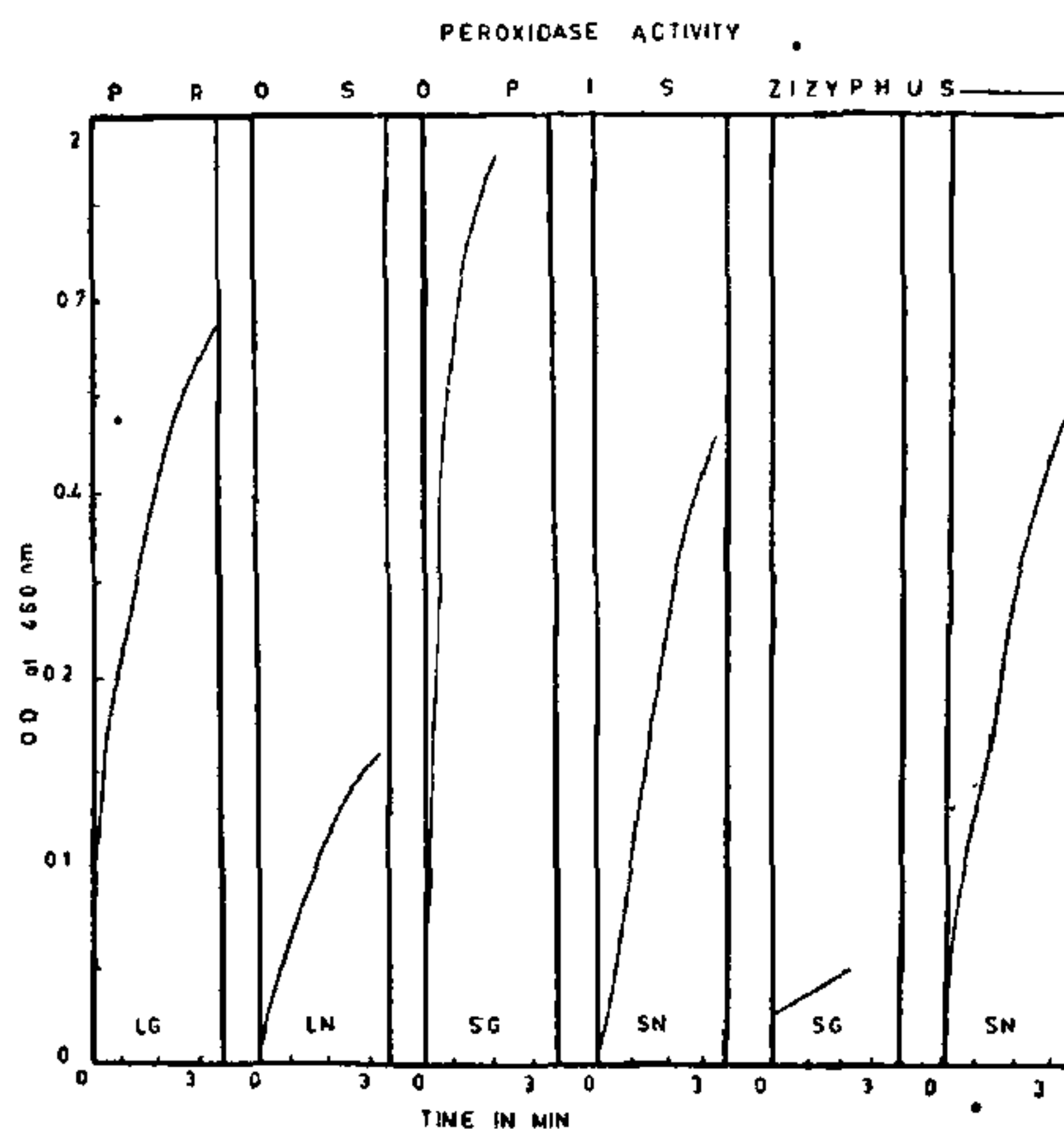


FIG. 4. Peroxidase activity in normal and gall tissues of *P. cineraria* and *Z. mauritiana*. (Abbreviations similar to Fig. 1.)

(Fig. 4) activities in *P. cineraria* leaf gall and *Z. mauritiana* stem gall showed the presence of such inhibitors/activators. The protectors of phenolic nature in *Zizyphus* gall have been isolated and characterized in our laboratory<sup>7</sup>. In the gall tissues PPO activity was much lower as compared with the normal tissues. PRO activity was higher in leaf gall while PRO remained suppressed in *Z. mauritiana* gall. This diversity of results is due to differences in the structure and nature of these two galls. Results also indicate that the concentration of phenolics was much higher in *Z. mauritiana* gall tissues compared to a normal stem. The inhibitory activity of the phenolase-phenol system is generally attributed to the reactivity of the quinones which the system generates. The presence of auxin protector-like substances<sup>7</sup> in *Z. mauritiana* stem gall is responsible for suppressed activities of PPO and PRO.

In the case of *P. cineraria* stem gall, low phenolics and high PPO, PRO activities were recorded. These results were uncomparable to those obtained with other plant tumors in this study or in others<sup>8,9</sup>. However, the concentration of phenolics in stem gall was comparable to concentration of phenolics in *P. cineraria* normal leaf. This indicates the absence of enzyme inhibitor/protector-like substances in these gall tissues. Increased PRO activity is correlated with (a) injury or invasion of insect larvae in the plant, or (b) activities of PRO increased to form high amounts of lignin. This might be the reason that more phenols were utilized to synthesize lignin.



It is thus concluded from the results obtained with three types of gall tissues that phenolics along with PRO and PPO play an important role in different types of gall growth and their formation. Further studies with auxin protectors and sulphahydral (-SH) group may be of much help to elucidate the mechanism of gall formation.

1. Mani, M. S., *Plant Galls of India*, MacMillan India, 1973, p. 131.
2. Purohit, S. D., Shekhawat, N. S., Ramawat, K. G. and Arya, H. C., *Indian J. Exp. Biol.* (In press).
3. Lowry, O. H., Rosebrough, N. J., Farr, A. L. and Randall, R. J., *J. Biol. Chem.*, 1951.
4. Kosuge, T., *Ann. Rev. Phytopathol.*, 1969, 7, 195.
5. Pridham, J. B., *Ann. Rev. Plant Physiol.*, 1965, 16, 13.
6. Towers, G. H. N., In *Biochemistry of Phenolic Compounds*, J. B. Harborne, ed., Academic Press, New York, 1964, p. 249.
7. Tandon, P., "Further studies on the process of gall induction on zizyphus and the factors involved," *Ph.D. Thesis*, University of Jodhpur, 1976.
8. Raj Bhansali, R., Kumar, A. and Arya, H. C., *Indian J. Exp. Biol.*, 1978, 16, 850.
9. Shekhawat, N. S., Ramawat, K. G. and Arya, H. C., *Curr. Sci.*, 1978, 47, 780.

## PREGNANCY RECORD OF SOME INDIAN BATS

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### ABSTRACT

Most of the species of Indian bats studied here are monotocous and exhibit varying degrees of physiological dominance of one side of the female genitalia over the other. In some species there is a functional alternation of the two sides of the female genitalia in successive cycle. Ovulation and gestation occurs on the ipsilateral side in all the species except *Miniopterus schreibersii fuliginosus* in which ovulation as a rule occurs from the left ovary and the embryo migrates to the right uterine cornu where it undergoes implantation and further development.

### INTRODUCTION

THE occurrence of physiological dominance of one side of the female genitalia over the other has been noticed in a number of bats<sup>1-10</sup>. There is a functional alternation of the two sides of the female genitalia in successive reproductive cycles in some bats<sup>3,4,11-16</sup>. In polytocous species the two sides of the genitalia are functional synchronously in each breeding cycle<sup>17-20</sup>.

Investigations on the breeding biology of a number of Indian bats have been carried in this laboratory for the past 30 years and a detailed record of the condition of the genitalia of these bats during all the calendar months of the year is maintained. The present paper embodies observations on pregnancy and ovulation in 17 species of Indian bats.

### OBSERVATIONS

Table I, which gives some details regarding pregnancy of 17 species of Indian bats studied in this laboratory, reveals that all the species except some vespertilionids are monotocous and bear the single young in one of the two uterine cornua during each cycle. The female genitalia are, however, morphologically bilaterally symmetrical. Most vespertilionids studied here

normally carry a young in each of the cornua during each cycle, and it is exceptional when a specimen carries a single foetus in one of the cornua. One specimen of *Pipistrellus mimus mimus* carried three foetuses, two in the right cornu and one in the left. Further, among the monotocous species, whereas the two sides of the genitalia are equally functional in the three megachiropteran species (*Rousettus leschenaulti*, *Pteropus giganteus giganteus* and *Cynopterus sphinx gangeticus*) and *Taphozous longimanus*, there is a distinct physiological dominance of one side of the genitalia over the other side in the other species. Barring exceptional specimens, as a rule only the right uterine cornu carries a single conceptus in *Rhinolophus rouxi*, *Taphozous melanopogon* and *Miniopterus schreibersii fuliginosus*, and the left cornu bears the conceptus in *Megaderma lyra lyra*. One specimen of *Rhinolophus rouxi* among 285 pregnant specimens had an embryo in each of the uterine cornua and one specimen of *Taphozous melanopogon* among 57 pregnant females carried the conceptus in the left cornu and none in the right. Among the hipposiderid bats there is a distinct dominance of the left uterine cornu over the right in carrying the pregnancy, the degree of dominance varying among the different species.