were observed in the cells of pith parenchyma and also in xylem and phloem parenchyma of infected stem (figure 3); no such PAS positive bands were observed in any tissues of uninfected stem (figure 4). The bands present in the pith, xylem and phloem parenchyma were also richly RNA-positive (figure 5). Some of these RNA positive bands were also present in the tracheal elements (figure 6).

Mycoplasma-like organisms are known to disrupt normal translocation process in the diseased plant. In the present investigation the abnormal deposition of starch in the tissue of mycoplasma-affected stem suggests that it is linked with disturbed photosynthesis and energy-mediated transport. This observation also lends support to the earlier work of viral-infected plants[10]. The presence of thick PAS-positive and RNA-positive bands in the stem of affected plant indicates the production of gum-like substance in the cells of pith parenchyma and xylem and phloem parenchyma. The gum is generally considered to be a decomposition product of carbohydrates especially starch, moving into tracheal elements. It is often been described as wound gum showing lignin reaction[11]. Such series of drastic biochemical changes naturally affect the normal translocation path ultimately bringing the degeneration of various tissues which further lead to stunting or cotton stenosis.

20 September 1986; Revised 29 November 1986

1. Capoor, S. P., Pande, P. K. and Sinha, R. C., *Hindustan Antibiot. Bull.*, 1972, **15,** 40.
2. Cousin, M. T., Bschweisguth, A., Faivre Amiot, K. K., Kartha, T. Staron and Morean J. P., *C. R., Acad. Sci. Paris*, 1971, **272,** 830.
3. Kenther, K. K., Cousin, M. T. and Ruegg, E. F., *Indian Phytopathol.*, 1975, **28,** 51.
4. Anantha Padmanabha, H. S., Bisen, S. P. and Nayar R., *Experientia*, 1973, **29,** 1571.
5. Bawyer, J. W., Atherron, J. G., Teakle, D. S. and Aherne, G. A., *Aust. J. Biol.*, 1969, **22,** 271.
6. Doi, V., Teranaka, M., Yora, K. and Asuyama, H., *Ann. Phytopathol. Soc. Jpn*, 1967, **33,** 259.
7. Maramorosch, K., Heitefuss, R. and Williams, P. H. (eds), *Encyclopedia of plant physiology, Physiological plant pathology*, Springer-Verlag, Berlin, 1976, Vol. 4, p. 150.
8. Raju, B. C. and Muniyappa, V., *Phytopathol. Z.*, 1981, **102,** 232.
9. Jensen, W. A., *Botanical histochemistry*, Freeman and Co., SanFrancisco, 1962.
10. Holmes, F. O., *Contr. Boyce Thompson Inst.*, 1931, **3,** 163.
11. Esau, K., *Bot. Rev.*, 1948, **14,** 413.

HABITAT DIVERSITY AND FROND MORPHOLOGY OF TWO CYATHEACEOUS FERNS OF RAJASTHAN

SATISH PADALA and T. N. BHARDWAJA
Department of Botany, University of Rajasthan, Jaipur 302 004, India.

RAJASTHAN ferns occur in diversified habitats ranging from the comparatively drier Haroti plateau plains with lesser rainfall to humid habitats of Aravalli ranges, the highest peak of which is Mt. Abu (height 1727 m), the only hill station in the state of Rajasthan[1-2]. The frond morphology of two Cyatheaceous ferns; *Ampelopteris prolifera* (Retz) Copel, a fern with a prolific presence at Sitabari, Kota division (Haroti plateau plain) and *Dryopteris cochleata* (Don) C. Chr. occurring widely at Mt. Abu is described.

A. prolifera endures characteristic habitat dryness and frequent water deficiency for most of the year while *D. cochleata* happens to grow in a habitat with a rather extended period of humidity and in thickly shaded forest at Mt. Abu. It is relevant to mention here that comparative studies of leaf morphology and anatomy from diverse habitats possesing dissimilar vegation have been routinely carried out in Angiosperms[3-5], but have never been reported in ferns or fern allies.

Fresh fronds of *A. prolifera* from Sitabari (Kota) and *D. cochleata* from Mt. Abu (Sirohi) were fixed in 50% ethanol[3]. Sections of pinna were cut and stained with safranin-fast green combination and also with eosine.

The average thickness in microns of the frond tissue in these two ferns is shown in table 1. It is observed that *A. prolifera* possesses a thick cuticle and a thick palisade with thinner upper as well as lower epidermis, while in *D. cochleata* the cuticle and palisade are relatively thin and both the upper and lower epidermis are thick. *A. prolifera* is thus better adapted to the drier conditions prevailing at Haroti plateau plains whence water-deficit and soil-nitrogen deficiencies contribute further towards physiological dryness. *D. cochleata* with its thin

Table 1 *Average thickness of different tissues of fronds in two Rajasthan ferns* (μ)

	A. prolifera	*D. cochleata*
Locality	Sitabari	Mt. Abu
Cuticle	0.86 ± 0.046	0.67 ± 0.031
Upper epidermis	22.22 ± 0.332	26.21 ± 0.216
Palisade	181.8 ± 0.658	155.39 ± 0.569
Lower epidermis	19.91 ± 0.365	23.45 ± 0.481
Upper + lower epidermis	42.13 ± 1.611	49.66 ± 1.008
Total thickness of pinna	224.79 ± 1.484	205.72 ± 1.045

cuticle and palisade leading to overall pinna thinness (205.72 ± 1.045 μ) is better adapted to humid situations at Mt. Abu where organic humus rather exaggerates the prevailing humidity. The present study reveals that although different genera were used for the investigation, the overall dimensional changes in cuticle, epidermis, palisade and pinna are indicative of physiological adaptations of the Rajasthan ferns to their respective habitats.

Financial assistance by UGC, New Delhi is gratefully acknowledged.

8 December 1986

1. Bhardwaja, T. N., Yadav, A. K. and Gena, C. B., *J. Bombay. Nat. Hist. Soc.*, 1978, **75,** 533.
2. Bhardwaja, T. N., Gena, C. B., Takker, T., Kaur, R. and Wadhwani, C., *J. Bombay. Nat. Hist. Soc.*, 1981, **78,** 639.
3. Bhatt, J. G. and Andal, R., *Proc. Indian Acad. Sci. (Plant Sci.)*, 1979, **B88,** 451.
4. Magitt, M. and Magitt, E., *Bot. Centr.*, 1930, **17,** 223.
5. Shields, L. M., *Bot. Rev.*, 1950, **16,** 399.

CONSTITUTIVE HETEROCHROMATIN IN THE PALM SQUIRREL, *FUNAMBULUS PALMARUM* LINN (MAMMALIA—RODENTIA)

N. V. ASWATHANARAYANA and
S. KRISHNA RAO
Department of Zoology, University of Mysore, Manasagangotri, Mysore 570 006, India.

THE genus *Funambulus* includes 5 species viz *F. pennanti*, *F. tristriatus*, *F. palmarum*, *F. sublineatus* and *F. lyardi*. All the species are distributed in peninsular India and Sri Lanka except *F. pennanti* which is confined to North India[1]. Some karyological data are available for *F. pennanti*, *F. tristriatus* and *F. palmarum*[2–9]. In this communication, G- and C- banding of the chromosomes of *F.p. palmarum* are presented for the first time for the genus *Funambulus* and the karyotypes of the known species are compared.

In this study 12 males and 12 females caught in the environs of the University campus and the outskirts of Mysore (S.W. India) have been used. Bone marrow and spleen were utilized for chromosome preparations applying air-dry method. The technique of Sumner *et al*[10] for G- banding and Sumner's method[11] with a slight modification for C- banding were applied.

All the specimens showed a diploid chromosome number of 46 with an autosomal fundamental number (FN) of 68. The karyotype has 4 pairs of metacentric, 2 pairs of submetacentric, 6 pairs of subacrocentric and 10 pairs of acrocentric chromosomes in graded series. A pair of acrocentrics bear small 'satellites'. The *X* chromosome is submetacentric measuring 5.2% of the haploid genome while the *Y* chromosome is the smallest acrocentric (0.6%) whose identification is unequivocal (figures 1 and 2).

Distinct G- bands are observed in all the chromosomes except in the *Y* chromosome which has a uniform light staining. In the *X* chromosome each arm consists of 2 dark and 2 faint bands. The number of clear bands varies from 1–5 (figure 3). The dark centromeric bands are in 12 acrocentric chromosomes while the bands are light in 4 subacrocentric chromosomes. The rest of the autosomes are devoid of C–bands. In the *X* chromosome the distal region of the long arm is C–positive. The acrocentric *Y* chromosome is almost entirely heterochromatic (figure 4).

The chromosome banding is an essential tool in any cytogenetic studies. Both G- and C- bandings are described for the first time in *F.p. palmarum* of this genus and these are very much wanting in other species for comparison.

The karyotype of *F.p. palmarum* described earlier[8] is essentially similar to the present karyotype except for the submetacentric nature of the *Y* chromosome and for a few structural changes in the autosomes. However, the present karyotype is similar in all the individuals analyzed, hence this is considered as the 'standard' karyotype. But the karyotype of *F.p. bellaricus* (from Pune; S.W