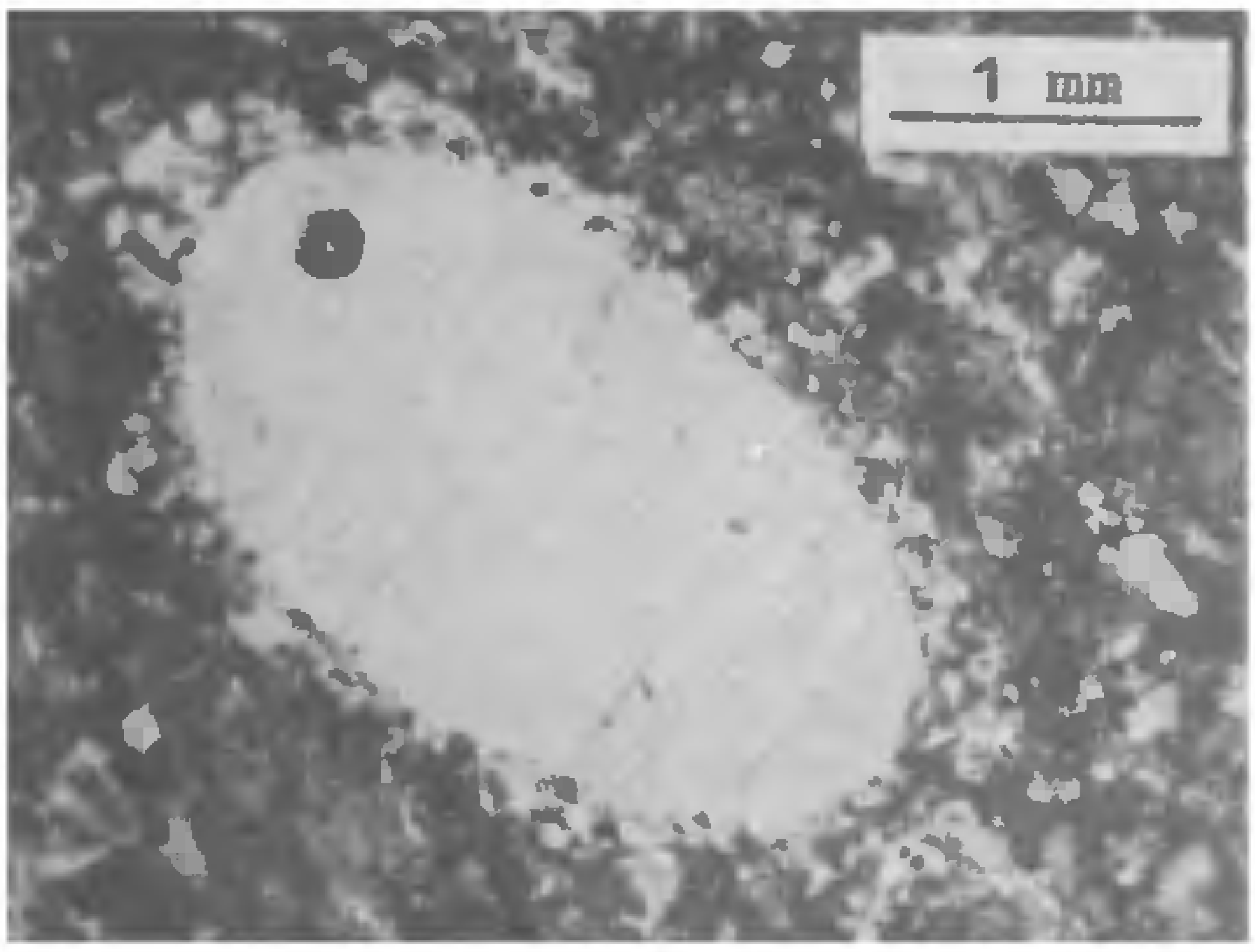

Figure 3. An oval-shaped, single-grain ocellus of orthoclase and marginal granules of orthoclase, amphibole and biotite. Crossed polars.

range of size distribution of ocelli making sharp contacts with the matrix implies their evolution by a slow fall of temperature along the composition–temperature slope of the silicate–silicate liquid immiscibility field through diffusion of various ions within the parental liquid[11].

In the nearby alkaline complex of Elchuru, lamprophyres occur in nepheline syenites, malignites and shonkinites, and the lamprophyres are considered to be comagmatic with the hosts[2,3]. The Kellampalle lamprophyre, however, does not occur in any alkaline rock but is significantly associated with the early formed tholeiitic gabbros, and whether the lamprophyre and the gabbro have any genetic link it is difficult to decide at this stage. The derivation of tholeiitic magma first followed by an alkaline magma, as at Kellampalle, is possibly connected to either heterogeneity, or varying depth levels of melting, within the mantle—obviously, the lamprophyric magma having a relatively deeper source.

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Chemical analysis of a sediment core from Paradip Lake, Orissa and its application to environmental reconstruction for 450 years

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In this paper an attempt has been made to study the palaeoenvironmental changes around Paradip Lake, Orissa on the basis of elemental variations in a 3-m sediment core covering a time span of 450 years. The result shows that there is a marked increase in alkali and alkaline earth metals prior to 290 years BP, indicating a period of intensive soil erosion and biotic activity. This is probably due to unstable landform conditions as a result of poor vegetational cover.

Mackereth[1,2] and Engstrom[3,4] have firmly established on the basis of chemical analysis of lake sediments that chemostratigraphic study can be used to describe the development of ecosystem. Their study has placed chemical analysis in the same category as pollen, diatom or macro-fossil analyses to obtain proxy climate information. The basis for this study is that the concentration and nature of chemical constituents in the sediments are the cumulative effect of both biotic and climatic changes. Any change in environment gets reflected as changes in chemical constituents of sediments both in quantity and type. In India very little study has been carried out on the reconstruction of past environmental changes as reflected in the variations of chemical constituents in the sediments. This paper reports the elemental analysis in a 3-m-soil profile collected near Paradip Lake, Orissa. The reconstruction of environment and landscape condition around Paradip Lake is attempted using the results of the elemental analysis and ^{14}C dates for the profile.

A sediment core from the soil profile at Paradip near

Mahanadi river mouth (lat. *20° 15′:20° 55′N* long. 86° 40′:87° E, Figure 1) was collected using peat Auger by Gupta and Yadav[5] for pollen analytical study. The sediment column is composed of soft clayey silt with organic matter.

Seventeen samples at regular intervals from this sediment core were analysed for chemical constituents. Each sample was separated into three fractions—namely authigenic, biogenic and allogenic components by fractionation techniques described by Engstrom (op. cit.). The concentrations of chemical constituents were measured in each fraction using an atomic absorption spectrometer.

The ^{14}C age measurements of this profile at four intervals have been carried out using standard procedure[6] at the Radiocarbon Laboratory of the Birbal Sahni Institute of Palaeobotany. The ^{14}C dating results are shown in Table 1.

From the ^{14}C age data it can be seen that sedimentation rate was not uniform. There was an abnormal increase in the sedimentation rate between 2.35 and 1.85 m, indicating a period of mass deposition of erosion products which is also reflected in elemental concentration of chemical constituents during this period.

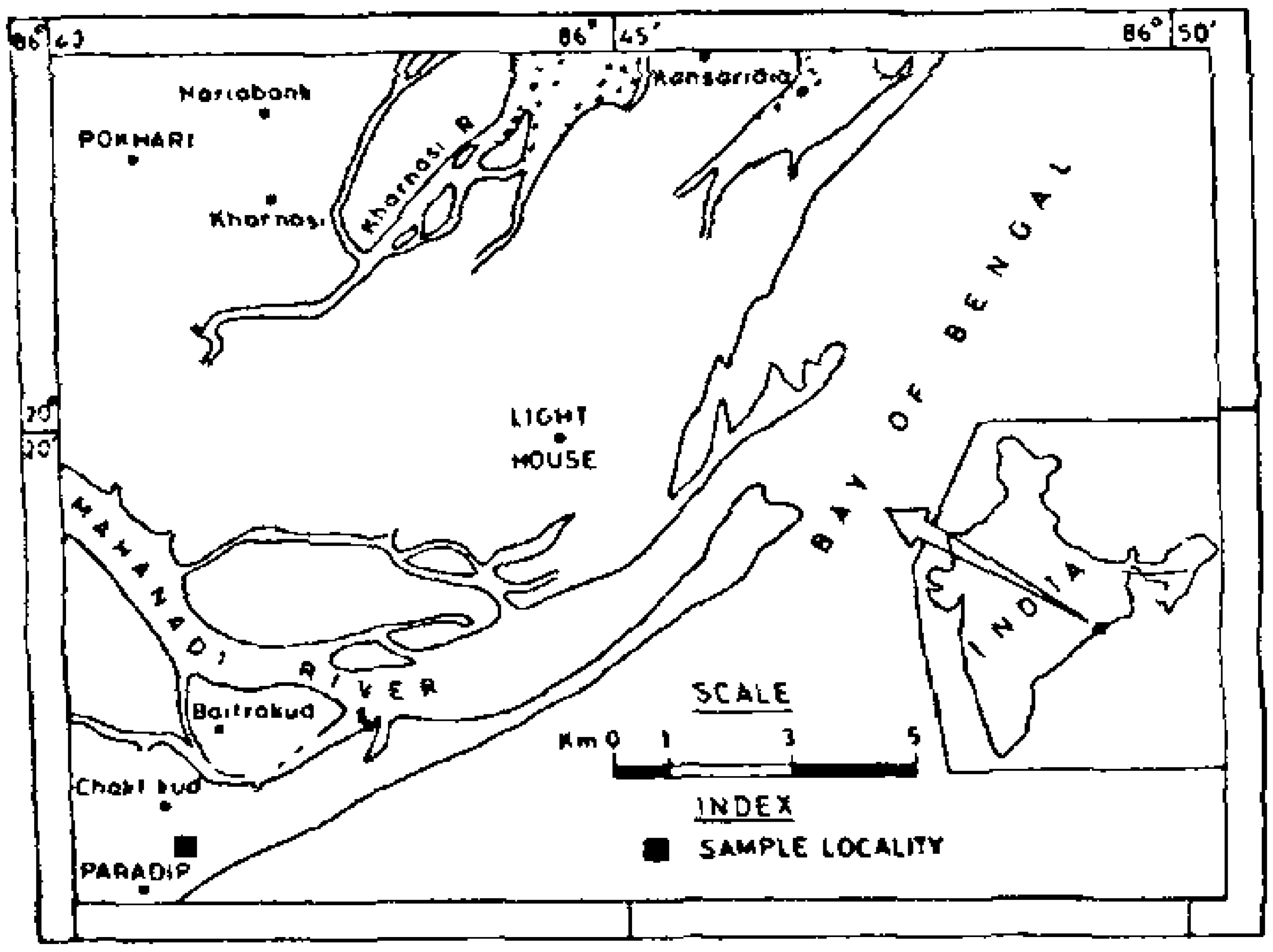

Figure 1. Location map of Paradip Lake, Orissa

Table 1. ^{14}C age results of sediments from Paradip Lake, Orissa.

Sample no. and depth range	Material	^{14}C age and error ($T_{1/2} = 5730 \pm 40$ yrs)
BS-690 2.7–3.0 m	Carbonaceous sediment	450 ± 120 Years
BS-693 2.2–2.5 m	Carbonaceous sediment	300 ± 120 Years
BS-692 1.7–2.0 m	Carbonaceous sediment	290 ± 100 Years
BS-691 1.1–1.2 m	Carbonaceous sediment	Modern

Gupta and Yadav identified four zones in this core on the basis of pollen analysis. The chemical analysis of the core at close intervals also indicates high concentration of Na, K and Mg at these four zones. The palaeoenvironmental reconstruction of Paradip Lake around 450 years inferred from these four zones is shown in Figure 2.

In zone 1, 2.2–3.0 m (representing the time span of 450 yrs BP to approx. 275 yrs BP), the average Na, K, Mg concentrations are 0.75%, 0.76% and 0.08% respectively. This decreased level of chemical constituents indicates relatively stabilized landform conditions with a low erosion rate. This has been supported by moderate mangrove pollen shown by palynological analysis. This corresponds to palynological zone I of Gupta and Yadav[5].

In zone II, corresponding to a depth of 1.7–2.1 m (about 290 yrs BP), there was a marked increase in levels of alkali and alkaline earth metal concentrations. The average Na, K and Mg concentrations are 1.03%, 1.09% and 0.12%. The variation of chemical constituents with time indicates unstable landform conditions due to less vegetation cover resulting in erosive activity. This is supported by a decline of mangrove taxa derived from pollen data by Gupta and Yadav, (op. cit.).

Zone III (0.8 – 1.0 m), dated modern, also shows moderate levels of these metals indicating a favourable environment for mangrove vegetation. The average concentration values for these elements are 0.63%, 1.14% and 0.09% respectively. This corresponds to palynological zone III which was the most conducive environment for the luxuriant growth of mangrove vegetation.

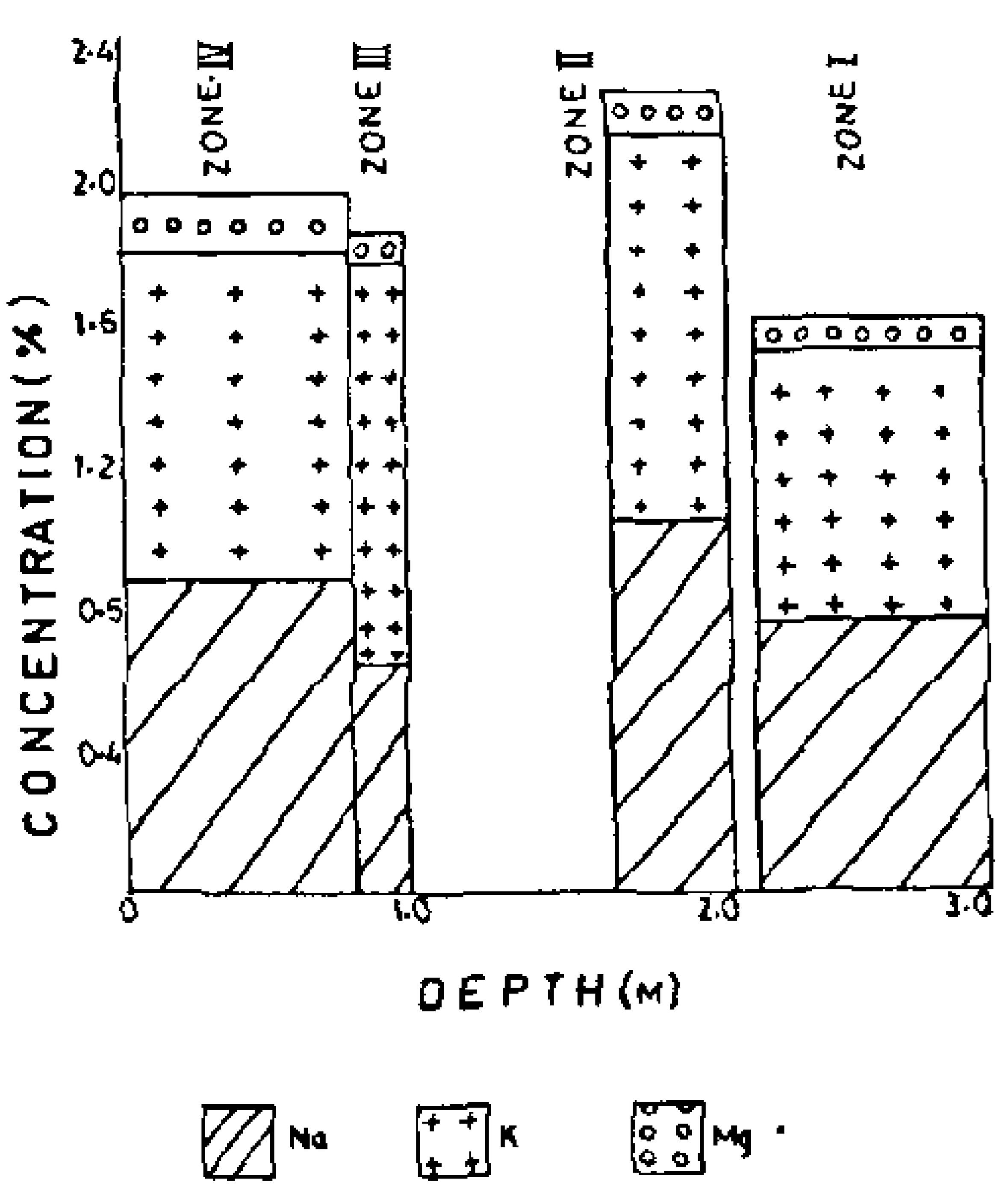

Figure 2. Concentration of Na, K and Mg (allogenic) in a sediment core from Paradip Lake, Orissa.

Zone IV (0.0–0.8 m), dated modern, also shows increased levels of these metals, indicating again an unstable period. The average concentration values of these elements are 0.87%, 0.91% and 0.16%. This is also supported by the sharp decline of mangrove vegetation. The unfavourable landscape condition may have been caused by higher biotic activity (palynological zone IV). Large areas were cleared during 1955–60 for the construction of Paradip port. Its effect was noted by Gupta and Yadav in the palynological analyses of the sediments from Paradip Lake. The decreased percentage of mangrove pollen can therefore be linked to the higher erosion rate from poor vegetational cover.

The environment around Paradip, changed from stable landform conditions around 450 years to unstable landform conditions around 290 years to present time on the basis of elemental variation and mangrove vegetation.

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Comparison of codon usage in genes of plant viruses and their hosts

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A preliminary analysis of plant viral genes was made using all the available 85 viral sequences from GenEMBL database. It is found that in plant viruses and their hosts, amino acids with a high frequency of occurrence have a similar distribution of codons (codon usage profile) within their set of synonymous codons as indicated by the high match coefficient. However, the codon bias indices of the plant viruses with respect to their hosts are low, indicating that the preferred codons of the host are not used often in the plant viruses.

CODON usage in an organism has been thought of as one of the strategies used for regulating gene expression[1,2]. Detailed analyses on the patterns of codon usage in several organisms including bacteria, bacteriophage, yeast, fruitfly, mammalian viruses, man and plants have been reported. However, no information is available till date on the codon usage pattern of plant viral genes. Many viruses capable of infecting a wide variety of plant species are known. Of these, some viruses (e.g. barley yellow mosaic virus) are known to infect only one plant species; while others (e.g. tobacco rattle virus) could infect more than 400 species of plants[3]. As considerable molecular information is available for the plant and the viral genomes, a comparison of codon usage in genes of plants and the plant viruses was made to see if the virus–host relationship can be explained in terms of codon usage. It has been established that monocot and dicot plant genes differ considerably in their codon usage[4]. Recently, Wada *et al.*[5] have shown that the codon usage pattern remains unaltered even when codons from several genes (with varying functions) of an organism are considered in summation. Hence, patterns of the codon usage of predominantly monocot infecting viruses (PMIVs) as a group and predominantly dicot infecting viruses (PDIVs) as another group were compared with those of the monocot and dicot plants respectively. From such an analysis we have attempted to find out whether the codon usage of plant viruses has any role in determining host range.

The 85 plant viral genes included in the sample are from the database GenEMBL (release 24.0). Coat protein genes were primarily analysed here as they are known to be highly expressed[6,7]. The data for codon usage by dicot and monocot plants were from Murray *et al*[4].

Relevant sequences from GenEMBL were extracted using the University of Wisconsin Genetics Computer Group program (version 6.2). Codon usage tables were compiled using the program CODONFREQUENCY from the UWGCG package[8]. The program CODON was developed by us to determine the choice of preferred codons and analyse the correlation between the distribution of codons among codon usage tables.

The codon bias index which determines the level of usage of preferred codons in a gene has been defined earlier[9]. In this study, the same definition of the codon bias index is used. However, the selection of preferred codons is not based on the percentage occurrence of codons within a set of synonymous codons. The significance of a percentage occurrence depends on the number of synonymous codons. For example, 50% occurrence for a codon is not significant when there are only two synonymous codons but can be considered preferred if there are three or more synonymous codons in the set. Hence, we have calculated the standard deviation in percentage occurrence within the set of synonymous codons for each amino acid. Those codons in a synonymous set whose percentage occurrence is above a given cut-off limit times the standard deviation are flagged