water, add 10 ml. of EDTA-ethanolamine reagent and titrate against standard magnesium solution using Eriochrome-Black T indicator. This will give total concentration of magnesium, calcium and strontium.

Transfer one ml. of sea-water sample to centrifuge tube and make up to 4 ml. with distilled water. Add two drops of bromocresol green indicator, two drops of 2N HCl and one ml. of saturated ammonium oxalate solution. Heat in a water-bath to about 90°C and add 2% ammonia drop by drop till the colour has just changed from green to blue. After 10 minutes in water-bath, allow to stand at least four hours at room temperature. Centrifuge and decant the supernatant.

Wash the precipitate once with 2% ammonia and then redissolve by adding three drops of 2N hydrochloric acid, 4 ml. of water and heat in a water-bath. As soon as the precipitate has dissolved, reprecipitate by the addition as before of indicator, ammonium oxalate and ammonia. After heating for 10 minutes in water-bath allow to stand for four hours at room temperature. Centrifuge and wash the precipitate three times with 2% ammonia. After final washing dissolve the precipitate in three drops of 2N HCl. Add 5 ml. of EDTA ethanolamine and titrate against standard magnesium solution using Eriochrome-Black T indicator.

Magnesium in sea-water is calculated from the difference between the first and second determinations. Chlorinity determinations were made by titrating sea-water samples with AgNO₃ as described by Viswanathan et al. The values obtained for Magnesium/chlorinity ratios by titrimetry and Atomic Absorption Spectrophotometry are given in Table I.

### Table I

<table>
<thead>
<tr>
<th>Magnesium/chlorinity ratio by EDTA titration</th>
<th>Magnesium/chlorinity ratio by Atomic Absorption Spectrophotometry</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0708</td>
<td>0.0732</td>
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<tr>
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<tr>
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<td>0.0720</td>
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<tr>
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<td>0.0713</td>
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<td>0.0713</td>
</tr>
</tbody>
</table>

*Values taken from Viswanathan et al.*

From Table I it is seen that the Magnesium/chlorinity ratio is found higher in the Arabian Sea than those reported by Culkin for other regions which range from 0.0663 to 0.0691.

Our thanks are due to Dr. A. K. Ganguly for his interest in the work.

Health Physics Division, S. M. SHAH, Bhabha Atomic Research Centre, Bombay-74 (AS), October 4, 1968.


### SOME LEAF IMPRESSIONS FROM THE KASAULI SERIES OF THE SIMLA HILLS

**ABSTRACT**

Six species of monocotyledon and dicotyledon leaf impressions are described from the suggestive of close proximity of the source rocks and the basin of deposition.

The material which forms the basis of present study was collected by the author from the micaceous sandstone of the Kasauli Series exposed near Banog Grahat (30° 50' 07", 78° 59' 30") on the left bank of the Koshalia river. Plant fossils were also found to occur at the following places:

(i) About 1.5 km. downhill of the Kurar bridge on the left bank of the Koshalia river; (ii) Near Kasauli Water Works on the Kalka-Kasauli bridle path; (iii) Near Kasauli bazar; (iv) Kasauli sandstones exposed at the Dogshai Ridge; and (v) At a number of places between Kumarhatti and Barog on the Kalka-Simla Highway.

Medicott collected some leaf impressions from the Kasauli beds of the type area (Kasauli) which were studied by Dr. Kane. Fiestmantel sketched and described Sabal major Heer from the Kasauli and Murree beds. In a posthumous paper Sahn described angiosperm leaf impressions from the Kasaulis of the type area (Kasauli).
Owing to the poorly preserved nature of the plant fossils it was not possible to make specific identification.

**A. MONOCOTYLEDONS**

*Poacites* sp. (Fig. 1)
The leaf fragment has an entire margin with parallel veins. It is 17 cm. long and 0·8 cm. broad. A depression in the middle (throughout the length) perhaps indicates the presence of midrib.

Specimen Number—PKc-64.

**Remarks.**—The present leaf impression has been described under the genus *Poacites* which includes impressions of grass-like leaves of unknown affinity.

*Palmophyllum* sp. (Fig. 2)
The specimen shown in Fig. 2 represents an impression of a palm leaf more probably that of a part of fan palm. The preserved length is 9 cm., the width 3 cm. towards the apex, while at the base it is 0·5 cm. From the base arise six prominent veins which diverge towards the apex.

Specimen Number—PKc-16.

**B. Dicotyledons**

*Dicotyledon* sp. 1 (Fig. 3)
Only the lower half of the leaf is preserved which is 3 cm. in breadth possessing an entire margin and a prominent midrib. The petiole is 0·7 cm. in length.

Specimen Number—PKc-2 a.

**Remarks.**—The leaf impression is comparable with the one described by Sahni (op. cit.).

*Dicotyledon* sp. 2 (Fig. 4)
The leaf is 11 cm. long, 4 cm. broad and possesses an entire margin. It has an obtuse apex and a cuneate base. It is an oblong lanceolate with a prominent midrib. At one place the lateral veins are also prominent appearing sub-parallel and arise at an angle of about 70 degrees. The distance between the two laterals of the order of 0·5 cm.

Specimen Number—PKc-1.

**Remarks.**—The leaf impression resembles *Dicotyledon* sp. 2 described by Sahni (op. cit.).

*Dicotyledon* sp. 3 (Fig. 5)
The leaf has an entire margin and is 10 cm. long and 2 cm. broad. It is lanceolate with an acute apex. The midrib is seen; other details are not clear.

Specimen Number—PKc-3.

*Dicotyledon* sp. 4 (Fig. 6)

The fossil leaf impression is 5 cm. long, 2·5 cm. broad and has an entire margin. It is elliptic in shape with an acute apex. Midrib well preserved; other details are not clear.

Specimen Number—PKc-4.

Due to poor preservation, the fossil leaf impressions do not afford much towards the reconstruction of the geological history. The organic remains, however, are indicative of the close proximity of source rocks and the basin of deposition. The later fact supports the contention held by the author\(^1\) about the provenance of the Kasauli sediments.

The age of the Kasauli Series is precisely well defined\(^1\) and ranges from Upper Oligocene to Lower Miocene. The age of the fossil flora described in this paper is, therefore, Lower Miocene as the leaf impressions occur
towards the top of the Kasauli Series which attain a thickness of 2,136 mt. in this area. This is in harmony with the view held by Fiestmantel\(^2\) and Sahni.\(^4\)

The author is grateful to Professor P. R. J. Naidu and Professor I. C. Pande for the facilities provided, and to Mrs. S. Sahni, Drs. K. R. Surange, R. N. Lakanpal, U. Parkash and R. Dayal of the Birbal Sahni Institute of Palaeobotany, Lucknow, for extending cooperation.

Centre of Advanced Study R. S. CHAUDHRI
in Geology,
Panjab University, Chandigarh,
July 29, 1968.


\section*{PHENOTYPIC STABILITY OF HYBRIDS AND VARIETIES IN GRAIN SORGHUM}

An ideal variety is one that combines high yield and stability of performance. Stability assumes added importance in breeding dry land crops, the yields of which are subject to climatic fluctuations. Since Finlay and Wilkinson\(^5\) proposed a linear regression analysis of general adaptation, attempts have been made to analyse the stability of performance in crops like barley and wheat.\(^2,6\) Using a model developed by Eberhart and Russel,\(^1\) the stability of performance of two commercial sorghum hybrids CSH-1 and CSH-2, the tall improved local varieties and a recently developed improved variety Swarna, a hybrid derivative, is examined. Stability is described by three parameters, mean yield, regression of mean yield on an environmental index and deviations from regression.

Grain yields obtained under rainfed conditions over a period of five years at 7-12 locations per year, representing diverse environments under which \textit{khari} (July-November) sorghums are cultivated in India over an approximate area of 12 million hectares, are evaluated. The rainfall was normal during the years 1963, 1964 and 1967, while severe drought was experienced at several locations during 1965 and 1966. The grain yields over years and locations fluctuated from less than 200 kg./hectare to over 5000 kg./hectare, thus, providing a representative range of environments. The parameters estimated may, therefore, be expected to provide satisfactory measures of stability.

The stability parameters estimated from this study are presented in Table I. It will be seen that the mean yields of the hybrids are consistently superior under normal and stress environmental conditions over the locals, CSH-1 being superior to CSH-2. The improved variety S. 413 has shown a tendency to outyield CSH-1 under favourable environmental conditions only, a detailed performance of which was presented earlier by Rao et al.\(^7\)

The local checks are consistently low yielding. The size of the regression coefficients for the locals, in general, are lower than the hybrids as well as the improved variety \((b < 1.0)\). Relative to the hybrids, the regression coefficient is greater for Swarna \((b > 1.0)\). Although the average regression coefficients of the hybrids are of similar magnitude and near 1.0, the differences in \(b\)'s are maximum in years where the mean yields are higher as in 1965 and 1967. The deviations from regression are maximum in CSH-2 during 1963 and 1965 indicating that under certain environmental conditions the departure from linearity is substantial for CSH-2. While the high mean yields in the hybrids are associated with larger deviations from linearity, the behaviour of the locals is erratic.

It is often stated that hybrids, in general, are economically feasible in areas of adequate rainfall or under irrigation.\(^8\) The consistency of performance of sorghum hybrids under normal and stress environmental conditions has belied the general belief that the hybrids are for favourable environmental conditions only. CSH-1 appears to be the best genotype that has consistently high performance over several environments. The hybrid CSH-2 and the improved variety Swarna tend to outyield CSH-1 as the environment becomes more and more favourable. The locals are consistently low yielding. The degree of heterozygosity, the diversity in the origin of alleles and the nature of gene action in the material under study could furnish the possible causes for the differential behaviour. The local checks are pure lines selected under low fertility conditions and most of them are late maturing.