various species of *Caesalpinia*, stand distinct on account of the possession of one or more unique chemical characters, which are not shared by all. Thus the anthraquinones are found in *C. gleditschioides*; aucubin compounds (Ehrlich test) in *C. coriaria*; catechol tannins (HCl/Methanol or Isenberg Buchnan's test) in *C. coriaria* besides both the varieties of *C. pulcherrima*; Juglone, a rare napthoquinone in *C. sappan*; leucoanthocyanins (leucoanthocyanin test A) in *C. cacalaco*, *C. gleditschioides*, *C. sappan* and *C. sepiaria*; and methylene dioxy functional compounds (Labat test) in *C. bonducella* and red flower variety of *C. pulcherrima*. The activity of polyphenolase as measured in terms of cigarette and hot water tests is strongly positive in *C. bonducella* and *C. digyna*. The presence of steroids alone as indicated by Salkowski reaction is recorded in *C. cacalaco*, *C. coriaria*, *C. digyna*, *C. gleditschioides* and *C. sappan*. With the development of green colour in the lignified elements, it is inferred that syringaldehyde (syringin test A) might be present in *C. bonducella* and both the varieties of *C. pulcherrima*, while in others it is proved beyond doubt about its absence. *C. cacalaco*, *C. coriaria*, *C. ferrae* and *C. gleditschioides* are found to be tanniniferous taxa.

An artificial key, based on the distribution pattern of some of the above chemical characters is presented below for the identification of the taxa of the present study.

Despite the fact that each of the present species of *Caesalpinia* is distinct in possession of some chemical characters there are several overlapping characters, common to them. A numerical assessment[2] of such similarities is indicative of close phyletic relationship among them.

The authros are thankful to the Director, Botanical Survey of India, Howrah for the permission to collect some of the material and for identification. GN and MR are thankful to Dr M. V. Pattabhiraman for interest and encouragement.

13 December 1983

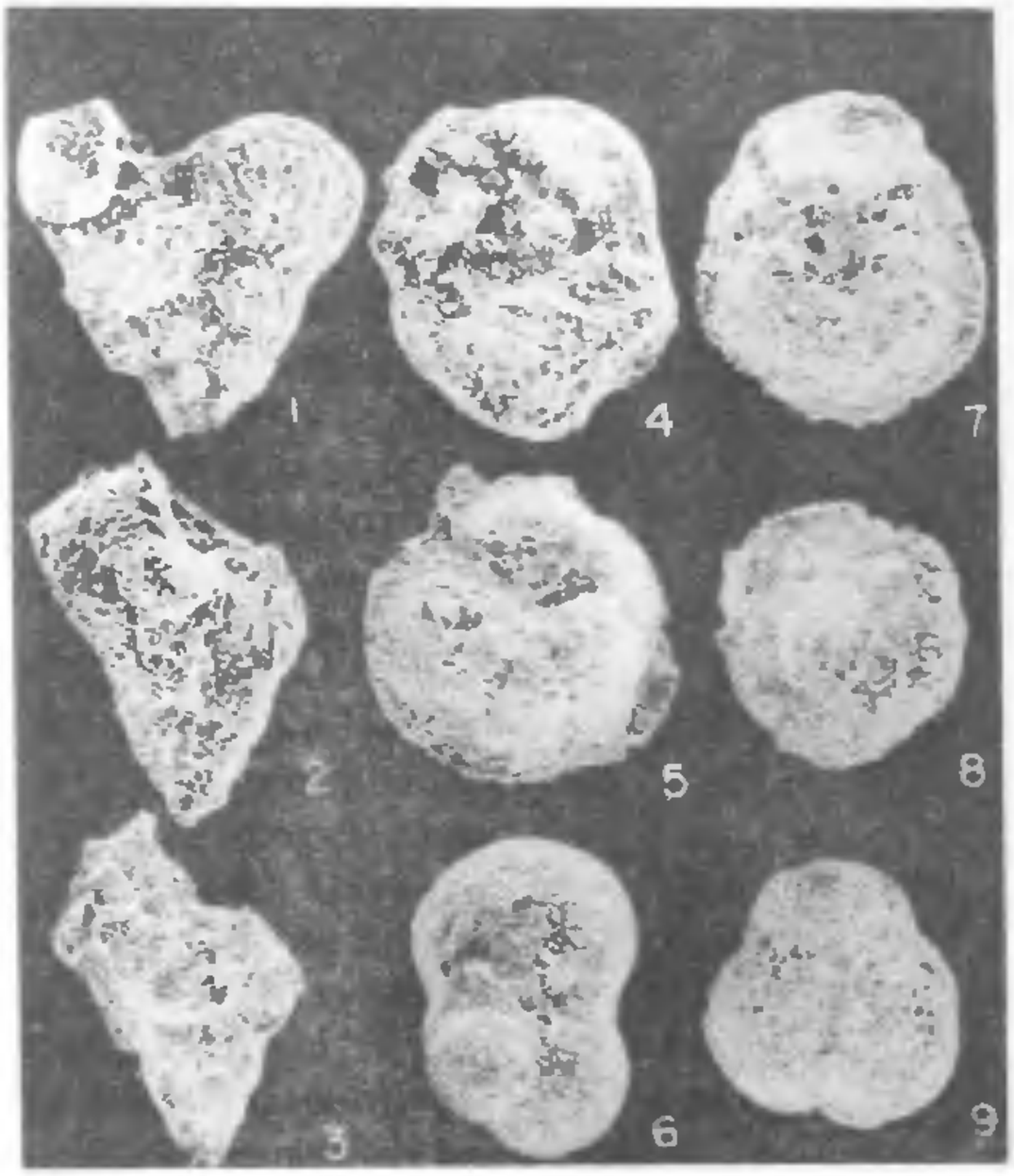
1. Gibbs, R. D., *Chemotaxonomy of flowering plants I–IV*, McGill Queen's University Press, Montreal and London, 1974.
2. Sokal, R. R. and Sneath, P. H. A., *Principles of numerical taxonomy*, W. H. Freeman, San Francisco, 1963.

ON THE AGE OF THE EJECTED MATERIAL FROM MUD VOLCANO OF BARATANG ISLAND, ANDAMAN.

R. M. BADVE, M. A. GHARE and C. RAJSHEKHAR
Maharashtra Association for the Cultivation of Science, Research Institute, Law College Road, Pune 411004, India.

THOUGH the mud volcanoes of Ramri and Cheduba islands were known from the last century[1], Poddar[2] was the first to report mud volcanoes from the Baratang island of the Andaman group of islands and he examined the ejected material for possibility of hydrocarbon around four of them near Wrafter's Creek and considered sediments of south Baratang probably of Eocene and Oligocene age.

More recently Banerjee[3], studying these mud volcanoes, especially of Baratang island considered them as associated presumably, with Baratang Formation (Upper Cretaceous—Eocene). The present authors have visited the two mud volcanoes in south Baratang



Figures 1–9. SE microphotographs. **1.** *Heterohelix striata* (Ehrenberg), **2.** *Heterohelix* sp., **3.** *Ventilabrella glabrata* Cushman, **4.** *Globotruncana monumouthensis* Olsson, **6.** *Globigerinoides quadrilobatus* (d'Orbigny) *trilobus* Reuss, **9.** *Globoquadrina venezuelana* (Hedberg) (Magnification × 266).

island near Jarwa Creek (figure 11) and collected freshly ejected material. The mud volcanoes are cone type effusing through their vents, mainly light grey plastic clays, with saline water, gas and traces of hydrocarbons. The rocks exposed in the vicinity are fine-grained, compact, thinly bedded, brown coloured sandstone with well-preserved trace fossil *Torrowangea* (figure 10).

A moderate calcaricity and assumed marine origin of the plastic clay prompted the authors to examine these samples critically for microbiota. Out of five samples collected from mud volcano no. 1 only one sample yielded the microfossils particularly well preserved foraminiferal tests and small specks of coaly material.

So far the identified foraminiferal assemblage includes both Upper Cretaceous and Early Cenozoic

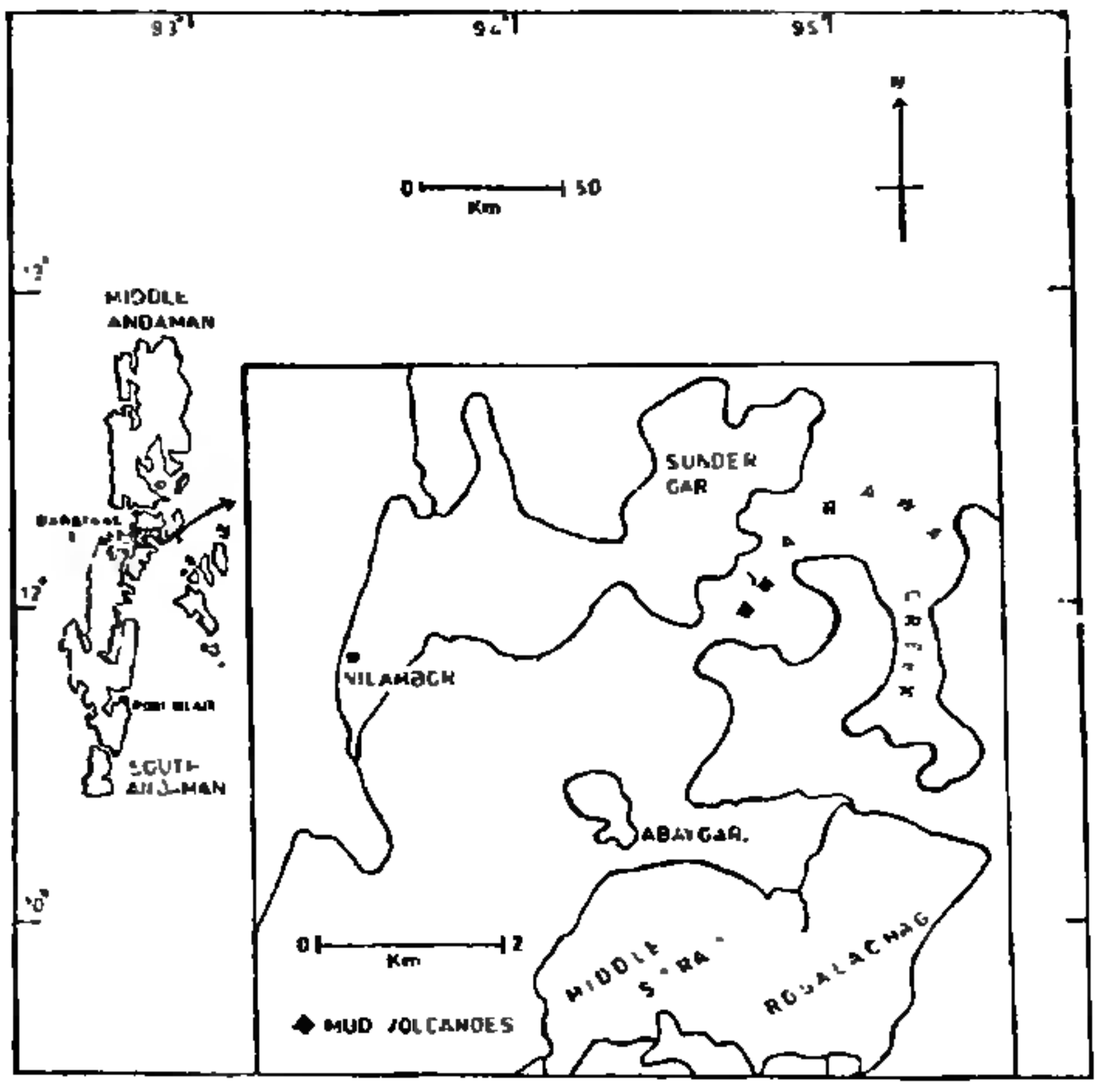


Figure 11. Location map showing mud volcanoes in the inset blown up part of Baratang island (shaded) Andaman.

Figure 10. Trace fossil *Torrowangea* (× 1.4)

foraminiferal elements. The Upper Cretaceous forms comprise *Heterohelix striata* (Eherenberg), (figure 1), *Heterohelix* sp. (figure 2), *Ventilabrella glabrata* Cushman (figure 3), *Globotruncana aegyptiaca* Nakkedy (figure 4), *Globotruncana monumouthensis* Olsson (figures 5, 7, 8). The last two forms are known to occur only during Maestrichtian[4] respectively from Egypt and Texas, (USA).

The most interesting feature of this foraminiferal assemblage is the occurrence of *Globigerinoides quadrilobatus* (d'Orbigny) *trilobus* Reuss (figure 8) and *Globoquadrina venezuelana* (Hedberg) (figure 9). The two planktonic foraminiferal species essentially belong to the Miocene age in Andaman region[5]. Thus the mixture of fauna belonging to two separate ages points out the presence of horizons representing the rocks of Maeshtrichtian and Miocene.

The sandstone exposed in the vicinity of these mud volcanoes will have to be attributed to Miocene age, or perhaps an age even younger than Miocene. The sandstone contains only the trace fossils which have no age determinative value. The initial work on limestones occurring in the south Baratang island has revealed the presence of distinct Late Miocene foraminiferal elements. Thus a critical stratigraphic and faunal studies will be required to understand the obscurely known geology of this region.

Financial assistance from the DST is gratefully acknowledged.

21 February 1984, Revised 17 April 1984

1. Mallet, F. R., *Rec. G.S.I.*, 1878, **2**, 2.
2. Poddar, M. C., *Indian Min.*, 1954, **8**, 251.
3. Banerjee, A., *Indian J. Earth Sci.*, 1975, **2**, 11.
4. Saito, T., Hillman, S., Norman and Janal Martin, J., *Catalogue of Planktonic foraminifera, Am. Mus. Nat. Hist.*, New York, Vol. 6 (1 & 2), 1980.
5. Azmi, R. J. and Srinivasan, M. S., *Proc. IV Colloq. Indian Micropal. Strat.*, Dehra Dun, 1974.

REGENERATION OF DOWNY MILDEW RESISTANT PLANTS FROM INFECTED TISSUES OF PEARL MILLET (*PENNISETUM AMERICANUM*) CULTURED *IN VITRO*.

BHAGYALAKSHMI PRASAD,
M. SATISHCHANDRA PRABHU
and C. SHANTHAMMA*
*Department of Applied Botany and * Department of Botany, Manasagangotri, University of Mysore, Mysore 570 006, India.*

DOWNY mildew of pearl millet caused by *Sclerospora graminicola* (Sacc.) Schroet.—an obligate pathogen, receives much importance in pearl millet cultivation. Much emphasis has been placed on the study of the biology and control of the disease[1], and work on the development of resistant lines to downy mildew through breeding techniques is being continued at the Downy Mildew Research Laboratory in the University of Mysore, India. Selection of resistant cell lines by exposing the host cells to toxins extracted from the concerned pathogens appears to be the most recent and advantageous technique[2–5]. Such selected cultures and even mutated cell lines well screened for resistance frustrate researchers by the lack of regenerability[3]. Exposing the plant cells directly to the pathogen attack, instead of exposing to toxin extract, and further screening for resistant cells has been a new and present approach. An experiment[14] conducted with the explants from mycoplasma-diseased brinjal plant indicated the possibility of obtaining disease-symptomless regenerants through tissue culture, but whether the regenerants were actually disease-free or carried latent infection was not confirmed. So far no attempt has been made to understand the nature of regenerants from obligate fungal pathogen infected tissue. The results obtained were novel and seem to indicate an important breakthrough in the field of plant science.

A genotype of pearl millet susceptible to downy mildew disease (HB_3) was used in the experiment. Diseased immature inflorescence explants (with phyllody—a symptom of disease) served as the source material. Inoculation and incubation were done as explained earlier[6]. The nutrient medium for the growth of the callus as well as the pathogen was standardized earlier[7]. Callus cells were screened regularly to ensure the presence of downy mildew mycelia. For this, a smear preparation with propionohematoxylin was used (1% hematoxylin in a mixture of 4.5 : 5.5 propionic acid : ethanol). Screening for disease resistance was done by sowing the seeds collected from regenerated plants in a sick plot between the rows of diseased plants (the latter 30 days old), because soil borne inoculum has been considered as the most important source of disease initiation[8–10], and also because root, coleoptile and leaves act as excellent sites for infection by zoospores[7] (also results obtained in our laboratory by Subramanya, 1982). The results were compared with control plants raised similarly from seeds collected from diseased plant groups from which the explants for *in vitro* culture were taken. Screening experiment was conducted in three different seasons, *i.e.* February-April, May-July and August-October of 1981.

Callus formation of soft coherent type and also of hard opaque nodular type was observed at least twenty days after inoculation. Younger the explant more was the formation of opaque nodular callus. The latter, upon transfer to IAA (3–5 ppm) supplemented MS medium[11] very rarely differentiated into shoots. However, when the mycelial mat was observed at the surface of the callus, such cultures produced only roots upon transfer to MS + IAA medium. Although some mycelial strands ramified from the callus on to the medium, the pathogen never grew on the medium alone. All the differentiating cultures did not succeed in completing the process. Hence some of the shoots, soon after initiation, degenerated. Some shoots, soon after the onset of differentiation, grew rapidly and produced roots on the same medium. The plantlets thus formed could be reared to maturity in pots. Only four plants could be obtained from infected callus tissue over a period of eighteen months. When dry, the seeds were harvested from the regenerated plants.