Table 1 *Difference between healthy and infected plants*

Characters	Healthy (Average of 20 plants)	Infected
Number of branches per plant	6.0	14.8
Production of shoots from base of the plant	0.5	35.0
Number of grain per capsule	9.5	1.17
1000 grain weight	54.76 g	5.16 g

al shoots with phylloid flowers were used as scion for grafting. The inoculated plants in green house (28–30°C) showed chlorosis with marked reduction in the leaf size. These early symptoms were visible 20 days after inoculation. When the flowers were produced, they were characteristically phylloid. It appeared that when the flowers were partially infected, pod formation was only partial. Based on these symptoms the disease is named as 'Phyllody'.

The disease was artificially induced on a 25-day-old *Vigna sinensis* (Torner) Savi (var. C. 152), *Phaseolus Mungo* var. *radiatus* L. (var. Co 2) and *Sesamum indicum* L. (var. TMV. 3) by side wedge grafting. These crops produced typical phylloid symptoms in 30–35 days. Production of new shoots from closely placed axils due to possible stimulation of axillary buds resulted in crowding of shoots at apical portions, giving a bushy appearance to the plants. The symptoms described on green gram, cowpea, black gram and sesamum are similar to those described by Ramiah and Narayanasamy on cowpea[2] and by Vasudeva and Sahambi on sesamum[3].

The similarity of the symptoms due to the phyllody diseases observed on green gram, black-gram, cowpea and sesamum suggests that the causative agents of the phyllody diseases might be related to each other. To test this assumption cross-inoculation test was carried out. The results indicate that the agents causing phyllody diseases of these crops might be related to each other. The occurrence of Phyllody on green gram has not been reported so far and this appears to be the first record.

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A NEW SPHENOPSID FROM THE BARAKARS OF THE SOUTH KARANPURA COALFIELD, BIHAR, INDIA

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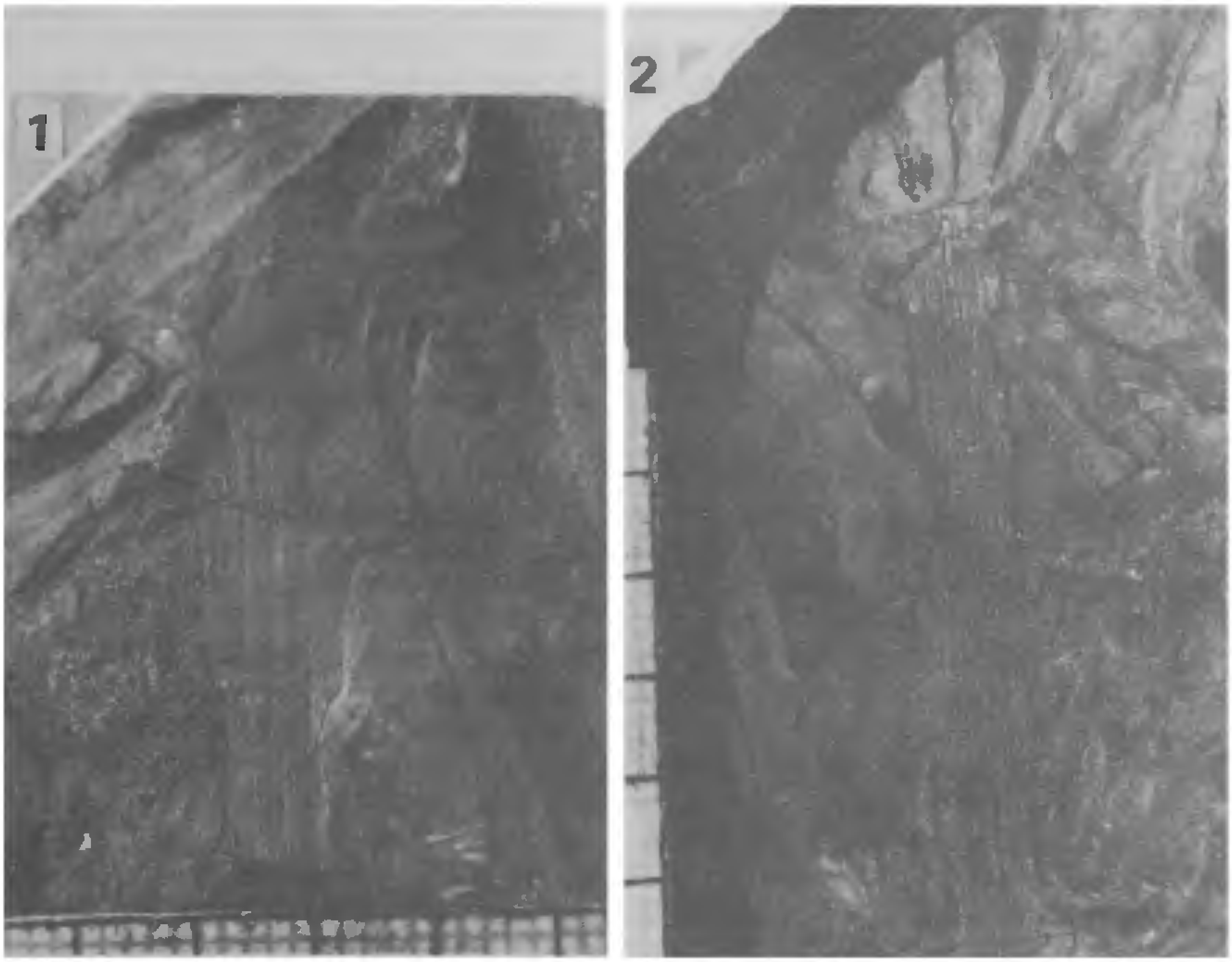
THE Sphenopsida is represented meagrely in the Indian Gondwana flora. The lower Gondwana sediments contain a greater number of genera and species of sphenopsids compared to the upper Gondwana rocks[1]. In the lower gondwanas the following genera are recorded: *Trizygia* Royle (= *Sphenophyllum* Koenig) belonging to the Sphenophyllales and *Schizoneura* Schimper & Mougeot, *Phyllotheca* Brongniart, *Stellotheca* Surange & Prakash (= *Lelstotheca* Maheshwari), *Raniganjia* Rigby, *Barakaria* Feistmantel and the questionable *Diphyllopteris* Srivastava[2] belonging to the Equisetales. The arborescent and hence robust representatives of the Calamitales are said to be absent in the Gondwana flora[1]. Of the equisetalean genera mentioned above, *Phyllotheca* is represented by about eight species, *Schizoneura*, *Raniganjia* and *Stellotheca* (= *Lelstotheca*) by two species each and *Barakaria* and *Diphyllopteris* by one species each.

During a fossil collection trip to the South Karanpura coalfield in Bihar some years ago, the present author collected from the Barakar sediments near Argada Colliery, several fragments of a sphenopsid that do not fit the description of any of the lower Gondwana sphenopsid species mentioned above. The leafy plant fragments are preserved as an overlapping tangle of impressions on hard shale of a light grey colour. The whorl of leaves at each node of the stem forms a cup-like sheath at the base (figure 1) and the linear, free distal parts of the leaves are as much as 6–8 cm long and about 3–5 mm wide. There are about 6–8 leaves per node (only 4 in some), though only half this number are visible at any one place in the impressions. The leaves show a strong unbranched midrib, and in some places, the characteristic transverse wrinkling on the lamina reported in *Barakaria*[3] and *Stellotheca*[4]. The leaf-bearing axes are about 5 mm in



Figures 1 and 2. 1. A node with leaves forming a cap-like sheath (×2.5). **2.** Part of an axis showing ridges and furrows running contiguously in the successive internodes (×2).

width and show the characteristic ridges and furrows that run contiguously (without alternating) in the successive internodes (figure 2). There are also leafless fragments of the stem that are as much as 3 cm wide found in association with the leafy fragments.

This new sphenopsid shows some similarity to *Stellotheca robusta* Surange & Prakash, but the longer and wider leaves forming a cup-like sheath at the base are features that are unknown in *Stellotheca*. Hence, the present author is inclined to treat this as a new species of that genus and name it *Stellotheca surangeii* sp. nov. in honour of the well known Indian Palaeobotanist Dr K. R. Surange who instituted the genus *Stellotheca* with Gyan Prakash in 1962[5]. A fuller description and diagnosis of this new species with amended diagnosis of the genus is being given elsewhere.

Incidentally, *Stellotheca* (= *Lelstotheca*) has been known for a long time only from the Barakar sediments around Rajmahal hills in Bihar[1,4]. This is the second report of the genus outside that area. Also, a sphenopsid with such robust leaves is being recorded for the first time in the fossil flora of the South Karanpura coalfield. It is thus apparent that robust sphenopsids of *Stellotheca* type were quite prevalent in the lower Gondwana Barakar times and a recent report[6] of this genus from the Barakars of Raniganj coalfield, W. Bengal, testifies to this point further. The climate of Barakar times must have been conducive for the growth and support of arborescent members of sphenopsids.

The fossil specimens of this sphenopsid, numbering over 25 pieces of shale, are code-numbered and preserved in the private fossil collections of the author housed now in the Laboratory of Palaeophytology, Madras Christian College.

The author thanks the authorities of Coal India Ltd. for the physical assistance provided during his field trip to the South Karanpura coalfield in February–March 1978 and also wishes to place on record his gratefulness to late Dr K. M. Lele of the Birbal Sahni Institute of Palaeobotany, Lucknow, for preliminary discussions on the subject. Thanks are also due to Dr K. R. Surange for going through this paper and for agreeing to the use of his name for the specific epithet.

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SCIENCE NEWS

SEVERE ACCIDENTS

Utilities worldwide are paying increasing attention to operator training, with emphasis on enhancing operators' ability to recognise abnormal plant conditions — especially slowly evolving small leaks or transients, which are much more likely to occur than potentially more severe accident sequences such as those triggered by major pipe breaks.

The underlying thinking is that slavish adherence to the rule book can sometimes lead operators into error. The TMI-2 accident was triggered by equipment failure of a type which *had* been considered in earlier safety reviews, and for which operating procedures to shut the reactor down safely *had* been devised. But the operators did not correctly understand what was happening, adopted procedures which turned out to be "wrong", and thereby compounded the severity of the accident.

Much the same thing happened at Chernobyl, although in that case the operators did of course depart from the rule book. They did not understand what was happening. But it began with a slowly-developing chain of events which culminated in a catastrophe.

At the post-accident review conference, convened by the IAEA in Vienna in August 1986, the Soviet authorities presented data on the cause of the accident and its consequences within the Soviet Union. After that meeting, the IAEA's International Nuclear Safety Advisory Group (INSAG) presented an analytical summary report concluding, inter alia, that the accident represented "almost a 'worst case' in terms of the risks of nuclear energy." INSAG noted that there had been at least three accidents involving power excursions in reactors before Chernobyl (NRX, EBR-1 and SL-1), and went on:

As described by the Soviet experts and discussed in detail among the experts, the accident was caused by a remarkable range of human errors and violations of operating rules in combination with specific reactor features which compounded and amplified the effects of the errors and led to the reactivity excursion.

There is no escaping the conclusion that however well-trained and for whatever reason, operators have made and will make mistakes. What then can be done to prevent severe accidents? INSAG have recently produced a document outlining *Basic Safety Principles for Nuclear Power Plants*, which promotes the establishment of a "safety culture" to motivate all parties to achieve excellence.

All this forms background to the convening of a symposium on severe accidents — defined as those resulting in significant core damage — held in Sorrento, Italy, in March this year. It was co-sponsored by the IAEA and by the Nuclear Energy Agency of the OECD, and was hosted by the Italian National Commission for Nuclear and Alternative Energy Sources. More than 300 nuclear power plant operators, engineers, industry officials and government representatives, from 35 countries and three international organizations, took part.

The key role of the operator was stressed repeatedly. A. M. Bukrinski and V. A. Sidorenko, from the USSR State Committees for the Utilization of Nuclear Energy, and Safety, for example, stressed the importance of INSAG's *Basic Safety Principles*, terming them "a qualitatively new conception of modern safety philosophy."

They argued that "it has ultimately become clear that design basis accident orientation is insufficient for reaching the highest level of safety... Human factor duality is once more revealed: on the one hand as a source of unpredictable mistakes, and on the other hand as the main figure in crisis situation management." The *Basic Safety Principles* and their possible implementation were further discussed at a special panel session in the course of the symposium.