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WELTRICHIA (MALE *WILLIAMSONIA*) FROM THE BOREHOLE SAMPLES OF MALDA, WEST BENGAL, INDIA

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WHILE studying the bore hole samples of Malda in West Bengal, two interesting specimens of bennettalean male 'flower' at a depth of 214 m below the surface were recently found.

Drilling operation was taken up in Malda district to prove the existence of Gondwana formations below the alluvial cover and, upto 1972, four bore holes were drilled in Milki (MK-1), Mathurapur (MR-1), Bankipur (BK-1) and Ratua (RT-1) (figure 1). In the MK-1 bore hole, Gondwana sequence is met with below an alluvial cover of 92 m. Traps and intertrappeans similar to the Rajmahal area were encountered upto a depth of 410 m. The present specimens come from the intertrappean beds between volcanic flows IV and V. The associated flora at this level comprises *Taeniopteris spatulata* McClelland and *Ptilophyllum* spp.

The bore hole data suggest that Malda basin is the eastern continuation of the main Rajmahal basin with a probable fault in between, along the channel of the river Ganga. Out of 14 flows in the type area, the bottom eight flows of traps are encountered in the

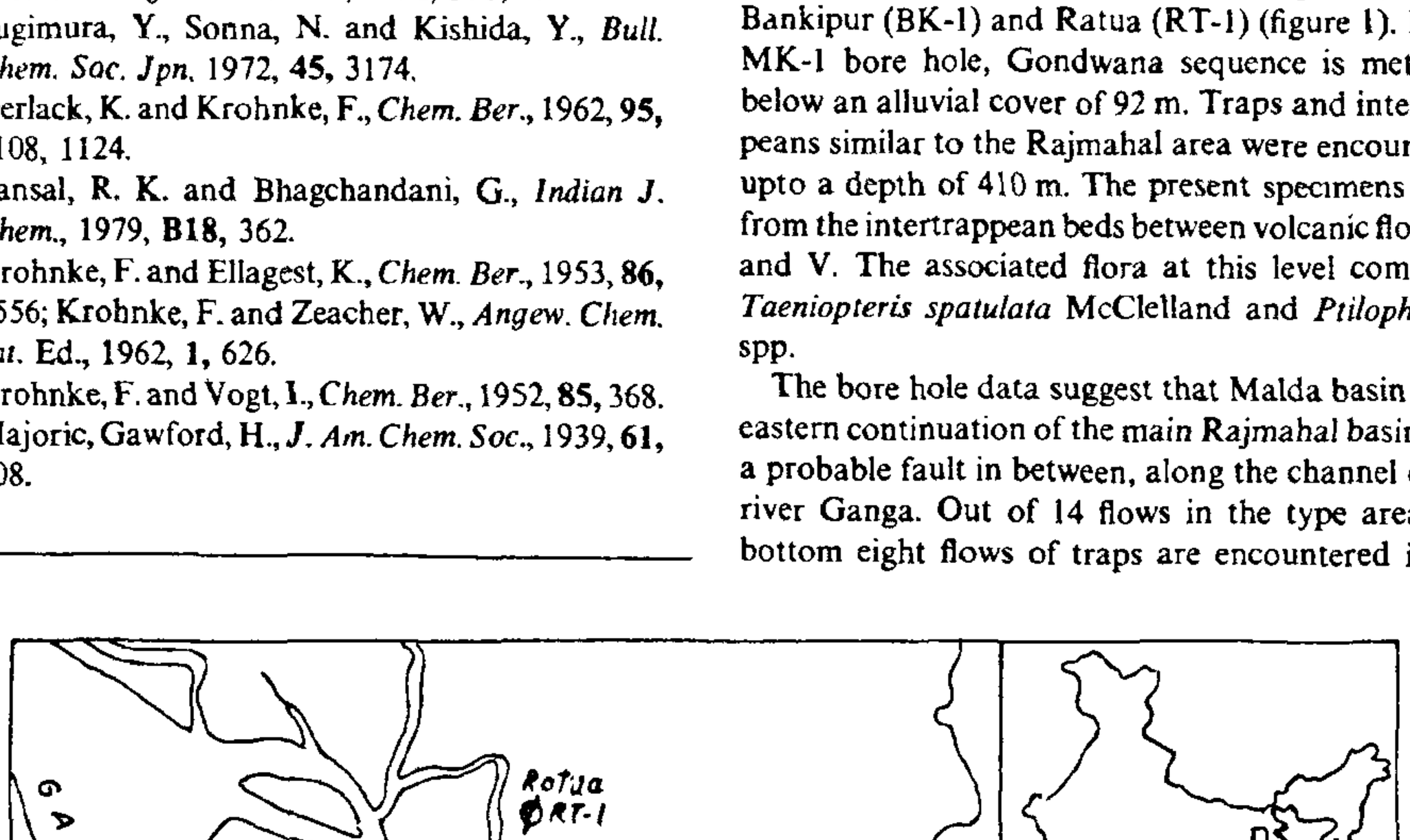

Figure 1. Showing the drilling operation in Malda district.

southern part of the Malda basin as seen in bore hole MK-1. The generalised sequence of the concealed Malda basin is given in table 1.

The fructification occurs as a compression fossil in brownish ash beds (figure 2). Eight microsporophylls are seen in a half flower coalescing towards base. These are upto 2.5 cm long and 0.5 cm wide (slightly broader distally). Segments are concave, the distal end which is obtusely rounded is warped upward and often broken; small circular projections are laterally aligned on either side of each segment of microsporophyll; the arrangement of these circular projections resemble pollen-bearing organs (figures 2 and 3; a few circular projections are encircled by black dots in the right hand side of figure 2). However, no pollen could so far be recovered.

Similar whorls of bennettitalean microsporophylls were earlier referred to *Williamsonia*, the name proposed by Carruthers[1] in 1870. However, Braun[2] had already described a similar whorl of microsporophylls as *Weltrichia* in 1847. Bose[3] suggested that all bennettitalean male 'flowers' should be referred to *Weltrichia*. Harris[4] also points out that *Weltrichia* has priority over *Williamsonia* (used for male or female

Table 1 *Generalised stratigraphic sequence of Malda basin.*

Formation	Description	Thickness (M)
Alluvium	Surface soil, clays, loose sands & pebbles	92
Flow VIII	Basaltic trap	58.34
Intertrappean	Carb. Shale, Lignitic coal	0.54
Flow VII	Basaltic trap	11.88
Intertrappean	Sandy shale, carb. shale,	24.14
	Tuff & Carb. shale	33.33
Flow VI	Doleritic at core	9.67
Intertrappean	Siltstone & shale	0.84
Flow V	Basalt with vescicles	7.38
Intertrappean	*Shale with coal bands	3.62
Flow IV	Basalt and doleritic	28.03
Intertrappean	Shale and siltstone	0.72
Flow III	Basaltic with chilled margin & doleritic core	135.10
Intertrappean	Ash beds with carb. shale	16.04
Flow II	Basaltic rocks with vescicles	0.45
Intertrappean	Tuff & shale	1.15
Flow I	Basaltic rocks	2.94
	Unconformity	
Infratrappeans	Mottle clays, chocolate clays & shales, green & grey sandstones, calcarous at places.	581 - 1158

* Level where the present specimens occur.

Figure 2.

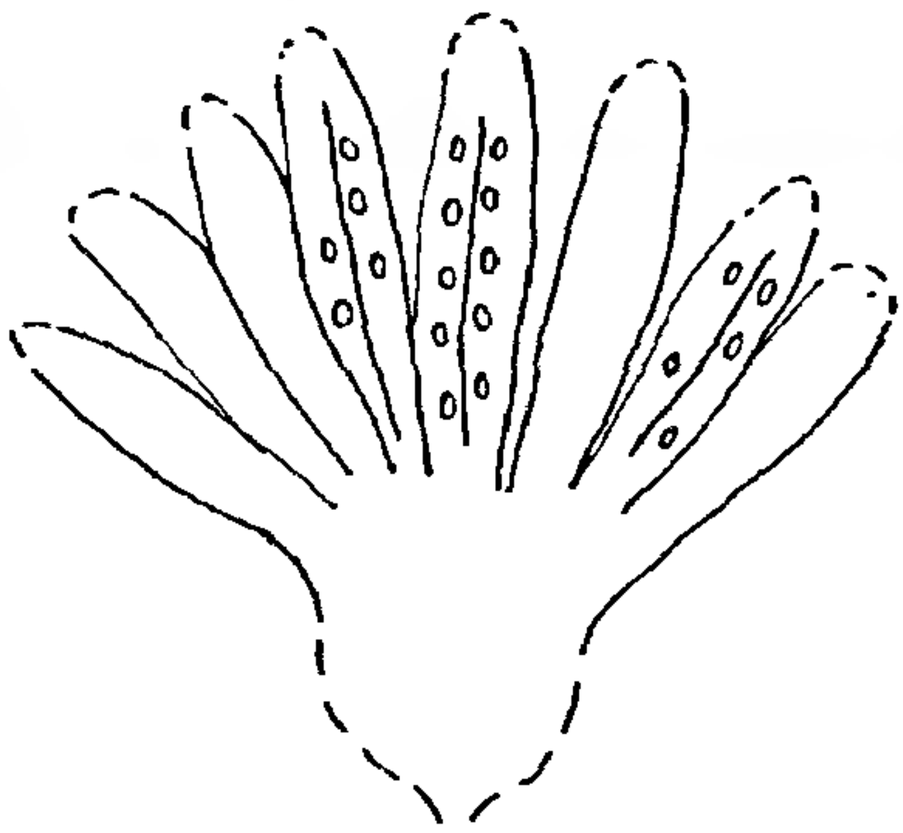

Figure 3.

flowers) and he prefers to use *Weltrichia* for the male flowers only and keep *Williamsonia* for the female ones. This approach is followed by the present authors pending decision if it conforms with the spirit of the code.

The present specimens agree with the initial description of Braun[2] and the emended diagnosis for *Weltrichia* given by Harris[4]. Only three species of *Weltrichia* are so far known from the Indian subcontinent, all from the Rajmahal area in Bihar[3,5]. Of these, *W. santalensis* Shitholey and Bose has 20 microsporophylls and thus differs from the present material. The other one, *W. singhii* Bose differs from the present specimens by having fewer (only 12) microsporophylls[3]. In *W. polyandra* (Ganju) Shitholey and Bose, the microsporophylls are thicker and longer

than in the present specimens. *W. setosa* (Nathorst) and *W. mirabilis* Braun possess 20 microsorophylls in a whorl[4]. *W. whitbiensis* (Nathorst) of the Yorkshire Jurassic flora[4] and also occuring in West Malaysia[6] looks very similar to the Malda specimens and have almost similar number of segments (13–16), but differs from the present materials by having segments which are shorter in length. As such, the present specimens with distinctive characteristics are designated *Weltrichia maldaensis* sp nov; the specific epithet being after the locality where the fossil comes from.

Chandra and Ghosh[7] published the palynological details of the Milki bore hole. They described several pteridophytic spores and gymnospermous pollen grains from samples between 110 m to 254 m levels and suggest that these are comparable with the Rajmahal flora of Upper Jurassic age. Almost all other records of *Weltrichia* are Upper Jurassic in age. The present finding of *W. maldaensis* in the subcrops of West Bengal is in conformity with the palynological results.

We thank the Director General and the Sr. Dy. Director General, Geological Survey of India for their kind permission to publish this account.

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JUVENOID ACTIVITY IN EXTRACTS OF CERTAIN PLANTS

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IN 1961, Schmialek[1] discovered a juvenilising substance in the excrements of *Tenebrio molitor* and identified it as farnesol which is a component of the essential oils of certain plants. When he treated insects with farnesol itself, he found that it showed very low but distinct juvenile hormone-like activity. Four years later, Slama and Williams[2] discovered that the paper used in certain American newspapers contains a factor which mimics juvenile hormone in respect of its effect on insects. This well known "paper factor" was later traced in the wood of balsam fir from which the paper pulp is produced[2,3]. About the same time, Nakanishi *et al*[4] reported the occurrence of a moulting hormone substance in the evergreen plant *Podocarpus nakai*. Moulting hormone substances have been discovered in several ferns and other plants also.

In view of the suggestion of Williams[5] that juvenile hormone mimics may be used as third generation pesticides to control insect pest populations and the above mentioned examples showing that hormonally active substances occur in plants, there has been a search for insect growth regulators in plants. Stall[6] assayed a large number of ever green plants for juvenoid activity, using impregnated paper discs for contact with *Dysdercus* nymphs but obtained more or less negative results with all the plants tried. In fact, the extract of the wood of the balsam fir *Abies balsamea* also did not give him positive results. On the contrary, Tarnepol and Ball[7] reported that out of 48 species of flowering plants which they assayed on *Tenebrio molitor* pupae, five showed limited juvenoid activity. Saxena and Srivastava[8,9] also reported strong juvenoid activity in *Iris insata* and *Tagetes minuta* against *Dysdercus cingulatus*.

The occurrence of insect growth regulating substances in plants is evidently related to their metabolic activity and physiological state which may differ from season to season, place to place and in different parts of the same plant. In view of the potential which insect growth regulators of plant origin possess for pest control, it appeared worthwhile to undertake a survey of Indian plants for the presence of juvenoid activity. In the present communication, the results of the bioassay of extracts of 20 flowering plants is being reported, using *D. cingulatus* as the test insect.

Shade dried plant material was soxhlet extracted with petroleum ether (B.P. 40–60°C). The extract was filtered and evaporated under reduced pressure. The residue was extracted with acetone and the acetone extract was concentrated at room temperature under reduced pressure. The residue was redissolved in acetone and 1 μl of this solution containing 500 μg of the residue was topically applied to the dorsum of the early 5th instar nymphs of *D. cingulatus* with the help