BOTRYODIPLODIA THEOBROMAE PAT A PATHOGENIC FUNGUS CAUSING LEAF-SPOT ON JACK FRUIT LEAVES

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A LEAF-SPOT disease of *Artocarpus heterophyllus* Lamk (jack fruit) incited by a species of the form-genus *Botryodiplodia* Sacc has been reported which is a new record[1].

Leaf-spots are light to grey brown with dark brown margins, irregular outlines and occurring anywhere on the lamina. Minute punctiform pycnidia are seen on both sides, but more on the bottom side of the leaves. This pathogen was isolated from the infected leaves on potato-dextrose-agar medium. A single conidial transfer was carried out after the tissue segments were surface-sterilized. Colonies are white at young stage, turning olive grey to dark olive grey with age. The hyphae are broad, septate and hyaline when young. Pycnidia are gregarious, black, erumpent, globoid to irregular, occasionally ostiolate, measuring 135.0–398.5 × 100.0–315.0 μ with an average of 286.8 × 217.5 μ. The young pycnospores are hyaline and one-celled, becoming dark-coloured and bicelled at maturity. The spores are oblong to ellipsoidal and measured on an average 28.0 × 10.9 μ.

The germ tube or the primordial mycelium appears as a small protuberance from any portion of the spore between 4 and 5 hours of soaking. Sometimes two germ tubes, one each from the two cells of the septate spore, are formed.

Pathogenicity of the fungus by spraying a spore suspension on young leaves of jack fruit yielded typical leaf spot symptoms in about eight days. Re-isolations of these spots on PDA plates yielded colonies of the fungus. It tallied with description of *B. theobromae* given earlier[2,3]. The culture of this fungus has been deposited at the Indian Type Culture Collection, IARI, New Delhi.

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EFFECT OF SOWING ORIENTATIONS ON THE GERMINATION OF PINE SEEDS

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THE seed sowing technique have attracted much attention in recent years for their role in optimum recovery and vigorous production of the planting stock. Donald[1] reported direct sowing as an established technique for *Pinus radiata*. On the other hand, Thapliyal[2] maintained that seed orientation in chir pine has a pronounced effect on the emergence of the upright seedlings and is of considerable importance in the sowing programme.

The present experiments were set up in plastic pails (20 cm diameter), under natural conditions. The germination medium consisted of autoclaved soil-sand mixture in equal proportions.

The seeds were surface dressed with Dithane M-45 fungicide, for 10 min before sowing. These were arranged in the following orientations in three replicates of 40 seeds each: (i) broadcast (O), (ii) horizontal or flattened (O_1), (iii) vertical micropylar end upwards (O_2), (iv) vertical micropylar end downwards (O_3), (v) micropylar end upwards at 45° (O_4) and (vi) micropylar end downwards at 45° angle (O_5; figure 1). Observations were recorded on germination, on the seventh day and continued daily up to 30 days. Final counts of seedlings were taken only after the cotyledons became free and the seed coat had been cast off.

The data given in table 1 show that the germination percentage was highest in treatment category of vertical micropylar end upwards (O_2) and lowest in those with micropylar end downwards (O_5) at 45° angle. This trend was observed in all the four pine species studied. However, in the treatment O_2, the mortality was highest as compared to the other treatments and ranged from 45–56% in *Pinus caribaea*, *P. kesiya* and *P. patula* and merely 17%, the lowest of all, in *P. oocarpa*. The highest survival of seedlings was observed in the treatment horizontal or flattened (O_1) position, though a similar trend was obtained in the treatment vertical micropylar end downwards (O_3) and vertical micropylar end upwards at 45° (O_4) wherein the mortality was also appreciably low. The broadcast method, however, as reflected in treatment (O) resulted in a comparatively low germination and

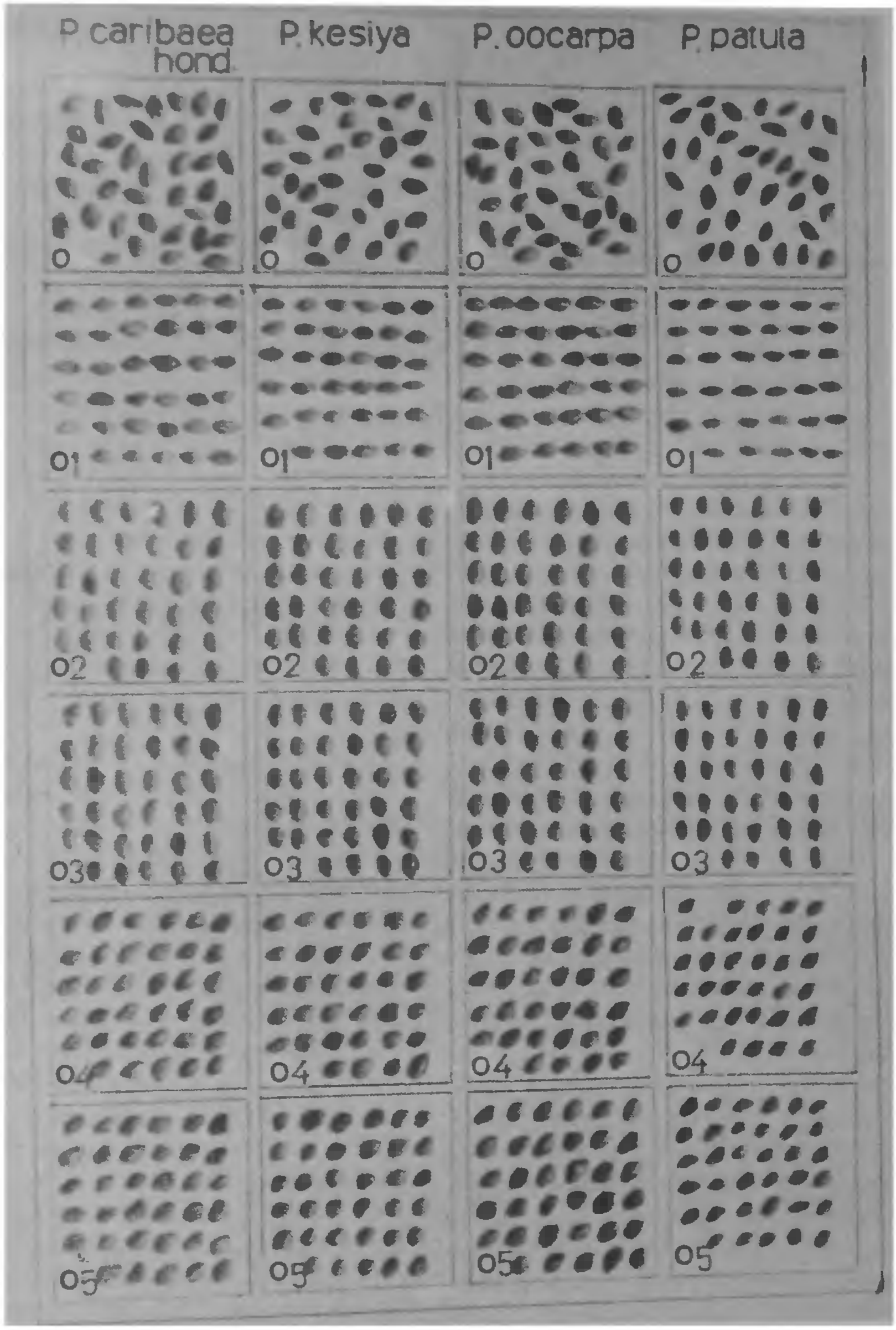

Figure 1. Outline of various sowing orientations (O, Broadcast; O_1, horizontal; O_2, vertical, micropylar end upwards; O_3, vertical, micropylar end downwards; O_4, micropylar end upwards at 45° angle; O_5, micropylar end downwards at 45° angle) in four species of *Pinus*.

survival. It may, therefore, be concluded that better germination and survival can be obtained by sowing seeds in horizontal position.

Pines are characterized by epigeal germination. In this type, the cotyledons enclosed within the seed coat are carried above the soil by the expanding hypocotyl which at first forms an arch and then straightens out into an erect seedling. Among the various factors which influence the development of embryo during germination, phototropism and geotropism are very

Table 1 *Effect of sowing orientations on the germination of pine seeds.*

Species	Orientation	Germination	Mortality	Survival %	Significance
Pinus caribaea (hond.)	O	52.50	19.05	80.95	*
	O_1	75.00	3.3	96.70	***
	O_2	77.25	54.84	45.16	*
	O_3	75.00	3.33	96.67	***
	O_4	67.50	3.70	96.30	**
	O_5	47.50	10.50	89.50	*
P. kesiya	O	47.00	6.67	93.33	*
	O_1	70.00	N	100.00	***
	O_2	75.00	45.83	54.17	*
	O_3	62.00	N	100.00	***
	O_4	60.00	8.33	91.67	**
	O_5	42.50	11.77	88.23	*
P. oocarpa	O	75.00	13.33	86.67	*
	O_1	80.00	N	100.00	***
	O_2	87.50	17.14	82.86	*
	O_3	82.50	3.33	96.97	***
	O_4	77.50	3.22	96.77	**
	O_5	70.00	9.32	90.62	*
P. patula	O	42.50	11.76	88.24	*
	O_1	60.00	N	100.00	***
	O_2	62.50	56.00	44.00	*
	O_3	59.00	N	100.00	***
	O_4	60.00	8.7	91.30	**
	O_5	32.50	15.38	84.62	*

O, Broadcast; O_1, Horizontal; O_2, Vertical, micropylar end upwards; O_3, Vertical, micropylar end downwards; O_4, Micropylar end upwards at 45° angle; O_5, Micropylar end downwards at 45° angle; *poor survival %;** good survival %; *** very good survival;

important. Moreover, the movement or orientation of the developing seedlings is in response to gravity or light which are mediated through a delicate balance of phytohormones. The effect of sowing orientations in the seed bed is to subject the hypocotyl-radicle axis of the embryo to different intensities of gravity stimulus on the plumule-radicle axis in a diametrically opposite direction. Thapliyal[2] emphasized that the response to stimulus varies among the populations of seed and he related the phenomenon to the inherent vigour. Bennet-Clark *et al*[3] suggested that the inversion of seedlings might bring about abnormal chemical or physiochemical changes and the manifestation of these changes are abnormal morphological developments at the collar of the seedlings, exhibited by the erratic behaviour of seedlings resulting in mortality.

In the broadcast sowing, the seeds usually attain horizontal orientation and mostly lie flat. Depending upon the soil texture, however, the possibility that seeds attain other orientations, i.e. vertical (micropylar end upwards or downwards), upright or at an angle of 45° cannot be excluded. In horizontal and vertical orientations (micropylar end downwards), the seedlings showed a healthy appearance and had no deformities at the collar. The vertical (micropylar end upwards) orientations, however, showed high mortality due to specific contortion at the collar of the seedlings (figure 2). The contortion in turn is formed due to the faulty emergence of the radicle and hypocotyl above the soil, subsequent to re-entry in the soil as a result of the geotropic effect. In the other types of orientations also, in general, a similar type of mortality occurs in the seedlings.

The study reveals that the seedlings without deformities and in large numbers can be obtained by adopting correct seed sowing orientation. The findings have special relevance in experimental test situations where the individual seed is sown as in the case of direct sowing practices or where every seed is expected to yield a seedling due to preciousness of the material or

Figure 2. A comparative analysis of the influence of various sowing orientations (O, broadcast; O_1, horizontal; O_2, vertical, micropylar end upwards; O_3, vertical, micropylar end downwards; O_4, micropylar end upwards at 45° angle; O_5, mycropylar end downwards at 45° angle) in four species of *Pinus*.

1. *P. caribaea* hond. 2. *P. kesiya*. 3. *P. oocarpa*. 4. *P. patula*.

limited availability of the seed.

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AN ABNORMAL *LYCOPODIUM PHLEGMARIUM* L.

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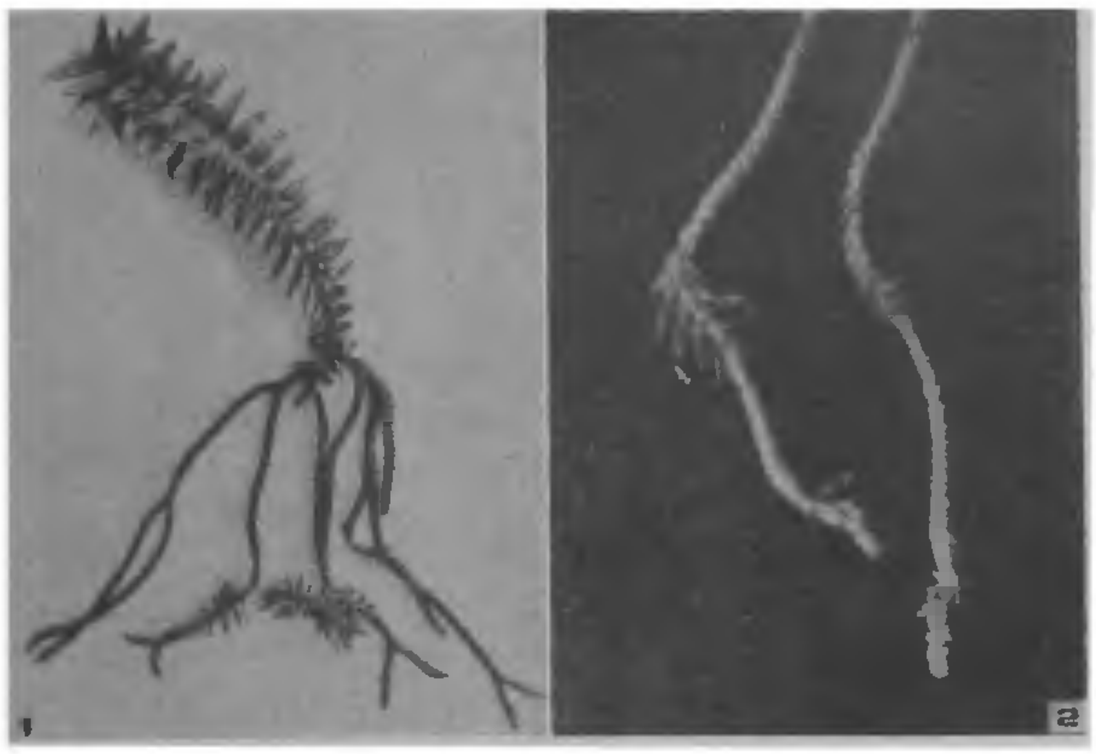
LYCOPODIUM PHLEGMARIUM L. is one of the tropical epiphytic species and grows hanging from the tree trunks. In this species the sporophylls are smaller than the foliage leaves and are compactly arranged to form distinct strobili which are dichotomously branched at the terminal ends of the stem and its branches. Plants were collected from Kodaikanal (Tamil Nadu) and planted in the green house of this Department.

It was interesting to observe that the plant instead of producing the normal strobilus developed alternate fertile and sterile zones in the strobilus region. In the sterile region leaves were morphologically similar to the normal leaves except for their smaller size. Two to three sterile zones were recorded in each branches of the strobili. It was also noted that all the strobili produced by this plant showed this nature of fertile and sterile zones.

In the simple and primitive species of *Lycopodium* all of which belong to the subgenus *Urostachya*, every leaf on the plant is a sporophyll or at least potentially so. But in the species of subgenus *Rhopalostachya* and in some species belonging to *Urostachya* (*L. phlegmarium*) the leaves near the apices of the branch bear sporangia and are arranged in a compact manner to form distinct strobili. This rare nature of strobilus of *L. phlegmarium* clearly implies that there occurred a gradual transformation of the sterile vegetative leaf into fertile sporophyll by the simultaneous alterations in the structure and size and also its progressive shift towards the distal end of the stem. Hence it is probable that *L. phlegmarium* is one of the connecting links between the *Urostachya* and *Rhopalostachya*.



Figures 1–2. 1. Single strobilus showing fertile and sterile zone. **2.** Portion of the strobilus with sterile and fertile zone.

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PREVALENCE OF ENDOMYCORRHIZAL FUNGUS *GLOMUS FASCICULATUM* IN RELATION TO PHOSPHORUS CONTENT OF SOIL

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ENDOMYCORRHIZAL fungi have earlier been shown to increase the ability of roots to absorb more nutrients than non-mycorrhizal plants [1–5]. The present study was carried out to obtain information on the prevalence and infection of *Glomus fasciculatum* (Thaxter sensu Gerdemann) in different maize soils with varying phosphorus content.

Fields which were mainly planted with maize for the last five years were selected. Soil samples were collected before planting maize and 30 and 60 days after sowing maize. Five plants were selected randomly from each site along with the rhizosphere soil. The number of