TABLE 1

Determination of B. thuringiensis phage titer in some soil samples.

Isolation site	No. of Samples screened	No. of Samples containing phage	No. of phage in 100 g or ml positive samples
Garden soil	32	6	20–40
River/canal side soil or water or mud	32	18	20–200
Field soil	34	4	20–40
Municipal dumping ground	10	—	—

μg/ml of streptomycin), Tc(d) (resistant to 75 μg/ml of tetracycline), Bnc (resistant to 20 u/ml of bacitracin) and TcSm (resistant to 20 μg/ml of tetracycline and 100 μg/ml of streptomycin) were used. Bacterial lawn in M-1 medium was made, using the spore inocula of all the strains and each plate was inoculated at three sites with isolated phages P-1, P-2 and P-3. Infection of the bacteria was recorded noting the lysis at the inoculated spots.

The study shows that phages P-1, P-2 and P-3 could lyse the cells of *B. thuringiensis* ATCC 13366 and its mutant strains NSm, Tc(d), Bnc and TcSm but ineffective to all other *Bacillus* strains studied.

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1. Burges, H. D. and Hussey, N. W., *Microbial control of insects and mites,* Academic press, London, New York, 1971, 67.
2. Yoder, P. E. and Nelson, E. L. J., *Insect Pathol.*, 1960, **2,** 198.
3. Van Tassel, L. and Yousten, A. A., *Can. J. Microbiol.*, 1976, **22,** 583.
4. Skvortsova, M. M., Burtseva, L. I., Shashkina, N. I., Robertus, L. A., Fillippova, E. A. and Zhuravetskaya, N. I., *Izv. sib. Acad. Nauk, SSSR Ser. Biol.*, 1976, Nauk **49.**
5. Chapman, H. M. and Norris, J. R., *J. Appl. Bacteriol.*, 1966, **29,** 529.
6. Vasantharajan, V. N. and Munirathnamma, N., *Curr. Sci.* 1980, **49,** 248.
7. Prescott, S. C. and Dunn, C. G., *Ind. Microbiol.*, IIIed., McGraw Hill, 1952, p. 762.

DISCOVERY OF ENDOTHYRIID FORAMINIFERS FROM THE BEDDED MALDEOTA PHOSPHORITE, GARHWAL HIMALAYA

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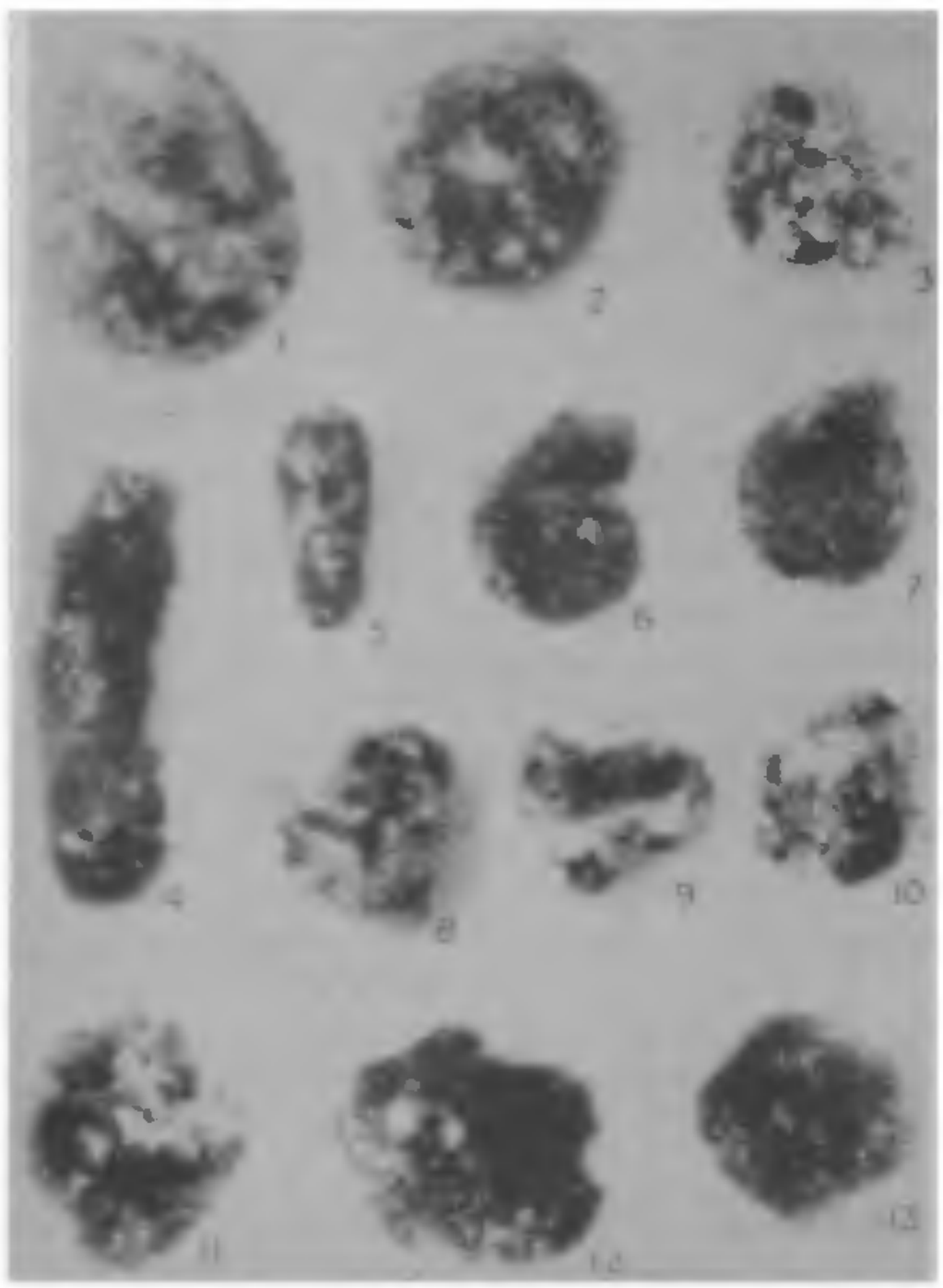
ENDOTHYRIID foraminifers are being recorded from the rock phosphates of Mussoorie-Dehradun Sector, Garhwal Himalaya. The occurrence of endothyriids from the Transitionary Limestone unit, intervening between the Upper Krol and the Phosphorite horizon, from Maldeota, Dehradun has been earlier reported[1,2]. The present samples yielding foraminfers were collected from the Phosphorite (Surkhet) mine, Maldeota, Dehradun. The samples were collected from the phosphorite overlying the Krol-Limestone (Sample No. 1a), from the Chert-Phosphorite (Sample No. 1), from the level in phosphorite rich in chert (Sample No. 2) and from the Chert-main ore contact (Sample No. 3). The samples (Nos. 1–3) have yielded relatively few foraminiferal remains. The sample of phosphorite sampled near the adit one (No. 4) has yielded a rich and diverse assemblage of endothyriid foraminifera. The main ore body (Nos. 4–6) contains rich assemblages of foraminifera. Sample (Nos. 4 and 5) contain mainly *Endothyra* spp., *Nodosinella* spp., *Paraendothyra* sp., *Globivalvulina bulloides* and *Tetrataxis conica.* In Sample No. 6 taken from the upper middle part of the ore body, a few members of the family Tournayallidae also appear.

The foraminiferal assemblage recorded from Phosphorite includes, *Endothyra* spp. (figures 1–3) *Nodosinella digitata* Brady, 1876, (figure 4), *N. Nodosariformis* (Cushman and Waters), 1828, (figure 5), *Tetrataxis conica* Ehrenberg, 1854, (figures 8, 9, 11, 12), *Paraendothyra* sp. (figure 10) and *Globivalvulina bulloides* Brady, 1875, (figures 2, 13). The members of the family Tournayallidae are commonly present in the upper-middle part of the ore body and are represented by *Tournayella* sp. (figure 7) and *Glomospiroides* sp. (figure 6). This assemblage is characteristic of Carboniferous-Permian age[3].

The discovery of endothyriid foraminifers from the phosphorites of Garhwal Himalaya is significant for the geology of the region since, these foraminifers are reliable indices of the geological age. The occurrence is significant because only the endothyriid group of foraminifers is present along with skelatal blue green algae, preserved in phosphorite. Such an association indicates restricted basin with low salinity[4].



Figures 1–13 1. *Endothyra* sp. A. × 75 (sample no. 4). 2, 13. *Globivalvulina bulloides* Brady, 1875, × 76 (sample no. 4). 3. *Endothyra* sp. B. × 47 (sample no. 5). 4. *Nodosinella digatata* Brady, 1876. × 76. (sample no. 5). 5. *Nodosinella nodosariformis* (Cushman & Waters). × 47 (sample no. 6). 6. *Glomospiroides* sp. × 47 (sample no. 6). 7. *Tournayella* sp. × 76 (sample no. 6). 8, 9, 11, 12. *Tetrataxis conica* Ehrenberg, 1854. × 76 10. *Paraendothyra* sp. × 76 (sample no. 5).
The specimens are white stained for clarity.

The age of the Mussoorie Phosphorite horizon was deciphered as Upper Palaeozoic on the basis of the record of Moravamminids by Patwardhan[5]. The presence of endothyriids provides the definitive basis for the age determination of this formation as Upper Palaeozoic. The precise age would be confirmed only after the systematic study of the foraminiferal assemblage is completed, although the presence of *Nodosinella digitata* and *N. nodosariformis* indicates Permian age. Recently[6] Lower Palaeozoic condonts have been reported from the phosphorites of this area. The condorts are resistant fossils which can withstand transportation without any marked sign of wear and tear. It is possible that these may have been reworked from the Lower Plaeozoic Provenance into the Upper Palaeozoic phosphorites.

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1. Kalia, P., *J. Paleont. Soc., India,* (In press).
2. Ravishankar, *J. Paleont. Soc., India,* 1971, **16**,1.
3. Ellis, B. F., Messina, A. R., Charmatze, R. and Ronai, L. E., 1968, *Catalogue of index smaller foraminfera,* Vol. 1 (Cretaceous Planktonic and Palaeozoic Foraminifera), *Sp. Publ. Amer. Mus. Nat.*, History, New York.
4. Mamet, B. L., in *Concepts and methods of biostraigraphy,* (eds.) Kauffman, E. G. and Hazal, J. E., Dowden Hutchinson and Ross Inc., 1977, 445.
5. Patwardhan, A. M., *Natl. Acad. Sci. Lett.*, 1978, **1**, 7.
6. Azmi, R. I., Joshi, M. N. and Juyal, K. P., 1980. Abrtract, XI Himalyan Geology Seminar on Paleont. Strt. of Himalaya, pp. 4, 5.

A NEW SEED-BORNE DISEASE OF RADISH CAUSED BY *ALTERNARIA ALTERNATA*

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DURING a study of various diseases on vegetable crops, radish (*Raphanus sativus* L.) was found heavily infected with *Alternaria* sp. at the Experimental Farm of Indian Institute of Horticultural Research, Bangalore. The infection occurs on all the above ground parts of the plant including capsules. The symptoms consist of water-soaked circular spots on leaves which at later stages coalesce becoming dull yellow and turn light brown to dark in colour, concentric rings appearing on the dead tissue of the old spots. On the stem and branches, irregular streaks, black in colour are formed. The infected capsules are shrivelled, when infection takes place at the initial stages of the capsule development, resulting in underdeveloped and shrivelled seeds. The seeds collected from such cap-