Table 1 *Semi-quantitative determination of the lump ore by optical emission spectrograph and spectrophotometer*

Bi	Pb	Cu	Ag	As	Mo	Sr
20–30%	1%	0.5%	0.1%	2%	250 ppm	700 ppm

emission spectrograph and spectrophotometer scanning of the lump ore revealed a high elemental concentration of bismuth (table 1). The light creamish coloured lumpy ore with soft greenish clayey encrustation effervesces very strongly with cold HCl. The ore has a high specific gravity (7–8).

The X-ray diffraction pattern of the lump ore shows characteristic lines of bismutite $(BiO)_2CO_3$ and beyerite $CaBi_2O_2(CO_3)_2$. The strongest intensities in the pattern are of the 2.944 Å and 2.844 Å lines, which correspond to the two minerals. The XRD data are given in table 2.

The ore occurs as a lensoid segregation of dimensions 1.5 m × 1 m × 0.5 m within a weathered and crushed unzoned pegmatite body which is emplaced in the axial zone of an appressed reclined fold structure plunging westerly (15°–20°). The country rocks are predominantly calc-silicates with subordinate felsic tuffs belonging to the Delhi-Super group of Proterozoic age. Syn- to post-tectonic intrusives of pegmatites, basic dykes and albitites (albite-rich monomineralic rock)[1] are frequent in the calc-silicates.

Table 2 *X-ray diffraction data*

Intensity	d(Å) of lump ore	Bismutite*	Beyerite*
M	10 88	—	10.88 (90)
M	6.87	6.90 (7)	—
M	3 71	3.72 (7)	3.72 (30)
W	3.61	—	3.62 (20)
W	3.42	3.42 (6)	—
M	3.33	—	3.35 (80)
VS	2.944	2.95 (10)	—
S	2.844	—	2.85 (100)
S	2.726	2.73 (7)	2.72 (20)
W	2.66	—	2.67 (70)
VW	2.58	—	2.60 (30)
VVW	2.53	2.54 (4)	—
W	2.27	—	—
M	2.14	2.14 (10)	2.15 (70)
W	1.93	1.93 (7)	—
M	1.749	1.75 (8)	1.754 (50)
W	1.7155	1.71 (7)	—
W	1.683	1.68 (7)	1 689 (60)
M	1.616	1.62 (10)	—
W	1.572	—	1 578 (70)

*Values appearing in Chandy *et al*[2]; W, Weak; M, Medium; S, Strong; VS, Very strong; Numbers in parentheses are approximate intensity values on a scale of 1 to 10 for bismutite and 10 to 100 for beyerite.

In the course of preliminary scanning more pegmatites in the adjoining areas have indicated higher-than-normal lithophile abundance of bismuth (e.g. 700 ppm and more). Favourable areal and depth continuation of bismuth and allied mineralization may therefore be assumed in the area. But locating them by drilling will be difficult because of their lensoid and segregated nature.

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EFFECT OF CADMIUM–ZINC INTERACTION ON YIELD AND CADMIUM AND ZINC CONTENT OF MAIZE (*ZEA MAYS* L.)

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CADMIUM is a potentially harmful element for plants. It causes toxicity, reducing crop growth and yield. Zinc is an essential plant nutrient, but its application beyond a certain level to the soil may also prove toxic to growing plants. Due to their geochemical kinship, the presence in the environment of Cd is normally linked to the presence of Zn. Cadmium and Zn are taken up actively by plants at concentrations normally found in the soil[1,2]. Due to similarity of their electronic structures, Zn and Cd should compete for absorption sites on the root surface of plants. Several workers[3,4] have reported antagonistic effect of Zn on Cd uptake by radish and bush bean, although enhancement of Cd content of soybean by Zn was also noted[5]. Similarly Cd has been found to reduce the uptake of Zn by rice and berseem[6,7].

Since the nature of Cd–Zn interaction is expected to differ with the crop, an attempt was made to study the possibility of reducing Cd poisoning of maize by soil application of Zn. Maize can very efficiently accumulate Cd even when the element is present at low levels in the soil[8].

A surface (0–15 cm) sample of an Ustipsamment loamy sand soil collected from Punjab Agricultural University Farm at Ludhiana was air-dried and sieved through a 2 mm plastic screen. The soil had pH 8.5, electrical conductivity 0.3 dS/m (1:2 soil/water suspension), organic carbon 0.4%, calcium carbonate 0.4%, 1 N HCl-extractable Zn 0.46 mg/kg, Cd 0.12 mg/kg and Pb 0.08 mg/kg. Before filling 5 kg capacity polyethylene-lined pots with the soil, it was treated with 36 combinations of Cd (0, 0.5, 1, 2, 4 and 8 mg Cd/kg soil as cadmium sulphate) and Zn (0, 2.5, 5, 10, 20 and 40 mg Zn/kg soil as zinc sulphate) levels. A basal dose of N, P and K at the rate of 120, 13 and 25 mg/kg soil, using $CO(NH_2)_2$, KH_2PO_4 and KCl respectively, was applied to all the pots. Fodder maize was raised for up to 45 days in the greenhouse. Deionized distilled water was used for irrigating the pots.

After 45 days the maize plants were harvested and dry-matter yield was recorded. Plant samples were washed successively with 0.1 N HCl, distilled water and deionized water, dried and ground in a Wiley mill. Dried samples were digested in a di-acid mixture (HNO_3:$HClO_4$ = 4:1). Cadmium and Zn in the digests were determined in an atomic absorption spectrophotometer.

Dry-matter yield and Cd and Zn contents as influenced by different combinations of Cd and Zn levels in the soil are shown in figure 1. When no Zn was applied, increasing the level of Cd up to 2 mg/kg soil did not significantly affect the yield. However, further increase, up to 8 mg/kg soil, significantly reduced the dry-matter yield. At the highest level of Cd application, about 18% reduction in dry-matter yield was observed. The corresponding increase in Cd content of maize was from 0.4 to 16.6 μg/g. The detrimental effect of Cd on dry-matter yield of maize was possibly due to its phytotoxic nature. Bazzaz *et al*[9], have explained that the reduced rates of respiration and photosynthesis caused by Cd toxicity were responsible for reduction in plant growth. Lee *et al*[10] observed a decrease in the activity of carbonic anhydrase of soybean seedlings with the addition of Cd. Since carbonic anhydrase activity is Zn-dependent, reduced activity of this enzyme was attributed to the antagonistic effect of Cd on Zn absorption. Zinc content significantly decreased with the application of Cd, and in the case of no addition of Zn, it decreased even below the critical limit of 18 μg/g dry weight (figure 1).

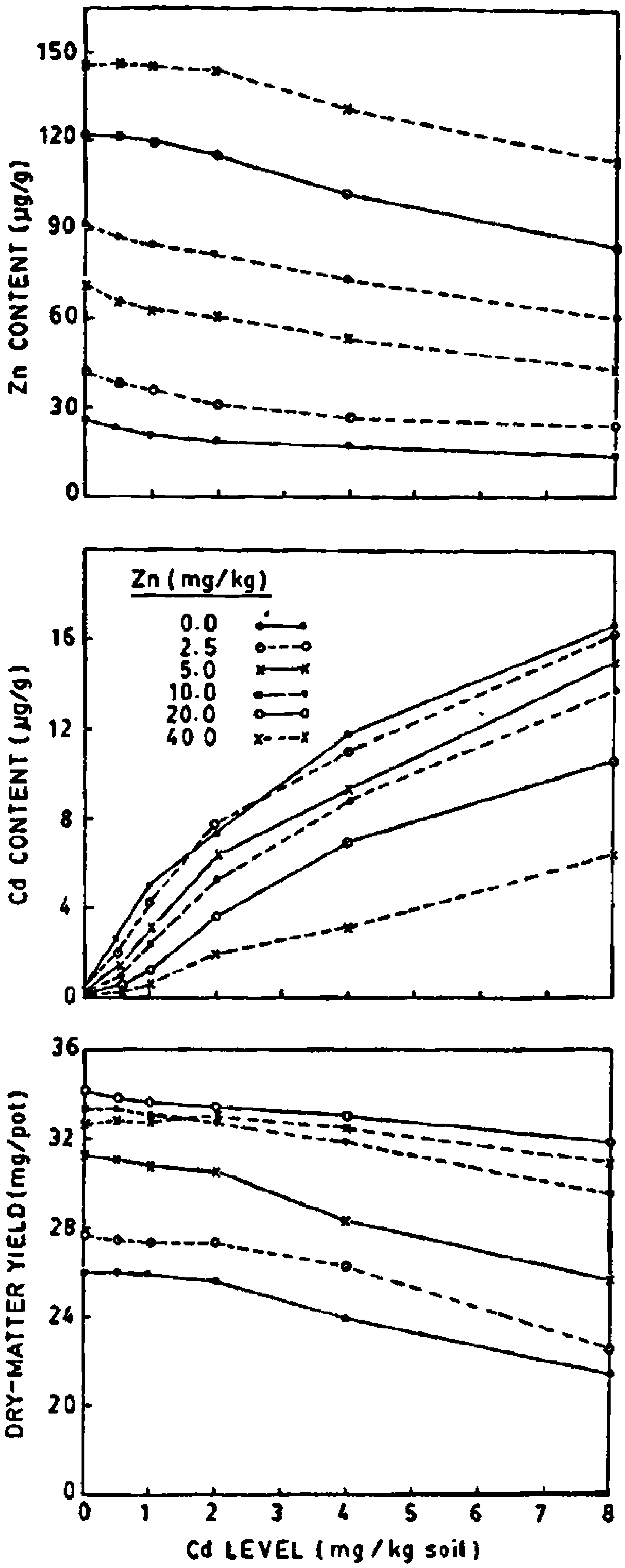

Figure 1. Effect of Cd and Zn levels on yield and Cd and Zn content of maize.

Since the soil under investigation was deficient in Zn, significant response to Zn could be observed up to 20 mg Zn/kg soil. Increasing levels of Zn reduced the toxicity due to Cd. While there was 18% reduction in the dry-matter yield with 8 mg Cd/kg soil in the case of no addition of Zn, reduction in yield was only 5% when the same level of Cd was applied along with 40 mg Zn/kg soil. Zinc content, at the highest level of Cd, showed a significant increase, from 14.5 μg/g in no-Zn control to 114 μg/g with 40 mg Zn/kg soil. The corresponding decrease in the Cd content was from 16.6 to 6.2 μg/g. The results thus indicate an antagonistic effect of Zn on Cd uptake and vice versa. Wallace *et al*[4] observed in bush bean that Cd tended to depress Zn uptake and when Zn was added without chelating agents it reduced the toxicity of Cd. In fact several workers have reported antagonistic effect of Cd and Zn on each other in different crop plants[3,6,7].

Increasing levels of Zn decreased the per cent reduction in Zn content caused by Cd application. At 8 mg Cd/kg soil, per cent reduction in Zn content decreased from 46 in no-Zn treatment to 21 with the addition of 40 mg Zn/kg soil. Increasing levels of Zn in the soil help to reduce the inhibitory effect of Cd on Zn uptake. This behaviour is characteristic of competitive inhibition.

The present results thus indicate that addition of increasing amounts of Cd to the soil significantly reduces both dry-matter yield and Zn content and increases Cd content of maize. Applying increasing levels of Zn to such soils can effectively reduce the Cd toxicity, ameliorate Zn deficiency and thus increase crop yields.

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TYROMYCES SUBCAESIUS DAVID, A NEW RECORD FROM INDIA

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DURING routine collections of wood-rotting fungi in West Bengal in 1987, a species of *Tyromyces* hitherto unrecorded from India was encountered. This fungus is described and illustrated in the present paper. Dried materials are deposited in the Mycological Herbarium of the Visva-Bharati University (VBMH) and a part of it also in the Herbarium of the Division of Mycology and Plant Pathology, Forest Research Institute, Dehra Dun, India. (FRI, Herbarium No 8630).

Tyromyces subcaesius David, *Bull. Soc. Linn. Lyon. Spec.* Vol. 119–126, 1974

Morphology: Basidiocarp (figure 1) pileate, dimidiate, pileus 5–8 × 2.5 × 1.5–2.5 cm, soft when fresh, hard but light in weight when dry; surface pubescent, azonate, greyish blue; margin thin and slightly

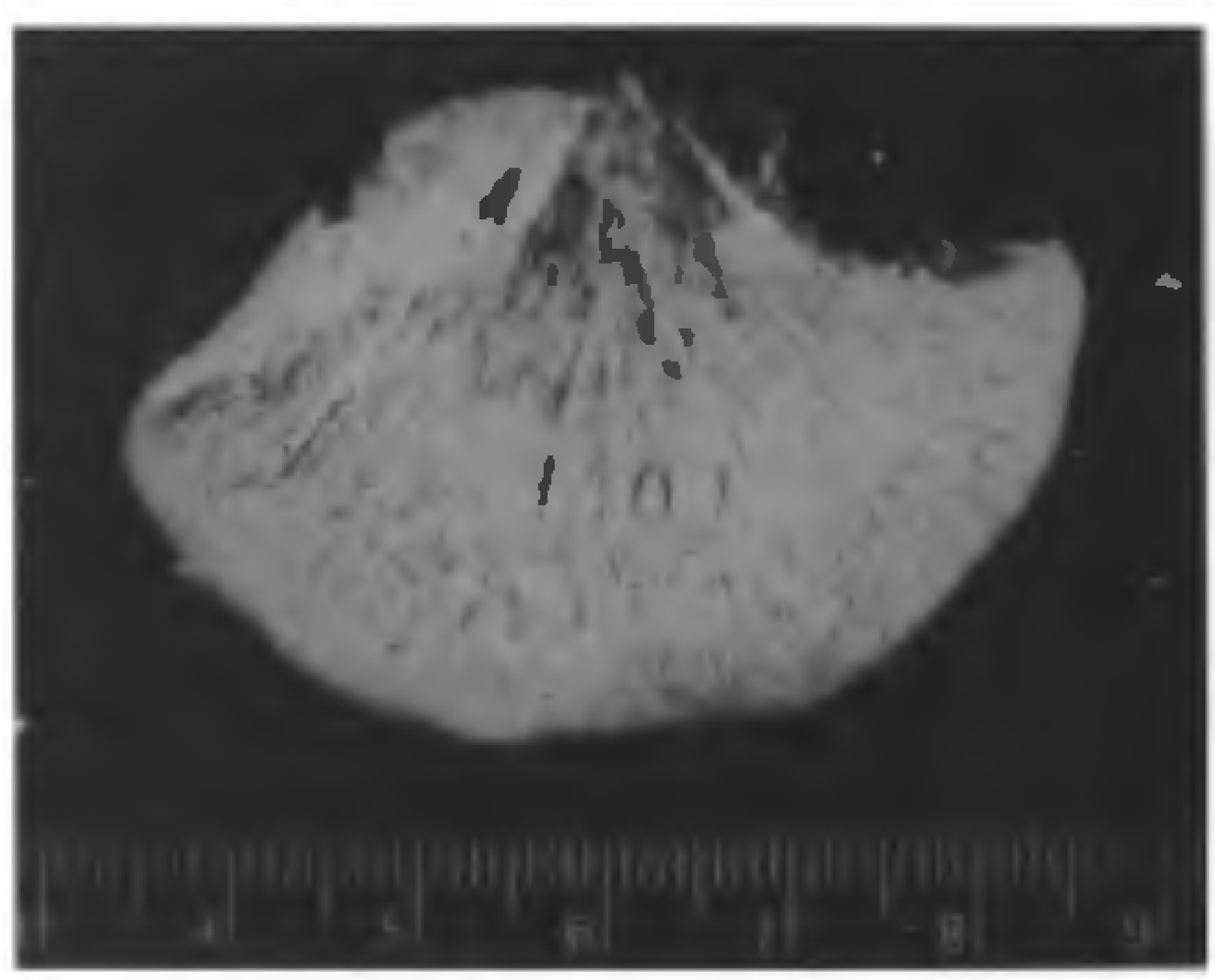

Figure 1. Basidiocarp of *Tyromyces subcaesius* David.