

Short communication

**Fungicidal elements accumulated in *Cryptothecia punctulata* (Ascomycetes lichen) of an arecanut orchard in South India**

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**Abstract :** Different nutrient elements were analyzed in the lichen *Cryptothecia punctulata* collected from the arecanut trees which were exposed to several sprays of a fungicide Bordeaux mixture. The study revealed the accumulation of fungicidal elements such as Cu, Ca and S in higher concentration of 575.4, 10,000 and 21,000  $\mu\text{g g}^{-1}$ , respectively.

**Key words :** Lichen, Fungicide accumulation, *Cryptothecia punctulata*

**Introduction**

Various agricultural practices, such as shifting cultivation, farming, grazing, fertilizer and agrochemical (pesticide, fungicide and herbicide) usage, have contributed significantly to the loss of lichen diversity and changes in their community structure (Brown, 1992; Benfield, 1994; Singh and Sinha, 1997; Jensen *et al.*, 1999; Ruoss, 1999; Vagts and Kinder, 1999; Bartók, 1999). Lichens depend on atmosphere sources for their nutrients (Nieboer *et al.*, 1978) and have an ability to accumulate heavy metals and other air pollutants to a level far above their expected physiological needs (Puckett, 1988). Various heavy metals considered to be toxic to many other living organisms may also be accumulated simultaneously (Garty, 1993). Lichens may be equally capable of trapping and possibly accumulating organic molecules (Thomas, 1986). A number of chlorinated hydrocarbon pesticides, such as hexachlorobenzene (HCB), hexachlorohexane (HCH) and polychlorinatedbiphenyls (PCB), have been studied in respect of their accumulation in lichens (Carlberg *et al.*, 1983; Bacci *et al.*, 1986; Garty *et al.*, 1982). In the present communication we report the accumulation of fungicidal elements such as Cu, Ca and S in *Cryptothecia punctulata* Makh. and Patw., exposed to several sprays of Bordeaux mixture.

**Materials and Methods**

Bordeaux mixture is the fungicide sprayed on arecanut trees (*Areca catechu L.*) to control the 'fruit rot' disease caused by *Phytophthora palmivora Butt.*, in South India. It consists of 1.5 to 2 kg of copper sulphate and 1.5 to 2 kg of lime in 200 liters of water (Rangaswami, 1996) and is sprayed on trees thrice in a rainy season (June –

September), i.e. before the on set of monsoon, middle and at the end of the season with 45 days interval. In present communication the arecanut orchard studied (Pillai's arecanut orchard, Koppa, Chikmaglore district, Karnataka) was 21 year old and the trees have been exposed to the fungicide at least 42 times at the time of study (December 2000).

The arecanut orchard is dominated by *Cryptothecia punctulata* Makh. and Patw. The other associated species are *Graphina anadamanica* Makh., Adwa. and Patw., *G. cleistoblephora* (Nyl.) Zahlbr., and *Graphis ceylanica* Zahlbr. They form a white powdery crust on the whole trunk. A total of 25 samples of *Cryptothecia punctulata* were collected from the arecanut trees for elemental analysis. *Cryptothecia punctulata* with a thin, ecorticated, endophloedal thallus, was carefully removed from the bark using a snapper blade and oven dried to a constant weight at 80°C. The dried samples (three replicates) were then powdered for metal analysis by the wet digestion method. Ca, K and Na were analyzed by flame photometer, Fe, Mn, Zn and Cu by an Atomic Absorption Spectrophotometer, and S by turbidimetric method.

**Results and Discussion**

Of the different elements analyzed in *Cryptothecia punctulata*, S was accumulated to a maximum of 21,000  $\mu\text{g g}^{-1}$ , followed by Ca, Fe, K and Cu with 10,000, 2,226, 1,500 and 575.4  $\mu\text{g g}^{-1}$  respectively. Poelt and Huneck (1968) reported an accumulation of 5,000  $\mu\text{g g}^{-1}$  of Cu in *Lecanora vinetorum* derived from a copper fungicide sprayed on a vineyard at Central Europe. There are no other similar studies available for comparing the remaining elements. However, we

compared our data with the literature: the concentration of Cu in lichens range from 2.19 to 23,300  $\mu\text{g g}^{-1}$  (Jaakkola *et al.*, 1967; Czehura, 1977), Ca range from 190 to 7,970  $\mu\text{g g}^{-1}$  (Pakarinen, 1985; Looney *et al.*, 1985), S and Fe range from 101 to 4,800  $\mu\text{g g}^{-1}$  and 60 to 90,380  $\mu\text{g g}^{-1}$  respectively (Puckett, 1978; Takkala *et al.*, 1985; Prussia and Killingbeck, 1991; Seaward, 1973). The values for Zn, Mn, Na and K (55.8, 159.1, 250 and 1,500  $\mu\text{g g}^{-1}$  respectively) in the present study are not significantly different (Pakarinen, 1985; Prussia and Killingbeck, 1991).

The above observations clearly indicate the accumulation of Cu, Ca and S, which are the major elements of Bordeaux mixture. Though Fe is not a component of this fungicide, its high accumulation can be attributed to its presence in water, but we do not have any empirical evidence to support this. Generally lichens have the ability to accumulate iron in high concentrations. The present study could be used as reference information to assess the fungicidal load in the arecanut orchard in future since it will be exposed to continuous spray of Bordeaux mixture.

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