



EFFECTS OF FLUORIDES ON PLANTS AND PLANT COMMUNITIES: AN OVERVIEW

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ABSTRACT

Considerable information has been accumulated on the direct effects of airborne fluorides on terrestrial vegetation. Among the effects studied have been production of lesions on leaves, stems and fruits; altered biochemistry and physiology; reduced growth, yield and quality; rates and amounts of fluoride accumulation and its potential toxicity to herbivores; and community and ecosystem effects. Indirect effects of fluoride on plants, including the plant's adaptability to the environment and the response of insects and pathogens to plants exposed to fluoride, have not been studied extensively. Even less is known of effects of fluoride on soil structure and chemistry, micro- and macroflora, and on fluoride availability to the plant. Increased acidity in precipitation has heightened interest in these subjects. Although fluoride occurs naturally in most waters, especially the oceans, the effects of fluoride enrichment on aquatic biota has not been the subject of extensive research. The status of our current knowledge in some of these areas is highlighted and a scheme is presented that postulates effects induced in plants, plant communities and other parts of the ecosystem by increasing doses of fluoride.

INTRODUCTION

Plants are the most sensitive biological receptors of airborne fluoride. Although a threshold limit value of 2.5 mgF m³ for an 8-hour-day, 5-day-week has been proposed for the protection of industrial workers (OSHA, 1971), some species of plants might be injured at dosages more

than three orders of magnitude lower (NAS, 1971). Not only is the plant vulnerable to airborne fluoride but, by virtue of its capacity to accumulate fluoride in its tissues, it plays a central role in the welfare of herbivores: damage to livestock in the form of dental and skeletal defects follows ingestion of fluoride from plants.

A large body of laboratory and field experimental data on the effects of fluoride on man, animals and plants has been amassed over the years, and the areas of agreement and controversy were important subjects of this Symposium. Certainly, there has been more litigation on alleged damage to agriculture by fluoride than all other pollutants combined. Seven papers in this Symposium consider plants and their sensitivity and tolerance to fluoride with respect to their invaluable contribution as indicators and biomonitors of fluoride pollution; the metabolic, physiologic and ontogenetic events that occur after exposure to fluoride that may eventually lead to changes in growth, yield or quality; and the many abiotic and biotic factors that modify the response of the plant to fluoride.

Several reviews on the effects of fluoride on plants have been published, especially in the past 20 years or so (Thomas, 1961; Thomas and Alther, 1966; NAS, 1971; Chang, 1975; Groth, 1977; Weinstein, 1977; Rose and Marier, 1977; Amundson and Weinstein, 1980; Weinstein and Alscher-Herman, 1982), but here, for the first time, each important aspect of the fluoride-plant relationship was discussed by scientists with special expertise in a particular subject area.