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Fractal analysis of the modifications induced on tomato plants by heavy metals

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The fractal analysis is most useful in characterizing the structure of branching trees, root of plants, leaves, membrane surface of cells and so on. The fundamental underlying principle in fractal geometry is self-similarity and scale invariance which is a principle in the development and growth of biological forms. The exponent of these properties is the fractal dimension. The fractal dimension is a fractional quantity and it is a direct measure of the relative degree of complexity and roughness of the figure and it can never be greater than the Euclidian dimension of the space where the object is embedded. Fractal geometry has been applied to describe various aspects connected with the complexity of plant morphology. Many authors used the fractal analysis to study the form of the different kind of plants and tissue. The main objective of this study was to evaluate the impact of the treatment with zinc and cadmium on growth of tomato plants, using fractal analysis. In order to evaluate the change on tomato plants we determined the fractal dimension for untreated and treated tomato plant shoots. Our results showed that the average fractal dimension for untreated tomato plant is 1.4486, for treated tomato plants with zinc it is 1.3254 and for treated tomato plants with cadmium it is 1.2401. These results demonstrated that the fractal structure tomato leaves changed after the treatment with these heavy metals by comparison with the control ones. We suggest that these heavy metals diminished both the plant growth and their capacity to develop complex leaves.