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Cucumber Mosaic Virus Detection by Artificial Neural Network Using Multispectral and Multimodal Imagery

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Abstract

Cucumber is a source of essential minerals to the diet. However, it is attacked by Cucumber mosaic virus that can reduce its yields. We propose in this study a strategy for early detection of this virus by artificial neural networks using the fingerprint of the cucumber leaves in the transmission, reflection and diffusion modes. We demonstrates in this work that the use of the optical spectral fingerprints of plants leaves contents, such as cucumber, is a powerful technique to resolve their contents and for earlier detection of some related diseases. We have built and used a cost-effective light emitting diodes multispectral and multimodal imaging which enabled the acquisition of the spectral and spatial information, used for an earlier detection of Cucumber mosaic virus.

1. Introduction

Cucumber (*Cucumis sativus* L.), of the Cucurbitaceae family, plays a vital role in human consumption. It is a source of vitamins A, B, C and E. It is also rich in phosphorus and potassium and contains 96% water [1]. It is a source of income for vulnerable groups including women and school dropouts engaged in vegetable gardening. Its production grew worldwide to about 20t / ha [2]. However it is subject to several attacks of pests and diseases including viral diseases such as cucumber mosaic that causes considerable losses [3]. Cucumber mosaic virus (CMV, genus Cucumovirus, family Bromoviridae) is found in Ivory Coast where it causes symptoms of light green mosaic on cucumber and zucchini leaves and their deformation in critical cases of its manifestation [4]. It is transmitted by more than 80 species of aphids on non-persistent mode and by mechanical way to a wide host range including several species of Solanaceae and Cucurbitaceae [5]. This virus is able to suppress dsRNA-induced Post-transcriptional gene silencing (PTGS), an intrinsic plant defense mechanism in tobacco [6]. A better knowledge of CMV allows considering methods of control. Serological (Enzyme-linked immunosorbent assay or ELISA) and molecular tests are