Claims

1. A method of real time detection and quantitation of an innate immunity response in a plant, the method comprising:

(a) obtaining a Raman spectra of carotenoids and/or proteins *in vivo* and *in situ* (i.e., *in planta*) in tissue of a plant leaf from a plant in a plant population, wherein the Raman spectra includes one or more peaks characteristic of carotenoids and/or proteins;

(b) obtaining a Raman spectra of carotenoids and/or proteins *in vivo* and *in situ* (i.e., *in planta*) in tissue of a plant leaf from a control plant, wherein the Raman spectra includes one or more peaks characteristic of carotenoids and/or proteins;

(c) comparing intensity of the one or more peaks characteristic of carotenoids and/or proteins from the Raman spectra obtained from the plant in the plant population with intensity of the one or more peaks characteristic of carotenoids and/or proteins from the Raman spectra obtained from the control plant; and;

(d) determining if there is an increase in the relative intensity of one or more peaks characteristic of carotenoids and/or proteins from the Raman spectra obtained from the plant in the plant population,

wherein an increase in relative intensity of the one or more peaks characteristic of carotenoids and/or proteins from the Raman spectra obtained from the plant in the plant population is indicative of an early stage infection, and

wherein the one or more peaks characteristic of carotenoids in the Raman spectra are selected from the group of peaks consisting of 1001 cm^{-1}, 1151 cm^{-1} and 1521 cm^{-1}, and wherein the peak characteristic of proteins in the Raman spectra is at 1550 cm^{-1}.

2. The method of claim 1, wherein the tissue of the plant leaf is a leaf blade.

3. The method of claim 1 or 2, wherein the increase in relative intensity of the peak characteristic of carotenoids is determined at peaks consisting of 1001 cm^{-1}, 1151 cm^{-1} and 1521 cm^{-1}, and wherein the increase in relative intensity of the peak characteristic of proteins is determined at a peak at 1550 cm^{-1}.

4. The method of any one of claims 1-3, wherein the Raman spectra is obtained using near-infrared excitation wavelength.

5. The method of claim 4, wherein the near-infrared excitation wavelength is 830 nm.

6. The method of any one of claims 1-5, wherein obtaining the Raman spectra is non-invasive and non-destructive to the tissue of the plant leaf.

7. The method of any one of claims 1-6, wherein the real time detection and quantitation of an innate immunity response in a plant is applied to urban farming.

8. The method of any one of claims 1-6, wherein the real time detection and quantitation of an innate immunity response is applied to open farming.

9. A method of containing the spread of pathogen infection of plants in a plant population comprising:

detecting and quantifying an innate immunity response in a plant in a plant population real time according to the method of any one of claims 1-8 to identify infected plants; and

removing infected plants from the plant population.