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| **Pre-visual and early detection of myrtle rust on rose apple using thermal and hyperspectral indices** |
| **Introduction:**Myrtle rust, caused by the fungus*Austropuccinia psidii*, is a serious disease, that affects many Myrtaceae species. Commercial nurseries that propagate Myrtaceae spp. are prone to myrtle rust and require a reliable method that allows pre-visual and early detection of the disease.**Objectives:**This study uses time-series thermal imagery and **visible-to-short-infrared spectroscopy** measurements acquired over 10 days from 81 rose apple plants (*Syzygium jambos* (L.) Alston) that were either inoculated with myrtle rust or maintained disease free. Using these data the objectives were to (i) quantify the accuracy of models using thermal indices and narrowband hyperspectral indices (NBHI) for pre-visual and early detection of myrtle rust using data from older resistant green leaves and young susceptible red leaves and (ii) identify the most important NBHI and thermal indices for disease detection.**Results:** Using predictions made on a validation dataset, models using indices derived from thermal imagery were able to perfectly (F1 score = 1.0; accuracy = 100%) pre-visually distinguish control from infected plants one day before symptoms appeared (1 DBS) and for all stages after early symptoms appeared. Compared with control plants, plants with myrtle rust had lower and more variable normalised canopy temperature, which was associated with higher stomatal conductance and transpiration. Using NBHI derived from older resistant green leaves, excellent pre-visual classification was achieved 3 DBS, 2 DBS and 1 DBS (F1 score range = 0.89 to 0.94).**Conclusion:** The accurate characterisation of MR during pre-visual and early stages of disease development suggests that a robust detection methodology could be developed within a nursery setting. |