A Bioinformatic Analysis of Foliar Fungal Endophytes in Litter Decomposition

Chang, Matthew (School: Woodbridge High School)

Plant litter decomposition is a key ecological process that plays a vital role in the global carbon cycle. While the effect of soil microbes on decomposition has been well studied, the role of fungal microbes within the leaf, or foliar fungal endophytes, remains largely unclear despite their ubiquity in all species of land plants. In the present study, the relationship between endophyte abundance and litter mass loss was examined in the Torrey pine (Pinus torreyana). Total DNA and RNA was extracted, followed by next-generation sequencing and bioinformatic analysis to identify core endophyte species across geographic regions. Endophyte abundance was discovered to be positively correlated with mass loss, and fungal strains OTU4 and OTU211 were most prevalent throughout all samples. A Naive Bayes algorithm was developed to more effectively classify mycological genuses based on their ITS1 sequences. Optimizing for hyperparameters led to a model accuracy of 94.0% with an AUC value of 97.1% as well as identification of OTU4 and OTU211 as the species Salinomyces thailandica and Aulographina pinorum, respectively. With the high accuracy of the model and novel CTAB protocol, this work is the first of its kind in this field.

Awards Won:
First Award of $5,000