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Seasonal associations and atmospheric transport distances of Fusarium collected with unmanned aerial vehicles and ground-based sampling devices

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Spores of fungi in the genus Fusarium may be transported through the atmosphere over long distances. Members of this genus are important pathogens and mycotoxin producers. New information is needed to characterize seasonal trends in atmospheric loads of Fusarium and to pinpoint the source(s) of inoculum at both local (farm) and regional (state or country) scales. Spores of Fusarium were collected from the atmosphere in an agricultural ecosystem in Blacksburg, VA, USA using a Burkard volumetric sampler (BVS) 1 m above ground level and autonomous unmanned aerial vehicles (UAVs) 100 m above ground level. More than 2,200 colony forming units (CFUs) of Fusarium were collected during 104 BVS sampling periods and 180 UAV sampling periods over four calendar years (2009-2012). Spore concentrations ranged from 0 to 13 and 0 to 23 spores m-3 for the BVS and the UAVs, respectively. Spore concentrations were generally higher in the fall, spring, and summer, and lower in the winter. Spore concentrations from the BVS were generally higher than those from the UAVs for both seasonal and hourly collections. Some of the species of Fusarium identified from our collections have not been previously reported in the state of Virginia. A Gaussian plume transport model was used to estimate distances to the potential inoculum source(s) by season. This work extends previous studies showing an association between atmospheric transport barriers (Lagrangian coherent structures or LCSs) and the movement of Fusarium in the lower atmosphere. An increased understanding of the aerobiology of Fusarium may contribute to new and improved control strategies for diseases causes by fusaria in the future.