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Italian researchers test rapid flow cytometry to detect airborne vineyard fungi

The proof-of-concept study sought Botrytis cinerea and Aspergillus carbonarius in just five vineyard air samples to speed disease monitoring

Friday, November 27, 2026



Researchers in Bari, Italy, have carried out a preliminary test of a rapid flow cytometry method designed to detect airborne spores of two important vineyard fungi, Botrytis cinerea and Aspergillus carbonarius, in an early effort to speed up disease monitoring in

grape production.

The study, published in Plant Methods, examined whether flow cytometry could be used to identify fungal inoculum collected from vineyard air. In practical terms, that means looking for the spores or other infectious particles that can spread disease through a vineyard before symptoms become obvious on the fruit.

The work focused on two organisms that matter to grape growers for different reasons. Botrytis cinerea is widely known as the fungus behind gray mold and bunch rot, which can damage yield and fruit quality. Aspergillus carbonarius is one of the black aspergilli found on grapes and is a concern because it can be associated with ochratoxin A, a toxin that can contaminate fruit under some conditions.

Flow cytometry is commonly used to analyze cells or particles quickly by passing them through a beam of light and measuring the signals they produce. Applied to vineyard monitoring, the idea is to move from slower laboratory checks toward a faster screening tool that could help growers assess fungal pressure in the air during the season.

The researchers described the method as rapid, but the evaluation remained limited. According to the study summary, the test on natural vineyard samples was based on only five samples. That small number means the results should be treated as an initial proof of concept rather than a validated field system.

That limitation is important because vineyard air contains a complex mix of biological material, dust and other particles that can make detection more difficult outside controlled conditions. A method that appears promising in early trials still has to show that it can reliably distinguish target fungi across different vineyards, weather patterns, grape varieties and stages of the growing season.

Even so, the work points to a possible route for earlier and more targeted disease surveillance. If the approach is confirmed in larger studies, growers could eventually use faster readings of airborne inoculum to better time fungicide applications or other control measures, rather than relying only on visible symptoms or broader calendar-based treatment schedules.

That possibility also matters for the beverage industry, especially wine production. Better tracking of rot-related fungi in vineyards could help protect grape quality and reduce losses before harvest. In the longer term, a reliable rapid test could support decisions that affect both crop protection costs and the condition of fruit going into wineries, although the current study does not establish that the method is ready for routine commercial use.

The study’s preliminary nature leaves several open questions, including how well the method performs at larger scale and whether it can be integrated into regular vineyard surveillance programs without extensive sample preparation or specialized interpretation. More field testing will be needed before growers or wineries can treat flow cytometry as a practical operating tool rather than an experimental approach.