New discoveries on emerging postharvest diseases of apples in Northern Italy

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Postharvest apple diseases are mainly caused by fungal pathogens entering fruits through wounds during harvesting, handling, storage, transport, and marketing. *Penicillium* spp. *Botrytis* spp. *Rhizopus* spp. and *Mucor* spp. are common wound pathogens. Other pathogens are characterized by latent infections in field and symptom development during the postharvest phase. Latent pathogens are increasingly relevant on Italian apples during postharvest. *Neofabraea alba* and *N. kienholzii* cause bull's eye rot, infecting late-harvested varieties as Cripps Pink via lenticels. Propagules of *N. alba* are found in rainwater collected from apple orchards. Another pathogen infecting the lenticels is *Ramularia mali*, agent of dry lenticel rot, common on Golden Delicious and Ambrosia apples. White haze, reducing fruit quality, is attributed to various basidiomycetous genera, with *Entyloma*, *Golubevia*, and *Tilletiopsis* species being common in Northern Italy. New species like *E. mali* sp. nov. and *G. mali* sp. nov. have been identified. Fruit microbiome analysis showed that the agents of white haze are only epiphytic and they occur on the fruit skin just before harvest. On the contrary, *Ramularia mali* first appears as an endophyte at least 3 months before harvesting, but it becomes epiphytic starting from September and during storage. Changes in microbiota assembly and composition over time are crucial for understanding postharvest pathogen epidemiology. A SYBR Green qPCR assay detects and quantifies *R. mali* in apples, revealing its presence on asymptomatic fruits. *Ramularia mali* was found early in the season in the aerial microbiome analysed from spore traps placed in apple orchards. Other latent pathogens are emerging on apples in Italy, as *Colletotrichum* spp. agents of bitter rot, and *Alternaria* spp. agents of black rot. Fruit and aerial metabarcoding are valuable tools for the assessment and prediction of postharvest diseases, and to design targeted crop protection strategies.

Latent pathogens; Colletotrichum spp.; fruit microbiome; metabarcoding; Neofabraea spp.; Ramularia mali; spore trap; white haze