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## Effects of environmental nutrient supply on virus prevalence and competitive interactions

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Nitrogen and phosphorus supply and ratio mediates host susceptibility to plant virus inoculation, virus interference and co-infection.

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### Background/Questions/Methods

Nutrient supplies of primary producers are known to regulate several ecosystem processes such as productivity, and the abundance and diversity of interacting organisms along the food chain. Micro-organisms hijack the host cellular and metabolic machinery, as well as host resources in metabolites, enzymes and proteins to complete their reproduction cycle. As the synthesis of these molecules requires nitrogen and phosphorus, microbial dynamics could also be influenced by host nutrient supplies. Positive effects of elevated host supplies on the incidence and/or the multiplication of single species of parasites have been reported, however, differential responses of parasites to host nutrition could mediate probabilities of co-infection. In addition, the relationship between host nutrition and pathogen incidence can be tested through the ecological stoichiometry theory that provides an understanding of the effect of both nutrient supply and ratio on ecological processes. To better understand the outcomes of nutrient addition on plant-parasites interactions, we singly- and co- inoculated two species of phytoviruses, (Barley yellow dwarf virus- PAV and Cereal yellow dwarf virus - RPV) to plants of the cultivated crop species *Avena sativa*. In each inoculation type, hosts received four different nutrient treatments representing a full factorial combination of two levels of nitrogen and phosphorus.

### Results/Conclusions

Both nutrient supply rate and ratio affected virus inoculation success. Low nitrogen (N) to phosphorus (P) ratio negatively affected the proportion of plants infected by RPV, but nutrient ratio did not affect PAV infection rates. As N:P increased, the ability of RPV to infect a host increased which resulted in higher probabilities of coinfection with PAV and RPV. Low phosphorus and nitrogen supply rate reduced the infection rate of both PAV and RPV in co-inoculations (*vs.* single- inoculations). Increased nitrogen resulted in greater or equal infection rates in co-inoculations compared with single-inoculations for both virus species suggesting an effect of nitrogen addition in releasing virus species interference on each other's ability to invade a host. Co-infection rates could be predicted by the joint probability of successful single (PAV or RPV) inoculations. In the context of elevated nitrogen and phosphorus addition to global biochemical cycles caused by human activities, these results provide insights on how nutrient-host-virus interactions might drive pathogen dynamics and increase the risk of co-infection.

**Keywords:** Stoichiometry, host susceptibility, Barley and cereal yellow dwarf viruses (B/CYDVs, Luteoviridae), *Avena sativa* (Poaceae), *Rhopalosiphum padi* (Aphididae).