Plant nutrient resources differentially alters two virus species dynamics

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PLANT NUTRIENT RESOURCES DIFFERENTIALLY ALTERS TWO VIRUS SPECIES DYNAMICS

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BACKGROUND and OBJECTIVES

Competitive interactions among free living organisms such as plants and algae are known to be regulated by rates and ratios of environmental nutrient supplies[1]. Micro-organisms that rely on a host for their reproduction cycle hijack host metabolic machinery, as well as host resources in metabolites, enzymes and proteins. As the synthesis of these molecules requires nitrogen and phosphorus, altered host nutrients supplies have been hypothesized and thereafter shown to influence microbial dynamics, based on the response of single and a group of micro-organism species[2]. Yet, rates and ratios of nutrients supplied to hosts could also mediate the interactions among co-occurring micro-organisms. Understanding these effects would be an important advance because interactions among co-occuring microbes can alter both host population dynamics and epidemiological processes[3]. The objective of our study was to determine the outcomes of nitrogen and phosphorus addition to plant hosts on infection rates of and interactions among two plant virus species.

MATERIALS and METHODS

We singly- and co- inoculated two virus species, (Barley yellow dwarf virus- PAV and Cereal yellow dwarf virus - RPV) to plants of the cultivated crop species *Avena sativa*. In each condition, hosts received one of four different nutrient treatments. The latter represented a full factorial combination of two levels of nitrogen and of phosphorus that created a gradient of N:P supply ratios, one being replicated at low and high nutrient supply. Each plant was tested 19 days after inoculation for virus infection using RT-PCR and specific primers for each virus species.

RESULTS

P addition lowered CYDV-RPV prevalence. N addition altered the interaction strength among viruses. The co-inoculation of BYDV-PAV lowered CYDV-RPV infection rate. However, this antagonistic interaction only occurred at low nutrient supply rates and was alleviated at high N supply rate. BYDV-PAV infection rates were unaffected by nutrient supply rates and by the co-inoculation of CYDV-RPV. Infection rates after co- and -single inoculations were better predicted by nutrient supply rates while coinfection rates were better predicted by a joint probability of successful inoculation of both virus species (i.e. product of infection rate of each virus species in single inoculations) calculated by N:P ratio.

CONCLUSIONS

The results of our study are one of the first empirical demonstrations that plant nutrient resources can mediate interspecific interactions among co-occurring parasites. 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 alter virus prevalence and risks of co-infection, with potential effects on virus epidemiology.

REFERENCES

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