Spatial Analysis Applied to Plant-parasitic Nematodes: The Case of *Globodera pallida* in Idaho

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ABSTRACT

- The potato cyst nematode *Globodera pallida* is a globally regulated and quarantine pest in the state of Idaho.
- A spatial analysis was performed to understand the spatial arrangement of infested fields and to predict the potential threat of *G. pallida* for entry to new areas.
- Results showed the presence of spatially clustered fields infested with *G. pallida*.
- The spread of *G. pallida* grew in diameter from the original center of infestation toward the southwest as an ellipsoidal-shaped cluster.
- *Globodera pallida* spread followed a contagion effect scenario, where nearby infested fields contributed to the infestation of new fields, through soil contaminated agricultural equipment.

INTRODUCTION

- *Globodera pallida* can survive in the soil for up to 30 years without a suitable host as a cyst containing the nematode eggs. In highly infested fields, *G. pallida* can reduce tuber yields up to 80%.
- Spatial analysis applied to plant-parasitic nematodes provides useful information on the spatial pattern and spatio-temporal dynamics of disease progression.
- Spatial analysis allows the characterization of infection foci and can be used as a tool for predictive modeling of *G. pallida* population dynamics in the field.
- Spatial analysis is regarded as a decision support system for policymakers and stakeholders.
- In this study, we proceeded in exploring the data by doing a cluster analysis followed by a point pattern analysis and spatial interpolation of infested fields using the attribute variables of number of cysts and the values of egg viability.

OBJECTIVES

- The objectives of this study were to: (i) describe the spatial distribution pattern of fields infested with *G. pallida* in southern Idaho, and (ii) predict the potential risk of *G. pallida* spread to new areas.

METHODS

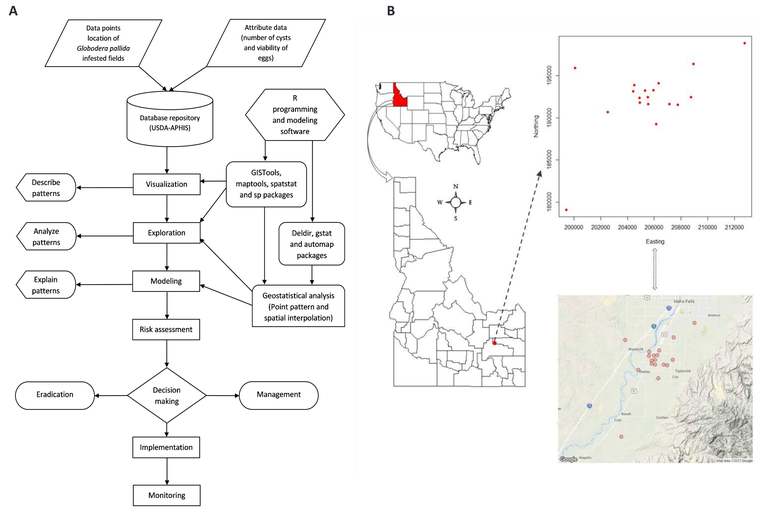

Fig. 1. A. Conceptual framework for spatial analysis of *Globodera pallida* in Idaho. **B.** Locations of the fields infested with *G. pallida* in southern Idaho.

RESULTS

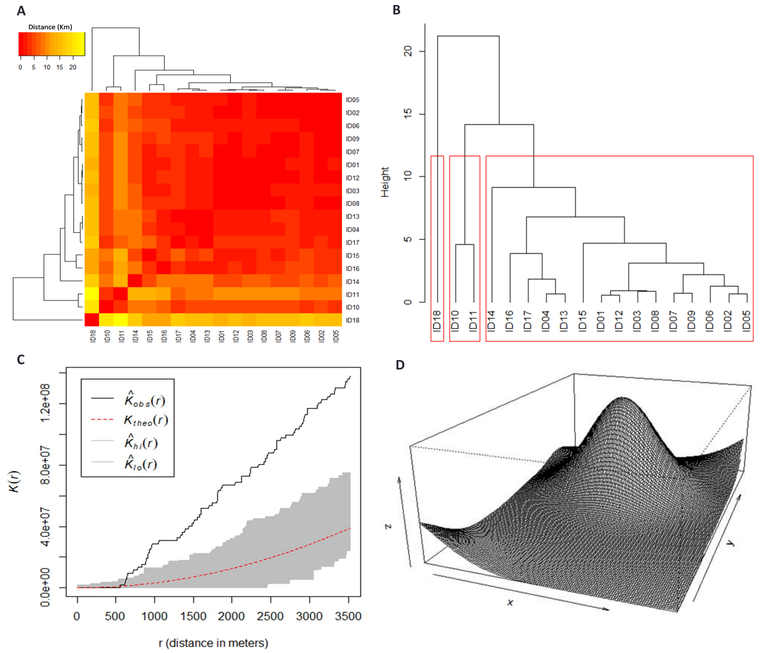

Fig. 2. A. B. Cluster analysis of *Globodera pallida* infested fields. **C.** Ripley's K-function plot showing evidence of spatial aggregation. **D.** Kernel density estimation 3D-plot of infested fields.

RESULTS

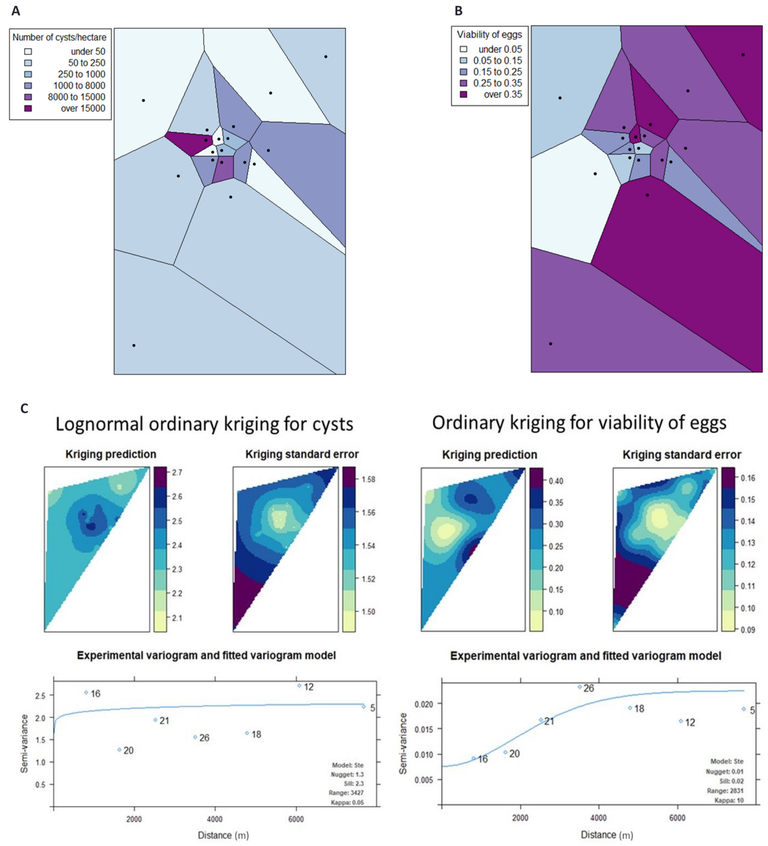

Fig. 3. A. B. Nearest neighbor approach (Thiessen polygons) for spatial interpolation of number of cysts/ha and the values of egg viability of *Globodera pallida*. **C.** Kriging prediction maps and semivariogram analysis for the number of cysts/ha and the values of egg viability.

CONCLUSIONS

- Fields infested with *G. pallida* are spatially aggregated (P = 0.003) and the direction of infestations is oriented toward southwest as an ellipsoidal-shaped cluster.
- *Globodera pallida* spread followed a contagion effect scenario, where nearby infested fields contributed to the infestation of new fields, through soil contaminated agricultural equipment.
- Spatial aggregation of infested fields, with an average of 4,263 cysts/ha and egg viability of 25%, facilitates quarantine activities and confines this pest to a small area of 1,233 ha.

References

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