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Characterization of cryptic species in the *Globodera* genus including the quarantine species *Globodera pallida*



Social-economic context

Invasion of alien species is one of the major factor impacting biodiversity at the world wide scale. Invasive species can also induce important crop losses, like observed for the plant parasitic nematode species, *Globodera pallida*, that is a major pest of potato and a quarantine regulated species in 55 countries. In case of detection in a field, the potato culture can be strictly forbidden for several years and in all cases costly control methods must be applied by the farmer to circumvent the problem.

Scientific context

Speciation is the process that explains new species apparition and its mechanism can fluctuate according to the biology of the organism. Specifying species status is difficult in the plant parasitic nematode genus *Globodera* where previous studies have suggested that *G. pallida* and *G. tabacum* could also be considered as species complex with cryptic entities. Historically taxonomy of nematodes was based on morphological traits but the genetic approach has modified this trend. Nowadays an integrative taxonomy approach that includes genomic, morphologic and biologic characters is preferred to distinguish species.

Objectives

1. Investigate species limits in *G.pallida* and *G.tabacum* complex with genetic and genomic tools.

To identify species, three ways will be explored. The GENETIC WAY to investigate intra and inter-population diversity. Different scale of geography and genome diversity will be considered. Firstly we will use microsatellites markers to investigate the genetic diversity of *G. pallida* in its native area (the south of Peru). Secondly, using Genotyping By Sequencing on a larger set of South American populations potential new cryptic species will be identified.

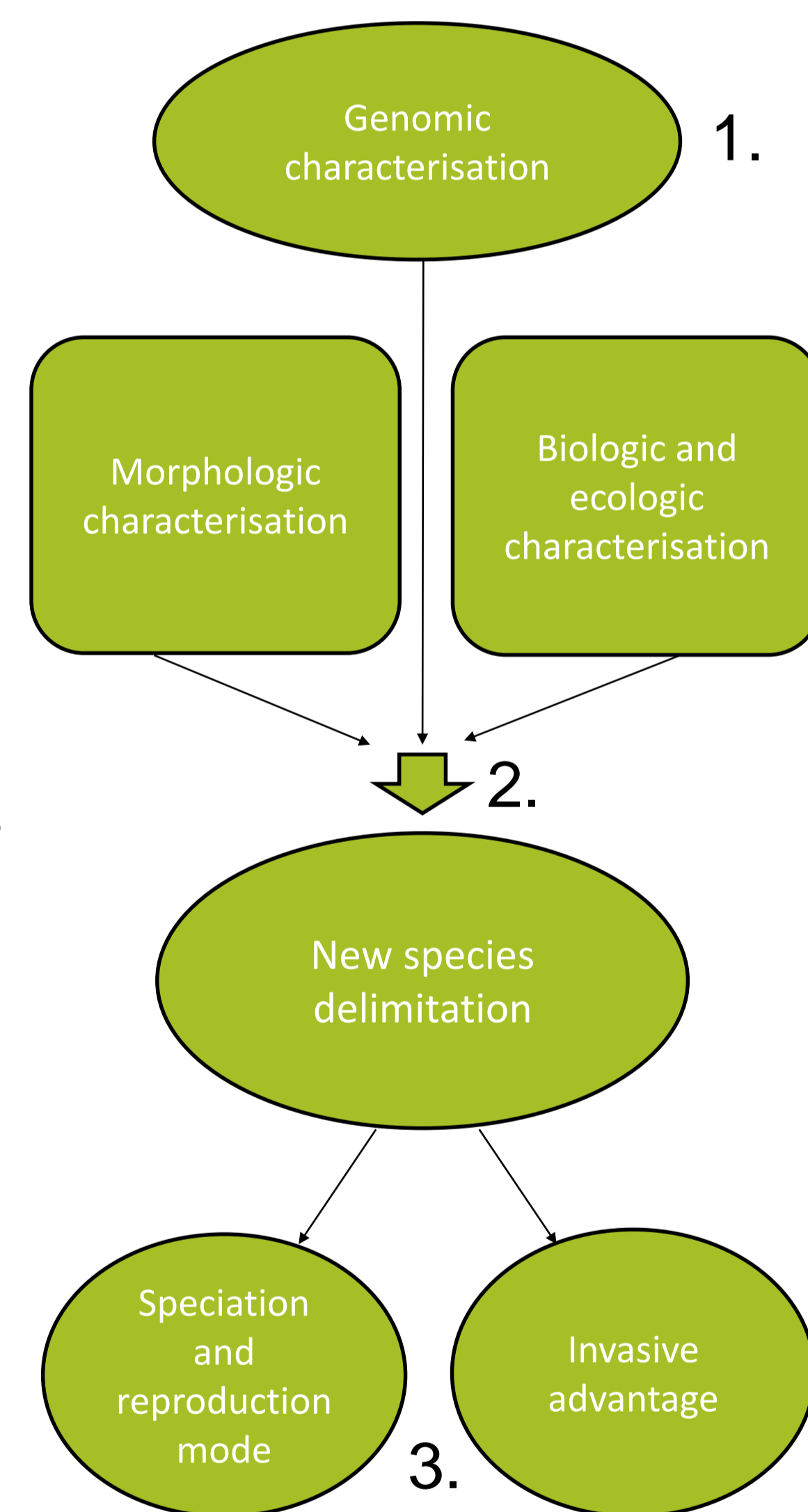
2. Identify morphologic and biologic character matching the genetic / genomic groups

the MORPHOLOGIC WAY will be examined to investigate if the genetic differences observed are reflected in morphologic traits. A new morphobiometric automated analyse will be developed in order to improve the identification of new and unbiased characters to distinguish *Globodera* species. Finally, the BIOLOGIC AND ECOLOGIC WAY will be studied. An investigation of putative assortative matings will be conducted in order to improve our understanding about the mode of reproduction and speciation occurring on these species.

3. Does speciation give an advantage for invasive success ?

If the existence of cryptic species is supported, the question of their invasive success and of their presence or absence in Europe will be investigated. Some life history traits will be measured in each cryptic species as well as their fitness on different plant hosts. Analysis of these results will allow us to understand if during the speciation process, one of the species has retained or gained an advantage for invasion process.

In fine, this work will allow a better characterization of the genetic, morphologic, biologic and ecologic characters that define the different species in the *Globodera* genus. Knowledge of the speciation that occurred in this genus will be important to anticipate the evolution of this pest and better characterize the life history traits impacting invasive success.



Results

This work will produce a revision of the taxonomy in the *Globodera* genus. The development of novel molecular and morphometric tools should allow the identification of cryptic species. Finally a better understanding of the traits that confer an advantage in invasive process will improve the risk assessment in the invaded area.

Perspectives

This project will improve our knowledge for a better risk assessment and improvement of the regulation of quarantine organisms at the national or even European scale.

