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Characterization of fungal diseases infecting quinoa

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Introduction

Quinoa (***Chenopodium quinoa***) is an ancient crop from the Andes of South America. It is increasingly cultivated on all continents. New environments, sudden or extreme changes on weather conditions, increase the incidence of a wider range of diseases. In turn those are able to build-up as seed-borne propagation structures that interfere with seed quality and crop production.

Aims of the project

I. Describe fungal diseases at different stages of quinoa crop development. Understand host/pathogen interactions.
II. Look for sources of resistance in a large sample of native and cultivated Bolivian quinoa genotypes.

I. FUNGAL DISEASES OF QUINOA

1. Disease source

Symptomatic leaves from Quinoa cultivars grown in Tåstrup, Denmark.

KOCH'S POSTULATES
Causative microbe disease relationship

2. Isolation and identification

Identifications of fungi was achieved through amplicon ITS1, morphology of the mycelia and cultured colony. The sequences were found to be 98% and 99% similar to:

a) Alternaria infectoria

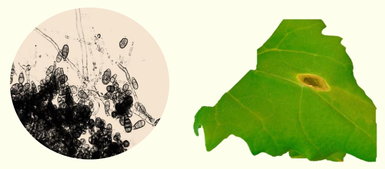
b) ***Alternaria tenuissima***

c) ***Didymella chenopodii***

d) ***Epiccocum nigrum***

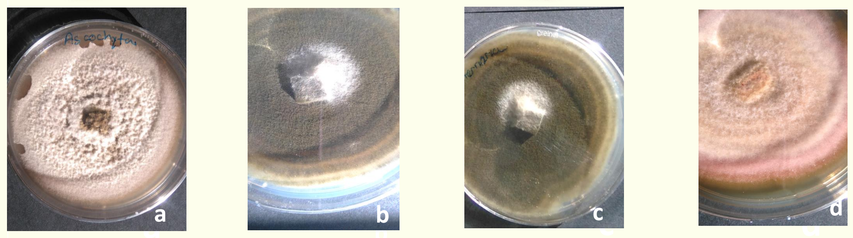
Alternaria infectoria

Alternaria tenuis*sima*



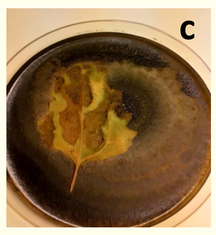
Didymella chenopodii

Epicoccum nigrum

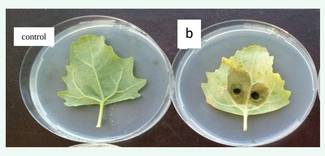


4. Re-isolation

Re-isolation from infected leaves and flowers was successful for all the pathogens except ***E.nigrum***



3. Infection



1.1 Assessment of leaf chlorosis in the field

Four experimental blocks were planted with 3 the Danish cultivars: 10 lower and upper leaves were sampled per cultivar and block.
%Severity=[∑disease grade/∑#of score x maximum grade) x 100]

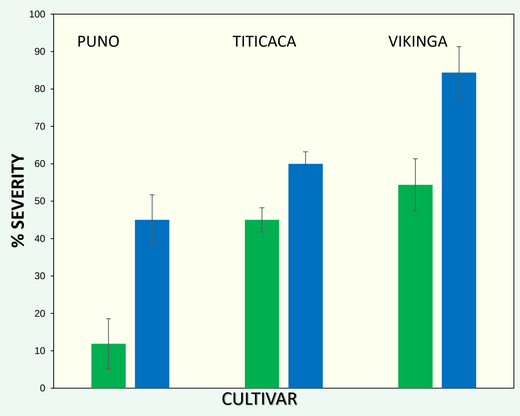


Fig. 1 Severity of leaf chlorosis for three Danish cultivars (%)

3.1 Pathogenicity test on seedlings

10 clean seeds were placed in each tube and there were 8 tubes per treatment (40 µl of spore solution). A two way ANOVA demonstrated that pathogens, cultivars and interaction are significant when measuring seedling dry weight. Fig 2
Treatment: cultivar < 0.0241

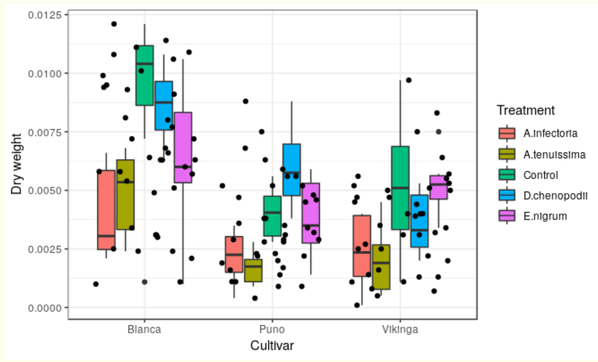
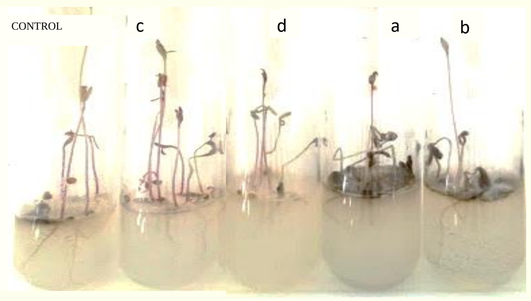


Fig. 2 Differences in seedling-dry weight in relation to Cultivar and Pathogen



Blanca seedlings challenged with different pathogens

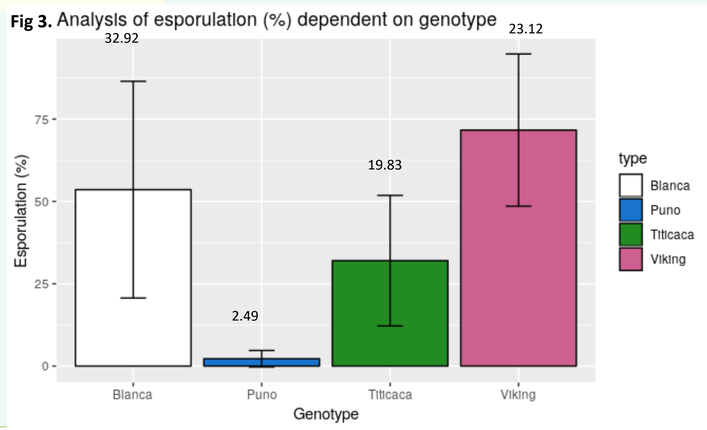
II. DOWNY MILDEW CHARACTERIZATION

Phenotyping downy mildew sporulation in three Danish cultivars and Bolivian cultivar Blanca

120 plants of each genotype were challenged with ***Peronospora variabilis*** and phenotyped according to the amount of esporulation (a comprehensive indicator of pathogenicity).
We estimated the percentage of abdaxial leaf area covered with spores (Fig 3).

Esporulation on abdaxial side of leaf cv. Blanca

Fig 3. Analysis of esporulation (%) dependent on genotype



Work in progress

120 Bolivian genotypes were selected according to different levels of resistance against downy mildew. Self-fertilized plants were grown under greenhouse conditions. DNA extracted from their leaves for genotyping. GWAS of quinoa foliar disease interactions has been phenotyped .

Foliar microbiota from leaf samples collected in the field have been analysed with molecular tools.