

This manuscript reported the analysis of *Geotrichum candidum* domestication in cheese making. This MS expands the studies on the domestication of fungi in fermented products. It presents a set of results on the genomic diversity of the fungus and its phenotypic diversity. It shows that three groups of cheese populations have diverged genetically and phenotypically from populations with wild and mixed-origin and revealed some interesting feature on the evolutionary trajectories of the cheese populations. I found that the work done was adequate with the scope of the manuscript. The analysis of the interactions between *Geotrichum candidum* and its competitors is very original in a study on domestication. My comments are just made to improve the manuscript.

Majors :

I suggest to use the term domestication with more care. Please define domestication and discuss the results with respect to selection by cheese making practices and to migration via the use of industrial strains. Similarly, the paper refers several times to phenotypic convergence but the processes underlying this convergence should be explained. In other words, it would be interesting to propose the different scenarios that could explain these convergences.

We are left with not knowing if the *Geotrichum candidum* cheese populations have adapted to the high lipid content of cheese. The lack of lipolysis signature of domestication raised questions. The maladaptation of cheese populations to cheese agar medium, and to salt is intriguing and would deserve additional comments. Other hypothesis than evolutionary constraints could be suggested.

More generally, the involvement of evolutionary forces other than selection in the evolution of the cheese populations should be further discussed. I would expect migration, especially those associated with the sale of starter strains. I would also expect drift in environments that are often disinfected.

In terms of structure, there are several elements of discussion in the results, especially the comparison with *Penicillium*. I would move them into the discussion in order to reduce and clarify results and enrich the discussion.

Title – I would not call a group of genetically closely related fungal strains a variety. To me, a variety refers to a group of genotypes (most often a single genotype) that has been consciously selected by human.

Minor

L28-29: “The genetic diversity ...was high”: high compared to what ?

L29: I would not state in such determine way that the data indicates a lack of strong bottleneck because of the sampling biases. There are many more cheese strains than strains coming from elsewhere.

L32 “attractive” for who ?

L34 what do you mean by “a more advanced state of domestication” ? I don’t think the data allows the quantification of the response to selection . Moreover, the decrease in genetic diversity is not a signature of domestication. Several studies have now shown that domestication may also lead on the contrary to a diversification, at least for some traits or genetic clusters.

L74-75: *S. cerevisiae* has been domesticated to make a large number of fermented products beyond beer, wine and bread. Please complete and cite either a complete set of recent reviews on *Saccharomyces cerevisiae* domestication or a complete set of major research papers in the field. I would go for research papers and add at least Barbosa et al. 2018 (sake), Bigey et al. current biology, 2021 (bread), Gonçalves et al. current biology, 2016 (beer, wine), Ludlow et al. current biology, 2016 (coffee, cacao)

L105-if you really want to use it, define degeneration and cite a reference. Personally, I find it more informative to speak about accumulation of deleterious mutation if this is what is meant.

L125....--it is a repeat of the abstract. If you wish to add a summary of the results at the end of the introduction, it should be more concise and differ from the abstract.

L186- clarify “cheese type distribution”

L189-103- move the comparison with *Penicillium* to the discussion. In addition, FST are used to measure the extent of divergence among populations of the same species relative to the net genetic diversity within the species. To compare species, absolute measures of divergence between populations should be used in preference to relative measures such as FST. (Charlesworth’s paper and others, DOI: 10.1093/oxfordjournals.molbev.a025953)

L232-233: avoid suggestion in the results, move to the discussion

L243: I can’t see the yellow Figure 1B.a., and therefore the position of commercial strains on the tree. Please, complete the Figure 1 legend as well

L247- 1,200 SNPs: how did you choose this threshold ?

L252: move to the discussion

L242-254 or elsewhere: I was not able to find any information on ploidy. Are all the strains haploid ? please, add the information.

L350-avoid example on *Penicillium* in the results, move to the discussion

L353-356- what does “harsh conditions” mean ? this part should go to the discussion. Furthermore, the relaxed selection hypothesis applies to industrial strains but does it really apply to non-industrial cheese strains?

L357-I would have expected “local adaptation”, i.e. a higher growth on cheese media of cheese strains compared to wild strains. I would discuss this result further in the discussion

L369- move the convergence analysis to the discussion session.

L411: delete “known to be key compounds in fermented beverages such as wine and beer”

L452-456: discussion

L485 / L498: Why do you compare the *Geotrichum candidum* cheese populations diversity with the ones of *Penicillium* sp. ? did you have any prediction based on the use of these species for cheese making ? What does the *Penicillium* and *Geotrichum* diversity comparison brings ? I would made a single paragraph comparing both genera rather than speak about it all over the discussion. This would allow to better show the hypothesis you have to explain their evolutionary trajectories.

L503-506: the secondary domestication hypothesis can be discussed in a more general context of domestication. There is the example of the cachaça *S. cerevisiae* populations (Barbosa et al 2018) but other examples could also be added.

Does cheese making practices could explain the differentiation in three groups of the cheese strains ?

L533-L534: What do you mean by “ first step of domestication” ? why “a more advanced state of domestication” ? There is no dating here, no analysis of evolutionary dynamics. I think you can't tell where the cheese populations are on the adaptive peak. You may also have several adaptive peaks.

L555- Why is “convergence” an important question in evolution ? a deeper discussion on the interest of studying convergence would be interesting. Explaining the process behind phenotypic convergence (standing genetic variation, de novo mutation, migration/gene flow, horizontal gene transfert) would help to understand your approach.

Figures legend-please describe in more details your figures in their legend, so they can be understood as themself.