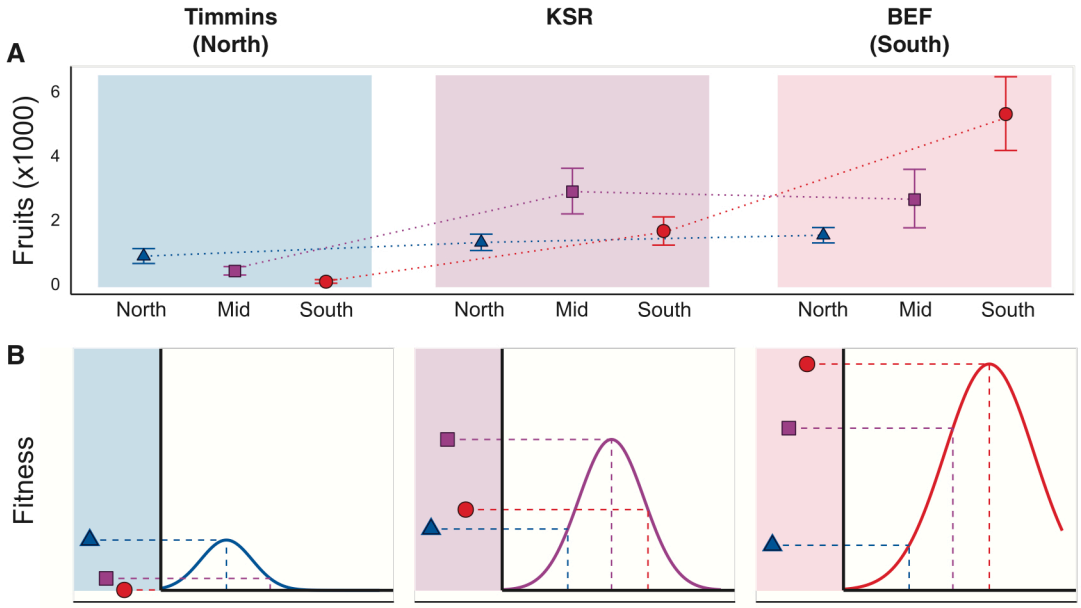
Name:

BIOL415 Quiz #5:



1) Given what you know about adaptation in *Lythrum salicaria* (and the above Figure 1 from Coulatti & Barrett 2013), do you think the species will be able to continue adapting to more Northern latitudes? Explain why/why not (feel free to refer to or mark up the figure). 2–4 sentences, 2 pts.

Model answer: *L. salicaria* adapts to shorter growing seasons in the North by flowering at an earlier age and smaller size. Because of this, the species is genetically constrained and trades-off local adaptation for maximum fitness (or population growth rate). I think the species will likely not be able to adapt to a growing season much shorter than its current Northern range limit, because the benefit of local adaptation will be overwhelmed by the cost of the genetic constraint, and populations will not be able to reproduce enough to persist.

For full points, the response must be logical, coherent, and refer to genetic constraint and/or local adaptation vs. maximum fitness/population growth rate. A "yes" answer is possible, if properly qualified (e.g. in the context of climate change or a limited expansion North).

2) Explain why the loss of shattering is an important domestication trait in many crops. 1 sentence, 1 pt.

Model answer: The loss of shattering is an important hallmark of domestication/part of a domestication syndrome because it indicates a transition from the wild ability to disperse seeds to dependence on humans for dispersal and propagation (1 pt).
Could mention instead (or in addition) that the loss of shattering has likely been selected for by humans to make harvesting more efficient (1 pt).

3) Describe how one of the major threats to crop diversity is predicted to impact our food supply. What is one approach that could be used to address that threat? 2–3 sentences, 2 pts.

Any coherent, logical response based on material covered in lecture, discussion, or the readings. 0.5 pts for identifying a threat, 0.5 pts for describing its impact, 0.5 pts for a potential solution, and 0.5 pts for a clear connection between threat and solution.

4) *Lithops amicorum* (a pebble plant) exhibits two leaf colors: reddish leaves in a population on red substrate, and grayish leaves in a population on gray substrate. You have found a gene responsible for leaf color in these two populations. Briefly describe one method (including predicted result) you could use to determine if this gene is under divergent natural selection. 1–2 sentences, 2 pts.

Either of the following (or any other reasonable method described coherently, e.g. nucleotide diversity):

I could look at the ratio of nonsynonymous to synonymous substitutions (Ka/Ks) in the coding region of the gene. If Ka/Ks is above one, then the gene is likely experiencing divergent natural selection.

I could look at pairwise distance (Fst) between the two populations for that gene relative to Fst for other loci. If Fst is significantly higher for the color gene than for other loci, then the gene is likely experiencing divergent natural selection

1 pt for describing a method and 1 pt for describing what to expect under divergent selection.

Note that a reciprocal transplant will only tell you about divergent selection on the trait or something correlated to the trait, not on the gene of interest. If some other gene is also contributing to color, or another correlated trait is actually the target of selection, you could see evidence for divergent selection in your reciprocal transplant but not see evidence for divergent selection on your gene of interest.