**Provenance and Parentage: How the Collection Locations of Seeds affect the Flower, Fruit, and Seed Traits of their Offspring in a Common Garden**

**Overview and Introduction**

*Background*

* Phenology
  + Timing of life-history events
  + Subject to the same gene flow that other traits are subject to
  + Extremely plastic within species (Elzinga et al., 2007) – careful here! Really depends on the phenophase and the species
* Flower, fruit, and seed characteristics
  + Seed size (mass) has been shown to be related to success of the seedling (due to an increase in the nutrients that the seedling has to survive) (Ambika, Manonmani, & Somasundaram, 2014) – great!

*Aims and Objectives – what about phenology?? Also fruits and seeds are synonymous*

1. Discover correlations between latitude and a variety of flower, fruit and seed characteristics.
   1. Seed size (mass, length, width) and collection site of the parents
   2. Fruit size (mass, length, width) and collection site of the parents
   3. Flower size (mass, length, width) and collection site of the parents
2. Discover correlations between collection date and flower, fruit, and seed characteristics. – how do you mean collection date? Like before or after budset? Not sure you need this section. You should pick a standardized BBCH for collection I would say
   1. Seed size (mass, length, width) and collection date
   2. Fruit size (mass, length, width) and collection date
   3. Flower size (mass, length, width) and collection date
3. Discover correlations between plant size and seed and fruit size
4. (Hopefully) present linear trends that show correlations with these characteristics

*Hypotheses*

1. I expect that:
   1. Seed size will decrease as provenance latitude increases (Moles & Westoby, 2003). Further away from the tropics, the seed size decreases, most likely in relation to the shorter growing season. – cool!
   2. Fruit size will decrease as latitudes of parental collection move northwards. I cannot find sources, Cat. – fruits and seeds are synonymous Nothing talks about fruit size and latitude. I’m basing this on that there are shorter growing seasons further north, meaning that there will be smaller fruits from the seeds further north since they have adapted for their seeds to survive with less fruit.
2. I expect that the later in the season the samples are collected, the larger that they will be. This is due to the fact that they will have had more time to grow. \ - this sounds good to me!
3. It has been shown that larger, older plants produce larger seeds (Leishman, Westoby, & Jrado, 1995), and many of the plants that I will be collecting from are around a similar age. Therefore, I would expect that the larger plants (in width and height) would show larger flowers, fruits, and seeds. – well done here!

*Significance and Implications*

Because phenology is multifaceted and affected by many different things, it is difficult to study exactly what affects it. This study aims to pinpoint how seed provenance can affect the flower, fruit, and seed traits and ELEPHANTS (timing? Beginning of flowering? Rate of ripening?). By gathering samples and making phenology observations from a common garden, we assume that these

**Plan for Research**

*Design*

Using a common garden, I hope to establish that flower, fruit, and seed traits are at least partially determined genetically based on their provenance. By having these plants whose seeds came from different locations

Notes by Cat:

Great work overall! Good work finding some literature to support some of your ideas.

In my mind you were going to test how fruit size, flower size, etc would predict the timing between fruits and flowers.

So, thinking of this statisitically:

Y = day of year (ripe fruit or just fruits – ideally BBCH 79) – day of year (open flowers – maybe 61?)

Y ~ fruitsize + flowersize + provenancelatitude + species

Ex hypothesis: Higher provenance latitudes will have faster rates of fruiting due to the shorter growing season. (I have no idea about this just trying to give an example)

For the other test:

Y = fruitsize, or number of fruits, or ripe fruit date (BBCH 79)

Y ~ flowersize + provenancelat + species + plantsize + pollinationsyndrome (wind or insect pollinated?)

The reason why phenology is so important is because it helps us track shifts in climate. Say flowering starts sooner in the year with climate change but fruits are taking longer to ripen, we may have phenological mismatches with the flowers (pollinators coming out later than the flowers because they are responding to other cues) or with the fruits because the frugivores are looking for them at a different time then the fruits are ripening.

Another thing to keep in mind, with climate change, summers are getting hotter and drought frequency is increasing. If fruits or flowers are coming out too soon and then being exposed to droughts, what does that mean for forest recruitment?

Happy to chat about this more sometime this week. I think what you have is fine for now but we should change around your goals for the rest of summer. This is totally on me, I should’ve been more clear about this! Again, great first stab!