## **General Notes**

* Before working with plant pathogens like white mold or anthracnose, you’ll need some safety certifications. [Here’s the EHS site with all of the courses available](https://www.mcgill.ca/ehs/training#:~:text=%C2%A0-,Safety%20Training%20Courses,-Biosafety%20Training%20(including).
  + You’ll want the Intro to Biosafety, Safe Use of BSCs, and Hazardous Materials courses to be authorized to work with mold.
    - Only the biohazard part of the hazmat course is relevant to what we do here, but the rest is at least kind of interesting.
  + Make sure to do the certifications while you’re on McGill wifi or using the McGill VPN, it won’t let you take the quiz at the end if you’re somewhere else.
  + Contact Christina Jarabek at Mcgill Environmental Health and Safety to get added to the lab’s Biohazardous Materials Use sheet. christina.jarabek@mcgill.ca
* Anthracnose has a very diverse population structure, and some races of anthracnose are a lot more virulent and prevalent than others. Resistance to all races is rare, and bean cultivars tend to be resistant to a few races at a time (sometimes those that were more prevalent where they are normally grown, sometimes not, depends what cultivar you’re looking at).
  + [Michigan State University](https://www.canr.msu.edu/beanbreeding/research/antracnose) has a brief primer on anthracnose in beans.
  + [Gilio et al 2020](https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0239763481,%20Kaboon%20(resistant),%20TO%20(susceptible),%20TU%20(resistant)%20and%20G%202333%20(susceptible),%20were%20used%20as%20internal%20controls%20for%20successful%20inoculation.%20For%20race%2023,%20the%20cultivars%20Widusa,%20Michigan%20Dark%20Red%20Kidney,%20Perry%20Marrow%20and%20Michelite%20were%20used%20as%20susceptible%20controls.) mentions a few common anthracnose races and which cultivars are resistant to them, but it isn’t super in-depth.
  + Check with past lab members or Valerio about more anthracnose readings - Andrea and Jenny worked in anthracnose and might have good sources for you.
* G 2333 is the gold standard for anthracnose resistance, but it is still susceptible to a couple of anthracnose races (mainly Mesoamerican).
  + A set of 12 differential cultivars is the standard for testing anthracnose resistance, as bean cultivars in the panel show resistance to complementary races of anthracnose and thus can give a more accurate picture of which race a particular sample of anthracnose might belong to and how virulent it is. We have a large amount of seed from these 12 cultivars on hand at Lods, and they have been used to check KASP markers relating to anthracnose resistance in the literature. The MSU link above also has some information on the differentials.
* ***Bring back the seed packets you use before seed treatment and planting season -*** get in touch with Shamus and Valerio about when that will be.

## **Literature**

**Valentini et al. 2017** “[High-resolution mapping reveals linkage between genes in common bean cultivar Ouro Negro conferring resistance to the rust, anthracnose, and angular leaf spot diseases](https://link.springer.com/article/10.1007%2Fs00122-017-2920-6)”

Markers

* 8 SNP-based KASP markers associated with the *Ur-14/Co34* locus were used in this paper. [Here’s the link](https://link.springer.com/article/10.1007/s00122-017-2920-6/tables/4) to a table of their SNP IDs, position in the genome, and primer sequences.
* Add markers for *Co4²* locus from unpublished data (see Intertek KASP markers spreadsheet lines 8-9). [Here’s some further information](https://link.springer.com/article/10.1007/s001220050713) about the *Co42* locus and why it is likely one of the most important sources of anthracnose resistance for us to study

Cultivars

* The paper focused on using their own cross population from Rudá x Ouro Negro. It would be useful to expand the scope of these findings by running the 8 potential markers (or a subset of them, as you please) against the anthracnose differential cultivars.
  + Michelite, **Michigan Dark Red Kidney (MDRK**), **Perry Marrow**, Cornell 49242, **Widusa,** Kaboon, Mexico 222, PI 207262, TO, TU, AB 136, and **G 2333.**
* **USPT-ANT-1 for anthracnose resistance.** This cultivar is part of the MDP and is available at Lods, but is not in the drawer that it is supposed to be in. Check around, keep an eye out for it while doing weights and data entry, and ask Shamus about it. Known to possess resistance genes at Co-42 locus.

**Gilio et al 2020 “**[Fine mapping of an anthracnose-resistance locus in Andean common bean cultivar Amendoim Cavalo](https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0239763)**”**

Markers

* 2 SNP- based KASP markers: ss56 and ss92 for Co-AC locus.

Cultivars

* **Amendoim Cavalo** for resistance to most anthracnose races. We do not have access to it, but considering how widespread its resistance is, we should consider ordering some.
* Widusa has resistance to several prominent anthracnose races, but not as many as Amendoim Cavalo ([Vidigal et al. 2006](https://www.researchgate.net/publication/225189435_Inheritance_of_anthracnose_resistance_in_the_common_bean_cultivar_Widusa%20common%20bean%20cultivar%20Amendoim%20Cavalo))
* The entire set of anthracnose differentials were used as checks, and there were good details about which were susceptible and which were resistant - “Several cultivars differentially resistant to race 3481, Kaboon (resistant), TO (susceptible), TU (resistant) and G 2333 (susceptible), were used as internal controls for successful inoculation. For race 23, the cultivars Widusa, Michigan Dark Red Kidney, Perry Marrow and Michelite were used as susceptible controls. In relation to the spectrum of resistance in AC, one resistant cultivar and one susceptible cultivar were used as controls for each race.”

**Vidigal et al. 2020.** “[New Andean source of resistance to anthracnose and angular leaf spot: Fine-mapping of disease-resistance genes in California Dark Red Kidney common bean cultivar](https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0235215)”

Markers

* 28 potential SNP markers. See [Supplemental Figures](https://journals.plos.org/plosone/article/file?type=supplementary&id=info:doi/10.1371/journal.pone.0235215.s004) for a list with their positions.

Cultivars

* CDRK
* Yolano
* MDRK, Kaboon, and Perry Marrow from differentials.

Notes

* These markers are just SNPs and do not yet have KASP markers designed for them. That’s something you may want to explore after you’re comfortable with the KASP protocol through this lab.