PhD School on Agriculture, Environment and Bioenergy

(http://sites.unimi.it/dottorato_aab/)

(XXXVII cycle, 2021-24)

Project draft

1. **Field of interest: (***Indicare* ***il/i*** *settore/i scientifico disciplinari)* ***AGR 07***
2. **Project title:** Genetic improvement of Camelina (Camelina sativa L. Crantz) for glucosinolate content and yield.
3. **Tutor: Roberto Salvatore Pilu**

- Eventually: co-tutor/s

4. Relevance of the topic and state of the art:

Camelina (Camelina sativa L. Crantz) is an herbaceous annual oilseed crop belonging to the family Brassicaceae (Cruciferae) originated from southeastern Europe and southwestern Asia.

The interest in this crop has increased significantly in recent years, especially for the short cycle, the high oil content (up to 40%), the high level of unsaturated fatty acids (30-40% alpha linolenic acid fraction, 15-25% acid fraction linoleic, 15% oleic acid fraction and about 15% eicosenoic acid) and low-input agronomical practices (*Martinelli & Galasso, 2011*). The erect plants reach heights between 30 and 90 cm. The leaves are lobed both in the rosette and along the single stem, which becomes woody towards the end of the vegetative cycle. The flowers are small, yellow, in terminal clusters without bracts. The pear-shaped siliques contain the seeds 7 to 9 mm long are not susceptible to deiescence *(Canadian Food Inspection Agency, 2017).* Genetic studies of the C. sativa genome suggest a polyploid structure, possibly hexaploidy (2n = 40, genome size ~ 782 Mb) (*Manca et al., 2013*). A limiting factor regarding the utilization of Camelina sativa is the presence of high level of glucosinolate in the seeds, Glucosinolates are sulfur-containing glucosides, mainly present in Brassicaceae, involved in plant defence *(Russo et al., 2014).*

In fact, the aim to reduce the glucosinolate content to reduce the toxic effect is a goal of plant breeding programs.

However, few breeding programs have been developed on this plant, mainly aimed at improving yield, fatty acid profile or glucosinolate content.

5. Layout of the project (draft)

The primary aim of the project is to perform a breeding program by pedigree method regarding the genetic improvement of glucosinolate and oil content.

The pedigree scheme will be aimed by a phenotyping analysis of the most interesting agronomic traits and genotyping process. Another aim of this project is to identify QTLs associate to glucosinate content to speed further breeding programs.

The project is divided in the following task:

Task 1) Collection of commercial Camelina sativa varieties available on the market

Task 2) Agronomic (yield, time of planting, flowering period, plant architecture), genetic (GBS, SSRs) and chemical (fatty acid and glucosinolate content) characterization of the selected varieties with the aim to select the more promising parentals.

Task 3) Generation of segregating progenies for the breeding program

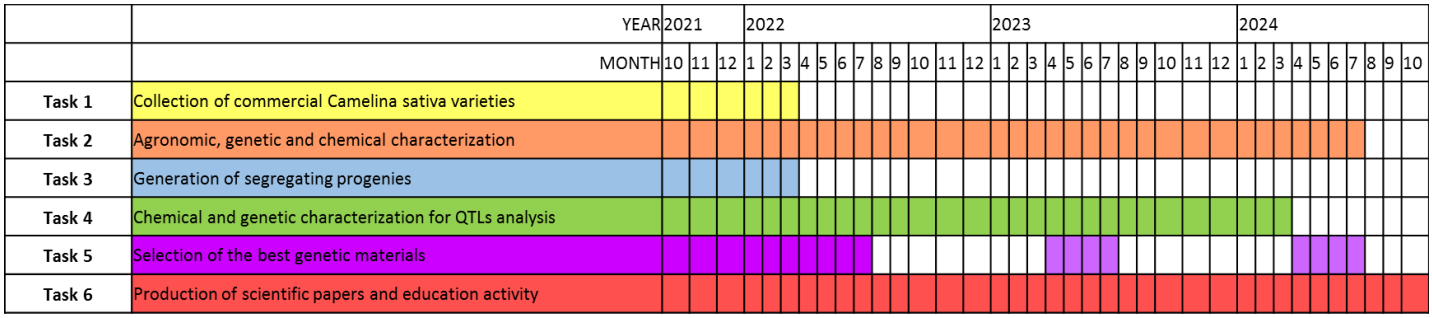
Task 4) Chemical and genetical characterization for QTLs analysis

Task 5) Selection of the best genetic materials

5.1. Materials & Methods:

- Greenhouse, growth chambers
- Experimental fields
- QTLs analysis
- Genotyping by GBS
- Chemical analysis performed in DISAA lab (HPLC)
- Software for data elaboration: MapMakerQTLs, etc..

5.2. Schedule and major steps (3 years):



Gantt chart

6. Available funds

SOCIAAALP,GEMMA, MIND HUBS and Private funding (about 100000 E)

7. Literature:

Canadian Food Inspection Agency. The Biology of Camelina sativa (L.) Crantz (Camelina). Part of the Guidance Document Repository (GDR), 2017. A companion document to Directive 94-08 (Dir94-08), Assessment Criteria for Determining Environmental Safety of Plant with Novel Traits. http://www.inspection.gc.ca/plants/plants-with-novel-traits/applicants/directive-94-08/biology-documents/camelina-sativa-l-/eng/1330971423348/1330971509470. Accesso del 27 Settembre 2020.

Manca A, Pecchia P, Mapelli S, Masella P, Galasso I. Evaluation of genetic diversity in a Camelina sativa (L.) Crantz collection using microsatellite markers and biochemical traits. Genetic Resources and Crop Evolution 2013; 60(4): 1223–1236. doi: 10.1007/s10722-012-9913-8.

Martinelli T, Galasso I. Phenological growth stages of Camelina sativa according to the extended BBCH scale. Annals of Applied Biology 2011; 158: 87–94. doi:10.1111/j.1744-7348.2010.00444.x.

Russo R, Galasso I, Reggiani R. Variability in Glucosinolate Content among Camelina Species. American Journal of Plant Sciences 2014; 5: 294-298. doi:10.4236/ajps.2014.53040.