

|                                                                               | Implementation schedule | Physically/<br>Remotely              | Workload (hours)<br>On site | Autonomous work for students (max hours) | Learning outcomes                                                                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------|-------------------------|--------------------------------------|-----------------------------|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Activity 1- Literature review, project planning and sample preparation</b> | Week 1                  | Remotely                             | -                           | 20                                       | Explain the role of quinoa saponins in plant defense and sustainable crop protection, formulate research questions and experimental design, become familiar with metabolomics workflows and quinoa saponin chemistry.                                                                                            |
| <b>Activity 2- Metabolomic profiling of quinoa saponins</b>                   | Weeks 2-5               | Hybrid (physically (AUA) & remotely) | -                           | 80                                       | Perform sample preparation and LC-HRMS metabolomic analyses, characterize and compare saponin profiles of quinoa genotypes with contrasting saponin contents, identify and quantify hederagenin- and oleanolic acid-derived saponins, gain practical experience in metabolomics data acquisition and processing. |
| <b>Activity 3-Data analysis, interpretation and scientific presentation</b>   | Week 6                  | Remotely                             | -                           | 20                                       | Analyze and interpret metabolomic datasets, evaluate relationships between saponin composition and potential bioactivity, discuss the application of quinoa saponins as biopesticides, communicate scientific results through a written report and oral presentation.                                            |