



Project No: 720726

Project acronym: LIBBIO

Project title: Lupinus mutabilis for Increased Biomass from marginal lands and value for BIOfineries

Deliverable: D1.1 Unified EU collection

Start date of project: 1st October 2016 Duration: 48 months

Due Date: 30th September 2018

Actual Submission Date: 30th September 2018

Lead beneficiary for this deliverable: Wageningen University

Type of deliverable		
R	Document, report	X
DEC	Websites, patents filing, press & media actions, videos, etc.	

Dissemination Level of Report		
PU	Public	X
CO	Confidential, only for members of the consortium (including the Commission Services)	

Revision History:

Version	Date	Author(s)	Description
1.0	4.07.2018	Luisa Trindade	Initial Draft



Lupin Bioeconomy Development



Horizon 2020
European Union Funding
for Research & Innovation



This project has received funding from the Bio Based Industries Joint Undertaking under the European Union's Horizon 2020 research and innovation programme under grant agreement No 720726.



Summary

In the first year of LIBBIO we have made a selection of highly genetically diverse *Lupinus mutabilis* available worldwide. The accessions selected for analysis in LIBBIO field trials, in particular WP1, are composed by the collection of INIAP, breeding material from the ISA collection, and part of the JKI breeding program. The Unified EU collection, that will further be used for the GWAS is composed of 226 accessions.



Description deliverable

The scope of this deliverable is to build a collection of *Lupinus mutabilis* accessions that are genetically and phenotypically diverse. This set of accessions will be tested under European conditions and genetic markers for different traits will be identified that are relevant for the development of new varieties for EU.

One of the primary aim of LIBBIO is to develop new high-yielding and resource use efficient *Lupinus mutabilis* varieties of good quality using modern breeding technologies. These varieties will be developed for EU conditions, either suitable for winter cropping in Mediterranean or summer cropping in north-central European conditions.

Lupinus mutabilis is originally from the Andes, where a great genetic diversity in this species can be found in the wild. Andean lupins, also called tarwi or chocho, have been developed as a crop in different countries in Central and South America, where some varieties have been breed for food and feed purposes. Although *Lupinus mutabilis* have attracted interest from European researchers in the past, no extended breeding program or varieties optimized for European conditions is yet available. There are some *L. mutabilis* accessions kept in some germplasm banks in Europe but the plant material available it has been poorly characterized.

In LIBBIO WP1 we aim to characterize and explore genetic diversity in *Lupinus mutabilis* in order to develop molecular markers for different agronomic and quality traits relevant for the production of tarwi in Europe. We will use a Genome Wide Association mapping (GWAS) approach to identify such molecular markers or quantitative trait loci (QTL's). These markers will be further used in Tasks 1.2 and 1.3 to assist the development of new *L. mutabilis* varieties for European conditions.

The success of the GWAS analysis in LIBBIO will be largely dependent on the plant material we use, therefore it is of great relevance to assemble a collection of *Lupinus mutabilis* accessions with large genetic and phenotypic diversity, in particular for the traits of interest.

As the material available in Europe is limited and poorly characterized we have set up a collaboration with INIAP (Quito, Ecuador) in order to construct the Unified EU collection (task 1.1). INIAP has an outstanding collection of *Lupinus mutabilis* accessions representing (probably) the largest genetic diversity collection available for this species. The seeds of the INIAP collection, that will be later used for the GWAS, are currently being multiplied in Quito, Ecuador.

In addition, the GWAS collection will also include the best material of two European breeding programs: Instituto Superior de Agronomia (ISA, Lisbon, Portugal) and Julius Kühn-Institut (JKI, Quedlinburg, Germany). The selection of lines from the JKI collection is depicted in Figure 1. These accessions have been propagated in isolations in 2017 at ISA (Portugal).

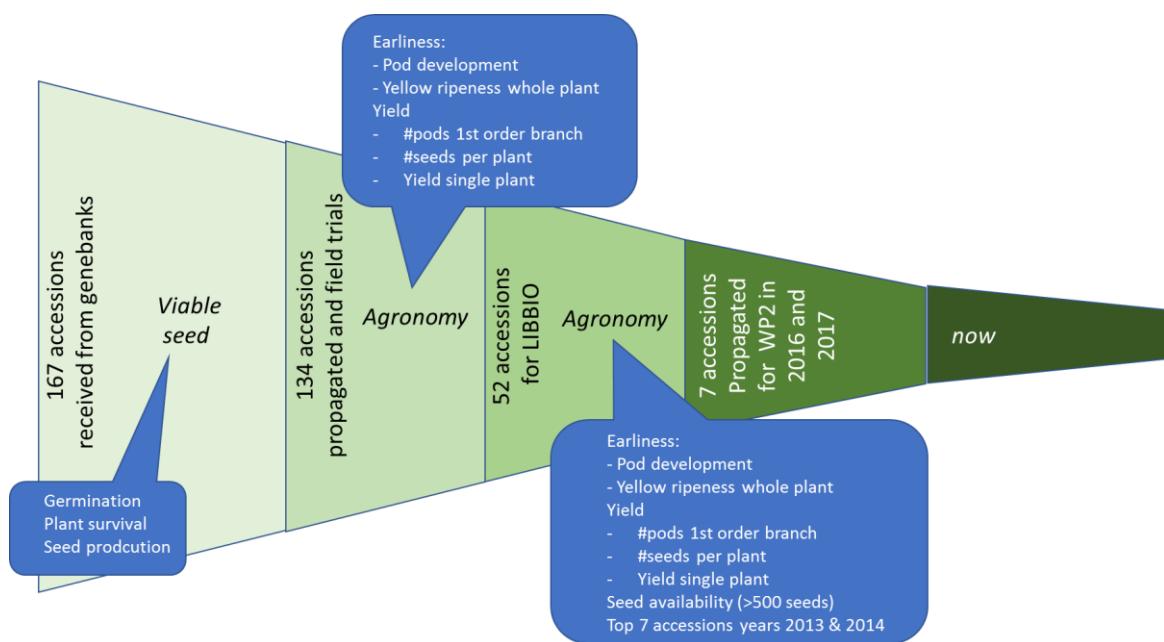


Figure 1 – Selection procedure of the *L. mutabilis* accessions on JKI collection.

The accessions selected for the GWAS field trials were reported in Deliverable 1.4. The seeds of these accessions were propagated in Ecuador and in Europe, and almost all, with the exception of accession LIB191, yield enough seeds for the two GWAS field trials (120 seeds per accession). Two new



accessions LIB225 and LIB226 that were initially not part of the selection have been added to the GWAS panel. The accessions that will be used in the GWAS field trials, and thus the basis of the Unified EU collection, are presented in Table 1.

List of selected accessions

Table 1: *L. mutabilis* accessions that will be used in LIBBIO GWAS field trials and are the basis of the EU Unified collection.

Accession code	Species	Country of Origin
LIB001	mutabilis	Ecuador
LIB002	mutabilis	Ecuador
LIB003	mutabilis	Ecuador
LIB004	mutabilis	Ecuador
LIB005	mutabilis	Ecuador
LIB006	mutabilis	Ecuador
LIB007	mutabilis	Ecuador
LIB008	mutabilis	Ecuador
LIB009	mutabilis	Ecuador
LIB010	mutabilis	Ecuador
LIB011	mutabilis	Ecuador
LIB012	mutabilis	Ecuador
LIB013	mutabilis	Ecuador
LIB014	mutabilis	Ecuador
LIB015	mutabilis	Ecuador
LIB016	mutabilis	Ecuador
LIB017	mutabilis	Ecuador
LIB018	mutabilis	Ecuador
LIB019	mutabilis	Ecuador
LIB020	mutabilis	Ecuador
LIB021	mutabilis	Ecuador
LIB022	mutabilis	Ecuador
LIB023	mutabilis	Ecuador
LIB024	mutabilis	Ecuador
LIB025	mutabilis	Ecuador
LIB026	mutabilis	Ecuador
LIB027	mutabilis	Ecuador
LIB028	mutabilis	Ecuador
LIB029	mutabilis	Ecuador
LIB030	mutabilis	Ecuador
LIB031	mutabilis	Ecuador



Accession code	Species	Country of Origin
LIB032	mutabilis	Ecuador
LIB033	mutabilis	Ecuador
LIB034	mutabilis	Ecuador
LIB035	mutabilis	Ecuador
LIB036	mutabilis	Ecuador
LIB037	mutabilis	Ecuador
LIB038	mutabilis	Ecuador
LIB039	mutabilis	Ecuador
LIB040	mutabilis	Ecuador
LIB041	mutabilis	Ecuador
LIB042	mutabilis	Ecuador
LIB043	mutabilis	Ecuador
LIB044	mutabilis	Ecuador
LIB045	mutabilis	Ecuador
LIB046	mutabilis	Perú
LIB047	mutabilis	Perú
LIB048	mutabilis	Perú
LIB049	mutabilis	Perú
LIB050	mutabilis	Perú
LIB051	mutabilis	Perú
LIB052	mutabilis	Perú
LIB053	mutabilis	Perú
LIB054	mutabilis	Perú
LIB055	mutabilis	Perú
LIB056	mutabilis	Perú
LIB057	mutabilis	Perú
LIB058	mutabilis	Perú
LIB059	mutabilis	Perú
LIB060	mutabilis	Perú
LIB061	mutabilis	Perú
LIB062	mutabilis	Perú
LIB063	mutabilis	Perú
LIB064	mutabilis	Perú
LIB065	mutabilis	Perú
LIB066	mutabilis	Ecuador
LIB067	mutabilis	Ecuador



Accession code	Species	Country of Origin
LIB068	<i>mutabilis</i>	Ecuador
LIB069	<i>mutabilis</i>	Ecuador
LIB070	<i>mutabilis</i>	Ecuador
LIB071	<i>mutabilis</i>	Perú
LIB072	<i>mutabilis</i>	Perú
LIB073	<i>mutabilis</i>	Ecuador
LIB074	<i>mutabilis</i>	Ecuador
LIB075	<i>mutabilis</i>	Ecuador
LIB076	<i>mutabilis</i>	Ecuador
LIB077	<i>mutabilis</i>	Ecuador
LIB078	<i>mutabilis</i>	Ecuador
LIB079	<i>mutabilis</i>	Ecuador
LIB080	<i>mutabilis</i>	Ecuador
LIB081	<i>mutabilis</i>	Ecuador
LIB082	<i>mutabilis</i>	Ecuador
LIB083	<i>mutabilis</i>	Ecuador
LIB084	<i>mutabilis</i>	Ecuador
LIB085	<i>mutabilis</i>	Ecuador
LIB086	<i>mutabilis</i>	Ecuador
LIB087	<i>mutabilis</i>	Bolivia
LIB088	<i>mutabilis</i>	Ecuador
LIB089	<i>mutabilis</i>	Ecuador
LIB090	<i>mutabilis</i>	Perú
LIB091	<i>mutabilis</i>	Perú
LIB092	<i>mutabilis</i>	Perú
LIB093	<i>mutabilis</i>	Perú
LIB094	<i>mutabilis</i>	Perú
LIB095	<i>mutabilis</i>	Perú
LIB096	<i>mutabilis</i>	Perú
LIB097	<i>mutabilis</i>	Perú
LIB098	<i>mutabilis</i>	Perú
LIB099	<i>mutabilis</i>	Perú
LIB100	<i>mutabilis</i>	Perú
LIB101	<i>mutabilis</i>	Ecuador
LIB102	<i>mutabilis</i>	Ecuador
LIB103	<i>mutabilis</i>	Ecuador



Accession code	Species	Country of Origin
LIB104	mutabilis	Ecuador
LIB105	mutabilis	Ecuador
LIB106	mutabilis	Ecuador
LIB107	mutabilis	Ecuador
LIB108	mutabilis	Ecuador
LIB109	mutabilis	Ecuador
LIB110	mutabilis	Ecuador
LIB111	mutabilis	Bolivia
LIB112	mutabilis	Bolivia
LIB113	mutabilis	Bolivia
LIB114	mutabilis	Bolivia
LIB115	mutabilis	Bolivia
LIB116	mutabilis	Bolivia
LIB117	mutabilis	Bolivia
LIB118	mutabilis	Bolivia
LIB119	mutabilis	Bolivia
LIB120	mutabilis	Bolivia
LIB121	mutabilis	Bolivia
LIB122	mutabilis	Bolivia
LIB123	sp.	Ecuador
LIB124	mutabilis	Ecuador
LIB125	mutabilis	Perú
LIB126	mutabilis	Perú
LIB127	mutabilis	Perú
LIB128	mutabilis	Perú
LIB129	mutabilis	Perú
LIB130	mutabilis	Perú
LIB131	mutabilis	Perú
LIB132	mutabilis	Perú
LIB133	mutabilis	Perú
LIB134	mutabilis	Perú
LIB135	mutabilis	Perú
LIB136	mutabilis	Perú
LIB137	mutabilis	Perú
LIB138	mutabilis	Perú
LIB139	mutabilis	Perú



Accession code	Species	Country of Origin
LIB140	mutabilis	Perú
LIB141	mutabilis	Perú
LIB142	mutabilis	Perú
LIB143	mutabilis	Perú
LIB144	mutabilis	Perú
LIB145	mutabilis	Perú
LIB146	mutabilis	Perú
LIB147	mutabilis	Perú
LIB148	mutabilis	Perú
LIB149	mutabilis	Perú
LIB150	mutabilis	Perú
LIB151	mutabilis	Perú
LIB152	mutabilis	Ecuador
LIB153	mutabilis	Ecuador
LIB154	mutabilis	Perú
LIB155	mutabilis	Perú
LIB156	mutabilis	Ecuador
LIB157	mutabilis	Perú
LIB158	mutabilis	Ecuador
LIB159	mutabilis	Ecuador
LIB160	mutabilis	Bolivia
LIB161	mutabilis	Ecuador
LIB162	mutabilis	Perú
LIB163	mutabilis	Ecuador
LIB164	mutabilis	Ecuador
LIB165	mutabilis	Bolivia
LIB166	mutabilis	C/S America
LIB167	mutabilis	C/S America
LIB168	mutabilis	C/S America
LIB169	mutabilis	C/S America
LIB170	mutabilis	C/S America
LIB171	mutabilis	C/S America
LIB172	mutabilis	C/S America
LIB173	mutabilis	C/S America
LIB174	mutabilis	C/S America
LIB175	mutabilis	C/S America



Accession code	Species	Country of Origin
LIB176	mutabilis	C/S America
LIB177	mutabilis	C/S America
LIB178	mutabilis	C/S America
LIB179	mutabilis	C/S America
LIB180	mutabilis	C/S America
LIB181	mutabilis	C/S America
LIB182	mutabilis	C/S America
LIB183	mutabilis	C/S America
LIB184	mutabilis	Ecuador
LIB185	mutabilis	Ex URSS
LIB186	mutabilis	Ex URSS
LIB187	mutabilis	Ex URSS
LIB188	mutabilis	Ex URSS
LIB189	mutabilis	Ex URSS
LIB190	mutabilis	Ex URSS
LIB192	mutabilis	Ecuador
LIB193	mutabilis	Ecuador
LIB194	mutabilis	Ecuador
LIB195	mutabilis	Ecuador
LIB196	mutabilis	Ecuador
LIB197	mutabilis	Ecuador
LIB198	mutabilis	Ecuador
LIB199	mutabilis	Ecuador
LIB200	mutabilis	C/S America
LIB201	mutabilis	C/S America
LIB202	mutabilis	C/S America
LIB203	mutabilis	C/S America
LIB204	mutabilis	C/S America
LIB205	mutabilis	C/S America
LIB206	mutabilis	C/S America
LIB207	mutabilis	C/S America
LIB208	mutabilis	C/S America
LIB209	mutabilis	C/S America
LIB210	mutabilis	C/S America
LIB211	mutabilis	C/S America
LIB212	mutabilis	C/S America



Accession code	Species	Country of Origin
LIB213	mutabilis	C/S America
LIB214	mutabilis	C/S America
LIB215	mutabilis	C/S America
LIB216	mutabilis	C/S America
LIB217	mutabilis	C/S America
LIB218	mutabilis	C/S America
LIB219	mutabilis	C/S America
LIB220	mutabilis	C/S America
LIB221	mutabilis	C/S America
LIB222	mutabilis	C/S America
LIB223	mutabilis	C/S America
LIB224	albus	Portugal
LIB225	mutabilis	Ecuador
LIB226	mutabilis	Ex URSS

C/S America stands for Central or South America, and it refers to material we cannot precise further the location where it has been collected or further developed.