

## COLLECTING OF ONION (*ALLIUM CEPA* L.) AND LEEK (*ALLIUM PORRUM* L.) LANDRACES IN SOUTH EASTERN EUROPE FOR FURTHER EX-SITU CONSERVATION

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**Key words:** *Allium cepa* L., *Allium porum* L., landraces, genetic resources, South East Europe

### INTRODUCTION

Most of the territory of South Eastern Europe (including the Balkan countries) is still a rich source of many indigenous onion and leek populations due to its favorable climatic and topographic diversity. Onion and leek are two main vegetable crops from the genus *Allium*, very important for the human health because of their nutritional values and healing attributes.

Both crops are cultivated in a wide range all over the world. In the participant countries, beside the modern varieties, the indigenous populations of pungent and sweet onion, have a long tradition of cultivation in old traditionally way, by application of organic manure. Also, the populations of leeks are well adapted to the climatic and soil specifics of the areas they are cultivated in.

Up till now, the populations are maintained by farmers without any expert attention. Taking into consideration the fact that both (leek and onion) are out breeds (cross pollinated) biennial crops it may very easily come to unlike crossings and loss of the authenticity in relation to growth, color and other characteristics. A part of these local populations and species are endangered and threatens danger of extinction caused by intense technological development in the vegetable production, introduction of foreign hybrids and degradation of domestic vegetable seed production (Agic et al, 2013.)

One of the primary reasons to sustain conservation of plant genetic resources in genebanks is to prevent the loss of genetic diversity. Several authors have reviewed vegetable genetic resources in the last twenty years (Sloten, 1980; Crisp and Astley, 1988; Cross, 1998), largely emphasizing the need to accumulate and conserve in genebanks the genetic diversity that is most useful to breeders. Thus genebank material is becoming more attractive to breeders. At the same time, the management of collections can be based on better knowledge of the diversity in stock. The enhancement of the links

between germplasm conservation and use will continue to depend, inter alia, on easy access to the genetic material (Magioni, 2004). The increasing concern in view of genetic erosion process, gave a strong motive for efforts to be devoted towards their collection, maintenance in controlled conditions, and secure conservation in gene banks. Both were included, also, in the mandate species list, attached to the strategy for the SEEDNet crops working group *Alliaceae*, and was elected as a priority species, too.

**RESEARCH GOALS:** The main goals were collecting and protecting indigenous germplasm which may be in danger of extinction, preserving onion and leek accessions of regional origin in the long-term – all of which to be well documented, described, and evaluated and strengthening regional, sub regional and international cooperation and documentation for a broad use and exchange of information and seed.

### MATERIAL AND METHODS

For realization of the objectives the working groups from participated countries have organized several collection missions during the whole project duration from 2007-2010 and following aims were carried out:

- Organization of collecting missions by the teams from both countries in different regions and collecting data about the local gene fund.
- Identification of the collected material.
- Collecting geographical and climate data about the investigated regions.

The inventorying and collecting of the autochthonous onion and leek germplasm was realized through the following steps:

**Step 1.** Preparing a detailed terrain plan.

**Step 2.** Determination of the target areas for inventory and collection with GPS (Global Position System) such as longitude, latitude, altitude. Each of the areas were visited several times by the following arrangement. In selected areas each village was explored for collecting not only seed material, but

also all available information about traditional growing systems, local method of plant protection, utilization for consumption or as medical plants.

**Step 3.** Filling out the collection forms and inventorying lists by EURISCO descriptors (passport data of all collections was recorded and computerized).

**Step 4.** Collecting seed or bulbs (very important part of the gene bank activities). Representative sample of dry and mature seed or bulb were taken randomly across the population, putted in paper bags and labeled with the appropriate collection number.

**Step 5.** Cleaning of seed in laboratory and getting ready for growing in coming year.

**Step 6.** Preparing a detailed work plan discusses and identifies the priorities for the coming year with all partners involved in this project.

For inventorying of the autochthonous onion and leek germplasm each partner in this project made national existing inventory list, which was upgrade all the time. In the framework of this project was made survey in many international crop databases, regional institute's collection in participating countries, foreign gene bank database, and botanical garden. We used the following germplasm catalogues: SEEDnet portal, EURISCO – data catalogue of the

European genebanks, USDA-GRIN –portal to the USDA ARS National germplasm Repositories of USA and GBIF. In order to avoid duplicates of accessions and exchange information among the participating countries we have made regional list.

The collecting mission was organized in each participant countries by local experts.

## RESULTS AND DISCUSSION

As a result of the whole activities in 2007, 2009 and 2010, from all project partners were inventoried and collected 584 accessions from 127 areas.

During the whole project period, the project partners inventoried in 127 geographical localities. For almost all collecting sites were recorded longitude, latitude and altitude with GPS and registered in passport data files and they are given in table 1.

The total number of *Alliaceae* accessions collected in 2007 was 212, 244 in 2009 and 128 in 2010. The detailed information for collected accessions by project partner for the whole project period is presented in table 2.



Figure 1. Map of the South Eastern Europe, the region where the collecting expeditions were conducted

Table 1. Longitude, latitude and altitude for the included areas in the participated countries

Country	Latitude		Longitude		Altitude (m)	
	from	to	from	to	from	to
R. Macedonia	41°08'--N	42°05'--N	20°38'--E	22°41'--E	63	778
R. Srpska	42°42'--N	44°54'--N	71°13'--E	19°08'--E	133	930
R. Srbija	42°28'--N	46°03'--N	19°35'--E	22°51'--E	69	711
Bulgaria	43°05'--N	43°61'--N	25°40'--E	26°33'--E	15	550
Albania	40°26'--N	42°25'--N	19°85'--E	20°99'--E	35	1026
Croatia	45°45'--N	48°38'--N	13°57'--E	18°11'--E	18	117
Federation BH	43°13'--N	45°02'--N	15°51'--E	18°47'--E	152	569
Romania	26°73'--N	47°95'--N	20°34'--E	26°57'--E	38	576
Kosovo	42°19'--N	42°22'--N	20°37'--E	20°45'--E	339	402

Table 2. Number of *Alliaceae* accessions per partner country and year

Country	2007		2009		2010		2007-2010	
	Onion	Leek	Onion	Leek	Onion	Leek	Onion	Leek
R. Macedonia	51	13	4	6	3	2	58	21
R. Srpska	11	1	2	3	6	/	19	4
R. Srbija	10	3	4	/	7	/	21	3
Bulgaria	86	18	67	16	30	12	183	46
Albania	7	2	1	/	2	/	10	2
Croatia	5	/	6	/	2	/	13	/
Federation BH	/	/	2	2	1	2	3	4
Romania	/	/	90	23	45	3	135	26
Slovenia	/	/	13	/	9	/	22	/
Kosovo	5	/	2	3	/	4	7	7
<b>Total</b>	<b>175</b>	<b>37</b>	<b>191</b>	<b>53</b>	<b>105</b>	<b>23</b>	<b>471</b>	<b>113</b>

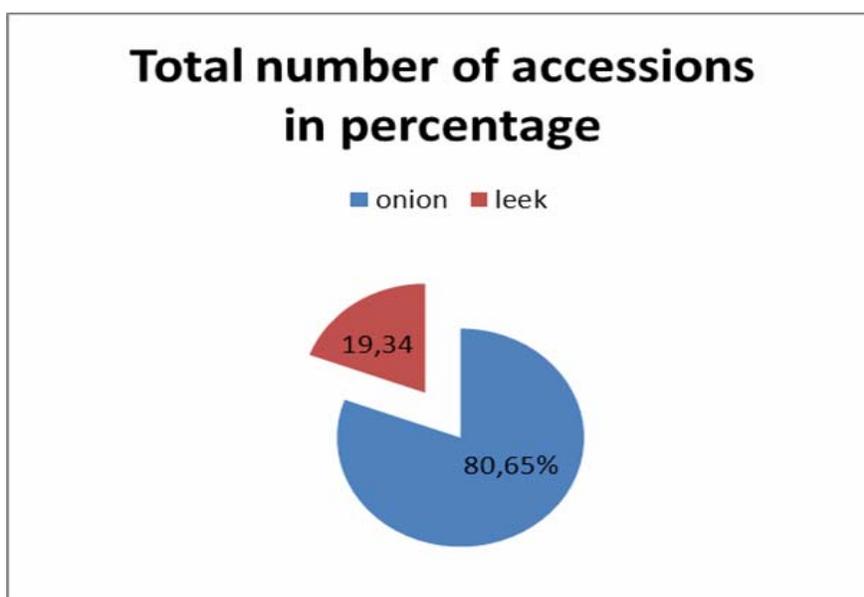


Figure 1. Total number of accessions in % for 2007-2010

**R. Macedonia** Following the work plan of this project for the period 2007-2010, the activities were directed to inventory of existing *Alliaceae* genetic resources and collecting materials (seed, sets, or bulbs) from selected areas in R. Macedonia. In 2007 the total number of registered onion accessions is 51: out of which 36 belong to the winter type; 4 to the pungent type of onion produced by sets with yellow colour; and 11 to the summer sweet onions landraces (so called arshlama) with straw yellow and

copper and violet. Also 13 very interesting leek landraces with different light and dark green color, and short and long stem have been collected. In 2009 the vegetable working group organized four collection missions in the South, West, Central, and South-West regions, mainly in rural areas, home gardens and traditional farms. As a result 10 accessions have been collected: out of which, 4 were onion landraces (3 pungent types of onion produced by sets with yellow colour, and 1 summer sweet

onion landraces). The other 6 were leek landraces with different light and dark green color and a long stem. Collection form and photo documentation. During 2010 in Macedonia were collected 5 accessions, 3 of onion and 2 of leek. Each sample from the terrain is followed by: a unique collection number, GPS data, information about traditional method of cultivation and use, which are included in the Macedonian data.

**Republika Srpska** In 2007 inventoried *A. cepa* and *A. porrum* has been done in the East Herzegovina area, Semberija and one part of Lijevo polje (RS), where 12 accessions were inventoried. During the inventoring, a registration of the name of the local variety and type of storage with seeds or bulbs has been made. In Republika Srpska during the expedition in 2009 have been collected 2 new accessions of *Allium cepa* and 3 new accessions of *Allium porrum*. In 2010 have been collected 3 accessions of onion.

**R. Srbija** The large variety of genotypes, including both domestic populations and cultivars, comprises the significant gene pool of this region. The onion collection of the Institute of Field and Vegetable Crops in Novi Sad is based on the populations and cultivars from the territory of the former Yugoslavia (Jelica Gvozdenovic Varga et al., 2013). During their collection expeditions in 2007-2008, the Serbian scientists have collected and conserved a total number of 13 populations. Two onion samples were taken from locations of central Serbia (Smilovci near Dimitrovgrad, Vrnjačka banja), from Prizren, Orahovac (locality Velika Hoča, 3 divergent populations) which have been transported to Aleksinac. The gathered samples have come from the regions of Banat - Novi Kneževac (2 samples); Crna bara (1 sample); and from Bačka - Kupusina village (2 samples). Partial passport data are completed. Two leek samples from the villages of Miloševac and Smilovci (central Serbia), and 1 sample from Bački Petrovac. All samples were in the seed phase so that in the following year these leek samples would be regenerated and basically characterised.

In 2009 collection mission has been organised in localities Lalić, Mokrin, Vojska, Temerin, Odžaci, Kikinda and Svilajnac. Beside 3 onion collected species, 1 was *Allium fistulosum* var *viviparum*. In 2010 were collected 37 accessions of onion.

**Bulgaria** Old cultivars and wild forms can still be found in Bulgaria. Sources of this germplasm are home gardens, mainly at the frontier with Serbia and Macedonia, as well as in the Rhodope and Belasitsa Mountains, the Black sea coast, and in north-eastern and central-southeastern Bulgaria.

Three collecting missions have been organized on October and November of 2007, in different regions of Bulgaria. The first expedition was in Northern Bulgaria; the second was in Central Southern Bulgaria. The third expedition was in Southern part

of Bulgaria – Petrich, Svilengrad, and in Northern Bulgaria – Shoumen. During these expeditions 86 local onion accessions and 18 leek accessions have been collected. Four collecting missions were organized at the end of July and November of 2009, in different regions of Bulgaria. The first expedition was in Northern Bulgaria - district of Veliko Tarnovo, Gorna Oryahovitsa, Pleven, Lovetch, Vratza, Ruse, etc.; The second was in Southern part of Bulgaria - district of Sofia, Pazardjik, Samokov, Kyustendil, Smolian, etc. The third expedition was in North-west part of Vidin, Bregovo, Dunavtzi, Lom, Montana, Boitchinovtzi. The fourth in the North-eastern part - Targovishte, Razgrad, Popovo, Silistra, Dulovo. During these expeditions 67 local onion accessions, 16 leek accessions, and 3 garlic have been collected. In Bulgaria during the expedition in 2010 were collected 30 accessions of onion and 12 of leek.

**Albania** The missions have achieved successfully their main goal, which was to collect some of the most distinctive genotypes. Finally, 7 onion genotypes (Sanjollasi, Drishti, Kuci i zi, Petrusha, Mirasi, Lini and Dishnica) and 2 leeks (Belortaja and Kashari) have been identified and collected at their natural areas of cultivation. The expeditions in 2009 were conducted in Berat, Permet, and Gramsh. Several interesting genotypes were identified, but only one was collected (seed sample). In 2010 were collected just 2 accessions of onion.

**Croatia** During the expedition 5 target old domestic onion varieties were found. For collected material passport data were filed and material was planted in collection field at the College in Krizevci where descriptions were done. The most interesting material was stored and prepared for regenerations. In 2009 two expeditions to the south west part of Croatia was organized. During the expeditions bulbs of 6 old domestic onion varieties were collected. For collected material passport data was filed and material was stored at the Agricultural College in Krizevci. Accession of old domestic onion variety Turopoljski collected a year before was regenerated in isolation and the seed is prepared for long term storage. In Croatia same as in Albania in 2010 were collected 2 accessions of onion.

**Federation of Bosna and Hercegovina** Following the work plan of this project for 2009, the activities were directed to inventory of existing *Alliaceae* genetic resources and collecting materials (seed, sets or bulbs) from selected areas in FB&H. The vegetable working group has organized five collection missions in Travnik, Buturovic polje, Herzegovina, Gracanica and Gradacac. As a result we have collected 9 accessions, out of which 2 onion landraces (pungent type of onion produced by sets with yellow color). We have collected 3 leek landraces with dark green color, short stem, 4 varieties of garlic (3 small cloves winter varieties and 1 large cloves autumn variety) were collected. Each

sample from the terrain was followed by unique collection number, GPS data, information about traditional method of cultivation and use. In 2010 were collected 1 accession of onion and 2 of leek.

**Romania** During 2009 the activities of the project were focused in collecting materials (seed, or bulbs) from these areas: Moldova, Transylvania, Muntenia, and Oltenia in Romania. Collection missions were carried out in 6 counties of Moldova (Bacau, Botosani, Iasi, Galati, Neamt, Suceava), in one county of Oltenia (Dolj), in 4 counties of Transylvania (Brasov, Cluj, Covasna, Mures) and two of Muntenia (Bucuresti and Buzau) different by their climatic conditions. In the expeditions materials from 40 localities were collected.

Six collection missions were organized in rural areas, home gardens and traditional farms. In 2009, 90 accessions of onion have been collected as it follows: 50 biannually and 40 three annually. Onion varieties vary in colour (yellow, dark or light red - copper), shape (from spherical to almost conical, and the diameter at the largest point from 3 cm to 15 cm or more), flavour, storage life and time to reach maturity. Yellow varieties of onion represent almost 75 % of all onions grown for bulb production in the Romania. In this year 17 leek landraces with different light and dark green color, short and long stem and 4 garlic samples were also collected. Each sample is followed by unique collection number and it has information about traditional method of cultivation and use.

In 2010 were collected 45 accessions of onion and 3 of leek.

**Slovenia** According to the program of the project in 2009, the working group from Agricultural Institute of Slovenia carried out activities about inventorying and collecting of new local onion accessions.

The expedition was organized in autumn in one of the traditional onion growing regions of Slovenia (Podravje) and were collected 13 onion accessions during 2009. The majority of them belonging to the old variety Ptujška rdeča. In 2010 were collected 9 accessions of onion.

**Kosovo** Collecting of indigenous onion (*Allium cepa* L.) and leek *Allium porrum* L. germplasm was the main intention of a numerous collection expeditions organized during summer and autumn time in 2007-2010. This was defined as a high priority, because of the high risk they lose forever from cultivation, due to fast changes which are happening in Kosova. The missions achieved successfully their main goal to collect some of the most popular genotypes. Finally, 7 onion accessions (one of them called "Pogaqja e Prizrenit"), and also 7 leek accession (one called "Hudhra e Rafovecit") were identified and collected at their natural areas of cultivation from 2007 to 2010. Collected seed accessions are documented in the vegetable crop data base accompanied by adequate passport information

following the EURISCO descriptors, later transferring to the main database, partially evaluated and uploaded in EURISCO.

## CONCLUSION

The undertaken activities during the project period have resulted in achieving the set goals, notably it was created new regional inventory list of *Alliaceae* genetic resources and it was made new collection of the targeted species. It was obtained new knowledge tool for their conservation and long term preservation. It was strengthen the collaborations and sharing responsibilities among vegetable working group and it was established a permanent access to the gene bank information through Internet. Also it was established regional, sub regional and international cooperation and documentation for a broad use and exchange of information and seed. The obtained data was included in the international information system and subsequently sent to the EADB (European Alliums Database).

## ABSTRACT

The SEEDnet program (South East European Development Network on Plant Genetic Resources) was established with the purpose of supporting the countries in their efforts to establish and strengthen national and regional activities on PGR with special focus on conservation, utilization, collaboration and networking among the stakeholders at both national and regional levels. During this period, SEEDNET project have enormously contributed to the management of vegetable genetic resources in South East countries, in national and regional level. Collaboration among the countries has been crucial for harmonization and transfer of the data and extend the scope of joint activities to the whole range of vegetable crops, obtained new knowledge tool for their conservation, long term preservation of accessions, strengthen collaborations and sharing responsibilities among vegetable working group. In the framework of the regional project "Inventorying and collecting of indigenous onion (*Allium cepa* L.) and leek *Allium porrum* L. germplasm for further ex-situ conservation", coordinated by Macedonia, following the work plan from 2007-2010, 10 countries (Macedonia, Serbia, R. Srpska, Bugaria, Albania, Croatia, BIH, Romania, Slovenia, Kosovo,) have focused on inventory and collecting the onion and leek landraces from predicted areas. The vegetable working groups from participated countries organized several collection missions from 2007 to 2010. As a result of the whole activities from all project partners 584 accessions from 127 areas were inventoried and collected. Collected seed accessions have been documented in the vegetable crop data base accompanied by adequate passport information

following the EURISCO descriptors, later transferring to the main database, partially evaluated and uploaded in EURISCO.

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#### ACKNOWLEDGEMENTS

The vegetable working group under the SEEDnet program would like to sincerely express their deep gratitude to the SEEDnet for financial support and assistance. We are also very grateful to the farmers we met during the expedition mission for sharing their knowledge and seed material. Special thanks and appreciation to all participants for good collaboration during this phase of the project.

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Figure 1. Old Croatian domestic onion variety Turopoljski - collected, described and regenerated during 2008



Figure 2. Serbia – Onion from Novog Knezevca (NK 1)



Figure 3. Onion Melnik - v. Gluvo Skopje



Figure 4. Traditional harvesting and storage of onion Gostivarska arzlama – v. Gorna Banjica- Gostivar



Figure 5. Open market in Gostivar



Figure 6. Lazecki onion – Ohrid



Figure 7. Onion Leskoec - Ohrid