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**COLLECTION AND CONSERVATION OF *ALLIUM* SPECIES FROM UZBEKISTAN
AND NEIGHBORING AREAS AND THEIR EVALUATION FOR ORNAMENTAL,
EDIBLE, AND MEDICINAL TRAITS**

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Executive Summary

Central Asia is one of the principal centers of plant genetic diversity of many important crops, including the genus *Allium*. About 230 of the 700 *Allium* species are concentrated in this region and over 100 are endemic to the area. Uzbekistan, located in the center of this region, is one of the richest sources of wild *Allium* species and landraces of domesticated alliaceous crops.

The project aimed at collection, documentation and preservation of *Allium* flora from Uzbekistan and neighboring areas. The collecting missions were aimed at: (1) Recording information on the distribution of wild populations of *Allium* spp. in Uzbekistan and neighboring areas in Central Asia; (2) Collecting representative samples of *Allium* species growing wild in the explored

regions and of edible *Allium* land races in Uzbekistan and neighboring areas. The collected material was sorted out, classified, documented and representative samples were transferred to Israel for preservation. Parallel collection will be established in Tashkent, Uzbekistan. Evaluation of the preserved material will start in 2001, both in Uzbekistan and Israel.

In March-April 2000 the Uzbek PI Dr. Furkat Khassanov visited Israel in order to become acquainted with the living *Allium* collection and local wild *Allium* species. The strategy of the collecting mission and methods of plant introduction were discussed.

Section I

A) Research Objectives:

The present project aims at collecting germplasm of the economically important *Allium* species from Uzbekistan and neighboring areas, documenting the geography and environment of their natural habitats, and evaluating traits of agricultural and economic importance. The latter include potential sources for resistance to pests and diseases; for tolerance to stress conditions; for new ornamental and/or edible crops, and for presence and level of S-containing (neutraceutical) compounds. We will also study the phenology, life cycle, morphology and florogenesis of some selected species showing economical potential, and determine the conditions required for efficient seed propagation of species with economic prospects.

The objectives for the first year were as follows:

1. To collect *Allium* species from Uzbekistan and neighboring areas, to document their geographical locations in the natural habitats and to record the local environmental conditions.
2. To conserve the collected plant material in Israel and Tashkent, Uzbekistan, in two parallel genebanks thus guaranteeing the safe keeping of the genepool.

B) Research Accomplishments:

Emergence, sprouting and growth of *Allium* flora in Uzbekistan and neighboring areas occur early in the spring. However, due to their size, shape and color, these plants can hardly be recognized before summer, when in bloom (Baitulin *et al.*, 1986; Kamenetsky, 1986). The time of bloom varies with species and ecotype, with geographical region, and with environment. It can stretch, even within a single region, over a few months. Hence, the success of a collection mission depends on basic knowledge of the plants' phenology and on the climatic conditions prevailing both in the previous and current growing seasons. The Uzbek and the Israeli (RK) PIs expertise on the phenology of *Allium* flora in these regions are therefore instrumental for the success of the collection chapter of this project. Since plants are collected at bloom, the collected material consists of vegetative propagules only (e.g., bulbs, rhizomes, etc.), but not seeds. Such a material can easily transmit pests, and thus requires thorough inspection and at least one quarantine season before it can be safely transplanted in the field genebank or to a designated plot for seed production.

Scientific activity:

November 1999- April 2000: all the necessary arrangements for the collecting missions and plant evaluation were made both in Israel and in Uzbekistan.

Samples of 12 species (17 accessions) were transferred to Israel, where bulbs were stored at low temperature (4°C X 8 weeks), thoroughly inspected and sterilized, and then planted in the *Allium* living collection (Bet Dagan) (Table 1). Phenological observations were performed during the vegetative growth and development of the plants.

February 2000: A new experimental plot for *Allium* living collection was prepared in the Botanical Garden in Tashkent.

April 2000: Plants of 27 species (54 accessions) were transplanted in the new experimental plot prepared in the Botanical Garden in February. Two collecting missions were organized to the southern region of Uzbekistan and Kirgizstan. Two southern districts (Surkhandarja and Kashkadarja) were investigated in order to collect the *Alliums* with ornamental potential in low mountainous and mountainous zones of the Western and Southern Pamiroalaj (Hissar, Kugitang and Bojssun ranges). This part of Uzbekistan is characterized by the shortest winter period (hence, frequently ephemers and ephemeroïds have their second vegetation in November-December) and cultivation of some subtropical crops outdoors. Summertime is extremely hot (up to 50°C) and dry (200-500 mm precipitation). In Kirgizstan, the second collection mission scouted the southern Osh district between the two mountain ridges of Tien Shan and Pamiroalaj, on the main ancient Silk Road from China to the West. The Osh valley is surrounded by high mountains (up to 5000 m asl). It is characterized by a long (November-April) and a severe (up to -30°C; 1-2 m snow cover) winter period. Summer is mild (up to 30°C) and dry. 27 accessions of 14 species were collected and subsequently planted in the living collection in Tashkent, as follows: (*A. suworowii* Rgl., *A. stipitatum* Rgl., *A. lipskianum* Vved., *A. sarawschanicum* Rgl., *A. barszczewskii* Lipsky, *A. giganteum* Rgl., *A. protensum* Wendelbo, *A. crystallinum* Vved., *A. backausianum* Rgl., *A. alaicum* Vved., *A. zergericum* Khass. et R. M. Fritsch, *A. pseudowinklerianum* R. M. Fritsch et Khass., *A. pallasii* Murr. and *A. aflatunense* B. Fedtsch.

May 2000 - August 2000. During this period two additional expeditions collected *Alliums* in Fergana and around the Tashkent district, including some regions of Kazakhstan. The Fergan valley, a large depression 200 km (West to East) and about 100 km (North to the South) is located in Uzbekistan with extensions into Southern Kirgizstan and Northern Tadzhikistan. Each

sample of the 31 accessions of 24 species collected in these missions was subdivided between the parties and then planted in Tashkent and in Israel. The list of collected species includes: *A. isakulii* ssp. *nuratense* R. M. Fritsch et Khass., *A. victoris* Vved., *A. popovii* Vved., *A. aroides* M.Pop. et Vved., *A. protensum* Wendelbo, *A. motor* R. Kam. et Levichev, *A. zergericum* Khass. et R. M. Fritsch, *A. giganteum* Rgl., *A. filidentiforme* Vved., *A. alaicum* Vved., *A. margaritae* B. Fedtsch., *A. talassicum* Vved., *A. pseudowinklerianum* R. M. Fritsch et Khass., *A. aff.fetissowii* Rgl., *A. altissimum* Rgl., *A. aff.altissimum* Rgl., *A. griffithianum* Boiss., *A. oshaninii* O.Fedtsch., *A. aff. simile* Rgl., *A. oreoscordum* Vved., *A. longicuspis* Rgl., *A. spathulatum* Khass. et R. M. Fritsch, *A. aff. tianshanicum* Rupr. and *A. haneltii* Khass. et R. M. Fritsch. Only one plant was collected for the three latter species and thus planted in Tashkent only.

In total, 58 accessions of 34 species (of about 380 bulbs) *Allium* species from Uzbekistan and neighboring areas were collected, and the geographical locations of their natural habitats and the environmental conditions were documented according to IBPGR rules (Astley *et al.*, 1982).

Following documentation, each sample was thoroughly inspected and only the clean and healthy-looking intact bulbs were shipped to Israel, for safe-storage. Following a professional inspection for pests, and surface sterilization, the collected material will be transplanted in quarantine in Israel.

To date (November 2000), 71 wild *Allium* species are already growing in Tashkent collection (out of which 16 species were included in regional Red Data Books).

Introduction of plant material to Israel: The collected *Alliums* were shipped to Israel at the beginning of November, sorted and treated with fungicides. Prior to planting in November-December, propagules were sorted in accordance with their morphological and taxonomical traits. Most bulbous plants were forced into flowering (4°C x 4-6 weeks or 9°C x 4 weeks). The rhizomatous species were planted on arrival, without cold treatment.

C) Scientific Impact of Collaboration: Dr. Khassanov's visit to Israel included field trips to regions with flowering wild *Allium* spp., to cultivated fields of alliaceous (both edible and ornamental crops) as well as to the national herbarium, maintained in Jerusalem at the Hebrew University of Jerusalem. Israel is considered as an important part of the secondary center of evolution of the genus. Hence, the scientific importance of this visit. In addition, the discussions we had on the appropriate methods of genebanking, with special emphasis on field collections, provided the sound basis for the establishment of a local collection in Tashkent. Dr. Khassanov's knowledge on *Allium* taxonomy and phenology is instrumental for the success of the expeditions. The discussions we had on these topics were illuminating and contributed to the Israeli PIs understanding of the nature of the wild *Allium*'s population distributions in the primary center of evolution in Central Asia.

D) Description of Project Impact

Due to diversity in blooming and its interaction with environment, the collecting missions were successful in collecting a sizable sample of natural *Allium* flora of eastern and southern Uzbekistan and southern Kirgizstan. Future missions to the Kyzylkum and Karakum deserts and the Kopetdag mountains (Uzbekistan and Turkmenistan) are planned in order to cover as many species of interest as possible, from the center of origin.

Most of the collected material seemed to be free of known pests, and therefore can be introduced into the field gene banks (following quarantine inspection) with a minimum risk to the current collections.

The material arrived safely in Israel and sprouted in the autumn. In Israel, *Allium* spp. grow through the winter and spring. Hence, phenological observations and initial evaluation of *Allium* seedlings and adult plans have just started in Israel, and will be performed from November 2000

onwards. The data collected in Israel and Uzbekistan will be compared and plants of interest will be reevaluated in 2001/2002. The most promising material will be propagated and tested for its potential as new sources of edible and ornamental crops.

E) Strengthening of Developing Country Institutions: Collection missions in Central Asia have been successful only when support was obtained to cover expeditions' costs as well as for equipment needed for the field works, in the natural habitats, and for the maintenance of the living collection in Tashkent. The passport data was recorded in accordance with IBPGR standards by the Uzbek team, using equipment obtained with the project's funds (computers, fax etc.). The administration of the Botanical institute supported the establishment of the living collection. Technicians were also supported by the institutional funds. All funds allocated (2865 \$) were spent on field trips, and purchase of the necessary equipment.

F) Future Work:

Detailed goals for 2000:

1. To continue the collection of *Allium* species in different regions in the Central Asian deserts and the Kopetdag mountains; document the geographical locations of their natural habitats and the environmental conditions, according to the International Board for Plant Genetic Resources (IBPGR) guidelines; documentation, sorting, and shipping of healthy-looking representative samples of each of the collected material to Israel;
2. To conserve the collected plant material in two parallel gene-banks: in Israel and Tashkent thus guaranteeing the safe keeping of the collection;
3. To perform phenological observations of the material collected in 2000;
4. Bulb forcing and study of florogenesis of the species with ornamental potential;
5. To evaluate samples of the collection in Israel for their dry matter content and S-containing compounds.

6. To study intrabulb florogenesis of the species with ornamental potential.

Section II

A) Managerial Issues: The project is being carried out according to the original plan.

B) Budget: Salaries for technical help were switched for the purchase of essential equipment, as the Tashkent administration of Botanical institute decided to pay the local help from their own funds. Moreover, the cost of the PC Notebooks for networks in expeditions as well as other institutions and herbaria was more expensive than originally estimated. It was necessary to get some new furniture for technical work related to the living collection and for the labs.

C) Special Concerns: The project is being carried out according to the original plan.

D) Collaboration, Travel, Training and Publications: Reciprocal visits and personal communication between the Uzbek and Israeli PIs by E-mail and FAX, aimed at planning, coordination and organization of the collection missions, has resulted in tightened research and personal relationships between the research groups. International standards and rules related to the above goals and activities have been introduced in Uzbekistan and adopted by local scientists as standard procedures.

Dr. Furkat Khassanov visited Israel between March 20 and April 3, 2000 in order to become acquainted with the *Allium* living collections at the Volcani Center (Bet Dagan) and the Faculty of Agricultural, Food and Environmental Quality Sciences of the Hebrew University of Jerusalem (Rehovot). Local Israeli species were studied in these collections as well as several wild populations in the Negev desert and near Ashdod. The strategy of the collecting mission and methods of plant introduction were discussed. In addition, Dr. Khassanov spent 3 days at the Hebrew University of Jerusalem, studying the Herbarium collection.

E) Request for American Embassy Tel Aviv or A.I.D. Actions No requests

Table 1. List of Allium accessions from Uzbekistan and neighboring countries, introduced to Israel for preservation and evaluation (1999-2000)

Number	Botanical name	Number of bulbs	Country	Date of collection	Location	Storage	Planting date
Received from Tashkent November 1999							
X-1-99	<i>A. isamulii</i>	3	Uzbekistan	October 1999	Allium genebank, Tashkent,	4°C Oct 27-December 10	
X-2-99	<i>A. popovii</i>	5 (4-small and dry)	Uzbekistan	July 99	West PamiroAlai, Nuratau mountains		November 1
X-3-99	<i>A. aroides</i>	4+5 small	Uzbekistan	10.08.99	West PamiroAlai, Gissar mountain, 1400 m.	4°C Oct 27-December 10	
X-4-99	<i>A. protensum</i> = <i>A. shubertii</i>	14+4 small	Uzbekistan	June 99	Kizilgiri, Bukhara	4°C Oct 27-December 10	
X-5-99	<i>A. motor</i>	3	Uzbekistan	May 99	Chimgan	4°C Oct 27-December 10	
X-6-99	<i>A. turkestanicum</i>	12	Uzbekistan	July 99	Pamiroalai, Djizak		November 1
X-7-99	<i>A. filidens</i>	11+8 small	Uzbekistan	20.06.99	West Tian Shan		November 1
X-8-99	<i>A. sabulosum</i>	11+4 small	Uzbekistan	5.06.99	Kizil Kum		November 1
X-9-99	<i>A. aff. simile</i>	6 + 9 small	Uzbekistan	15.08.99	West Tian Shan, Ugam mountain ridge	4°C Oct 27-December 10	
X-10-99	<i>A. filidens</i>	2	Uzbekistan	10.06.99	Nuratau range		November 1
X-11-99	<i>A. rosenorum</i>	3	Tadjikistan	97	Varzob	4°C Oct 27-December 10	
X-12-99	<i>A. victoris</i>	4+ 9 small	Kazakhstan	98	Alymtau		November 1

X-13-99	<i>A. backstanum</i> = <i>A. gulczense</i>	2	Kirgizia	May 98	Tian Shan, Fergan mountain range, near vil. Gun'ga	4°C Oct 27- December 10	
X-14-99	<i>A. aflatunense</i>	4	Kirgiizia	June 97	West Tian Shan, near Sarigenen	4°C Oct 27- December 10	
X-15-99	<i>A. pallasii</i>	5	Kirgizia	June 98	Near Osh town		November 1
X-16-00	<i>A. chinense</i>	seedlings	Uzbekistan	February 00	Dasha	-	March 2,00
X-17-00	<i>A. sp. (sect. Allium)</i>	seedlings	Uzbekistan	Jan 26 00	Tachkent-Akademgorodok	-	

Received from Tashkent November 7, 2000							
X-18-00	<i>A. zergericum</i>	2	Kirgizia	July 00	Uzgen	4 ⁰ C Nov 8- December 10	
X-19-00	<i>A. giganteum</i>	3	Uzbekistan	June 00	Surkhandarja disrtict	4 ⁰ C Nov 8- December 10	
X-20-00	<i>A. zergericum</i>	2	Kirgizia	July 00	Uzgen	4 ⁰ C Nov 8- December 10	
X-21-00	<i>A. filidentiforme</i>	1	Kirgizia	July 00	Dzalabad	9 ⁰ C Nov 8- December 10	
X-22-00	<i>A. alaicum</i>	1	Kirgizia	July 00	Aravan	9 ⁰ C Nov 8- December 10	
X-23-00	<i>A. margaritae</i>	2	Kazakhstan	June 00	Chu-Ili mnts	9 ⁰ C Nov 8- December 10	
X-24-00	<i>A. protensum</i>	1	Kazakhstan	June 00	Chu-Ili mnts	9 ⁰ C Nov 8- December 10	
X-25-00	<i>A. talassicum</i>	3	Kazakhstan	June 00	Chu-Ili mnts	-	
X-26-00	<i>A. pseudowinklerianum</i>	3	Kirgizia	July 00	Uzgen	9 ⁰ C Nov 8- December 10	
X-27-00	<i>A. aff.fetissowii</i>	3	Uzbekistan	June 00	Chimgan	9 ⁰ C Nov 8- December 10	
X-28-00	<i>A. altissimum</i>	8	Uzbekistan	June 00	Nuratau reserve station	4 ⁰ C Nov 8- December 10	
X-29-00	<i>A. aff.altissimum</i>	6	Uzbekistan	June 00	Dhizzak	4 ⁰ C Nov 8- December 10	
X-30-00	<i>A. aff.altissimum</i>	6	Uzbekistan	June 00	Dhizzak	4 ⁰ C Nov 8- December 10	
X-31-00	<i>A. aff.altissimum</i>	2	Uzbekistan	May 00	Samarkand	4 ⁰ C Nov 8- December 10	
X-32-00	<i>A. griffithianum</i>	7	Uzbekistan	May 00	Samarkand	4 ⁰ C Nov 8- December 10	

X-33-00	<i>A. sarawschanicum</i>	4	Uzbekistan	May 00	Samarkand	9 ⁰ C Nov 8- December 10	
X-34-00	<i>A. sarawschanicum</i>	2	Uzbekistan	May 00	Samarkand	9 ⁰ C Nov 8- December 10	
X-35-00	<i>A. suworowii</i>	4	Uzbekistan	May 00	Samarkand	4 ⁰ C Nov 8- December 10	
X-36-00	<i>A. stipitatum</i>	2	Uzbekistan	May 00	Samarkand	4 ⁰ C Nov 8- December 10	
X-37-00	<i>A. oschanini</i>	6	Uzbekistan	May 00	Samarkand	-	
X-38-00	<i>A. lipskianum</i>	3	Uzbekistan	June 00	Shargun	4 ⁰ C Nov 8- December 10	
X-39-00	<i>A. aff.simile</i>	6	Uzbekistan	August 00	Sidzhak	4 ⁰ C Nov 8- December 10	
X-40-00	<i>A. oreoscordum</i>	6	Uzbekistan	August 00	Sidzhak	-	