WAGENINGEN UR
For quality of life

Report of a *Spinacia* collecting expedition to Uzbekistan and Tajikistan

Itinerary, collected material and data

Chris Kik

CGN Report 2008/12

Centre for Genetic Resources, the Netherlands (CGN)

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Wageningen University and Research Centre
November 2008

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Copies of this report can be ordered by sending an e-mail to the address below.

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Foreword

The mandate of the Centre for Genetic Resources, the Netherlands (CGN), is to conserve crop genetic resources of interest to the Dutch breeding sector and other users, and to promote their use. To that end, CGN currently holds collections of over 20 crops and a total number of accessions of more than 24,000.
To contribute to an effective global system of *ex situ* collections, for each collection CGN has analysed the coverage of the crop genepool by its own collection and those of others. In a number of cases, this has resulted in the identification of gaps in the collections. In other words, some genetic diversity that is known or can be assumed to exist, is poorly represented or even absent from the genebank collections. Such cases warrant new collecting missions.

The CGN spinach collection is of global importance given its size and the small number of existing spinach collections. Wild relatives of spinach are poorly represented in any of those collections. Therefore, a collection mission has been performed aiming at the broadening of the genetic base of spinach *(Spinacia oleracea).* This report provides details on this collecting mission, i.e. the collecting of a wild relative of spinach, *S. turkestanica*, in its natural habitat in Central Asia, in particular in the countries Uzbekistan and Tajikistan. In addition, landraces of *S. oleracea* have been sampled.
A number of Dutch breeding companies sponsored the mission, which is duely recognized and appreciated.

The mission has been quite successful, both institutionally and technically. Institutionally, since it could be agreed with the Competent National Authorities of both countries that any collected germplasm would be made available under the terms and conditions of the Standard Material Transfer Agreement of the International Treaty, and since the expeditions were carried out in direct collaboration with local expert counterparts. Technically, since this resulted in a good harvest of a substantial number of collected samples that are currently grown out on the CGN premises. The mission is evidence for the feasibility of international collecting missions in a time frame in which appreciation of crop genetic resources as a common good is disputed and may sometimes seem far away.

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1. Introduction

Collecting landraces of spinach *(Spinacia oleracea)* and its wild crossable relative *S. turkestanica* was the aim of this expedition, which made this expedition a single crop expedition. Spinach and its wild relative *S. turkestanica* were choosen as the variation present in the *ex situ* maintained PGR of both species in the accessible collections worldwide was considered too low by stakeholders to fulfill present and future breeding needs. For a general overview of current spinach breeding and its breeding aims, the reader is referred to Morelock & Correll (2008). Currently, around 2300 accessions are available in genebanks worldwide of which ca. 700 landraces of spinach and ca. 25 wild relatives (*S. turkestanica* and *S. tetrandra*). CGN has the largest spinach collection worldwide with 387 accessions, followed by the USDA (USA) and Vavilov (Russia) collections with 361 and 281 accessions respectively. The spinach collection of CGN is the most requested collection of CGN with 7361 accession requests since 1988. The present expedition was carried out in Central Asia as this area is known to be the biodiversity centre of *Spinacia turkestanica* (Uotila 1997).
CGN has conducted several expeditions in the past, and the current spinach expedition in Central Asia fits into this tradition. Central Asia is not an unknown territory for CGN as L.J.M. van Soest has carried out two multi-crop expeditions in Central Asia, namely in 1997 in Uzbekistan and in 1999 in Uzbekistan and Kyrgistan. The present collecting expedition could therefore benefit from his knowledge and experience when travelling around in this part of the world.

In 2007/8 a Memorandum of Understanding adopting the standard Material Transfer Agreement (sMTA) of the Internal Treaty for Plant Genetic Resources for Food and Agriculture (IT-PGRFA), as a basis for distribution, was signed between CGN and the national authorities on access and benefit sharing in both countries. This formed the legal basis of the expedition.

2. Objectives of the expedition

There were two major aims of this single crop expedition namely:
1. to broaden the *Spinacia* collection of CGN by collection landraces of spinach (*S. oleracea*) and its wild relative *S. turkestanica* for breeding and research purposes, and
2. to contribute to the international need for the conservation of PGR.

3. Members of the collecting team

The collecting team in Tajikistan consisted of:

- Dr Hikmat Hisoriev, Institute of Botany, Tajik Academy of Sciences, Dushanbe, Tajikistan
- Mr Sobir Abrorov, Institute of Botany, Tajik Academy of Sciences, Dushanbe, Tajikistan
- Ir Loek J.M. van Soest, consultant and former head curator CGN, Bennekom, the Netherlands
- Dr Chris Kik, CGN, Wageningen, the Netherlands

The collecting team in Uzbekistan consisted of:

- Dr Furkat O. Khassanov, Institute of Botany, Uzbek Academy of Sciences, Tashkent, Uzbekistan
- Mr Mourat Aripdzhanov, Ministry of Nature Protection, Tashkent 700115, Chitanzar 1, 58, 9, Uzbekistan
- Dr Chris Kik, CGN, Wageningen, the Netherlands

In several cases also local people (students, farmers) helped us to find material.

4. Routes of exploration

The expedition in Tajikistan took place from May 28 – June 14 and in Uzbekistan from June 14 – June 28 2008. The area that was explored in both countries was approximately 100.000 km2 (+ 2.5 x the territory of the Netherlands) and the distance travelled circa 5000 km (Appendix I). In Tajikistan most of the collecting trips were carried out using Dushanbe as a basis, whereas in Uzbekistan a round trip was carried out. Temperatures during day time in both countries varied between 25-40 °C throughout the collecting period.
In Tajikistan a 4WD car was used in the first week for transport and a normal (2WD) car the second week. However the use of a 4WD car during the whole period (two weeks) would have been better due to the often bad condition of the roads. In Uzbekistan a normal car was used during the whole period, and this proved to be satisfactorily as the condition of the roads was in most cases good.

Tajikistan

As wild spinach (*S. turkestanica*) grows on altitudes between 200 and 1500 m the mountaneous East Tajikistan (Pamir region) was not visited. Also North Tajikistan (Ura-Tyube and surrounding areas) was not visited as we received information that not much spinach was present in the wild this year. The exploration concentrated on areas located in between Kurgan Tyube / Dushanbe in the east and the border with

Uzbekistan on the west and the border with Afghanistan on the south. These areas formed the focus of this expedition (Figure 1 and Appendix I). Especially the valley in between Lokhur and Isambay and the Khrebet Aktau mountain range, near the border with Uzbekistan, was found to be rich in *S. turkestanica*. Furthermore some accessions have been found near Gissar (ca. 20 km west of Dushanbe) and near Kurgan Tyube (ca. 80 km south of Dushanbe). The area on the west side of the Khrebet Aktau / Khrebet Aruk Tau was also explored as far south as Dzhilikul, however no wild spinach was found in this area although local people mentioned that spinach was found in the years before. The same was true for the area west of the Khrebet Karatua mountain range and the area north of Dushanbe (Kharangany – Semigandzh).

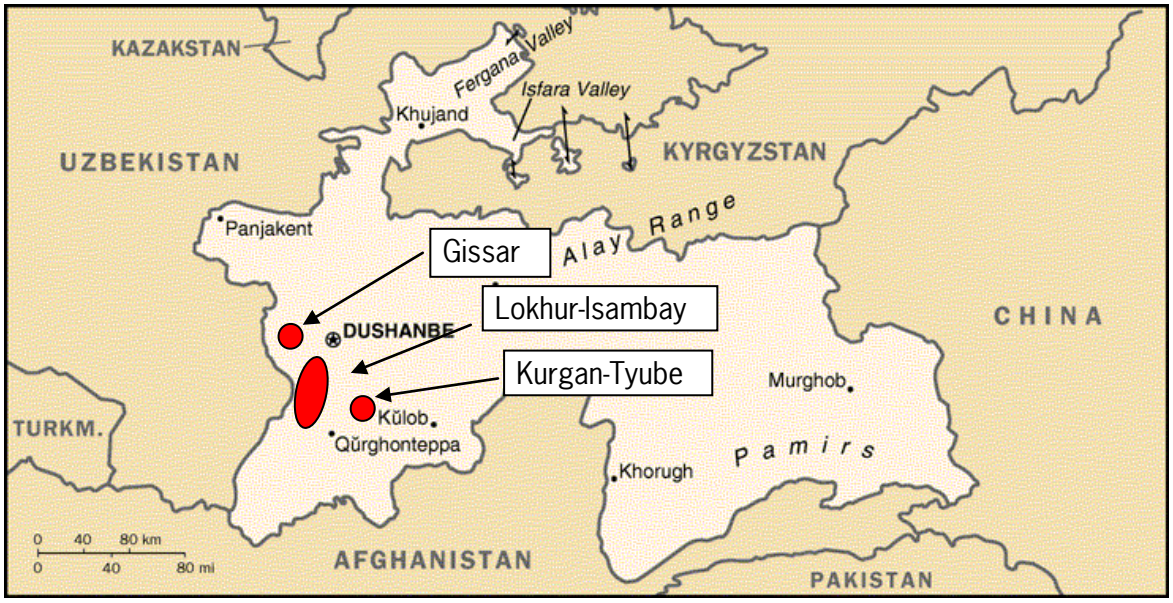

Figure 1. Map of Tajikistan with the areas where most accessions were collected indicated in red.

Uzbekistan

The areas visited in Uzbekistan were roughly located in between Tashkent / Angren in the north east, Sherabad / Termiz in the south, Yangikishtak (ca. 100 km north west of Samarkand, north of Nuratau mountain range) in the west and the border with Tajikistan in the east (Figure 2, Appendix I). Spinach was found in a number of geographically distinct areas, namely:

area a. around Baysun in the south,
area b. the Guzzar – Yakkabag area,
area c. the area along the road between Tashkent and Akhangaran,
area d. the area south west of the Krebet Nuraiau mountain range (Karabulok and Gallyaaral),
area e. the valley of the Sanzar river south east of Gallyaraal, and
area f. the area in between Dzhizak and Zaamin.

The last three areas (d-e-f) were particulary rich in wild spinach. In the area located between Gullistan and Tashkent no wild spinach was found as mostly irrigated agriculture took place in this area. Next to the collection of wild spinach also cultivated

spinach was bought at market places (bazars), this proved to be possible in Denau and Taskhent.

Figure 2. Map of Uzbekistan with the areas where most accessions were collected indicated in red.

Frequently areas were visited that fitted the required habitat conditions for wild spinach, however no wild spinach was found. This was especially true for the area west of the Khrebet Karatua mountain range south east of Dushanbe in Tajikistan and the area in between Parkent and Kursay east of Tashkent. Furthermore the area along the road between Guzzar in the south and Yakkabag in the north gave sometimes unexpected results: rich sampling sites alternated with very poor sampling sites although the environmental conditions seemed to be identical.

5. Field observations, data collecting and sampling

A field collecting form based upon a modified multi-crop passport descriptor list (MCPD) was used to document the passport data of the accessions sampled (Appendix II). All sampled material received a so-called collecting number, in this case HSK xx and KK xx for the samples collected in Tajikistan and Uzbekistan respectively (HSK xx: Hisoriev - van Soest - Kik followed by a number, KKxx: Khassanov - Kik followed by a number). Latitude, longitude and altitude were determined via GPS (Garmin, e Trex series Venture HC) with an inaccuracy of 1-5 meters and pictures were taken of most collecting sites. As a rule of thumb before starting the sampling at a location at least 5-10 individual plants needed to be seen at first glance. The area explored per accession varied from

ca. 0.1-2 ha. The plants were collected in a plastic shopping bag (50 x 40 cm) and a label with the collecting number was put in the bag. As the plants had spiny seeds along their stems, care had to be taken not to injure oneself. The most practical way to collect plants was to break the stems off at the transition point of the stems with the rooting system. Mostly around one plastic bag (50-100 plants) was collected per site. After a number of collecting days partial cleaning took place of the collected material and the seeds (plus debris) were transferred to a linnen bag (20 x 35 cm) with its collecting label. The collecting number was also written with a permanent marker on the bag. Upon arrival at CGN the material was transferred to a conditioned storage room with a temperature of 15 °C and 15% relative humidity.

6. Results

The determination of the period of sampling was based upon personal communications with Drs Hisoriev and Khassanov and a previously performed collecting expedition in Turkmenistan sponsored by the USDA. During the expedition it turned out that the period of choice was correct. However the year of collecting could have been better as the prevailing weather conditions in Central Asia in the winter and spring of 2008 (severe winter followed by a very dry spring) were in general not very beneficial for the growth of wild annual species like spinach.

Spinach (including wild spinach) is locally known as ismalok, ispaloq or spaloq. In total 30 samples were collected in Tajikistan and 38 in Uzbekistan (Appendix III). Two samples were identified as cultivated spinach (*S. oleracea*; KK002 and KK020) and the rest was wild spinach (*S. turkestanica*). The *S. oleracea* accession collected at the Denau Bazar (Uzbekistan) came from Buhara. It was mentioned that around this city commercial spinach cultivation was taking place on 10-20 ha. The spinach was planted in October and harvested in January. The other *S. oleracea* accession was sampled at the Tashkent Bazar and it was mentioned that this accession originated from Chirchick, a city ca. 20 km east of Tashkent. On the Tashkent Bazar also two *S. turkestanica* accessions were acquired. One originated from Andizhan and the other one from Samarkand/Dzhizak indicating that *S. turkestanica* is also cultivated in certain localities in Uzbekistan.

The distance between collecting sites were mostly in the order of several kilometers, although this was not always the case as a number of accessions collected in Tajikistan were more close to each other. The crude seed yield per accession (fruit aggregates and debris) can be found in Appendix III.

Spinach and wild spinach are used fresh by consumers as a spice in food (so mixed with rice, yoghurt or soup). Dried spinach is used outside the harvesting season in soups only. A water extract from spinach seeds, is used for kidney problems. The extract is obtained via 5 min. boiling in water of the seeds.

Figure 3. Collecting spinach in Tajikistan.
From left to right: H. Hisoriev, L.J.M. van Soest and A. Mahmat.

The habitat where *S. turkestanica* was predominantly found can be characterized as cultivated non-irrigated steppe having a loess soil, where the species grows along mostly cereal or sometimes flax fields (Figure 3; non-irrigated fields in Russian are called *bogara* and in Uzbek *lalmi*). Wild spinach can not be found in well-managed fertilized fields. In *bogara* fields the crop is growing in a very low density. Very limited or no use is made by farmers in *bogara* fields of fertilizers and crop-protection chemicals, due to limited budgets and/or limited availability. Individual plants in these locations are small and have growth heights of ca. 10-20 cm. They grow mostly within meters distances from each other. A second much less occurring habitat is a non-irrigated area with a loess soil, where the species is growing abundantly and reaches heights of ca. 50 cm. Such an area can be located along a road, but also on (abandoned) fields in which few other species grow. As the accessions we found were observed predominantly to be growing along field margins in rooted up soil, wild spinach can be characterized as a ruderal (so competition avoiding) species. As the plants collected were already withered no signs of fungal or insect attack could be determined.
Potentially the majority of the *S. turkestanica* populations are under threat. Nowadays wild spinach can survive in the field margins because of low input farming: no use of irrigation, chemical fertilizers and crop protection. However if the management of the fields changes via the use of irrigation and chemical fertilizers, the crop will become denser and more competitive towards other species which will decrease the chances for a ruderal species like wild spinach to fulfill its life cycle in these habitats.

The number of plants harvested per location varied from a few (5-10) to numerous (>100). The number of seeds (actually seed aggregates) per plant also varied: mostly from 5 to 50 (Figure 4). The quantity of seeds collected per accession is given in Appendix IV.

Figure 4. S. turkestanica plants growing along cereal fields in Uzbekistan.

Often plants from a location were not growing within a circular area but along a strip (e.g. field margins). Both the number of plants per population and the shape of the growing area can have effects on the basic assumptions underlying the concept of a panmictic population. Therefore it is more appropriate to view an accession as plants originating from a specific location and adapted to the local circumstances without assuming that they all are part of one population. Another observation was that male plants were found very rarely: is this due to a possible rapid degradation of these tiny plants; has it something to do with the reported niche differentiation of male and female spinach plants? (Freeman & Vitale 1985; Freeman et al. 1997).

Farmers in the Lokhur – Isambay valley in Tajikistan, but possible also in other areas in Tajikistan and possibly Uzbekistan, collect wild spinach April and sell them at the local market. A local farmer (Ali Said) told us that in his village around 10 persons harvested fresh wild spinach for a period of 20 days. Every day 2 bags containing around 20 kg of wild spinach per bag were collected per person. In total 20 days x 10 persons x 2 bags x 20 kg per bag = 8000 kg of wild spinach plants were harvested. Suppose that the fresh weight of 1 spinach plant is ca. 200 gram, then in total this village harvests 40.000 plants per year. As there are many of these small villages in the valley it means that a huge amount of wild spinach is harvested every year in this valley. However there was still enough left after the harvesting period in April, as we observed that this area was a rich sampling area. Each of the 10 gatherers earned during the

whole period 400 Somoni for harvesting wild spinach, which amounts to around € 75 per person. The cultivation of spinach in this valley was not taking place as the Tajik government, who rented the land for ca. 50 Somoni per hectare to the farmers, only allowed for the cultivation of wheat and flax in this area.

This expedition was a single crop expedition. The advantage of this narrow crop focus was that all energy was centered on finding wild spinach. Under the given circumstances this was certainly justified as it was sometimes difficult to find wild spinach populations. However on the other hand one could argue that on days that it was hard to find wild spinach one could also collect material from other (wild relatives of) crop species. Perhaps a bit broader focus of the expedition would have been advisable, resulting in an expedition which has its predominant focus on a specific crop and its wild relatives (in this case spinach) but which also pays attention to other crop species and their wild relatives. In case of this expedition this would have resulted for example in the obtenance of accessions of *Lactuca* and *Allium*.

7. Conclusions

a. The Memorandum of Understanding, based upon the sMTA of the IT-PGRFA, was signed between CGN and the national authorities in Tajikistan and Uzbekistan without any complications.
b. The collecting expedition in both countries did take place in a good mutual understanding between the team members and without encountering any major problems with local or national authorities.
c. The *Spinacia* collection of CGN could be broadened too a large extent as a 68 unique accessions could be added to it, amongst which 66 wild spinach *(S. turkestanica)* accessions. This means also a two-threefold increase of the global wild relative resources of this spinach species, which can be very beneficial for breeding and research activities in spinach.
d. Large gaps are still present in global genebanks concerning the wild crossable relative of cultivated spinach *(Spinacia oleracea)*. For *S. turkestanica* no or very little material from Iran, Afghanistan, Pakistan, India is available. For *S. tetrandra*, which has its centre of biodiversity in the Caucasus, the situation is even worse. Given the need for new germplasm for breeding and research it would be worthwhile to initiate more expeditions to collect spinach, preferably starting with collecting wild spinach *(S. tetrandra)* from the Caucasus.
e. Perhaps it would be advisable to broaden the scope of future expeditions a bit with respect to the material collected: not purely single crop but also keeping an eye on other crop species and their wild relatives.

8. References

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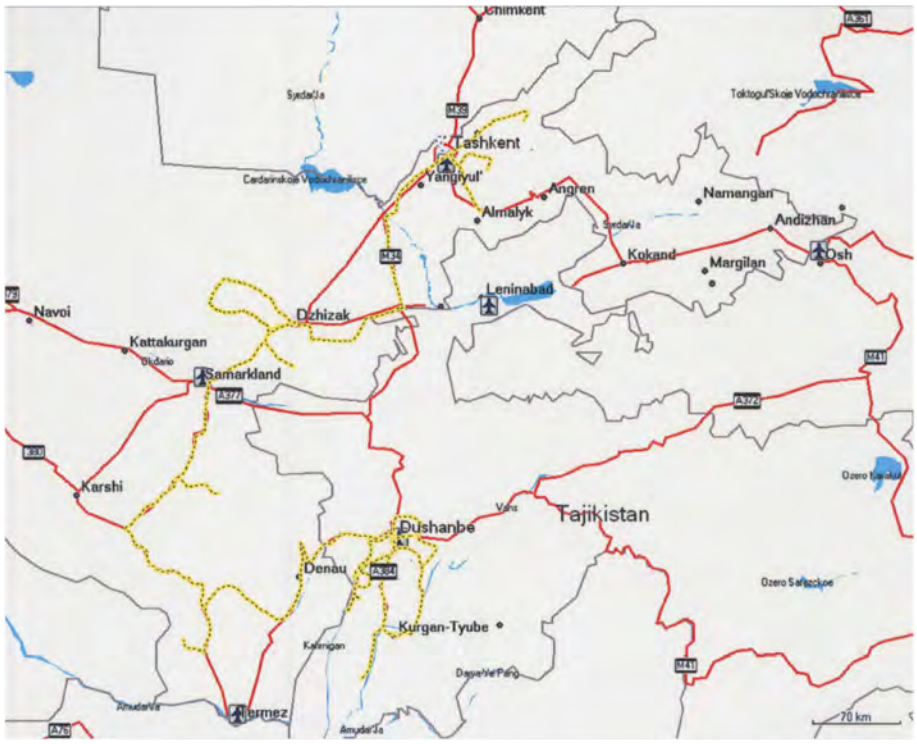
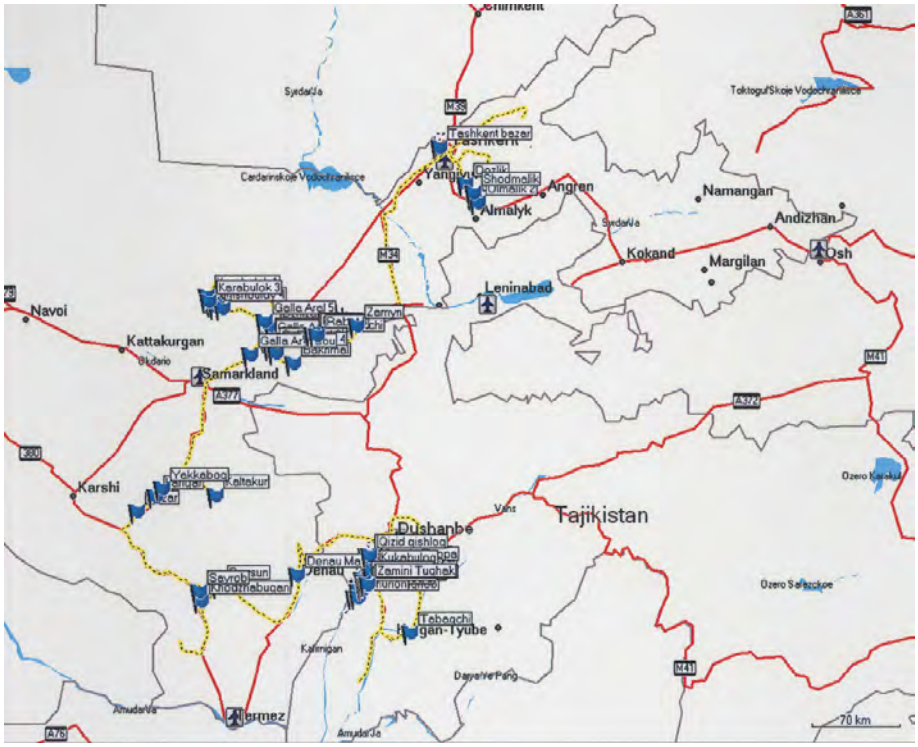
9. Acknowledgements

This expedition was made possible by the financial support from spinach breeding companies affiliated to PLANTUM-NL and the Dutch Ministry of Agriculture, Nature Conservancy and Food Quality. Furthermore CK would like to express his sincere gratitude to the other team members who made this trip to a success.

Appendix I. **Route travelled (in yellow) and samples collected in Tajikistan and Uzbekistan. Grey lines: borders between countries, red lines: main roads**





Appendix II. Expedition collecting form

Tajikistan- Uzbekistan- the Netherlands *Spinacia* collection expedition 2008

Team/collector(s) .....*Collecting number*.....

Date.....*Photo number*.....

Crop name.....*Cultivar name*.....

Latin species name.....

Locality.....

.....

Latitude.....*Longitude*.....*Altitude*.....

Sample.....population.....clone.....individual.....random.....non random.....

Frequency..... abundant.....frequent.....occasional.....rare.....

Topography.....swamp.....flood plain.....level.....undultating.....hilly..... steep.....

.....montainous

Biological status of accession (SAMPSTAT)

100) Wild
110) Natural
120) Semi-natural/wild

200) Weedy

300) Traditional cultivar/landrace

500) Advanced/improved cultivar

Collecting/acquisition source (COLLSRC)

10) Wild habitat
11) Forest/woodland
12) Shrubland
13) Grassland
14) Desert/tundra
15) Aquatic habitat

20) Farm or cultivated habitat
21) Field
22) Orchard
23) Backyard, kitchen or home garden
24) Fallow land
25) Pasture

30) Market or shop

60) Weedy, disturbed or ruderal habitat
61) Roadside
62) Field margin

REMARKS
(diseases, pests, other)

Appendix III. List of accessions collected in Tajikistan; mapdatum WGS 84, position format hddd.mm.mmm'

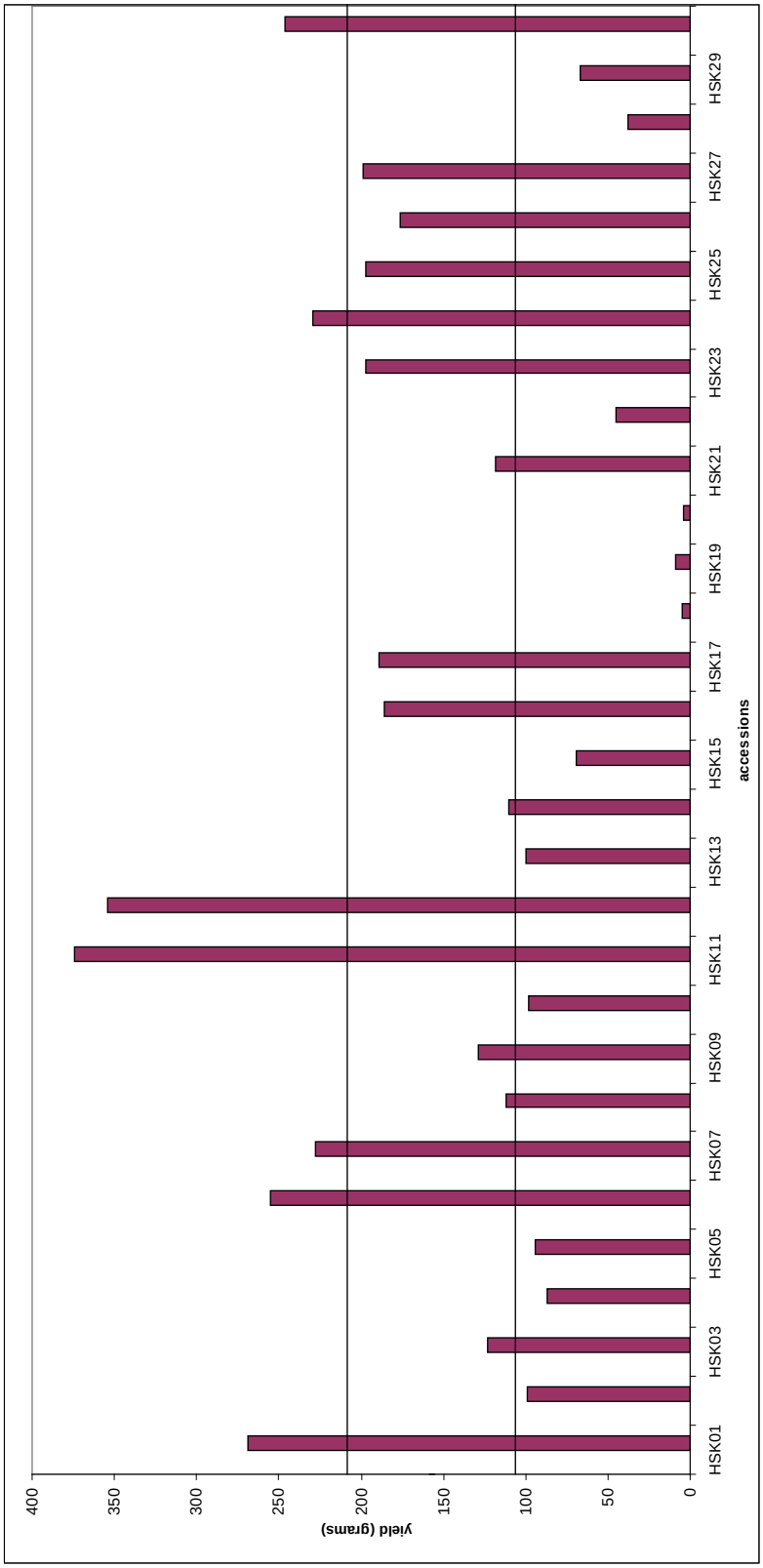
RNR	collecting number	date	photo		Locality name	latitude (N)	longitude (E)	altitude (m)	remarks		
			roll of film	number					frequency	topography	collecting source
080701	HSK001	310508	1	14-16	Istgohi hojboi	N38 14.470	E68 30.440	1047	abundant	hilly	field
080702	HSK002	310508	1	17-18	Istgohi (Boghaki poyon)	N38 11.198	E68 28.464	871	occasional	level	field
080703	HSK003	310508	1	21-25	Kasabuloq	N38 09.695	E68 27.721	845	occasional	hilly	field
080704	HSK004	310508	1	26-27	Chorrahai qunghuritha	N38 11.082	E68 28.936	938	frequent	hilly	field
080705	HSK005	310508	1	28-30	Khirmanak	N38 10.859	E68 30.923	1022	abundant	level	grassland
080706	HSK006	310508	1	31-33	Skirdiferma	N38 10.670	E68 31.213	1044	abundant	level	backyard
080707	HSK007	310508	1	34-36	Boghaki bolo	N38 10.599	E68 31.489	1072	abundant	level	grassland
080708	HSK008	310508	1	37	Rohatdarai mobain	N38 11.332	E68 31.973	1185	abundant	level	field
080709	HSK009	310508	2	0	Mazori (Khoja chasma)	N38 12.115	E68 33.038	1283	abundant	hilly	grassland
080710	HSK010	010608	2	4	Qutany bul (Zamini poion)	N38 12.216	E68 32.408	1270	abundant	undulating	field
080711	HSK011	010608	2	5	Yolai pistaho	N38 12.302	E68 32.329	1297	abundant	hilly	shrubland
080712	HSK012	010608	2	6-8	Zamini chuqurak	N38 12.034	E68 32.242	1260	abundant	level	field
080713	HSK013	010608	2	9	Khirmanaki	N38 12.141	E68 32.990	1290	abundant	undulating	shrubland
080714	HSK014	010608	2	11	Mazari khuja chasma	N38 12.105	E68 33.195	1238	frequent	hilly	grassland
080715	HSK015	010608	2	12-13	Zamini tughak	N38 12.086	E68 33.299	1300	occasional	undulating	field
080716	HSK016	010608	2	14	Skirdimazor	N38 11.879	E68 33.172	1244	frequent	level	grassland
080727	HSK017	010608	2	15-16	Tabaqchi mountain (Shikol)	N37 51.560	E68 57.573	657	frequent	hilly	grassland
080728	HSK018	050608	2	28	Lailak-khona	N38 24.598	E68 34.370	717	rare	hilly	grassland
080729	HSK019	050608	2	29	Qizil qishloq	N38 24.547	E68 34.229	710	rare	steep	grassland
080730	HSK020	050608	2	32	Darai kharar	N38 24.870	E68 32.760	840	rare	hilly	wild habitat
080717	HSK021	080608	2	36	Ganda teppa	N38 19.498	E68 36.634	1055	frequent	undulating	wild habitat
080718	HSK022	080608	2	36	Ganda drara	N38 19.851	E68 36.319	994	occasional	level	field
080719	HSK023	080608	-	-	Kakabuloq village	N38 17.828	E68 35.286	1157	abundant	level	roadside
080720	HSK024	080608	-	-	Chagan village (Zamini Ali Said)	N38 18.105	E68 34.096	1129	abundant	undulating	grassland
080721	HSK025	080608	-	-	Shurmanka village	N38 13.264	E68 30.630	1070	abundant	undulating	field
080722	HSK026	080608	-	-	Ghor	N38 13.413	E68 30.987	1098	abundant	undulating	wild habitat
080723	HSK027	080608	-	-	Nimboman	N38 13.186	E68 31.557	1179	abundant	level	roadside
080724	HSK028	100608	-	-	Shurion village (Devori Karim Devona)	N38 06.476	E68 27.834	1180	frequent	level	backyard
080725	HSK029	100608	-	-	Darai dughob	N38 06.571	E68 25.712	735	occasional	undulating	wild habitat
080726	HSK030	100608	-	-	Khosabuloq-2	N38 09.164	E68 27.987	881	abundant	undulating	field

Appendix III (con't). List of accessions collected in Uzbekistan; mapdatum WGS 84, position format hddd.mm.mmm'

RNR	collecting number	date	photo		Locality name	latitude (N)	longitude (E)	altitude (m)	remarks		
			roll of film	number					frequency	topography	collecting source
080764	KK001	140608	4	1-3	Denau bazar-1	N38 16.466	E67 53.329	524	-	-	-
	KK002	140608	4	1-3	Denau bazar-2	N38 16.503	E67 53.356	508	-	-	-
080731	KK003	140608	4	4	Boysun	N38 11.694	E67 10.033	1334	abundant	undulating	field margin
080732	KK004	140608	4	5	Khodzhabugan	N38 05.136	E66 59.777	930	occasional	level	field
080733	KK005	150608	4	10	Sayrob	N38 09.105	E66 58.730	1188	occasional	level	field margin
080734	KK006	150608	4	14-15	Guzar	N38 43.461	E66 23.656	485	abundant	level	field margin
080735	KK007	150608	4	16	Langar	N38 49.872	E66 34.213	565	frequent	level	roadside
080736	KK008	150608	4	17	Yakkabog	N38 53.337	E66 38.178	587	occasional	level	field
080737	KK009	160608	4	-	Kaltakur	N38 50.291	E67 07.750	1520	occasional	level	backyard
080743	KK010	160608	4	30	Gallaaral - south	N39 50.703	E67 27.431	813	frequent	level	roadside
080744	KK011	160608	4	31	Dzhizak-1	N40 02.713	E67 39.697	627	rare	undulating	field margin
080745	KK012	160608	4	32-33	Dzhizak-2	N40 03.292	E67 41.806	594	occasional	undulating	field margin
080738	KK013	170608	4	34	Rabot	N39 59.702	E68 01.349	423	frequent	level	field margin
080739	KK014	170608	4	35	Rabot-2	N39 59.478	E68 02.527	413	frequent	level	field margin
080740	KK015	170608	5	0-1	Rabot-3	N39 58.983	E68 04.804	415	frequent	level	wild habitat
080741	KK016	170608	5	2-3	Achchi	N39 57.667	E68 17.186	530	frequent	level	field margin
080742	KK017	170608	5	4	Zamyn	N40 03.198	E68 27.382	455	occasional	level	wild habitat
080766	KK018	190608	5	9-10	Tashkent bazar-1	N41 19.627	E69 14.080	446	-	-	-
080767	KK019	190608	5	9-10	Tashkent bazar-2	N41 19.627	E69 14.080	446	-	-	-
	KK020	190608	5	9-10	Tashkent bazar-3	N41 19.627	E69 14.080	446	-	-	-
080746	KK021	210608	5	12	Dzhizak-3	N40 02.753	E67 39.868	633	occasional	undulating	field margin
080747	KK022	210608	5	13	Gallaaral-1	N39 57.483	E67 37.075	656	abundant	level	wild habitat
080748	KK023	210608	5	14	Gallaaral-2	N39 56.628	E67 37.220	703	frequent	level	field margin
080749	KK024	210608	5	15	Gallaaral-3	N39 53.334	E67 39.488	767	frequent	level	field margin
080750	KK025	210608	5	16	Gallaaral-4	N39 51.566	E67 41.806	868	frequent	undulating	field margin
080751	KK026	210608	5	17	Bakhmal	N39 46.820	E67 51.627	1079	occasional	undulating	field margin
080752	KK027	220608	5	21-22	Karabulok-1	N40 15.847	E67 02.940	820	occasional	undulating	field margin
080753	KK028	220608	5	23-24	Karabulok-2	N40 13.807	E67 03.550	775	abundant	undulating	field margin
080754	KK029	220608	5	25-26	Karabulok-3	N40 13.579	E67 04.109	774	abundant	level	field margin
080755	KK030	220608	5	27	Ishbuldy-1	N40 12.561	E67 05.898	802	frequent	level	field
080756	KK031	220608	5	28	Ishbuldy-2	N40 11.982	E67 07.048	789	frequent	level	wild habitat
080757	KK032	220608	5	29	Ishbuldy-3	N40 11.165	E67 08.630	772	frequent	level	field
080758	KK033	220608	5	30	Ishbuldy-4	N40 10.799	E67 12.094	824	frequent	level	field margin
080759	KK034	220608	5	31-32	Gallaaral-5	N40 04.914	E67 35.198	608	occasional	level	field margin
080760	KK035	240608	5	34	Dozlik	N41 04.002	E69 28.770	460	frequent	level	field margin
080761	KK036	240608	5	35-36	Olmalik-1	N40 57.793	E69 33.452	545	occasional	undulating	field margin
080762	KK037	240608	6	0-1	Olmalik-2	N40 56.055	E69 35.423	527	abundant	undulating	field margin
080763	KK038	240608	6	2	Shodmalik	N41 00.077	E69 33.269	496	abundant	level	field margin

Appendix IV. Seed yield accessions collected

In Tajikistan



In Uzbekistan