

PHASEOLUS LUNATUS L. COLLECTED IN THE DANUBE DELTA

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Abstract:

SZABÓ T.A., MARINESCU A., VARGA P., 1987, Phaseolus lunatus L. collected in the Danube Delta. Not. bot. hort. agrobot., Cluj., XVII, 19-28 During a joint collecting mission of the Germplasm Resource Laboratories (I.C.C.P.T. Fundulea and the Agronomy Institute, Cluj-Napoca) Lima bean (Phaseolus lunatus L.) has been found at Chilia Veche in cultivation in Danube Delta. The collected sample belongs to supraconvex. lunatus convex. inamoenus (L.) h.l. prev. inamoenanus h.l. being a new species in the cultivated flora of Romania. Results and problems connected with his accession are discussed.

Index words: Phaseolus lunatus, lima bean, genetic resources.

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Phaseolus lunatus L. (Lima bean, Sieva bean) is the second important cultivated species in genus Phaseolus. Lima bean accessions represented 7 % of CIAF world Phaseolus collection (1984). This collection was built in the last years, mostly through IBPGR collection missions (Annual Reports, 1979-1984). Areas of the first priority for the species are Mexico (1981), Cuba, Haiti, Brazil (59/1982, 11/1983), Peru (43/1982, 74/1983), NW Argentina, NE Chile, SW Bolivia and Venezuela (figures in brackets indicate the number of samples collected in the indicated years).

These are the territories where large Lima bean (Andean Highlands, about 4000 B.C.) and the small Sieva bean (Pacific Mexico, about 1 200 B.C.) have been domesticated.

Germplasm collections reported in the period 1980-1986 in Plant Genetic Resource Newsletter registred about 350 *P. lunatus* Accessions throughout the world, but none from Europe (Table 1.).

Table 1.

Phaseolus in main germplasm collections reported in Plant Genetic Resource Newsletter (1980-1986)

Nr.	Main author	Year	PGR Newsl. (Nr./Pg.)	Region (Country)	Nr. of accessions luna- vulga- spp. tus ris div.
1.	ESQUINAS-ALCAZAR	1986	64/39	Paraguay	17
2.	GENIEP et al.	1986	64/11	N.Sudan	22
3.	ESQUINAS-ALCAZAR	1986	63/21	Brasil	-
4.	DAMANIA	1985	63/43	Mauritius	-
5.	ENGELS	1984	61/16	Ethiopia	? 263
6.	GEORGE	1984	59/24	Syria	-
7.	ESQUINAS-ALCAZAR	1984	58/05	Bolivia	? 341
8.	PERRINO et al.	1984	58/37	S.Italy	-
9.	ATTERE et al.	1983	56/3	Zambia	-
10.	HASSAN et al.	1983	56/39	Sudan	-
11.	ALMAN-CASTRO et al.	1983	54/11	Spain	-
12.	ALMAN-CASTRO et al.	1983	53/41	NE Spain	-
13.	AHMAD et al.	1982	52/04	Pakistan	? 1
14.	ESQUINAS-ALCAZAR	1982	52/31	Andean region	62 about 9000
			51/33		
			50/75		
			49/40		
15.	ASTLEY et al.	1982	51/17	Ethiopia	-
16.	ARORA et al.	1982	51/27	W.HIMALAYA	-
17.	MOTA et al.	1982	50/21	Portugal	104
18.	MEHRA	1982	50/46	Zambia	72
19.	Ng, N.Q	1982	49/26	Nigeria	281 1101
20.	PERRINO et al.	1982	49/32	S.Italy	32
21.	CROSTON et al.	1982	48/66	Nuthan	? 47 (incl. Vigna)
22.	TOLL	1982	48/22	Ethiopia	1
23.	HASHMI et al.	1981	47/34	Pakistan	? 94
24.	RASHID	1981	46/02	Afghanistan?	280
25.	ARORA	1981	46/22	India(Sikim)?	-
26.	ARORA	1980	44/29	Malawi, Zambia	245
TOTAL IBPGR:		1980-1986		cca 350	cca 11.500
27.	SZABÓ et al.	1982	-	Moldavia	1 23
		1986	-	Danube Delta	1 194
TOTAL ROMANIA 1982-1986				2	217

The species is of restricted economic importance: the best bush cultivars yield at the tropics up to 1500 kg/ha, the best climbing varieties up to 3000 - 4000 kg/ha. Traditional local varieties are widespread. Recently new cultivars have been selected in USA for early maturing, high vigour, cold- and heat hardiness etc. (DUKE 1981). A constant expansion of the cultivars with big, flat and white seed have been recorded, too (FRANKE et al. ap. ZEWEN et al. 1975, SMART 19 6). This trend seems to reach now the Danube Delta.

In Africa a large collection comprising 281 samples of *Ph. lunatus* has been gathered by International Institute of Tropical Agriculture (IITA), but Lima beans were dropped from the crop improvement program of IITA in 1981 (NG, 1982). The species is still considered important from genetic resource point of view (MUTHI ANYHETTY et al. 1981) and is of first priority for storage in collections monitored by IBPGR (ELLIAS 1984). A descriptor list for *Ph. lunatus* was published by IBPGR in 1982.

In Europe only small scale cultivation has been recorded namely from Italy and southern France (SALONTAI et al. 1982, TOTH 1979).

As a tuberous legume storing in roots fermentable carbohydrates too, Lima beans have been evaluated for tropical Australia as a potential fuel crop (SAXON 1981).

No reference have been found regarding the cultivation of *Ph. lunatus* L. in Romania (BORZA 1986, OLARU 1982, SALONTAI et al. 1982, TOPA et al. 1957, TORJE et al. 1978 etc.). The species has not been registred in our previous regional *Phaseolus* collections (SZABÓ 1985, SZABÓ et al. 1978), neither has in monographs dealing with *Phaseolus* species cultivated in neighbour countries (KODZUHAROV 1976, TOTH 1979).

Results

A small sample of *Ph. lunatus*, indicated as cultivated in Eastern Romania entered first in our collection in 1982. As this accession was inadquately documented, we considered it as a hazardous introduction.

On June 3, 1986 while on a joint collecting mission organized by the Germplasm Resource Laboratories of I.C.C. P.T. Fundulea and the Agronomy Institute "Dr. Petru Groza", Cluj-Napoca traditional Lima beans cultivation was detected in the Danube Delta at Chilia Veche (Fig.1),

Table 2

Phaseolus lunatus L. - seed characters of the "Chilia" accession^x, AC.Nr.: 15-030686-CL

Nr. of measurements	Seed			Obs.
	Length mm	Width mm	Thickness mm	
1.	25	14	5,5	
2.	24	13	5,0	
3.	24	13	4,0	
4.	23	13	4,0	
5.	21	12	4,0	
6.	21	13	4,5	
7.	21	12	5,0	
8.	20	13	4,0	
9.	19	12	5,0	
10.	18	11	3,5	
X	21,6	12,4	4,45	

x. 1000 seed weight = 960 gr.

Table 3

Phaseolus lunatus L. (A.C.Nr.15-030686-CL): legume characters of the "Chilia" accession.

Nr. of measurement	Legume					
	length mm	width mm	thickn. mm	apex mm	are depth mm	seed/ legume
1.	105	23	17	5	13	2
2.	105	21	11	6	15	2
3.	105	23	7	4	0	2
4.	103	22	10	5	11	2
5.	107	22	7	3	0	2
6.	96	20	10	5	11	2
7.	100	23	9	5	4	2
8.	85	28	10	5	17	1
9.	77	22	9	5	20	1
10.	75	21	10	6	9	1

Limits	75-107	20-28	7-17	3-6	0-20	1-2
X	95,8	22,5	10,0	4,9	10	1,7

The accession nr.15-030686-CN has been collected from the stock of Maslincov - a fisherman (Chilia Veche). It was harvested in 1985 from his own garden. According to Maslincov and his wife the collected variety is largely cultivated by their neighbours, too. We received no information regarding the origin of the sample and the time of first introduction. The local name of the variety is dodie țărcată (spotty beans); it is of bush type, planted in rows in garden similarly as French beans. The maturation of pods is continuous, till late in autumn. About 30-40 pods are produced per plant, if planted on fertile garden soil. It is used for soups, it boils more readily and is sweeter than Ph.vulgaris.

Seed and pod characters of the accession are presented in Table 2 and Table 3.

Discussion

The first, insufficiently documented accession of Phaseolus lunatus entered in our collection, was considered uncertain. This second, verified introduction surely indicates the presence of cold tolerant, early maturing Lima beans in Romania. The species reached - perhaps by ship on Black Sea - the Danube Delta. When was the first introduction? What is the origin of the sample? How large is the variability of founder population (s)? Is the cultivation restricted to Chilia Veche, where some other pulses (e.g. Cicer arietinum considered rare for Romania) are frequently cultivated? Is Lima bean still widely popular in the neighbouring territories? These and similar questions are subject to further research. What is certain: in the 16 localities studied for germplasm resources in the Delta of Danube only this P. lunatus sample has been collected besides about 160 Ph.vulgaris and 15 P. coccineus accessions. Ph.coccineus is also a relatively new crop plant in the Delta.

As this is the first report on Lima beans cultivation in Romania some problems of general importance regarding the identification, nomenclature, infraspecific taxonomy biology, genetics, breeding, evolution, gene pools and dispersal of the species will be also briefly discussed.

Identification: Inflorescences have fewer flowers and are shorter as the proximal leaf differentiating Ph. lunatus from Ph. coccineus and Ph. caracalla. Flowers are yellowish, seed testa bears a characteristic radial pattern due to large intercellular cells between the radial ones. This, and the lack of oxalate crystals

in testadifferentiate the species against *Ph. vulgaris*. The falci-
form legumes are glabrous, only 2-4 times longer than large (dif-
ferential against *Ph. mugo*). Thousand-seed weight is (250) 450-1200
(2000) gr; seeds are 15-25 mm long, flat. Testa colours are white,
yellow, brown, red, black striped, mottled, variegated.

Nomenclature: Lima beans represent a highly variable species,
and this variability is reflected by the great number of synonymies
(ESELTIME 1931, MANSFELD 1959). Various species names applied to
lima beans are compiled in Table 4.

Table 4

Species names used for *Phaseolus lunatus* L.

C E N T U R I E S		
XVII	XIX	XX
Species names		Cultivar groups
<u>lunatus</u> L.1753	<u>xuarezii</u> Zucc.1809	var. <u>lunonanus</u>
<u>inamoenus</u> L.1753	" Stokes 1812	Bailey 1949
<u>rufus</u> Jacq.1770	<u>parviflorus</u> Stokes 1812	var. <u>salicis</u>
<u>bipunctatus</u> Jacq.1770	<u>saccharatus</u> Stokes 1812	cvgr. <u>lunatus</u>
<u>macrocarpus</u> Moench 1794	<u>macrocarpus</u> Poir.1813	Mackie 1943
	<u>derasus</u> Schrank 1819	cvgr. <u>bipunctatus</u>
	<u>puberulus</u> H.B.K.1823	idem
	<u>maximus</u> Roxb.1832	cvgr. <u>inamoenus</u>
	<u>ilocanus</u> Blance 1837	idem
	<u>vexillatus</u> Blance 1837	- Java group
	<u>dumosus</u> Macf.1837	- Red Ragoon group
	<u>limensis</u> Macf.1837	- White Burma group
	<u>foecundus</u> Macf.1837	- Lima group
	<u>latisiliquus</u> Macf.1837	(cf. DUKE 1981)
	<u>saccharatus</u> Macf.1837	
	<u>platyspermus</u> Haberle 1841	
	<u>amazonicus</u> Benth.1862	
	<u>capensis</u> Thonb.?	

The taxonomic status of the cultivated taxa have been revised
here based on MACKIE 1943, BAUDET 1977 and DUKE 1981. MACKIE, designa-
ted three major groups (cf. Table 4). The first group is represented
by small Sieva beans spread first in Mexico by Hopi dispersal line.

The second is the "potato" group with spherical seeds and high
HCN content (Carib dispersal line). The third is the Big Lima group
with large, flat seeds and low HCN content (Inca dispersal line).

DUKE (1981) recognized four groups with no formal taxonomic
treatment: 1. Java beans (medium sized purple - red to black seeds,
high HCN content); 2. Red Ragoon beans (mostly plump, reddish or with
purple spots, with traces of HCN); 3. White Burma beans (with plump
seeds resembling small haricots, with traces of HCN); 4. Lima beans
(large, flat, mostly white seeds, said to contain no HCN).

BAILEY (1949 ap. 1975) distinguished a bush variety group (var.
lunonanus) and a willowleaf group (var. salicis).

In order to reflect taxonomically the evolutionary, divergen-
ce different of cultivar groups for reasons of germplasm grouping
(SZABO 1983) the following infraspecific taxonomy is proposed here:

1. Ph. lunatus L. ssp. sylvestris (Baudet 1977) h.l.: wild ancestor
2. Ph. lunatus L. supraconv. lunatus h.l.: cultivated populations
 - 2.1. -- conv. lunatus h.l. syn. P. lunatus L. s.str. (Sieva and
Potato beans cf. WESTPHAL ap. DUKE 1981)
 - 2.1.1. --- prov. lunatus: climbing types
 - 2.1.2. --- prov. lunonanus (Bailey) h.l.: bush types
 - 2.2. -- conv. inamoenus (L.) h.l.: Big Lima Beans (= Ph. macrocar-
pus Moench)
 - 2.2.1. --- prov. inamoenus (L.) h.l.: climbing types
 - 2.2.2. --- prov. inamoenonanus h.l.: bush types

This division seems to be sufficient for the practical
treatment of further Lima beans accessions potentially important
for Europe.

Our accession (nr.: 15-030686-CN) belongs to this system of
Phaseolus lunatus L. supraconv. lunatus conv. inamoenus prov. inamoenonanus (Ph. lunatus prov. inamoenonanus).

Problems related with the evolution, dispersal, breeding,
genetics or use of the species have been reviewed by DUKE 1981,
EVANS 1976, EVANS et. al. 1974, KLOZ et al. 1969, KAPLAN 1977,
Le MARCHAND et al 1976, MECKIE 1943, SMART 1980, 1984, SMOLENSKI
et al. 1981, WALL 1970 and others. All these results conclude that
Ph. lunatus is fairly isolated in the genus, producing no viable
and/or fertile hybrid with the members of the group. It means that
the primary gene pool of Ph. lunatus is restricted to the cultivar
collections, the secondary gene pool is represented by the wild

esp. sylvestris the tertiary is lacking, and just the quaternary contains the other Phaseolus species. Ph. lunatus is diploid (2n=22) with no detected polyploidy and chromosome structural changes.

Lima beans germplasm is considered as a source of tolerance for antrachnose, virus diseases, drought, heat and adverse soil conditions (laterite, high or low pH). This high tolerance was mentioned by the growers in Chilia as a reason of preference for the crop.

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MELILOTUS ALBA MEDIK. - O NOUA SPECIE CULTIVATA DE
INTERES PURAJER PENTRU DELTA DUNARII

O. STOIAN

Abstract:

STOIAN O., 1987, Melilotus alba Medik. - a new cultivated forage plant for the Danube Delta. Not. bot. hort. agrobot., Cluj., XVII, 29-34. (in Romanian) Melilotus alba germplasm collected from the spontaneous flora of the Danube Delta and evaluated for forage production in three experiments organized at Sfintu Gheorghe and Cișla Vădeni proved to be very successful as compared with other forage grasses (Lolium, Festuca, Dactylis, Bromus) and forage legumes (Medicago, Onobrychis, Trifolium). Dry matter production of Melilotus surpassed about 15-80 folds the production of traditional forage species used for comparison in these evaluations.

Melilotus alba - largely distributed in the spontaneous flora of the Danube Delta. - seems to be best adapted to the local ecological conditions for forage biomass production. The species may have a future as a new cultivated plant in this part of Romania.

Key words: Melilotus alba, Danube Delta, forage plants.

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Genul Melilotus L. (Fabaceae) este reprezentat în România prin 6 specii: M. alba Medik., M. arenaria Grec., M. dentata (W. et K.) Pers., M. officinalis (L.) Pallas, M. altissima Thuill și M. taurica (Bieb.) Ser.

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