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SCREENING OF *LATHYRUS* GERMPLASM FOR LOW TOXIN

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A total of 2604 *Lathyrus* collections were analysed for ODAP content. The results revealed medium to high range of ODAP content among indigenous and exotic collections. Gene pool did not vary for the trait on the basis of geographical location. Some of the collections had ODAP content less than 0.2 per cent while breeding lines developed through hybridization had very negligible amount of the toxin. Among species, *L. odoratus*, *L. aphaca* and *L. cicera* had low ODAP concentration and showed resistance against pod borers, that could be transferred to *L. sativus*.

Key words: *Lathyrus* species, neurotoxin, ODAP, germplasm

INTRODUCTION

Grasspe (*Lathyrus sativus* L.) is an important pulse crop of India mainly grown in drylands and extreme harsh condition of relay cropping, occupying an area of 0.95 million hectares with annual production of 0.58 million tonnes (Anon., 1996). Its cultivation is mainly concentrated in south eastern Madhya Pradesh (Chhattishgarh) and Vidarbha region of Maharashtra as relay (*utera*) crop. Cultivation of grain in this region is preferred because of its hardinature, low cost of production and additional use as nutritious cattle feed. But low productivity especially under utera and presence of neurotoxin compound β-N- Oxalyl - L-α, β- diaminopropionic acid (ODAP), a causative factor of neurolathyrism in human beings are the major bottle necks. Attempts are being made to develop varieties with high yield and low ODAP content. In view of this, a large number of germplasm and breeding lines were evaluated for ODAP content.

MATERIALS AND METHODS

For *Lathyrus* collection numbering 2604 and maintained at Indira Gandhi Agricultural University, Raipur were evaluated for ODAP content. Harvested seeds were subjected to ODAP estimation using spectrophotometric method

(Rao, 1978). Besides germplasm, large number of breeding lines were also evaluated for this trait.

RESULTS AND DISCUSSION

The genus *Lathyrus* comprises approximately 150 species (Allkin *et al.*, 1983) distributed principally over north temperate areas (Allkin *et al.*, 1985), but concentrated on the eastern mediteranean region. *Lathyrus sativus* and *Lathyrus cicera* are the only species cultivated for grain. *Lathyrus ochrus* and *Lathyrus aphaca* are used as fodder and *Lathyrus odoratus* (sweetpea) as ornamental. In present study major emphasis was laid on screening for toxin content. While no authentic report is available on the safe limit of toxicity, Pusa-24 having ODAP concentration of 0.20 per cent has been identified as low toxin cultivar. The same level of toxicity (0.200) has been taken in to account in the present study.

Screening of primary collections

To explore the available variability 2059 land races were collected from Raipur, Durg, Rajnandgaon and Bilaspur districts of Madhya Pradesh during 1988 and 1990. So far, 1043 land races have been analysed for ODAP content and characterized for sixteen discriptor (Pandey *et al.*, 1995). The ODAP content from 0.128 (RKL 240) to 1.50 per cent (RLK 390) (Table 1). More than 50 per cent accessions had ODAP content between o.401 to 0.600 per cent, while 39.59 per cent collections had ODAP between 0.201 to 0.40 per cent. Only 3.36 per cent of the collection shad ODAP content less than 0.20 per cent.

Table 1. ODAP distribution in primary collections of grasspea (winter 1990-1991)

Distt.	Number of accessions				
	<0.20	0.201-0.40	0.401-0.60	>0.6	Total
Raipur	13	162	297	36	508
Durg	7	85	104	21	217
Rajanandgaon	15	122	70	05	212
Bilaspur	0	44	61	01	106
Total	35	413	532	63	1043
Per cent	3.36	39.59	51.01	6.01	

Evaluation of breeding lines

One hundred and twenty nine progenies of four diverse crosses involving Canadian and Indian parentages were evaluated during 1994-95 and 1995-96

(Table 2). Toxin content varied from 0.068 to 0.522 per cent. Among those 53 progenies consistently gave ODAP content less than 0.10 per cent.

Table 2. Accessions having low ODAP content

Traits	Notable accessions
ODAP content 0.10-0.20	RLK- 17, 32, 52, 74, 117, 209, 225, 240, 241, 244, 248, 249, 251, 253, 259, 264, 268, 278, 279, 280, 282, 283, 288, 289, 290, 292, 297, 299, 532, 818, 903, 925, 932, 1010, 1074 IC-120456, 120518, 120527 AKLG-2, 9 LS-8545
ODAP content ≤ 0.10	LS 157-2-4, -8, -12, -14 LS 157-5-2, -3, - 8, -10, -14, 17, 19, -20 LS 157-6-1, -5, -6, -7, -8 LS 157-9-5 LS 157-11- 2, -3, -5, -7 LS 157, 12-2, -5, -12, -4, -6, -7, -8, -13, -16 LS 157-14-5, -11 LS 157-18-14 LS 185-3, -5, -6, -14 BIO R-202, BIO R-203, BIO R-208, BIO L-212, BIO R-231, BIO I-222, P 94-3

Screening of secondary collections

Out of 378 indigeneous collections received from different parts of the country, (Table 3) 371 were analysed for ODAP content which ranged from 0.185 (IC-120456) to 0.604 per cent in DL-265. Majority of the germplasm lines had medium to high range of toxicity. Only seven accessions were found to have ODAP content less than 0.20 per cent. Comperatively high range of toxicity was noted in the accessions from Bihar and Kanpur.

Table 3. Screening of secondary collections for ODAP content

Source	Accessions	ODAP [%] Range
Madhya Pradesh	150	0.192 to 0.43
Bihar	11	0.312 to 0.521
Maharashtra	14	0.190 to 0.310
W. Bengal	01	0.330(Nirmal)
New Delhi	27	0.190 to 0.340
NBPGR, Akola	146	0.185 to 0.346
IIPR, Kanpur	23	0.302 to 0.604
Total	371	

It needs to be added that this compound is very sensitive to environmental factors (Dahiya, 1986; Dixit *et al.*, 1995; Sharma *et al.*, 1997). Hence rigorous testing of the collection especially having low ODAP content be done under varying environments.

Screening of exotic collections:

A sum of 112 exotic collections of *Lathyrus sativus* belonging to twelve countries received through N.B.P.G.R., New Delhi (Table 4) were analysed for toxin concentration which ranged from 0.180 in LS-8545 from Canada to 0.765 percent in Sel. 531 from Ethiopia. Ethiopen collections in general had high concentration of ODAP. A wide range of genetic diversity was noted for this traits.

Table 4. Screening of exotic germplasm for ODAP content

Country	Accessions maintained	Accession analysed	ODAP range (%)
Lathyrus sativus			
Canada	6	6	0.180-0.554
France	7	5	0.526-0.697
Bangladesh	3	2	0.411-0.431
Germany	3	3	0.337-0.445
U.S.A.	1	1	0.506
Italy	65	65	0.273-0.740
Syria	3	3	0.311-0.605
Ethipia	14	14	0.622-0.765
Tunisia	1	1	0.332
Poland	1	1	0.332
Cyprus	3	3	0.305-0.372
Turkey	4	4	0.327-0.379
Greece	1	1	0.434
Total	112	109	
Lathyrus ochrus:			
Germany	1	1	0.416
Greece	6	6	0.472-0.505
Cyprus	7	7	0.442-0.490
Total	14	14	

Screening of *Lathyrus* species:

ODAP content in wild relatives was relatively low except in *Lathyrus ochrus* (Table 5). The lowest value of 0.052 per cent was recorded in *Lathyrus odoratus, Lathyrus cicera,* cultivated for grain in the mediteranean countries,

Table 5. Screening of wild relatives for ODAP content

Species	Source	Accession No.	ODAP range (%)
Lathyrus cicera	U.S.A.	2	0.121-0.135
Lathyrus aphaca	Gwalior (MP)	2	0.110
Lathyrus ochrus	Germany, Greece, Cyprus	14	0.-416-0.505
Lathyrus odoratus	Raipur (MP)	2	0.052
Total		19	

was found to be low in the neurotoxin and showed resistance to pod borer. Similarly, *Lathyrus aphaca,* found as weed in India and observed to be resistant against pod borer had lower concentration of the neurotoxin. The desirable genes from these species could be transferred to *L. sativus.* Kiyoshi *et al.,* (1986) and Khwaja (1995) reported successful hybridization among *Lathyrus* species.

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