Distribution of cyanide content in the lima bean in relation with the infraspecific classification and the seed coat pigmentation.

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One major deterrent still restraining a larger spread and consumption of the lima bean, Phaseolus lunatus L., is the presence of a cyanogenic glucoside (linamarin) in the seeds and the lack of information about the accurate content of this product in the whole gene pool. We have therefore initiated thanks to the financial support of the International Board for Plant Genetic Resources a large screening of a worldwide lima bean collection with two main objectives: to determine the diversity of cyanide content and to find out any relationships with the infraspecific classification or any other factors. The method to analyze the cyanide content has been described in BAUDOIN (1989) and BAUDOIN et al (1989); the release of HCN being realized through the action of the linamarase already present in the seeds and the value of cyanide being calculated with the utilization of a selective CN electrode.

Seeds samples are obtained mainly from the Centro Internacional de Agricultura Tropical (Colombia) but also from other institutions in the world. The material is originating from several countries, the most important in proportion being Mexico, Brazil, Peru, Colombia, U.S.A., San Salvador and Guatemala for the New World, Cameroun and Nigeria for Africa and The Philippines for Asia. The first results concerning more than 800 accessions reveal a very large diversity in the observed HCN values with a minimum of less than 5 ppm to a maximum of 4385 ppm.

Tables I and II show the data according to classes of HCN contents respectively for the wild forms and for the three traditional cultigroups. With regards to the wild material, results confirm data previously obtained, i.e. the very high values of HCN which may impart a selective advantage for the preservation of the plants in the natural vegetation. Concerning the cultivated forms, 72 % of the material provide seeds with HCN contents equal or less than 100 ppm. However several entries show high values exceeding very much the admitted norms for human consumption; the latter being distributed fairly evenly in the three cultigroups. From the data already obtained, it also appears that the Big Lima type is slightly richer in cyanide than the two other cultigroups, with the largest proportion of varieties exceeding 200 ppm of HCN.

The seed coat pigmentation displays a very wide array of diversity in the whole lima bean gene pool and it is consequently interesting to determine whether there is any relationships between this character and the HCN values. The first results do not show any tendency: for example the white-seeded varieties have a mean of 99,3 ppm HCN with 70 % of the accessions having less than 100 ppm while the black-seeded varieties display more or less the same values, with a mean of 102,9 ppm and 80 % of the accessions having less than 100 ppm. With respect to the seed coat color it is also worth mentioning the data obtained from a segregating wild population from the State of Campeche in Mexico (G 25713 of the CIAT collection). Selfing of this population has led to the establishment of four sub- populations one with white seeds, the three other with pigmented seeds.

The highest HCN value is observed in the white-seeded sub-population (1941 ppm) while the three other sub-populations give 523 ppm, 606 ppm

Table I. HCN contents of the wild forms of P.lunatus

Class of HCN contents	Nb of introductions (%)
501 - 1000 ppm	3 (7)
1001 - 1500 ppm	9 (20)
1501 - 2000 ppm	11 (25)
> 2000 ppm	21 (48)
Total	44
HCN ppm $\bar{x}$ = 2183,9	min = 606 max = 4385 V = 41,6 %

Table II. HCN contents of the 3 traditional cultigroups of P.lunatus

Class of HCN contents	Sieva	Potato	Big Lima
	Nb of introd. (%)		
≤ 50 ppm	144 (37)	56 (32)	38 (41)
51 - 100 ppm	136 (35)	86 (49)	10 (11)
101 - 200 ppm	66 (17)	17 (10)	17 (18)
201 - 500 ppm	25 (6)	12 (7)	20 (22)
>500 ppm	18 (5)	4 (2)	7 (8)
Total	389	175	92
HCN ppm $\bar{x}$ =	118,3	93,9	178,7
range =	<5 to 1795	10 to 837	<5 to 1058

and 805 ppm HCN contents. This confirms the lack of positive correlations between the seed coat pigmentation and the cyanide contents. Results of our screening trials have also shown the presence of white-seeded cultivated genotypes from the coastal area of Peru yielding more than 750 HCN ppm. Breeding materials involving such parental genotypes should therefore be monitored carefully along the improvement process.

Reference

BAUDOIN J.P. (1989); Bull.Rech.Agron.Gembloux 24(3): 263-296.

BAUDOIN J.P., J.P. BARTHELEMY, R. AGNEESSENS and A. MAQUET (1989); Bean Improvement Cooperative 32: 60-61.