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OPIUM POPPY ALKALOIDS PROFILE IN INDIAN GERMPLAM COLLECTIONS

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A comprehensive study of the alkaloids profile in opium poppy germplasm was undertaken to identify strains rich in morphinane alkaloids. The analysis of major alkaloids was done by liquid chromatographic method which revealed a very high morphinane alkaloids content in some of these strains. These studies further showed that the formation of morphinane alkaloids and isoquinoline alkaloids in opium-gum were negatively correlated. This information could be useful in breeding varieties with high morphine content.

The alkaloids of Opium poppy (*Papaver somniferum* L) are widely used in pharmaceutical industry. The latex obtained from the incised capsules (fruits), gets converted into semi-solid resinous mass called opium gum. Major alkaloids in opium gum are morphinane type (morphine, codeine and thebaine) and isoquinoline type (narcotine and papaverine); however, morphinane type alkaloids are of great medicinal importance.

Identification of strains possessing high latex yield and useful alkaloids is of paramount importance in developing better varieties in opium poppy. With this in view, a study was conducted to determine the latex yield and alkaloid content in some genetic stocks collected by the National Bureau of Plant Genetic Resources (NBPGR) and the results are presented in the paper.

MATERIALS AND METHODS

One hundred and twenty four accessions were collected from the opium growing regions of Madhya Pradesh, Rajasthan and Uttar Pradesh in India. These were evaluated for different characters including latex yield. On the basis of their performance, eight diverse genotypes originating from different states were selected for this study. These included IC 15, IC 19, IC 30 (from Rajasthan); IC 42, IC 83, IC 85, IC 88 (from M.P.); and IC 128 (from U.P.). These alongwith two controls (*Jawahar Afeem* and *Ranjhatak*-conventional varieties grown in M.P. and Rajasthan) were grown, at the Research Farm of NBPGR at Issapur, New Delhi for two crop seasons.

The opium latex was collected during the forenoon from the incised, both lateral and terminal, capsules of the 125-135 days old plants to avoid internal fluctuation in alkaloids content (Fairbairn and Wassel, 1964). The opium gum was processed and analysed on Waters Associates high-performance liquid chromatograph (HPLC) equipped with 6000 A solvent delivery system, 440 absorbance detector, Omniscribe B-5000 recorder, Shimadzu data processor and a reverse phase column with - CN functionality. The extraction procedure, solvent system and liquid chromatographic conditions employed were the same

as developed earlier at the NBPGR (Srivastava and Maheshwari, 1985). The contents of the individual alkaloids, namely morphine, codeine, thebaine, papaverine and narcotine, were calculated on per cent dry weight and yield (mg/plant) basis.

RESULTS AND DISCUSSION

The data on alkaloid content for two consecutive years showed that different accessions were characterised by variable proportions of morphinane, and isoquinoline type alkaloids. The proportion of morphinane alkaloids was always higher than isoquinoline alkaloids.

The data, pooled over the years, indicated that IC 30, IC 42, IC 85, IC 88 and IC 128 were superior in latex gum yield as compared to both the controls under study (Table 1). The total morhphinane alkaloids percentages were around 20 per cent in all the accessions except IC 30 and *Jawahar Afeem* with low values of 15.14 per cent and 15.44 per cent respectively. Higher values were obtained in IC 85 (23.20%) and IC 83 (23.07%) as compared to the high yielding control, *Ranjhatak* (20.31%). For morphinane alkaloids yield per plant, all the accessions performed better than both the controls.

Further, higher isoquinoline alkaloids yield was observed in IC 88 (43.98 mg/plant), IC 128 (47.34 mg/plant) and IC 85 (39.64 mg/plant) as compared to both the controls. However IC 42 and IC 83 possessed the isoquinoline alkaloids of almost same level as *Ranjhatak* which gave lower value of 28.89 mg/plant.

The variations in latex yield and alkaloids content in both the years may be ascribed to the effect of environmental conditions (Hofman and Menary, 1980) prevailing during these years. However five accessions (IC 30, IC 42, IC 85, IC 88 and IC 128) were found to be uniformly superior to controls in latex yield. Similarly, high morphinane alkaloids content was noticed (Fig. 1 & 2) in all the accessions except IC 30 in first year (12.50%) and IC 88 in second year (15.50 %).

It is noteworthy that whenever isoquinoline alkaloids content had gone beyond 10 per cent, there was appreciable decline in morphinane alkaloids content of the accessions (Fig. 1 & 2). The biosynthesis of opium alkaloids and variation in different genotypes in alkaloids biosynthesis has been shown to be genetically controlled (Jindra *et al.*, 1966; Bernath and Tetenyi, 1979 and Nyman and Hansson, 1978). Hence, the inverse relationship between morphinane and isoquinoline alkaloids as shown by different selections is possibly due to genetic system controlling the pathway for the formation of these alkaloids.

Since these two pathways are different but linked to each other by common substrate, the biosynthesis of one type of alkaloid will interfere in the formation of other types. Hence, whenever, isoquinoline alkaloids formation takes place more than normal (> 10%), biosynthesis of morphinane alkaloids are affected and these are lowered. Therefore, an improvement in availability of morphinane alkaloids from opium poppy can be brought about by decreasing the isoquinoline alkaloids through appropriate breeding techniques utilising some of the promising collections made from different parts of India.

Table 1. Average yield and alkaloids profile of different accessions in opium poppy

Sl. No.	Accession	Latex yield (mg/plant)	Morphine per cent (mg/plant)	Codeine per cent (mg/plant)	Thebaine per cent (mg/plant)	Total morphinane alkaloids per cent (mg/plant)	Narcotine per cent (mg/plant)	Papaverine per cent (mg/plant)	Total Isoquinoline alkaloids per cent (mg/plant)
1.	IC 15	379.88	12.88	5.01	1.81	19.70	05.49	0.02	5.51
			(48.91)	(19.02)	(6.87)	(74.80)	(20.87)	(0.07)	(21.94)
2.	IC 19	362.75	13.88	5.13	1.88	20.89	5.69	0.32	6.01
			(50.52)	(18.55)	(6.84)	(75.91)	(21.06)	(1.25)	(22.31)
3.	IC 30	489.63	9.63	4.13	1.38	15.14	3.25	0.89	4.14
			(46.42)	(19.87)	(6.40)	(72.69)	(15.27)	(3.68)	(18.95)
4.	IC 42	465.25	12.63	4.56	2.00	19.19	3.50	2.38	5.88
			(56.12)	(21.04)	(9.37)	(86.53)	(19.32)	(11.08)	(30.40)
5.	IC 83	356.00	16.13	5.25	1.69	23.07	5.49	3.36	8.85
			(57.82)	(19.24)	(6.20)	(83.26)	(19.50)	(14.74)	(34.24)
6.	IC 85	427.38	14.38	6.88	1.94	23.20	7.00	2.26	9.26
			(60.74)	(29.56)	(8.43)	(98.73)	(29.92)	(9.72)	(39.64)
7.	IC 88	480.75	12.25	4.69	1.38	18.32	6.00	3.39	9.39
			(60.43)	(22.61)	(6.59)	(89.63)	(28.71)	(15.27)	(43.98)
8.	IC 128	504.50	13.12	4.60	1.94	19.66	6.63	2.72	9.35
			(65.68)	(22.96)	(9.81)	(98.45)	(33.60)	(13.74)	(47.34)
9.	*Jawahar Afeem* (Control)	403.88	10.75	3.69	1.00	15.44	7.25	3.62	10.87
			(43.04)	(14.70)	(4.08)	(61.82)	(29.14)	(15.35)	(44.49)
10.	*Ranjhatak* (Control)	300.25	14.00	4.81	1.50	20.31	5.69	1.88	7.57
			(41.26)	(14.07)	(4.41)	(59.74)	23.22)	(5.67)	(28.89)

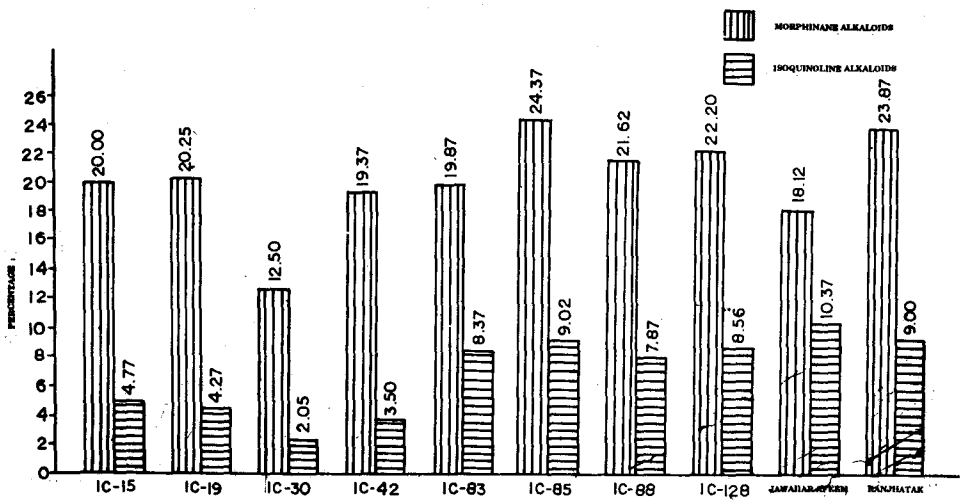

Fig. 1. **Alkaloids percentage in different varieties (first year).**

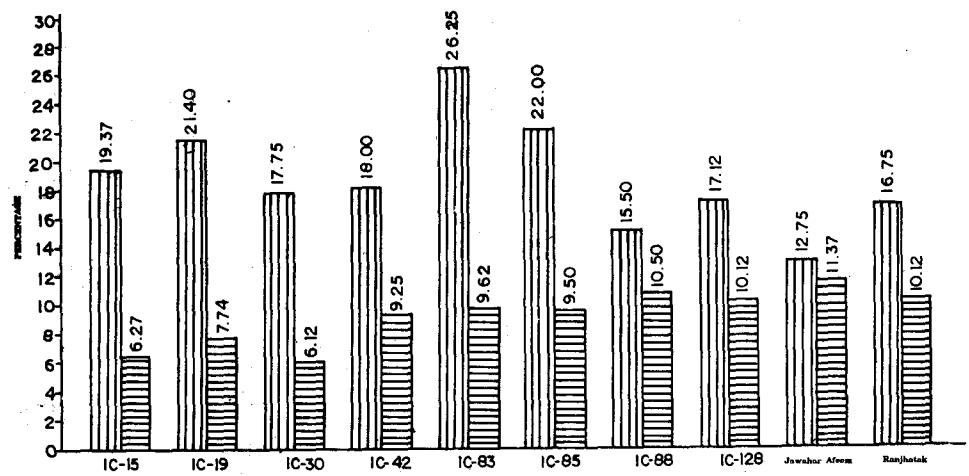

Fig. 2. **Alkaloids percentage in different varieties (second year).**

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