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Genotypic Control of Constitutive Heterochromatin in Eruca sativa L. (Rocket plant)

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ABSTRACT

The number and distribution of chromo centers have been studied in three varietal populations of rocket (Eruca sativa L.) and their six F1 hybrids. The varietal populations varied considerably among themselves, indicating different degree of heterochromatization in them. In all the F1 hybrids the number of chromocenters was found less than their parents. The populations having a narrow range of distribution of chromocenters showed dominance to those having a wide range. The experimental results indicate that the amount and the distribution of constitutive heterochromatin, as inferred from the chromocenter counts, are genetically controlled in rocket plant.

Keywords: Eruca sativa L., chromocenter, heterochromatization, population

INTRODUCTION

The chromocenters, observed in the interphase nuclei of several plant species as dark – staining heteropicnotic bodies, represent constitutive heterochromatin and roughly correspond to the centromeric regions (Lima De Faria and Jaworska, 1968; El – Bayoumi 1975; Dayal, 1975; Nagl, 1976). Since heterochromatin is known to play a key role in the process of chromosome pairing, so study of chromocenters may help in understanding this mechanism (LaCour and Well, 1970; Merker 1976; Dayal, et al., 1982). They have also been attributed considerable role in taxonomy and evolution (Heitz, 1948; Stebbins, 1971; Sharma, 1974). All the cells of rocket contains chromocenters so, rocket is a suitable material for studying constitutive heterochromatin. The present paper gives an account of the number and distribution of chromocenters in some varietal populations of rocket and their F1 hybrids in order to understand them in terms of their nuclear structure and organization.

MATERIAL AND METHODS

Three varietal populations of rocket viz., Taramira Ludhiana Composite (TMLC), Rajesthan Taramira (RTM-314) and Local variety Ichak (L.V.I.) and their six F1 hybrids viz., TMLC (F) X L.V.I.(M), TMLC(F) X RTM-314(M), RTM-314 (F) X TMLC(M), RTM-314 (F) X L.V.I.(M), L.V.I.(F) X TMLC (M), L.V.I.(F) X RTM-314(M) constituted the materials for present investigation. The plants of the hybrids along with their parents were grown in the field under controlled conditions during 2019 – 2020.

Methods for cytological analysis were same as used earlier (Dayal 1975). The chromocenters were counted only in the bottle – shaped receptive cells of stigma as they were easily countable and larger in size. Scoring was made in twenty cells per plant and a total of ten plants were studied in each variety and hybrids. The data were analysed statistically by using t- test.

RESULTS AND DISCUSSION

The number of chromocenters varied considerably in different varietal populations. Several chromocenters in the form of heteropycnotic bodies were observed in the interphase nuclei of these cells. They also varied in size. A pair of chromocenters was found attached to the nucleus.

The number of chromocenters differed greatly ranging form mean (22 to 30) per nucleus in different varieties in both the years of investigation. These varieties varied significantly among themselves in distribution and the mean number of chromocenters per nucleus. It was interesting to note that the mean number of chromocenters was quite constant in each of the varieties. Although their distribution pattern showed slight variation. RTM - 314 had the lowest mean number of chromocenters. TMLC had the highest number among all the varieties. There was no significant difference in the mean number of chromocenters between L.V.I. × RTM and L.V.I.× TMLC, all of which had more or less the same mean. Interestingly. L.V.I differed significantly from all other varieties in this parameter.

The individual plants within a variety also showed considerable variation in the number of chromocenters per nucleus. .

Table 1: Number And Distribution Of Chromo center In The Parental And Their F^1 Hybrids In Rocket

MATERIALS	NUMBER OF CHROMOCENTER PER NUCLEUS *a			
	MEAN± S.E.	CV%	RANGE	
TMLC	24.9 ± 0.31	3.97	(23-26)	
TMLC X L.V.I.	18.3 ± 0.36	6.28	(17-20)	
TMLCXRTM-314	17 ± 0.44	8.29	(15-20)	
RTM -314	20.8 ± 0.41	6.29	(19-21)	
RTM -314 X TMLC	17.4 ± 0.21	3.96	(16-18)	
RTM -314 X L.V.I.	18.4 ± 0.33	5.81	(18-20)	
L.V.I.	27.7 ± 0.32	3.70	(26-29)	
L.V.I. X TMLC	22.4 ± 0.47	6.63	(21-25)	
L.V.I. X RTM-314	21.7 ± 0.42	6.12	(20-24)	

*Based on 20 nuclei per plant.
*a. Mean difference of all the varieties except TMLC is significant at 1% level.

Constitutive heterochromatin has been an object of cytogenetic study for quite sometime. Different varietal populations of rocket may be used for studying the genetics of heterochromatin. The population vary among themselves in the number and distribution of chromocenters. There are the populations with both low and high number of chromocenters. Populations with high number may be regarded as more heterochromatized than those with a low number of chromocenters, if chromocenters are any indication of visible heterochromatin. It also indicates that the populations with a higher number and wider distribution of chromocenters may be less heterozygous than those with a lower number and narrower distribution. Thus intervarietal variation in this heterochromatin phenotype probably points to the varying degree of heterozygosity (Prasad and Srivastava 1993).

CONCLUSION

Our data show a genotypic control of the number of distribution of chromocnters in rocket. The hybrids have lesser number of chromocenters than their parental forms. Localized heterochromatin chomocenters may be considered as an adaptive character, but this adaptive value may become apparent only when more is known about the genes contained in them or genes controlling them. No such data at present available in rocket. Our results only indicate that the number and distribution of chromocenters are a function of genotype.

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