nation[14] and much evidence has accumulated indicating that phenolic compounds of several type are important in the resistance of plants to infection by fungal, bacterial and viral diseases[13,14]. *Thus, there is a clear evidence that these germination inhibitors associated with seed endosing glumes are compounds that are microbial inhibitors also, which seems to play an important role in prevention of seed decay before germination in natural semi-arid areas as most seeds that do not germinate rapidly after landing in soil would be decomposed before germination*, especially in the case of long unfavourable environmental condition, if they did not contain these microbial inhibitors—phytoncides. Therefore, this may be one of the most consistent and important ecological role of allelopathy in natural ecosystems, although the limited amount of research does not reflect its importance[14] and it appears that this is a fruitful phase of allelopathy for future research[15].

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1. Lahiri, A. N. and Kharabanda, B. S., *Ann. Arid Zone*, 1962, 1–2, 114.
2. Lahiri, A. N. and Kharabanda, B. S., *Proc. Natl. Inst. Sci. India*, 1963, Part B, **29**, 287.
3. Pandeya, S. C. and Jayan, P. K., *Proc. Indian Natl. Sci. Acad.*, 1978, **44**, 266.
4. Parihar, S. S., Kanodia, K. C. and P. Rai, Annual Report, IGFRI, Jhansi, 1981.
5. Seikel, M. K., In *Biochemistry of phenolic compounds* (ed.) J. B. Harborne, Academic Press, London, 1964, 33.
6. Harborne, J. B., *Comparative biochemistry of flavonoids*, Academic Press, London, 1967, 1.
7. Harborne, J. B., *Biochem. J.*, 1957, **70**, 220.
8. Saini, A. S., *J. Chromatogr.*, 1966, **24**, 484.
9. Ibrahim, R. K. and Towers, G. H. N., *Arch. Biochem. Biophys*, 1960, **87**, 125.
10. Hais, I. M. and Macek, K., *Paper chromatography*, Publishing House of Czechoslovak Academy of Sciences, Prague, 1963, 289.
11. Harborne, J. B., *Phytochemical methods—A guide to modern technique of plant analysis*, Chapman and Hall Ltd., London, 1973, 59.
12. Mayer, A. M. and Poljakoff-Mayber, A., *The germination of seeds*, Pergamon Press, London, 1975, p. 61.
13. Cruickshank, I. A. M. and Perrin, D. R., In *Biochemistry of phenolic compounds*, (ed.) J. B. Harborne, Academic Press, London, 1964, 511.
14. Rice, E. L., *Allelopathy*, Academic Press, New York, 1974, 174.
15. Rice, E. L., *Bot. Rev.*, 1979, **45**, 53.

RELATIONSHIP BETWEEN CHROMOCENTRES AND CHROMOSOMES IN CRUCIFERAE

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MEMBERS of the family Cruciferae are characterized by the presence of chromocentres in the interphase nuclei[1–3]. They are seen as dark staining heteropycnotic bodies and represent pericentric constitutive heterochromatin. Over the past decade Dayal[3–6] has made extensive cytogenetical studies on chromocentres in the cultivated radish, *Raphanus sativus* L. Localized heterochromatic chromocentres have been considered an adaptive character and attributed considerable evolutionary value[1,7]. The mean chromocentre frequency is known to be characteristic for a species or even a population. However, there is some evidence that it varies and depends upon chromosome length, genome size, degree of polyploidy and genetic factors[3–6,8]. Crucifers may be modelled for such studies. The present study has, therefore, been undertaken to see whether chromocentre frequency bears any relationship with chromosome number in the members of Cruciferae.

Seven species belonging to four genera of the family Cruciferae constituted the material for the present study (table 1). Chromosome number of these species

Table 1 *Chromocentres per nucleus and chromosome number (2n) in Cruciferae*

Materials	Chromosome number (2*n*)	Chromocentres per nucleus
Iberis amara L.	14	14.1
Brassica nigra Koch.	16	11.8
Raphanus sativus L.	18	13.6
Brassica campestris L.	20	14.3
Eruca sativa L.	22	16.2
Brassica alba Boiss.	24	15.4

are well known[9]. Flower buds were fixed in 1:3 acetoalcohol and mordanted with a few drops of $FeCl_3$. Methods for cytological analysis are the same as used earlier[3]. Chromocentre counts were made in only well squashed receptive cells of stigma. Twenty cells per plant were scored. A total of 30 plants, 5 from each species were examined.

Like earlier studies chromocentre counts were purposely made in well squashed receptive cells of stigma for obvious reasons. Several chromocentres in the form of heteropycnotic bodies were observed in the interphase nuclei of these cells in all the species. They also varied in size. All the six species varied significantly in mean chromocentre frequency (table 1). The mean chromocentre frequency has been plotted against the diploid chromosome number of these species in figure 1. The correlation analysis revealed a significant positive correlation the two parameters ($r = 0.95$; $P < 0.001$). In other words the mean chromocentre frequency was directly proportional to the diploid number of chromosomes in these species.

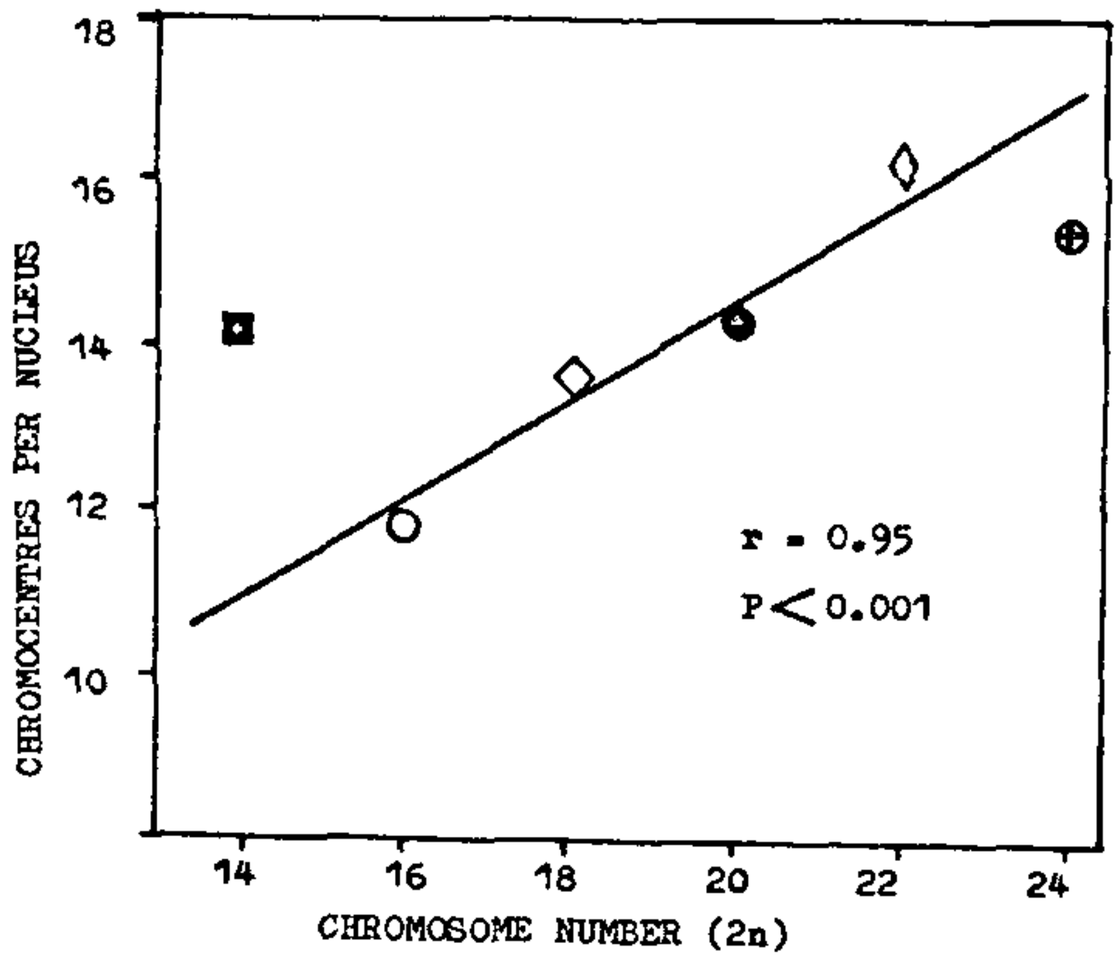

Figure 1. Chromocentres per nucleus plotted against chromosome number in Cruciferae. ■ – *I. amara*; ○ – *B. nigra*; ◇ – *R. sativus*; ● – *B. campestris*; ◇ – *E. sativa* and ⊕ – *B. alba*..

Chromocentres have been an object of cytogenetic study for quite some time. In radish it has been shown that the frequency and the distribution of chromocentres is a function of the genotype and in some way related to the homo- and heterozygosity of the material[3,4]. That they are regulated polygenically has also been demonstrated[6]. Besides chromocentre frequency is negatively correlated with chiasma frequency[5]. Cytogenetic investigations of chromocentres in the members of Cruciferae have an immense potentiality in understanding the role of constitutive heterochromatin in important genetic functions. The present study demonstrates that all the six species of the family Cruciferae differ significantly in mean chromocentre frequency as well as in their diploid chromosome number. It also shows that a positive correlation exists between the two nuclear parameters. In other words, within the family the mean chromocentre frequency increases with increase in the number of chromosomes. However, variation in chromocentre frequency is probably also due to the fusion of chromocentres. For example, in *Iberis amara* the chromocentre frequency is relatively higher than that of *Brassica campestris* which have $2n = 14$ and 20 chromosomes respectively.

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1. Stebbins, G. L., *Chromosomal Evolution in Higher Plants*, Edward-Arnold (Publishers) Ltd., London, 1971.
2. Steinz-Sears, L. M., *Genetics*, 1963, **43**, 484.
3. Dayal, N., *Caryologia*, 1975, **28**, 429.
4. Dayal, N., Kumar, S. and Prasad, C., *Curr. Sci.*, 1981, **50**, 29.
5. Dayal, N., Prasad, C. and Kumar, L., *Chromosoma (Berl.)*, 1982, **85**, 137.
6. Dayal, N. and Prasad, C., *Cytologia*, 1983, **48**, 245.
7. Sharma, A. K., *The Nucleus* (ed.) H. Busch, Academic Press, N.Y., 1974.
8. Delay, C., *Rev. Cytol. Cytophysiol. Veg.*, 1948, **10**, 103.
9. Federov, A. N., *Chromosome Numbers of Flowering Plants, Nauka*, Leningrad, 1969.