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### A PRELIMINARY STUDY OF HAEMOGLOBIN POLYMORPHISM IN SOUTH-INDIAN CATTLE

HAEMOGLOBIN polymorphism is one of the widespread polymorphisms in mammalian species, being polymorphic in some human populations<sup>1,2</sup>, cattle<sup>3,4</sup>, sheep<sup>5</sup> and in some primate species<sup>6,7</sup>. In the present communication, the haemoglobin variations in three recognised breeds of South-Indian cattle, namely, Kangayam, Alambadi and Hallikar have been reported.

Blood samples were aseptically collected in ACD (Acid-Citrate-Dextrose) from carefully selected, healthy and unrelated animals. The red blood cells were washed with saline to free them from plasma proteins, and then lysed with an equal volume of distilled water. The haemolysates were mixed with one-quarter volume of toluene and left at  $-20^{\circ}\text{C}$  overnight. After 24 hours, samples were thawed and centrifuged at 3,000 r.p.m. for 15 mts. and the clear haemoglobin solution separated and then subjected to starch-gel-electrophoresis according to Smithies<sup>8</sup>, using the *tris*-EDTA borate buffer system at pH 8.6. Gel was prepared from 12% hydrolysed starch (Connaught) in 1 in 20 diluted buffer.

In cattle, there are two common haemoglobins, Hb-A and Hb-B, which exist in three phenotypic forms Hb-AA, Hb-BB and Hb-AB, the former two being homozygous and the latter is heterozygous with respect to Hb-A and Hb-B, which are co-dominant alleles.

The percentage of haemoglobin variants in the case of the three breeds of cattle are presented in Table I. From the results in Table I, it is interesting to note that Hb-AA and Hb-BB, vary remarkably between the different breeds, whereas, the Hb-AB is found to be present almost equally in all the three breeds. Also, another electrophoretically

different rare variant of haemoglobin of cattle designated as Hb-C reported to be present in most of the North-Indian breeds, excepting Gir<sup>9</sup>, is found to be absent in the three South-Indian breeds studied by us. It is felt that the above studies on the predominant South-Indian cattle will be useful for their specific breed description.

TABLE I  
*Haemoglobin phenotypes percentage*

Breed	Hb-AA	Hb-AB	Hb-BB	Total tested
1. Kangayam	43.69	51.26	5.04	119
2. Alambadi..	35.71	60.00	13.85	70
3. Hallikar ..	30.00	42.50	25.00	40

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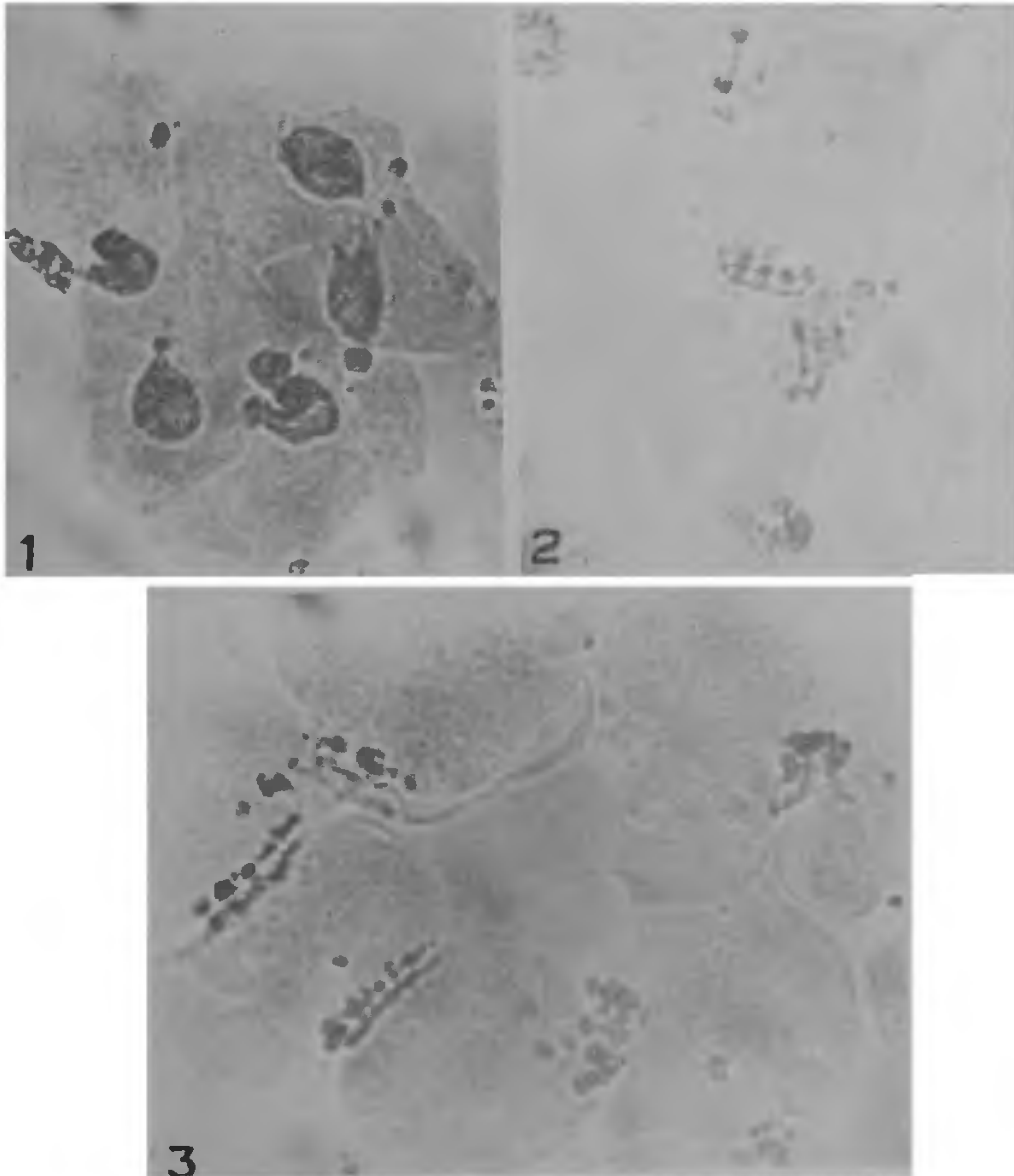
### CYTOMIXIS IN THE F<sub>1</sub> HYBRID OF *PISUM SATIVUM* L. × *P. ARVENSE* L.

THE present communication deals with the occurrence and significance of cytomixis in pollen mother cells of the F<sub>1</sub> hybrid of *Pisum sativum* L. T. 163 ♀ × *P. arvense* L. I.C. 13961 ♂. Passage of chromatin material from the nucleus of one PMC into the cytoplasm of an adjacent PMC of *Oenothera gigas* was termed 'Cytomixis' by Gates<sup>1</sup>. The phenomenon has been considered to be a fixation artefact or a degenerative effect<sup>2</sup>. The observations of West and Letchmere<sup>3</sup>, Sarvella<sup>4</sup>, Kamra<sup>5</sup>, Baquar and Husain<sup>6</sup>, Bhandari, Tandon and Jain<sup>7</sup> and Gottschalk<sup>8</sup> have proved that it is not due to faulty fixation, staining or squashing but it is a natural phenomenon occurring either during mitosis or meiosis. Cytomixis has been found to be mostly restricted in genetically unbalanced types such as

haploids, triploids, hybrids or otherwise disturbed plants<sup>8</sup>.

In the  $F_1$  hybrid obtained from the cross *Pisum sativum* L. T. 163 ♀ × *P. arvense* L. I.C. 13961 ♂ the PMCs showed more or less a regular meiosis. In a very few anthers some of the PMCs showed passage of portion of nucleus or chromatin material in the form of ill-defined masses or clumps. This has been observed in early prophasic stage during meiosis I (Figs. 1-3). This cytotoxic anomaly

or less uniform. As many as eight PMCs were observed to be taking part in the process of cytomixis (Fig. 3). The nucleolus was noticed to be normal and it does not take part in migration (Fig. 2). No transfer of chromatin material has been observed after prophase of the first meiotic division. The course of meiosis during second division was normal. No variation in the chromosome number has been observed in any of the cells. Pollen fertility was quite high (about 70%). This



**FIGS. 1-3.** Fig. 1. A complex of 6 PMCs showing transfer of nuclear material,  $\times 866$ . Fig. 2. A complex of 3 cells showing transfer of chromatin material in the form of ill-defined clumps,  $\times 1,003$ . Fig. 3. A complex of 8 cytomictic cells involving small chromatin lumps,  $\times 1,003$ .

was noted only in 14% of meiocytes of an anther. The direction of chromatin movement was more

shows that this process is a harmless meiotic anomaly in the sense that its occurrence does not effect the

development of normal pollen mother cells which have not been involved in cytomixis. Presence of cells with normal chromosome number only may indicate that the cells involved in cytomixis may have degenerated during or after the first division of meiosis. Gottschalk<sup>8</sup> observed cytomixis in some radiation induced mutants of *Pisum sativum* not only during meiotic prophase but during all stages of microsporogenesis. According to him it likewise occurs, although very rarely, in non-mutated pea plants. However, in the present study, migration of chromatin material has not been observed in either of the parents, i.e., *Pisum sativum* L. T. 163 and *P. arvense* L. I.C. 13961.

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### MONOTELOSOMIC ADDITION OF RYE CHROMOSOME 3R TO *TRITICUM* *DURUM*

IMPERIAL rye chromosome G (after Sears) carries a gene (or genes) for stem rust resistance. This rye chromosome is now redesignated as 3R since it was found to belong to the homoeologous group 3 by Acosta (1962) and Barber, Driscoll and

Vickery (1968). Hexaploid wheat variety, Chinese Spring, with an added pair of telocentrics for the arm of Imperial rye chromosome 3R which carries the gene(s) for stem rust resistance was tested for its seedling reaction to individual races of black stem rust at the Wheat Rust Research Station, Mahabaleshwar. The rye gene was found to confer a wide spectrum of resistance to stem rust (Table I).

The rye telocentric shows normal male transmission in the hexaploid wheat background. However, its transmission rate in the tetraploid background is not known. In order to test this, crosses were made to add the rye telocentric to a susceptible *durum* variety and then to determine its transmission rates in the *durum* background. If the rye chromosome is transmitted through the pollen with a low frequency at the tetraploid level, this would facilitate the transfer of the resistance gene to a wheat chromosome. The rye gene would be of great value in the breeding of tetraploid wheats if it can be transferred to a *durum* chromosome.

The 44-chromosome Chinese Spring ditelocentric addition line (21<sup>W</sup> + 1<sup>3R</sup>) was crossed to a susceptible *durum* wheat variety, Jaya. Two successive backcrosses were made to the *durum* variety using resistant plants with the least number of D genome chromosomes as the female parents each time. Three resistant plants with 14 normal wheat bivalents + 1 telocentric rye univalent were obtained following the second backcross.

The added rye telo showed a reduced rate of male transmission in the *durum* background (Table II). Transmission on selfing was only 13.66%. This low rate of zygotic transmission indicates considerable reduction of female transmission as well. All the resistant plants examined cytologically were found to be monotelosomic additions. The failure to obtain a ditelocentric addition provides further proof of the absence of any significant male transmission. The frequency of resistant plants in the selfed progeny was further reduced

TABLE I  
Seedling reaction to individual races of black stem rust

Stem rust race Wheat variety	11	14	15	15C	17	21-A	21-A-1	24	34	34-A	40	42	42-B-2	42-B-3	117	117-A	122
Chinese Spring	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Chinese Spring with added pair of rye telo-3R	R	R	R	R	R	S	R	R	SR	R	R	..	R	R	R	R	R

R = Resistant, SR = Slightly resistant, S = Susceptible.