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Asynapsis in Cluster Bean *(Cyamopsis tetragonoloba* (L.) Taub.)

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Summary. Asynapsis was noticed in a line G 150 of cluster-bean. In meiotic studies 14 univalents were observed at diakinesis and all subsequent meiotic stages were highly irregular. The asynaptic plants produced highly sterile pollen and there was very rare seed setting. The asynapsis was controlled by a single gene that was recessive to that for normal meiosis.

The occurrence of sterile plants in a commercial crop species is important to both the plant breeder and the geneticist. The sterility may be the result of undesirable environmental factors, cytogenetic abnormalities or the operation of genetically heritable systems. Among the germplasm of cluster bean *(Cyamopsis tetragonoloba* (L.) Taub.) under study at Ludhiana, a line G 150 was observed to segregate for sterility. The causes of sterility in this line were investigated and reported in this paper.

The line G 150 was space planted in unreplicated rows in 1969. Out of the total of 130 plants, 99 were fertile and 31 were sterile fitting a ratio of 3 fertile: 1 sterile. The sterile plants were about 25 per cent taller, and later in maturity by 20 days, than the fertile plants which were approximately 96 cm tall. The pollen produced by the sterile plants was highly sterile (97.3%) whereas that of the normal plants was 97.05 per cent fertile. The bearing of pods was normal in the fertile plants. The sterile plants had an average of only 1.5 pods per plant, the pods being very small with only one, or no, grain in them.

In order to find out the genetic and cytogenetic basis of sterility, the fertile and sterile plants grown in 1969 were harvested individually and were progeny tested in 1970. All the progenies from the selfed seed of 31 sterile plants were sterile. Out of 99 progenies of fertile plants, 31 were fertile and 68 again segregated into fertile and sterile plants, giving the expected ratio of 2:1 with χ^2 value of 0.182 (P=.50-.70). Among the 68 segregating

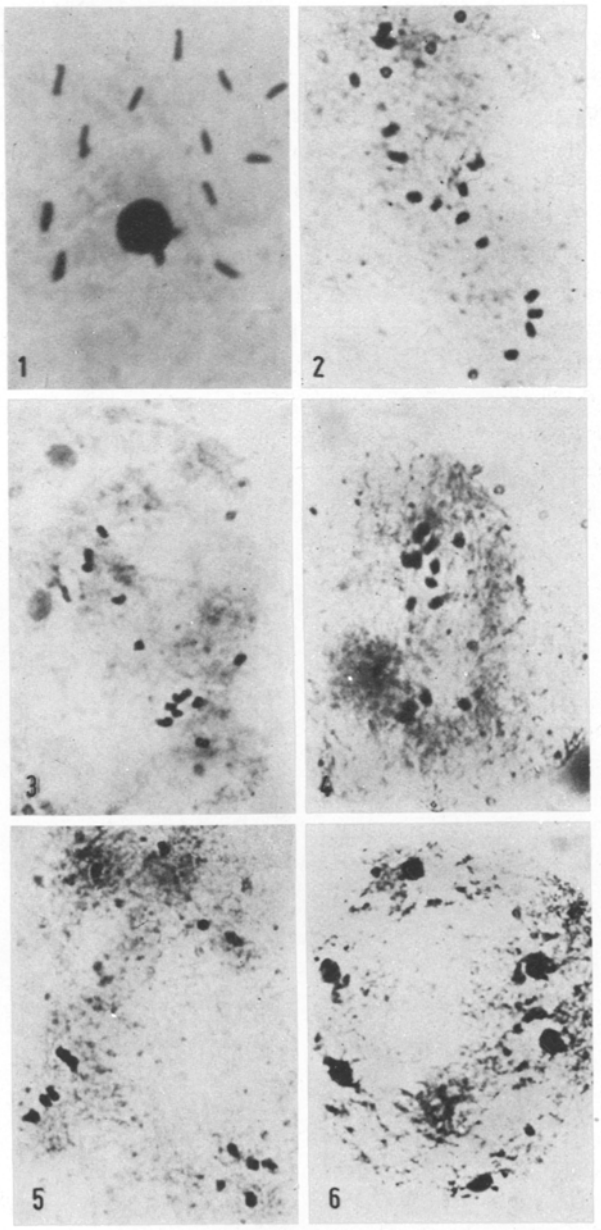

Fig. 1. Univalents at diakinesis.
Fig. 2. No spindle formation at metaphase I.
Fig. 3. Laggard at anaphase I.
Fig. 4. Anaphase I showing unequal distribution.
Fig. 5. Anaphase I showing irregular chromosome movement.
Fig. 6. Multinuclei formed (x 1650 approx.).

progenies, 412 plants were fertile and 131 plants were sterile, again fitting the ratio of 3:1 with χ^2 value of 0.245 (P=.50-.70). The 68 segregating progenies were homogeneous for the segregating pattern and χ^2 value for heterogeneity was 27.801. Sterility was thus associated with the homozygous condition of a recessive gene.

Meiotic behaviour of both normal fertile and sterile plants was also studied. The young buds were fixed in a solution of 1:3 aceto-alcohol and were transferred after 24 hours to 70% absolute ethanol. The pollen mother cells were studied for chromosome behaviour by making squashes in aceto-carmine. The meiosis in the fertile plants was normal. The normal homozygotes and the heterozygotes were cytologically indistinguishable since both types formed seven bivalents. The sterile plants, however, were asynaptic in meiotic behaviour. The chromosomes invariably occurred as univalents both at diakinesis and metaphase I (Fig.1). No spindle formation was observed at anaphase I and the distribution of chromosomes at anaphase I was irregular, resulting in multinuclei (Fig.2 to 6). Of 295 cells studied in anaphase, I, not one showed 7:7 separation. Lagging chromosomes occurred frequently even after telophase I.

The cytogenetic analysis of line G 150 thus showed that asynapsis in this material was controlled by a single recessive gene. Similar reports have also been made by Henry et al. (1964) in soybean, Ramulu (1970) in sorghum and Sethi et al. (1970) in barley. The asynaptic line reported here is being maintained and it is proposed that it should be utilized for developing trisomic stock which would be of great use in genetic studies.

Literature

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