in turn, bear the terminal basidiospores (Fig. 14). The nuclei and much of the cytoplasm migrate into the developing basidiospores through sterigmata (Fig. 13). The young basidiospore is uninucleate (Fig. 14) while the mature one contains two nuclei as a result of third nuclear division (Fig. 15). The basidiospores germinate sooner or later after detachment from the sterigmata.

In this rust the fusion nucleus undergoes three successive divisions instead of two (which is normal for most rust fungi) the first two occurring in the basidium followed by the third in the basidiospore. Allen[1] and Ashworth[2] have independently reported similar results with *Puccinia malvacearum* Burt.

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1. Allen, R. F., *Phytopath.*, 1933, 23, 572.
2. Ashworth, D., *Trans. Brit. mycol. Soc.*, 1931, 16, 177.

OCCURRENCE OF E-TYPE BRIDGES IN *ALOE BARBADENSIS* MILL.

Aloe barbadensis Mill. (*A. perfoliata* var. *vera* L., *A. vera Auth.* non Mill.) is known for its medicinal properties. While working out the details of its meiosis, E-type bridges have been recorded in a few pollen mother cells (Fig. 1). The bridge is formed during anaphase-I and assumes the appearance of a capital E, hence the name E-type.

FIG. 1. Late anaphase showing formation of E-type bridge, × 1,650.

Occurrence of E-type bridges, a little known meiotic event, has been reported earlier[1-3], but it was Brandham[4] who, for the first time, logically explained the formation of E-type bridges in the tribe Aloineae of Liliaceae. Bivalents involved in the formation of such bridges are heterocorphic with regard to the relative lengths of the long and the short arms. A pericentric inversion followed by a paracentric inversion results in the formation of heteromorphic homologues. Single crossover involving a segment in the long arm of normal chromosome pairing, with its homologous segment situated in the short arm of the inverted homologue, results in the formation of an E-type bridge and a large acentric fragment in anaphase-I; the latter may get lost sooner or later. High incidence of such bridges suggests interspecilfi hybridity.

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1. Ribbands, C. R., *J. Genet.*, 1937, 1, 35.
2. Sato, D., *Jap. J. Bot.*, 1942, 12, 132.
3. Darlington, C. D. and Keffallinou, M., *Chromosoma*, 1957, 8, 364.
4. Brandham, P. E., *Ibid.*, 1969, 27, 201.

NEW CYTOPLASMIC MALE STERILE LINES OF SUNFLOWER

SUNFLOWER hybrids in comparison with the open pollinated varieties were reported to exceed standard varieties by about 54% in seed yield[8] and 34% in oil content[8] in addition to being more uniform with regard to maturity, plant height and vigour. Consequently a number of hybrids using self-incompatibility and male-sterility were produced and are in cultivation in France, Rumania, U.S.A. and Canada[2,4-6].

As self-incompatibility in sunflower is not complete, in the production of hybrid using this mechanism, selfed seeds upto 35% have been recorded in S_3–S_4 inbred lines used as female parents[7]. Thus the full use of heterosis cannot be made. On the other hand, due to inbreeding, the production of highly self-incompatible lines and their maintenance would be difficult. The genetic male sterility due to a recessive gene linked with green colouring in seedlings requires seeding at high rates and increased cost of labour for the removal of anthocyanic male fertile plants. It was also found that genetic male sterility could be

TABLE I

Agronomic characters of male sterile lines of sunflower (Rabi 1974–75)

Male sterile lines	Characters							
	Days to 75% flowering	Days to 75% maturity	Plant height (cm)	Head diameter (cm)	Seed filling (%)	Yield/ plant (g)	Husk (%)	Oil (%)
P cms–1	106	134	161	14	78	40	27	41
P cms–2	98	126	134	14	41	38	28	40
P cms–3	96	130	137	13	86	41	31	43
P cms–4	96	130	146	14	70	41	28	41
P cms–5	113	149	135	13	85	45	30	45

altered by the presence of modifier genes and the linkage was not complete[8], thereby necessitating roguing in both male and female rows. Finally the discovery of cytoplasmic male sterility in *Helianthus petiolaris* by Leclercq[8] provided most economic and efficient source of hybrid seed production in sunflower and using this material hybrids have been developed in France, Rumania and U.S.A.[4–6].

Twenty-two male sterile plants were observed in "1970 R Composite" obtained from Dr. M. L. Kinman of U.S.D.A., College Station, Texas, in 1972. Paired crosses with male fertile plants produced progenies with varying degrees of pollen fertility restoration. Male sterile plants from F_1 progenies were crossed with 79 accessions. As the occurrence of pollen fertility restorer genes is reported to be quite common in sunflower, only 5 varieties, *viz.*, C.P.I. 14990 (Australia), Ireqiekos (Hungary), Commander (Canada), Armavirskiij 3497 and Smera (U.S.S.R.) which did not restore any pollen fertility could be detected. Through 4 successive back crosses, 5 male sterile lines were developed whose agronomic characters are given in Table I.

More than 600 S_3–S_4 inbreds have been crossed with the above male sterile lines. As varying degrees of pollen fertility restorations were observed in crosses with accessions from which the above inbred lines were developed, it is expected that a large number of hybrids with at least partial fertility restoration will be obtained. The hybrids with only 25% pollen fertility restoration could be cultivated commercially. Moreover, complete restorers and non-restorers with high selfing are also expected which will be of immense value in hybrid sunflower production.

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1. Enns, Henery, Dorrel, D. G., Hoes, J. A. and Chubb, W. O., *Proceedings of the Fourth International Sunflower Conference*, 1970, p. 162.
2. Gimenez, J. D. and Fick, G. N., *Crop Sci.*, 1975, **15**, 725.
3. Grebenjuk, G. K., *Ser. Brd. Agric. Sci.*, 1967, **11**, 51.
4. Kinman, M. L., *Proceedings of the Fourth International Sunflower Conference*, 1970, p. 181.
5. Leclercq, P., *Ibid.*, 1970, p. 123.
6. Singh, D., *Sunflower-Industry in U.S.S.R.*, Department of Agriculture, Lucknow, U.P., 1972.
7. Vranceanu, V., cf. *Pl. Br. Abstt.*, 1967, p. 3176.
8. —, *Proceedings of the Fourth International Sunflower Conference*, 1970, p. 136.

OBSERVATIONS ON ASEXUAL REPRODUCTION IN *TETRAEDRON* KÜTZ.

As known so far, asexual reproductiln in *Tetraedron* Kütz. takes place by the formation of several autospores by successive divisions of the cell contents[2-4], although zoospore formation has been reported in *T. bitridens*[1]. The pyrenoid does not divide but is transferred to one of the daughter masses and ultimately degenerates: each autospore developing its own pyrenoid in due course[2-3].

During observations on *Tetraedron minimum* (A. Braun) Hansgirg[1] var. *scrobiculatum* (Lagerheim) De Toni[4], the authors observed variant stages of asexual reproduction.

In the present material collected from a tank in Lucknow University campus, it was observed that generally, only a single autospore was formed in each cell, although rarely, 2–4 autospores were also