

TABLE I
Morphology of metaphase chromosomes in
root tips of *S. elaeagnifolium*

Type	Pairs	Description
A	1	Long chromosome with submedian centromere and terminal macrosatellite
B	1	Long chromosome with submedian centromere and terminal macrosatellite
C	1	Chromosome of medium length with median centromere
D	8	Chromosomes, medium to short, with submedian centromeres
E	1	Short chromosome with median centromere

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MEIOSIS IN A HAPLOID PEARL MILLET

ONE twin seedling was located among 100 seedlings of *Pennisetum typhoides* Stapf and Hubb., raised for an experimental purpose. One of the seedlings from the twins grew to maturity, produced two spikes and provided the cytological material for the present investigation. This plant was a haploid. The second plant was much weaker and died before flowering. The material for cytological study was fixed in acetic alcohol (1 : 3) and squashed in acetocarmine.

At diakinesis and meta-anaphase I seven chromosomes were observed instead of 14 chromosomes characteristic of the normal diploid *Pennisetum typhoides*. The types of chromosomal associations observed at diakinesis and meta-anaphase I are presented in Table I. The bivalents were of the rod type and looked just like the rod bivalents of the normal diploid plant. The associations of 3 or 4 chromosomes were of the chain type (Fig. 3). A study of the pachytene stages had revealed the occurrence of one, two or three bivalents per cell and the pairing

extended along the entire length of the chromosomes and was apparently complete (Fig. 1). The pachytene pairing, however, was



FIGS. 1-3. Fig. 1. Pachytene stage showing 3 bivalents. Fig. 2. meta-anaphase I showing two bivalents oriented on the equatorial plate. Fig. 3. Meta-anaphase showing association of 4 chromosomes.

not always followed by chiasma formation. In a number of cases the paired chromosomes, observed at diplotene and diakinesis stage, were observed to fall apart and thus at meta-anaphase I a maximum of only two bivalents per cell were realised in a small percentage of cells (Fig. 2), the more frequent condition being one bivalent per cell. The associations of 3 or 4 chromosomes do not seem to be the result of chiasma formation but in all probability represent secondary associations or might be the result of heterochromatic stickiness. In addition to the bivalents, e-s and s-s associations also were observed. At meta-anaphase I these associations were not observed to co-orient usually on the equatorial plate but were lying away from the equatorial plate or near the poles. The bivalents, on the other hand, in a number of P.M.C.'s, were observed to co-orient on the equatorial region with their daughter halves oriented towards the poles as they are at metaphase and early anaphase in normal cells.

TABLE I

Frequency of different types of association of chromosomes at meta-anaphase I in the haploid

Class	Frequency of cells	Total s-s associations	Total e-s associations
0 _{II} s	76	37	33
1 _{II} +5 _{IS}	65	24	16
2 _{II} s+3 _{IS}	20	6	3
Association of 3+1 _{II} +2 _{IS}	6
., 3+4 _{IS}	13	3	2
., 4+3 _{IS}	5
Total number of cells	185

The e-s and s-s associations in wheat haploids according to Person,¹ Riley and Chapman² and Kimber and Riley³ are supposed to be the result of the presence of homologous segments in the chromosomes and the realisation of a very low percentage of these associations is likely due to the relatively short nature of these homologous segments. The e-e associations in wheat, however, were supposed to be the result of heterochromatic stickiness or an expression of secondary association. Levan⁴ on the other hand has clearly shown that non-homologous pairing occurs in haploid rye and according to him "non-homologous pairing plays a dominant role".

At meta-anaphase I the following types of chromosome segregations were observed, 0-7, 1-6, 2-5 and 3-4, the last type being more fre-

quent. In a small number of P.M.C.'s one or two univalents were observed to divide during meta-anaphase I.

The second division was more regular but the wall formation at the end of the second division sometimes failed to take place in one or both the diads. This resulted in the formation of 2, 3 or 4 microspores and microspores with two nuclei. There was much size variation in the pollen grains as a result of irregularity in the wall formation after the second division and also due to the differences in chromosome numbers.

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A PRELIMINARY NOTE ON THE SEX-ORGANS OF *LUNULARIA* SPP.

Lunularia is a genus of the family Marchantiaceae among the liverworts. There are only two species in this genus, viz., *L. cruciata* and *L. lunularis*. The gametophytes of *Lunularia* resemble those of *Marchantia* to a great extent but they can easily be distinguished by the presence of the characteristic crescent-shaped cupules on the dorsal surface (Fig. 1). The thallus is light-green in colour and a little thinner than that of *Marchantia*. Rib-like thickenings are visible from the upper surface. The genus is well known for its very efficient method of asexual reproduction by means of the multicellular gemmæ, owing to which the plant became widely distributed in the western countries after being introduced from Europe with nursery stock. It is a very common liverwort found in the greenhouses in most parts of the United States, but is sufficiently acclimatised to the mild climate of California to grow out of doors (G. M. Smith, 1955). *Lunularia* is found as one of the common liverworts at higher elevations of the hills in South India particularly at Kodaikanal Hills. It does not occur commonly in green-