J. Indian bot. Soc. 50 : 175–179, 1971.

THE CYTOLOGICAL STUDIES ON THREE SPECIES OF *OEDOGONIUM* LINK, FROM RANCHI (BIHAR)[1,2]

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Introduction

Much work has been done on the cytology of *Oedogonium* in the past as reviewed by Bold (1951) and Tiffany (1957). Sinha (1958, 1963b) has made a detailed study on the chromosomal morphology in case of *O. cardiacum* Wittr. and *Oedogonium* sp. Hoffman (1961, 1965, 1967) has reported the occurrence of mitosis and meiosis in a number of species of *Oedogonium*. Henningsen (1963) has made the cytological investigation on a few species of *Oedogonium*. The cytological account on the Indian species of *Oedogonium* is meagre. Chowdary (1964) has presented a cytological account of *O. terrestris* Randhawa. The present paper deals with the cytological studies on three species of *Oedogonium* which were collected from Ranchi during rainy months from June to August in the year 1964.

Materials and Methods

The three species of *Oedogonium* viz. *O. autumnale* Wittr. Sect. Hirn; *O. magnusii* (Hass.) Wittr. and *O. flavescens* Wittr. were collected from tank at Hatma, Kishoreganj and Hinoo respectively. The cultures of all three species were successfully maintained in liquid culture media namely (i) Godward solution (Godward, 1942) fortified with soil extracts (ii) Mainx solution (Mainx, 1931a). The cultures flourished well in the media of Godward's solution (1942) with soil extracts and in Mainx solution (1931a) when the materials were exposed to light and dark for an equal period of 12 hours each. The range of pH values of culture was found between 7·5 and 8·0. The temperature was maintained between 22 and 24°C.

The diagnosis given by DeToni (1889, p. 39), and by Heering (1914, p. 216) for the species, *O. autumnale* agrees in all respects with the material presently investigated. The species, *O. magnusii* agrees considerably in morphological features as described by DeToni (1889, p. 78), Heering (1914, p. 193), Collins (1928, p. 236) and Tiffany and Britton (1951, p. 61) except a few minor variations. The filaments of the present material of *O. magnusii* have been found to be 1–2μ wider than that described by above authors. This material further differs from past records in having wider and longer antheridial cells. The species, *O. flavescens* bears similar diagnoses as recorded by past authors (cf. Heering, 1914, p. 174 ; Col-

1. Accepted for publication on October 26, 1970.

2. Part of Ph. D. thesis of Ranchi University. The author expresses his sincere gratitude to the University of Ranchi for awarding him Research Scholarship, in the tenure of which the present work could be done. The author feels his deep sense of indebtedness to his guide Dr J. P. Sinha for his kind guidance and criticism.

lins 1928, p. 249 ; Tiffany and Britton, 1951). However, the local species of *O. flavescens* has been found to possess narrower oogonia and oospores and smaller antheridial cells than already reported in the past for this species.

The materials for cytological studies were fixed in the Acetic Alcohol mixture (1:1). The iron alum acetocarmine (cf. Godward, 1948) was employed throughout the present investigation.

The three genera are further characterised by their karyotypic organisation. The position of centromeres has been clearly marked out at the bendings of chromosomes or chromatids. The median, submedian and subterminal centromeres are located in the proportion of 5:11:1 in the 17 chromatids of *O. autumnale*, (Figs. 1, 2, 5a) ; 5:6:2 in the 13 chromosomes of *O. magnusii* (Figs. 3, 5b) and in *O. flavescens* (Figs. 4 and 5c), the centromeres are located at median, submedian and subterminal position in the proportion of 5:11:3.

TABLE I.

Name of species	*O. autumnale*	*O. magnusii*	*O. flavescens*
Sexual type	Monoecious macrandrous	Dioecious macrandrous	Dioecious nannandrous
Interphase nucleus	Spherical measuring 5·6–6·4 μ in diameter.	Spherical measuring 3·72 μ in diameter	Spherical, sometimes oblong, measuring 8·5–7·4 μ in diameter.
Nucleolus	Single, deeply stained measuring 1·2–1·6 μ	Single measuring 0.62 μ.	One larger or sometimes two smaller larger measuring 1·86 μ and smaller 1 μ (approx).
Chromocentres	Around the nucleolus as dot shaped	Around the nucleolus as dot-shaped bodies.	Absent.
Enlarged prophase nucleus	1·5—2 times.	1·5—2 times.	1·5—2 times.
Chromosome length	2–2·50 μ.	1·5–2·0 μ	4–5·5 μ
Chromosome number	17	13	19
Cell width	16–20 μ	6·90–10·93 μ	18–24 μ

OBSERVATIONS

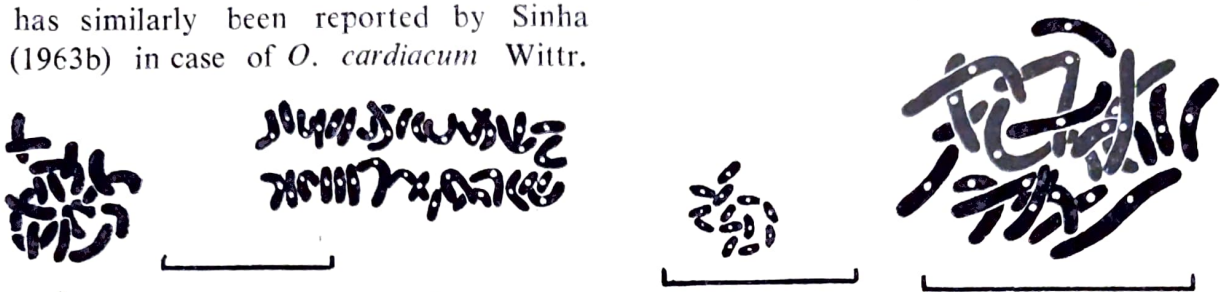
The cytological characters observed for the three species under investigation have been enumerated in table I along with their sexual types.

The nucleolus and nuclear membrane get dissolved during early prophase simultaneously in *O. magnusii* and *O. flavescens*. However, in *O. autumnale*, nuclear membrane dissolves in the mid prophase but nucleolus with its decreasing staining potentiality dissolves in late prophase.

DISCUSSION AND SUMMARY

The interphase nuclei in the three species of *Oedogonium* are spherical, surrounded by a distinct nuclear membrane. One nucleolus is present in each nucleus of *O. autumnale* and *O. magnusii*. Two smaller nucleoli and sometimes one big nucleolus were seen to be present in

case of *O. flavescens*. The occurrence of one big nucleolus and two smaller nucleoli has similarly been reported by Sinha (1963b) in case of *O. cardiacum* Wittr.



FIGS. 1–4. Camera lucida drawings. Figs. 1–2. *O.* autumnale wittr. Fig. 1. Metaphase plate showing 17 chromosomes. Fig. 2. Anaphasic separation showing 17 chromatids in daughter set, centromeres are seen clearly as non-staining regions. Fig. 3. *O. mangusii* (Hass) Wittr. showing 13 chromosomes. Fig. 4. *O. flavescens* Wittr. Premetaphase stage showing 19 chromosomes.

Fig. 5a–c. Idiogram showing relative length and position of centromeres. a. *O. autumnale* b. *O. magnnsii* c. *O. flnvescene.*

The dimension of interphase nuclei of three species vary in size from 3.72–7.4μ. Kretschmer (1930), Ohashi (1930), Sinha (1963b) and Chowdary (1964) have reported the dimension of interphase nuclei varying from 6-11 μ in different specis of *Oedogonium*. Tutley (1930) has reported the dimension of interphase nuclei as 12μ and rarely more than 13μ in his *Oedogonium* sp. The interphase nuclei do not

move upward at the onset of division. Chowdary (1964) has made similar observation in case of *O. terrestris* Randhawa. On the other hand, Ohashi (1930) has recorded the shifting of interphase nuclei towards the septum at the initiation of nuclear division in case of *O. grande* Wittr. The prophasic nuclei enlarge 1½–2 times which agree to the findings of Ohashi (1930), Hoffman (1965), Sinha (1963b) and Chowdary (1964), Tutley (1930) has reported the enlargement in the dimension of prophasic nuclei from 4 to 4½ times. At the early stage of the prophase, the fine chromosomal threads appear to be arranged in linear fashion in *O. magnusii* as reported by Kretschmer (1930) and Sinha (1963b) in the cases of *O pachyandrium* and *O. cardiacum* respectively. As evident from table I the chromosome length varies 1.5μ—5.5μ in the three species of *Oedogonium* investigated. The occurrence of longer chromosomes have also been reported by past workers (cf. Sinha 1263b, Henningsen 1963, Chowdary 1964 and Hoffman 1967). The present author agrees with the statement of Hoffman (1967) that large celled species have longer chromosomes than small celled species which is evident from the table I.

As evident from table I, the large-celled species (*O. flavescens*) has more number of chromosomes (n=19) and small celled species (*O. magnusii*) has less number of chromosomes (n=13). The species *O. autumnale* with intermediate width has also a chromosomes number (n=17) in between 13 and 19 for *O. magnusii* and *O. flavesces* respectively. Thus, the cell size, chromosome length and chromosomes numbers appear genetically correlated (cf. Hoffman, 1967). Tschermak (1943a) had postulated 9 as the basic number of chromosomes in *Oedogonium*, to which the present author also agrees. The species with 13, 17 and 19 number of chromosomes investigated here are aneuploid (cf. Tschermak, 1945a). The prevalence of odd number of chromosomes as noted in the present investigation is a feature characteristic of several species of *Oedogonium* (cf. Hoffman. 1967).

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J. Indian bot. Soc. **50** : 179–182, 1971.

EFFECT OF VANADIUM ON HYBRID MAIZE[1]

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ABSTRACT

The influence of varying levels of vanadium on the growth of hybrid-maize (*Zea-mays* L. Var. G-3) grown in sand culture was investigated.

Of all the attributes studied the net assimilation rate (NAR) was the least affected by vanadium deficiency. The effects were more pronounced on the growth rate. Dry matter accumulation and photosynthetic area was significantly affected by the application of this element.

INTRODUCTION

Vanadium has been proved essential for certain micro-organisms (Arnon and Wessel, 1955) especially of marine habitats (Bertrand, 1950). According to recent reports vanadium favours the growth of asparagus, lettuce, rice and corn and acts adversely on that of clover and wheat (cf. Steward, 1963). This paper deals with the effect of vanadium on the growth of hybrid maize.

1. Accepted for publication on October 26, 1970.

The author wishes to express his grateful thanks to Prof. S. M. Sircar, Director, Bose Institute, Calcutta for going through the manuscript and offering helpful suggestions. Thanks are also due to Prof. R. S. Choudhri, Principal, College of Agriculture, Banaras Hindu University for guidance and to Miss Neelam for assistance.

MATERIAL AND METHODS

Hybrid maize (*Zea mays* L. Var. G–3) plants were raised in sand culture at 4 levels of vanadium (V_0=0; V_1=·05; V_2 =0·25; V_3=1·25 ppm). For each treatment there were 20 pots arranged in two blocks. Each pot was filled with acid washed sand free from organic matter. Three seeds were sown in each pot, the young seedlings were progressively thinned until one vigorous plant remained. The plants were irrigated daily, care being taken not to disturb the roots. The complete and deficient solutions were prepared as described by Hoagland and Arnon (1950). Stock solutions were prepared from A.R. grade salts and were purified against vanadium. The pH of the solution was adjusted daily to 7·0. Vanadium was supplied as vanadium pentoxide.