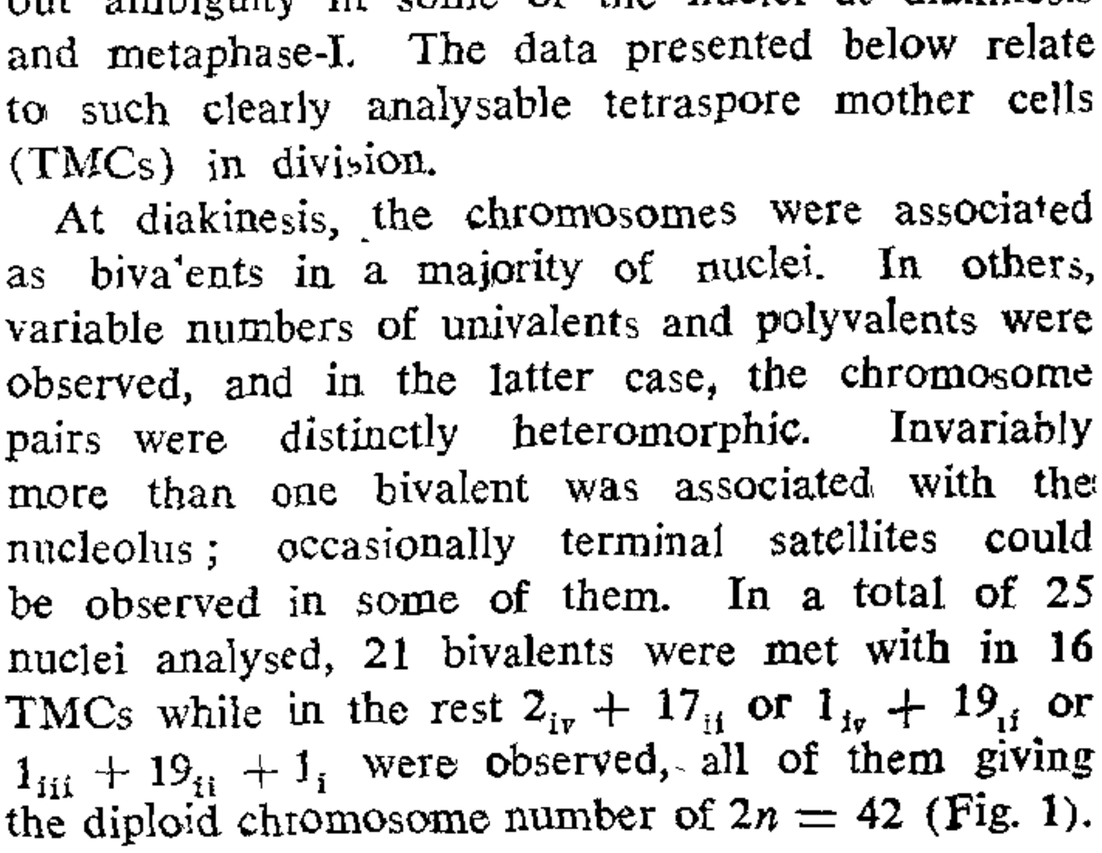
Small quantities of tetrasporangiate thalli, fixed in 1 : 1 glacial acetic aicd-rectified spirit solution, were smeared in aceto-carmine after pre-mordanting for two or three minutes in a weak solution of iron alum. The chromosome numbers and the types of their associations could be discerned without ambiguity in some of the nuclei at diakinesis and metaphase-I. The data presented below relate to such clearly analysable tetraspore mother cells (TMCs) in division.

At diakinesis, the chromosomes were associated as bivalents in a majority of nuclei. In others, variable numbers of univalents and polyvalents were observed, and in the latter case, the chromosome pairs were distinctly heteromorphic. Invariably more than one bivalent was associated with the nucleolus; occasionally terminal satellites could be observed in some of them. In a total of 25 nuclei analysed, 21 bivalents were met with in 16 TMCs while in the rest $2_{iv} + 17_{ii}$ or $1_{iv} + 19_{ii}$ or $1_{iii} + 19_{ii} + 1_{i}$ were observed, all of them giving the diploid chromosome number of $2n = 42$ (Fig. 1).



FIGS. 1–2 Fig. 1. Camera lucida drawing of a TMC at diakinesis showing $1_{iv} + 19_{ii}$. (Note heteromorphy of chromosome pairs in the quadrivalent). Fig. 2. Camera lucida drawing of a TMC at metaphase-I showing $19_{ii} + 4_{i}$. (Univalents unfilled).

At metaphase-I one or more polyvalents were observed in 10 cells while in the 19 other TMCs analysed, the chromosome associations ranged from $18_{ii} + 6_{i}$ to 21_{ii} per nucleus (Fig. 2). The $2n$ chromosome number of 42 and polyvlent frequency observed at metaphase-I correspond with those of diakinesis except for the higher number of univalents at metaphase-I. Secondary associations of non-homologous pairs could also be seen in metaphase-I nuclei.

Anaphase-I disjunction was normal with the chromosomes segregating individually rather than in clumps or plates reported for some red algae[1].

The high chhromosome number of $2n = 42$, occurrence of more than one nucleolar bivalent, formation of one or more polyvalents and heteromorphy of chromosomes involved in them, and the secondary associations of bivalents at metaphase-I suggest that this species is a polyploid of hybrid origin. The consistent diploid chromosome number of 42 and the normal disjunction at anaphase-I indicate that *C. fimbriatum* is a stabilized polyploid species on Visakhapatnam coast, and also that it is cytologically different from other Ceramiales studied so far[1,2].

We are thankful to the CSIR for the award of JRF to one of us (M. S.), and to Late Prof. T. Sreeramulu (Andhra University), for initiating us into these studies.

Department of Botany, Andhra University, Waltair 530 003, June 19, 1976.

B. G. S. RAO.
(MISS) M. SUNDARI.

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IN VITRO LIFE-CYCLE, REGENERATION AND APOSPORY IN *CERATOPTERIS PTERIDOIDES* (HOOK.) HIERON.

In vitro experiments have yielded useful information on many intricate problems of differentiation, development and life-cycle in aquatic ferns[1]. During our comparative *in vitro* studies on a few assorted aquatic ferns (both homo- and heterosporous), Ceratopteris pteridoides proved to be an excellent experimental material primarily owing to its shortest, generation-wise life-span.

C. pteridoides is an aquatic annual recently reported to occur in China and south-east Asia[1]. Spores collected from Calcutta (India) were surface-sterilized in 1% aqueous calcium hypochlorite and sown on Knop's medium (full strength) prepared with glass-distilled water and solidified with 0·8% agar. The cultures were maintained under 12 hr photoperiod at 25 ± 2° C.

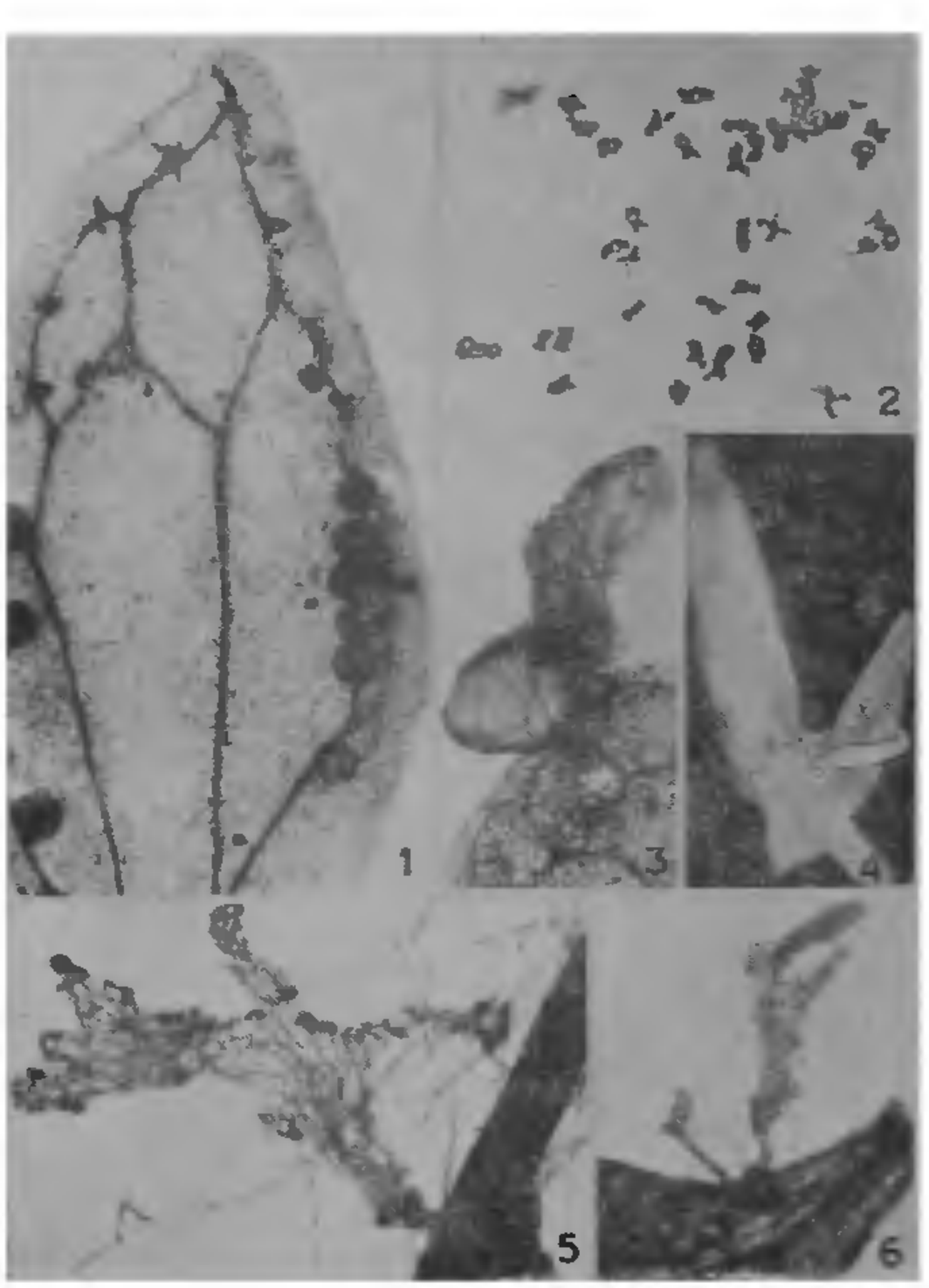
In 15–20-day old cultures, 3 distinct forms of gametophytes were observed: (1) cordate, with two equally-developed, symmetrical lobes; (2) cordate, asymmetrical with two or more unequally-developed lobes and (3) spatulate with or without branches. In types (2) and (3), antheridia appeared first in 30–35 days and archegonia a week later rendering them hermaphrodite. The spatulate ones,

on the other hand, remained antheridiate throughout their life-span. The fact that the 3 forms of gametophytes were observed persistently under uniform culture conditions make it certain that the differences observed in their adult phenotype and sex expression are indeed genetically controlled and in this respect they resemble with certain strains of *C. thalictroides*[5].

Fertilization was achieved in the presence of free water in the cultures and young sporophytes were observed 2 weeks after fertilization. During the vegetative phase which lasted for about 2 months, the earlier-formed leaves were deltoid with entire lamina and the sebsequent ones were 3-lobed. Thereafter, the fertile leaves, devoid of expanded lamina were differentiated; linear, undivided to begin with and 2–3 lobed later. As is known in other species of the genus, the sporangia developed on the underside of the fertile leaves protected by their reflexed margin. Interestingly, in some 7-month-old plants the factor(s) for the production of dimorphic fronds was/were lost because the sporangia were also formed on the expanded lamina of the vegetative leaves (Fig. 1). Meiosis (Fig. 2) and other stages of sporogenesis were perfectly normal resulting in 32 spores per sporangium. To the writers' knowledge, there is no report of *in vitro* completion of sporogenesis and subsequent stages of life-cycle in intact plants, a few earlier reports dealing with sporogenesis in excised leaves only[2,3].

Regeneration.—Vegetative leaves, both intact and excised, showed competence for bud formation on Knudson's medium; the degree as well as the sites of response were predictable. For example, while the buds produced on the juvenile leaves continued to produce vegetative leaves only, those on the adult leaves, which preceded the fertile ones on the parent plant, showed ability both for the differentiation of vegetative as well as fertile leaves. As to the site of response, groups of embryonic cells, situated near the leaf apices or below the sinus in the case of lobed ones, served as the bud initials (Figs. 3, 4). Thus in the absence of any exogenous growth factor in the medium, the bud development is related to the innate histological organization and physiological capacity of the plant.

Induction of apospory.—The object of this experiment was two-fold. First, to study the effect of starvation in favour of apospory; second, to assess the competence of apospory in intact *vs.* excised organs. Young sporophytes established on Knudson's medium containing 2% sucrose were transferred and maintained on the basal medium; no subculturing was done on the fresh medium. After 4 weeks the plants showed senescence followed by the differentiation of aposporous, diploid gametophytes from roots (Fig. 5), leaf lamina and stipe (Fig. 6). As regards the excised organs, while the roots of 1–3 hierarchial sequence failed to respond, the juvenile leaves of comparable sequence responded readily, as also reported earlier in *C. thalictroides*[7]. The aposporous, diploid gameto-



FIGS. 1–6. Fig. 1. Part of a morphologically vegetative leaf bearing normal sporangia in a 7-month-old sporophcte, × 9. Fig. 2. Meiocyte showing 40 bivalents at diakinesis, × 830. Figs. 3, 4, Regeneration of sporophytic buds from the margin. (3) and sinus of the leaf (4), S = vegetative, F = fertile leaf × 10, × 2. Figs. 5–6. Aposporous, diploid gametophytes originating from the root and stipe, × 19, × 10.

phytes generally tended to be intermediate in form between types (2) and (3) of haploid gametophytes resulting from spores; the only notable difference being the presence of tracheidal cells in some cases.

Viewed as a whole, the results of the present study make it plain that both the sporophyte and gametophyte generation of this fern have the same nutritional requirements for normal growth *in vitro*. Secondly, unlike in *Regnellidium diphyllum*[6], sugars were not essential for normal growth.

Department of Botany, D. S. LOYAL.
Punjab University, HARVINDER K. CHOPRA.
Chandigarh 160 014 (India), *June* 15, 1976.

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INTERACTION BETWEEN MOSAIC VIRUS AND *FUSARIUM OXYSPORIUM*, f. sp. *PISI* (LINF) INFECTING PEA PLANTS (*PISUM SATIVUM* L.)

THE studies on the rhizosphere mycoflora of the plants infected with fungi and bacteria have been done by a number of workers, but similar studies on virus infected plants have received attention only during recent years. These include a number of virus-host combinations such as *Dolichos* sp., infected by dolichos enation mosaic virus[4], in coffee infected by decline disease[7], *Chenopodium album* infected by tobacco mosaic virus[5], croton chilli and tomato infected by croton yellow mosaic virus, chilli mosaic virus and tomato mosaic virus respectively[6], groundnut sB II infected by groundnut rosette virus[3]. The present paper however, deals with the effect of the virus on the population of *Fusarium* causing wilt in pea plants.

Sterilized and sieved soil was used for raising pea seedlings at the rate of five per pot. At the two leaf stage of the seedlings, the soil of each pot was infested with 10 ml spore suspension of *Fusarium oxysporium*, f. sp. *pisi* in sterilized distilled water and two days later the top leaf of each plant was inoculated with the standard virus extract. The inoculated plants were incubated in the glass house at 25° ± 2° C along with the control in which leaves were rubbed with distil'ed water. After 20 days of incubation the rhizosphere and rhizoplane were studied following the method of Laxmikumari[4], and the number of colonies of the fungus per gram oven dry soil were recorded in Table I.

It is evident from Table I that the virus enhances the population of the fungus both in rhizosphere and rhizoplane. R/r ratio of virus infected roots is almost the same as in healthy one. These ratios (R/r, D/H) indicate that fungal growth is proportional in both the cases. These results are in agreement with those reported by Buxton and Perry[1].

Possibly the altered physiological set up of the diseased and healthy plants may account for the differences in exudation and microenvironmental

TABLE I

Number of Fusarium *colonies (per gram oven dry soil) in rhizosphere and rhizoplane of* Pisum sativum *L. var., bonneville infected with the virus*

Root	Rhizosphere (R)	Rhizoplane (r)	R/r
Diseased (D)	91·00	54·00	1·68
Healthy (H)	13·00	8·00	1·62
D/H	7:1	6·7:1	1·03:1

conditions of the root region which consequently affects the mycoflora differentially[2,3,4]. In most of the cases, an enhancement in the fungal population has been reported.

Therefore the variation in colony count may possibly be due to selective and differential assimilation of root exudates.

Botany Department,
Agra College,
Agra 282 002,
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R. K. SHARMA.
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NEW RECORD OF ALTERNATE HOST PLANTS OF GROUNDNUT LEAF MINER *STOMOPTERYX SUBSECIVELLA* ZELLER (SYN.: *S. NERTERIA* MEYRICK) (LEPIDOPTERA: GELECHIIDAE)

GROUNDNUT leaf miner *Stomopteryx subsecivella* Zeller has been reported to attack redgram, *Cajanus cajan* Millsp.[1,2,4], soybean, *Glycine max* Merr.[1,4,5], green gram, *Phaseolus aureus* Roxb.[6] and a wild leguminous shrub, *Psoralea corylifolia* Linn.[1-4]

During the second week of November, 1974, *S. subsecivella* was observed for the first time mining the leaves of waste land weeds, *viz.*, *Indigofera hirsuta* Linn. (Leguminosae: Papilionaceae) and *Phaseolus calcaratus* Roxb. (Leguminosae: Papilionaceae) and the fodder plant lucerne, *Medicago sativa* Linn. (Leguminosae: Papilionaceae). A large number of leaf miner adults have migrated and oviposited on these