node of the axis. The mesophyll of the leaf and bud, and the cortex of the axis and root is aerenchymatous. About 6-9 radial exarch vascular elements are present in the roots. Further, the axis is flattened. All these characters suggest the marshy and plagiotropic nature of the axis. Such axis in addition to the above characters is found in Xyridaceae than in Commelinaceae and other monocotyledonous plants. Further, the closer comparison is found with *Achlyphila* of Xyridaceae in respect of above described characters.

Department of Botany, G. V. PATIL.
Institute of Science,
Nagpur, *April* 30, 1979.

1. Jain, R. K., *Palaeobotanist*, 1963, **12** (1), 115.
2. Surange, K. R., *Trans. Nat. Inst. Sci. India*, 1950, **3** (4), 159.
3. Tomlinson, P .B., *Anatomy of Monocotyledons. III, Commelinales—Zingiberales*, 1969, Oxford.
4. Trivedi, B. S. and Ambwani, K., *Palaentographica*, 1971, **133**, 129.
5. — and Verma, C. L., *Ibid.*, 1971, **132**, 175.
6. — and —, *Ibid.*, 1972, **139**, 73.

AN UNRECORDED POST-HARVEST ROT OF APPLE

SAMPLES of diseased apple fruits were collected from markets of Karnal and Kurukshetra. Isolations from these samples yielded two species of *Fusarium, viz., F. solani* (Mart) Sacc. and *F. equiseti* (Corda) Sacc. Both the species incite quite similar symptoms. Lesions occur at any point on the outer surface of the fruit. They are inconspicuous in the early stages but eventually become distinctive as the whole fruit gets involved with white or pinkish colonies of the two fungi.

The pathogenicity of both the species was tested on healthy fruits of apple by artificial inoculation. It was found that both the species invade the fruits through the injured surface.

A survey of literature showed no previous records of *Fusarium solani* and *Fusarium equiseti* on apple and are, therefore, new records. The cultures have been deposited at C.M.I., Kew, Surrey, England, (I.M.I. 234441 and I.M.I. 234437).

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ADDITIONS TO THE FUNGI OF INDIA

DURING the course of an investigation on fungi causing diseases on plants, the author came across the following fungi which appear to be new to country after a perusal of the literature[1].

1. *Puccinia phyllostachydis* Kus.

On living leaves of *Phyllostachys mannae*, Shillong City, December 1977. Leg. R. C. Srivastava, IMI No. 234990 *a* and 234991 *a*.

2. *Puccinia canaliculata* (Schw) Lagerh.

On living axis and leaf parts of *Cyperus kyllingia*, Shillong City, Jan. 1978, Leg. R. C. Srivastava, IMI No. 234996.

3. *Gyrothrix flagella* (Cooke and Ellis) Pirozynski

On living leaves of *Cymbidium elegans*, causing leaf spots, Jan. 1978, Leg. R. C. Srivastava, IMI No. 235002.

4. *Leptoxyphium* sp.

On living leaves of *Kigalia pinnata*, I.B.G., Calcutta, Nov. 1977, (evident as black powdery coating on lower sides of leaves), Leg. R. C. Srivastava, IMI No. 234998.

5. *Phyllachora punctum* (Schw.) Ort. and Stev.

On living leaves of *Isachne fischeri*, Nov. 1977, Leg. R. C. Srivastava, IMI No. 234982.

Specimens of these have been deposited in the Herbarium of Commonwealth Mycological Institute, Kew, England on the numbers given above.

Author is thankful to the Director, C.M.I., Kew, England, for his help in confirming the identity of these fungi.

Botanical Survey of India, R. C. SRIVASTAVA.
Shillong 793 003,
May 9, 1979.

1. Bilgrami, K. S., Jammalludin, and Rizwi, M. A., *Fungi of India*, Today and Tomorrow's Publ., New Delhi, 1979.

CYTOMIXIS IN THE POLLEN MOTHER CELLS OF *HEMEROCALLIS* LINN.

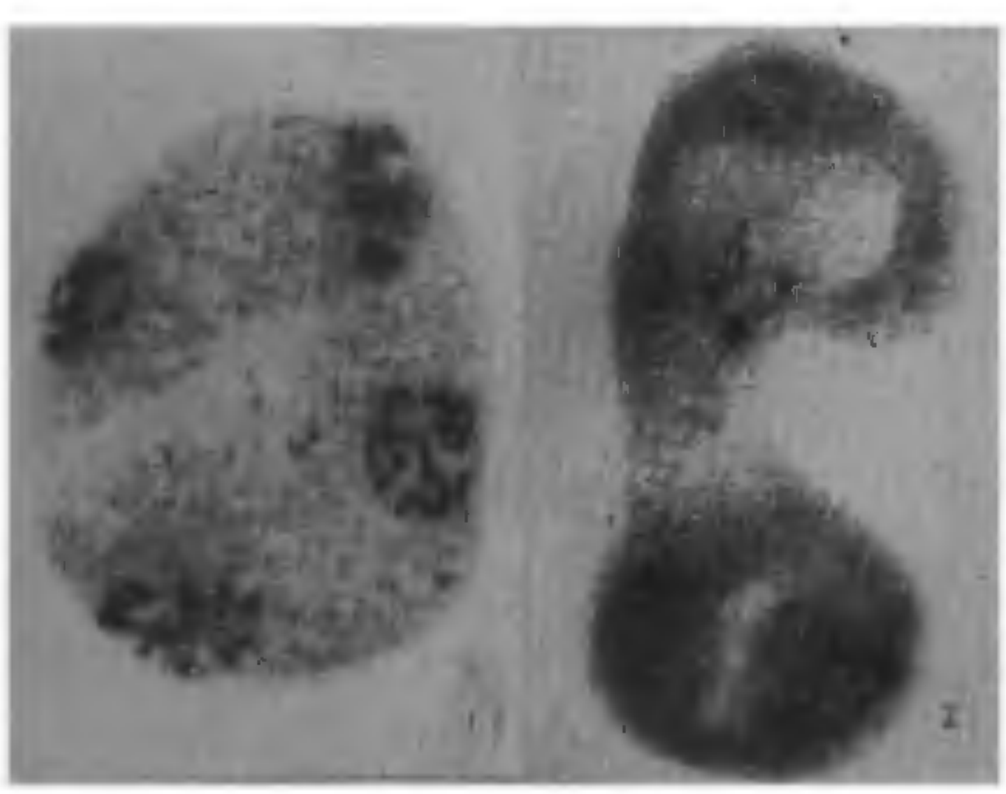
TRANSFUSION of nuclear substances into the cytoplasm of an adjacent cell, has been termed cytomixis. This phenomenon was for the first time discovered in the pollen mother cells of *Crocus vernus* by Koernicke[15] and in *Galtonia candicans* by Digby[7]. Later the same process was also found by Gates[8], who, while studying the pollen development in *Oenothera gigas* and *O. bienis* had recorded chromatin extrusions from nucleus of one pollen mother cell, through plasma strands into the cytoplasm of a contiguous cell. He considered this phenomenon to be natural and called 'cytomixis'.

Since then, it has been recorded in a very wide range of taxa, both in pollen mother cells and meristematic somatic tissues[1,2,10,18,20,21,24,29]. Gates and Rees[9], Maheshwari[16], Sarvella[22], Bell[1] and Narain[19] have reviewed the literature.

In the present case, cytomixis has been recorded in the pollen mother cells of a hybrid clone 'Norma Borland' (Vr. Spec. No. 8) of *Hemerocallis*. Further, the cytomixis has appeared at the second telophase.

The floral buds of 'Norma Borland' of *Hemerocallis* were collected and fixed in carnoy's fluid for 24 hours. Later smears were prepared in 1·0% acetic carmine followed by usual techniques.

Cytological analysis of *Hemerocallis* clone 'Norma Borland' revealed to be a diploid ($2n = 22$) based on $X = 11$. Eleven bivalents were seen at MI. Anaphase I and II were normal. However, by the end of telophase II, instead of normal tetrad formation (Fig. 1), nearly, in 28·0% pollen mother cells, some protoplasmic strands appeared between the two sister dyads. The chromatin material was also seen passing through an opening of the cell into the cytoplasm of the its sister dyad. A typical cell showing cytomixis has been depicted in Fig. 2.



FIGS 1–2. Fig. 1. PMC of Hemerocallis showing telophase II. Fig. 2. PMC showing cytomixis at telophase II, note the protoplasmic strands and chromatin material passing from one dyad into the cytoplasm of sister dyad.

Kihara and Lilienfeld[14] and several others[4,11,23,27] have observed cytomixis, generally occurring at meiotic leptotene to metaphase I. However, in *Hemerocallis*, cytomixis was recorded as late as, at the second telophase. A similar situation where cytomixis appeared at second telophase had also been recorded by Stebbins[25] in *Antennaria*.

Though, cytomixis had been observed in a large number of genera and species as a naturally occurring phenomenon both in the meiotic and meristematic somatic tissue, but authenticity is still disputable, because the causes that could lead cytomixis, are yet not known very clearly.

Gates[6], Gates and Rees[9], Schnack and Fehleisen[23], Kamara[13], de Nettancourt and Grant[6] had also reported cytomixis and hold the view that it is variously observed naturally.

Further, Woodworth[28], Gelin[11], Jacob[12], Maheshwari[16], Weiling[26] have considered cytomixis as an extremely abnormal nuclear behaviour and suggested its appearance due to faulty techniques in handling the living material. Factors like, actions of fixatives[12] mechanical pressure[22] temperature anomalies[19] and even pathological conditions[3] have been considered important for cytomixis. Cebotarev[5] is of the opinion that cytomixis is caused by changes and disturbances in the hydrostatical state of the sporogenous tissues. Milijajev[17] regarded cytomixis as due to deficiency of certain nutrients. Bobak and Herich induced cytomixis artificially, in the root tip cells of *Vica faba*, through a herbicide trifluraline and concluded cytomixis as due to the disturbances in the nucleoplasmatic relationships. However, in *Hemerocallis*, Cytomixis appears to be due to temperature anomalies leading to the physiological disturbances.

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Lucknow 226 001,
June 6, 1979.

PRAKASH NARAIN.

1. Bell, R. C., *Cytologia*, 1964, **29**, 396.
2. Bhandari, N. N. *et al.*, *Ibid.*, 1969, **34**, 22.
3. Bobak, M. and Herich, R., *Nucleus*, 1978, **21**, 22.
4. Bopp-Hassenkamp, G., *Exptl. Cell Res.*, 1959, **18**, 182.
5. Cebotarev, A. A., *An Mold SSR Seria Biol. Chim. Nauk.*, 7, *vide* Bobak, M and Herich, R., 1978.
6. de Nettancourt, D. and Grant, W. F., *Cytologia*, 1964, **29**, 191.
7. Diby, L., *Ann. Bot.*, 1909, **23**, 491.
8. Gates, R. R., *Ibid.*, 1911, **25**, 909.
9. — and Rees, E. M., *Ibid.*, 1921, **35**, 365.
10. — and Latter, J., *Jour. Roy. Micros. Soc.*, 1927, **47**, 209.
11. Gelin, O. E. V., *Acta Hort. Bergiani*, 1934, **11**, 99.
12. Jacob, K. T., *Curr. Sci.*, 1941, **10**, 174.
13. Kamara, O. P., *Heriditas*, 1960, **46**, 536.
14. Kihara, H. and Lilienfeld, F., *Jap. J. Genet.*, 1934, **10**, 1.

15. Koernicke, M., *Niederrhein Ges. Nature—U. Heilk Bonn*, 14, *vide* Gates, R. R. and Rees, E. M., 1921.
16. Maheshwari, P., *An Introduction to the Embryology of Angiosperms*. MGraw-Hill, New York, 1950.
17. Miljajev, E. L., *Autoreferat Kandidatskej dizertacia*, 1967, *vide* Bobak, M. and Herich, R., 1978.
18. Morrisset, P., *Can. J. Genet. Cytol.*, 1978, **20**, 383.
19. Narain, P., Cytogenetical and hybridization studies on some species and cultivars of *Gloriosa* and *Amaryllis*. *Ph.D. Thesis*, Agra University, Agra, 1972.
20. Omara, M. K., *Chromosoma*, 1976, **55**, 267.
21. Sapre, A. B., *Indian J. Bot.*, 1978, **1**, 29.
22. Sarvella, P., *Cytologia*, 1958, **23**, 14.
23. Schnack, B. and Fehleisen, S., *Darwiniana*, 1957, **11**, 244.
24. Siddiqui, N. H., Khan, R. and Rao, G. R., *Curr. Sci.*, 1979, **48**, 118.
25. Stebbins, G. L., Jr., *Bot. Gaz.*, 1934, **94**, 322.
26. Weiling, F., *Planta*, 1965, **67**, 182.
27. West, C. and Lechmere, A. E., *Ann. Bot.*, 1915, **29**, 285.
28. Woodworth, R. H., *Jour. Arn. Arboretum*, 1965, **12**, 23.
29. Youngman, W., *Ann. Bot.*, 1931, **45**, 211.

ASSOCIATION OF FUNGI IN TERMITE GUT

THE assoeiation of termites and fungi of the 'Termitarium' has been well documented[1–9], but the information regarding the occurrence of fungal strains in the termite gut is very scarce[10–11]. We report the presence of several species of fungi in the gut of worker termite, *Odontotermes obesus*. An attempt has also been made to compare the fungal flora of termite gut with those encountered on the infected wooden pole.

Worker termites *Odontotermes obesus* were obtained from a "sal" wooden pole in a sterile petri dish. Termites selected were from the same colony and of similar morphology. Surface sterilization of the whole termite body and the guts were carried out in absolute alcohol and/or mercuric chloride[13]. The inoculum consisted of 20 guts homogenized in 10 ml of 8·5% (w/v) aqueous saline solution and centrifuged to remove the cell debris. The uniform effluent solution (0·5 ml) was used for isolation of fungal strains.

Infested wooden pole from which termites were collected was used for enumeration of fungal association. Three specific layers, inner, middle and outer (0·5 g dry wt) were soaked separately in 50 ml of sterile water for an hour and then thoroughly shaken for 15 min in a conical flask using a magnetic stirrer at room temperature. The suspensions obtained were used as inocula.

Fungi isolated from the gut were : *Cunninghamella echinulata*, *Penicillium* Sp., *Fusarium moniliformae*, *Aspergillus amamori*, *A. flavus* and *A. nidulans*. The number of individual fungus colony er ml of the inoculum ranged from 4 to 10 (Table I). The inner layer of wooden pole consisted of *Paecilomyces fusisporus*, *Penicillium* sp., *Alternaria alternater* and *Cladosprorium* sp., *P. fusisporus*, *Penicillium* sp., *Cunninghamella echinulata*, *Rhizopus* sp. and *P. fusisporus*, *Penicillium* sp., *Cladosporium* sp., were isolated from the middle and outer layers of wooden pole respectively (Table II).

TABLE I

Fungi spp. *isolated from the gut of the worker termite* (Odontotermes obesus).

Results are average of six replicates

Fungi species	No. of individual fungal colonies/1 ml homogenized gut suspension
Cunninghamella echinulata	4
Penicillium sp.	10
Fusarium moniliformae	4
Aspergillus amamori	6
A. flavus	8
A. nidulans	6

The number of *Penicillium* colonies were most dominant on all the agar plates and they were invariably over 5000 counts per ml of supernatant suspension. *C. echinulata* and *Penicillium* sp. were isolated both from the termite gut and wood while *F. moniliformae* and three species of *Aspergillus* were recorded only from the termite gut. *P. fusisporus*, *A. alternater*, *Cladosprium* sp. and *Rhizopus* sp. were confined to tthe wooden pole.

Earlier findings[1–12] reported an entomophthoraceous fungus inside the tissues of *Coptotermes curvignathus*, *Conidiobolus* sp. from *Nasutitermes* and *Aspergillus glaucus*, *Aspergillus* sp., *Curvularia* sp., *Fusarium* sp., *Rhodotorula* sp. from the gut of worker termite *Odontotermes obesus*. The occurrence of *F. moniliformae* in the gut of worker termite is in agreement with the previous report[12]. However, contrary to the previous communications[10–12] *C. echinulata*, *Penicillium* sp. and three different species of *Aspergillus*