association shows the importance of kinetochore somatic pairing.

Juxtaposition of homologues is explained by the action of a specific sticky zone located along the chromosome length at corresponding points (Fig. 1). Once the homologues are close to each other they would dispose themselves in the most stable arrangement, preferably where sticky zones are juxtaposed. In normal metaphase and anaphase, this stickiness is not present, but in the material under investigation the stickiness may have developed on the chromosomes due to the effect of mitomycin-C.

In other organisms the somatic pairing is of different patterns. An analogous type of association was reported in plants by Feldman and Mello–Sampayo[5] (1966) where they presume that the kinetochore activity was responsible for the position of homologues near each other. In view of the present observation, we are inclined to believe that *kinetochores are responsible for placing homologues near each other as reported by Feldman and Mello–Sampayo (1966)*. In addition, our observations have support the hypothesis of Wagenaar[6] (1969) where stickiness is attributed to be a factor for association between homologous chromosomes. There is no particular evidence to support the views of Kitani[7] (1963) that the homologous chromosomes are always associated in somatic tissue which is also not supported by workers like Brown and Stack[8] (1968) and Colembera (1973).

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# SHORT SCIENTIFIC NOTES

## A Waxless Mutant in Rai (*Brassica juncea* Coss)

Very few seemingly different plant types had been observed in the population of an improved variety of yellow *sarson* (*Brassica campestris* var. *sarson*), *viz.*, B–9, at the Pulses and Oilseeds Research Station, Berhampore (W.B.), as early as 1970–71. These types were devoid of any waxy particles on the stem and leaves and appeared to be oily and shiny. Such non-waxy plants were subsequently noticed in brown *sarson* (*B. campestris* var. *dichotoma*), *toria* (*B. campestris* var. *toria*) and *rai* (*B. juncea*). It is seen that such non-waxy mutant was already known in the former three Brassica groups and breeding studies revealed it to be a monogenic recessive character[1]. Srinivasachar and Malik[2] reported the waxless mutant in the irradiated material of *B. rapa*. Thompson[3] claimed such mutant in *B. oleracea* var. *acephala*. They also indicated the association of the non-waxy character with aphid resistance. The occurrence of the non-waxy mutant in the *juncea* group of Brassica is being reported here from India, for the first time. The waxless mutants of *rai* and yellow *sarson* in the present observation showed that the plants were less damaged by aphid than their waxy counterparts. Further work on the utilization of the mutants of these varieties is in progress.

The authors are grateful to Dr. D. Mukherjee, Joint Director of Agriculture (Research) and Dr. K. Sengupta, Plant Breeder (Oilseeds), Government of West Bengal, for their keen interest in the work. Thanks are also due to the ICAR, and the Directorate of Agriculture, West Bengal, for providing facilities.

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**_Metarrhizium anisopliae_ (Metch.) Sorokin on Brinjal Mealy Bug and its Use in the Biological Control of the Pest**

There are many hyphomycetous fungi which grow on insects. The most common parasitic species belong to the genera *Beauvaria, Metarrhizium, Isaria* and *Spicaria*[1]. Among these the genus *Metarrhizium* is strictly entomogenous[2]. *Metarrhizium anisopliae* (Metch.) Sorokin, the cause of 'green muscardine' disease of diverse insects is the commonest species of *Metarrhizium*. In India its occurrence has been reported from a few insect species[3]. Narasimhan (1970)[2] held that the species has a potential importance in the biological control of insect pests. This note records *M. anisopliae* on *Centrococcus insolitus* Green, the brinjal mealy bug. Brief description of the species and observations on biological control of the pest are also given.

Mealy bug colonies on brinjal plants in the fields of Nadia District, West Bengal, were seen to be infected by the fungus, from November to March when the temperature ranged from 10–25° C and the maximum relative humidity remained lower than 75%. The infected colonies, particularly the ovisacs, instead of being cottony white, appear dark bluish green and powdery, due to sporulation of the fungus at the surface.

The fungus was brought into pure culture in honey-peptone agar (HPA) from spore mass on the infected insects. It could also be isolated from surface-sterilized eggs, indicating that, in the nature, eggs are also infected. Colonies on HPA and Sabourad's maltose agar start as white, fluffy mycelial growth which soon change to green from the center and ultimately become dark olive green. Sporophores and hyphae in culture extend upwards, being closely packed, and the branches remain intertwined. Conidia formation takes place by abstriction of the elongated buds which appear at the distal end of sporophores branching in the tip in the manner of a fork. Budding continues basipetally, forming chains of conidia. Chains of conidia arising from adjacent sporophores cohesce as prismatic masses. In old cultures they form a crust over the surface. Conidia are at first white and later become olive green. Conidia from culture measure 5·5–7·9 $\mu$ × 2·3–3·5 $\mu$, the range of length being higher on insects (3·5–8·5 $\mu$). Pathogenicity of the fungus to brinjal mealy bug could be proved by inoculation of the healthy insects which were grown from eggs on potato sprouts in sterile glass containers, and 2nd–3rd instars were dusted with spore mass. Seven to ten days after inoculation the insects were dead. Sporulation was obtained after another three days. On dissecting the dead insects, hyphae were seen to ramify deep in the tissue and conidiophores emerged at the surface. On the basis of the salient characters, the fungus was identified as *Metarrhizium anisopliae* (Metch.) Sorokin, and *Centrococcus insolitus* Green (Pseudococcidae, Homopetra) is a new host record.

Brinjal plants severely infested with the mealy bug in the fields were dusted with spore mass obtained from cultures grown on molasses-peptone agar (5% molasses, 1% peptone) at two seasons, November and February. Within 12–15 days after inoculation, mealy bug colonies on the leaves started dying and plants gained vigour after about a month. Approximately 80 and 56% of the inoculation tests were successful at the respective seasons. Judging by the results of inoculation tests and the performance of plants after inoculation, it appears that mealy bug infestation of brinjal can successfully be eradicated by using *M. anisopliae*.

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**Natural Control of Ground-nut Aphid, _Aphis craccivora_ Koch. in Central Gujarat**

The aphid, *Aphis craccivora* Koch. is a very serious pest of ground-nut, *Arachis hypogaea* L. throughout the State. During August, 1974 severe infestation by this species was noticed in ground-nut crop in Kapadwanj taluka. The pest was first observed in the second week of August when 10% of the plants were found infested. The aphid infestation spread very rapidly and built up large colonies on the tender shoots of different branches to the extent of 97% infestation during the third week of August.

The predators collected at this time revealed two species of coccinellids, *Menochilus sexmaculatus* (F.) and *Coccinella septempunctata* L.; one syrphid, *Xanthogramma scutellare* (F.) and *Chrysopa carnea* Steph. The aphid population decreased with the increased population of the natural enemies and by the fourth week of August *M. sexmaculatus* was quite abundant to bring about complete control of the aphid. The counts of preda-

tors made during the week in 5 different fields showed that each plant had on an average 5 grubs, 20 pupae and 10 adults of *M. sexmaculatus*. The population of *C. septempunctata* and *X. scutellare* was very low to record only 0·6 and 0·4 pupae per plant respectively. The incidence of *Chrysopa carnea* was negligible. The population of the predators declined by the first week of September when each plant had only 6 adults of *M. sexmaculatus* indicating that most of them must have migrated to other areas due to absence of food in the crop.

Thus, *M. sexmaculatus* played a very important role in controlling such a severe infestation of aphid as a natural control agent saving the cost of at least one round of insecticidal application. This also indicates that it is possible to check the aphid infestation in other endemic areas by early releasing of laboratory reared *M. sexmaculatus* adults.

The authors are indebted to Dr. R. M. Patel, Director of Campus for the facilities and interest in the work.

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*August* 5, 1975.

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**Residues of Certain Systemic Insecticides in Sweet Potato Tubers**

Sweet potato weevil (*Cylas formicarius*) is controlled by spraying 0·1% fenthion or carbaryl and the residues of these pesticides in the sweet potato tubers were found below the F. D. A., U.S.A. tolerance level (Subramaniam *et al.*, 1974). In this investigation the soil application of certain systemics Temik, Carbofuran and Disyston granules at 1·00 kg a.i/ha were made at the time of tuber formation for the control of Sweet potato weevil. The experiment was laid out in a randomised block design with three replications. The fresh tuber samples collected at the time of harvest were analysed for the residues of Temik (Jhonson and Stansburg, 1966), Carbofuras (Gupta and Dewan, 1971) and Disyston (Schumann and Olson, 1964).

The results of analysis are as follows :

| Insecticide | Residues in ppm | FDA tolerance level (ppm) |
|---|---|---|
| Temik | 0·095 | 0·20 |
| Carbofuran | 0·105 | 0·20 |
| Disyston | 0·326 | 0·75 |

The study indicated that all the three insecticides left residues in the tuber well below the tolerance level of FDA of USA indicating that they can be safely applied in the soil at 1·0 kg a.i/ha to control the sweet potato weevil.

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***Cuscuta reflexa*—A New Host for *Aphis craccivora***

While rearing *Aphis craccivora* (a virus vector) and *Cuscuta reflexa* (virus carrier) on different citrus plants, to study their efficiency in transmitting Tristeza virus of citrus, a large number of aphids migrated to *C. reflexa* and started feeding and breeding on the tips. Laboratory studies revealed that a single adult produced 10–12 nymphs in life span of 14–20 days and each nymph became adult in 6–7 days.

*A. crassivora* has already been reported tc feed on *Dolichous lablab, Cassia tora*, sweet orange, grape fruit and Rangpur lime (Verma *et al.*, 1965). *Cuscuta reflexa* thus appears to be a new host for the aphid.

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**Production of Teliospores in Artificial Culture of *Ustilago crameri* (Kornicke)**

*Ustilago crameri* the smut disease on *Setaria italica* (Linn). Beauv. is ubiquitous in its distribution and cause heavy damage and loss in several States in our country particularly in South India. In severe case of infection, 75% of the grains in the ears become smutted though rarely the terminal portion of the spike may escape. The

sori are 2–4 mm in diameter and appear slightly larger than the grains.

The spores are round or angular in shape, and dark-brown in colour. They are smooth and measure 7–10 $\mu$. Germination takes place without any rest period. During spore germination studies, it was observed that culture maintained by monoteliospore isolations develop teliospores in potato-sucrose peptone malt agar after a period of six weeks at 25° C. The teliospores formed in culture were more or less spherical, smooth and often slightly larger than the teliospores produced in the host plant. Similar type of teliospores formed in culture are reported earlier by Govindu and Fischer[1], for *Ustilago striiformis* (West.) Niessl.

The present report is the first record for the occurrence of teliospores in culture of *Ustilago crameri*. Germination studies of the teliospores formed in artificial culture as well as their method of formation and electron microscopy of morphology of surface structure are under investigation.

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**The Natural Occurrence of *Bipolaris tetramera* on Termites**

In October, 1974 at Varanasi, the authors observed stored woollen cloth being destroyed by a group of termites (*Odontotermes obesus* Rambur) with fungal infection.

This fungus was isolated on PDA and identified as *Bipolaris tetramera* (Mc Kinney) Shoemaker. Pathogenicity tests were conducted on living, healthy termites already kept under isolation for 15 days to ensure the absence of any other microorganism. The healthy termites were placed in sterile Petri-dishes lined with filter-papers, and inoculated with spore-*cum*-mycelial suspension of *Bipolaris tetramera*. All termites inoculated with fungal suspension died within 72 hours, while control individuals treated with sterile distilled water remained alive and healthy up to 15 days. Re-isolations from the artificially infected termites revealed the same fungus.

There appears to be no previous record of any species of *Bipolaris* on termites. *B. tetramera* though commonly a soil saprophyte has also been reported to be a weak pathogen on various economic plants. In view of this, the present report would indicate the possibility of biological control of termites.

Grateful thanks are due to Dr. R. Y. Roy, for his keen interest in the present work and one of us (KBK) also wishes to acknowledge indebtedness to the C.S.I.R., for appointment in the Scientist's Pool.

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**A Short Note on *Frerea indica* Dalz.**

*Frerea* Dalz. a monotypic genus, is represented by the endemic species *F. indica* Dalz., confined to the Sahyadri ranges of Maharashtra. Except for a solitary collection in June 1956 (Puri 2619, BSI) the plant has not been collected from its type locality at Junnar, since its original collection by Dalzell in 1864 and subsequently by McCann (McCann 137/18 H BLATT) though it has been recently reported from Kate's point at Mahabaleshwar and Purandhar fort as well. On the basis of the succulent stems and rotate corolla, Rowley (*Nat. Cact. and Succ. J.* 30 : 78, 1958) merged it under *Caralluma* R. Br. renaming it as *C. frerei* Rowley, but the profuse leafy nature, distinct floral features and the absence of any intermediate species of *Caralluma* with the fleshy large leaves justify the retention of *Frerea* as a distinct genus.

Somatic squashes after pre-fixation with 8-oxyquinoline for 2 hours and staining in acetic-orcein following the normal procedures revealed $2n = 44$ (voucher specimen : *Singh* 108937, BSI) which is a first report for the species. Though Dalzell has described the follicles and seed, the species has not normally been found to fruit in nature but under experimental cultivation, the plants fruited for the first time at Pune in 1971, the seeds exhibiting 50% germination. A redeeming feature of this rare plant is its successful ready propagation from cuttings and it is worth introducting in garden as an ornamental pot plant.

Botanical Survey of India, Western Circle, Poona-1, *September* 10, 1975.

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**A New Species of Septoria on Hops (*Humulus* Spp.) in Kashmir**

Hops is grown in Kashmir valley by the Department of Agriculture and other agencies for many years. Its flowers are used by various breweries in India and lot of foreign exchange is thus saved by making use of them.

During our survey of Hops (*Humulus* Spp.) plantation at the Agricultural Experimental Research Station, Shalimar, a new disease has been found manifesting itself on its leaves, particularly on local and late cluster varieties. The disease appears as small necrotic spots, which later on coalesce and forms bigger patches. Initial infection appears to resemble that of leaf necrosis of virus origin. The spots turn brownish or rusty with age.

The pathogen responsible for the disease has been identified as *Septoria lupulina* Ellis and Kellerman–(IMI 194898). Cluster of pycnidia appear in the centre of the spot, which can also be traced at its periphery pycnidia which measure 140–150 $\mu$ are round with small ostiole. Conidia are slender, faintly septate with slightly curved ends. They measure 30–45 $\times$ 2–2·5 $\mu$.

The species *Septoria lupulina* on hops is a new record for India. The pathogen was isolated on PDA from diseased leaves. The fungus grew well and a number of pycnidia bearing cluster of conidia were observed.

The disease incidence was estimated at 10–15% in most of the areas, which was even higher in other fields.

The authors express their gratitude to Dr. M. B. Ellis, Commonwealth Mycological Institute, Kew, Surry (England), for confirming the species.

Grateful thanks are also due to Mr. A. G. Malik, Director of Agriculture, J & K Government, for the facilities and his keen interest in this study.

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**_Zinnia elegans_ Jacq.—The Latent Host of Watermelon Mosaic Virus**

The watermelon mosaic virus (WMV) was previously known to have its host range limited to the family Cucurbitaceae only[1]. Later studies by Freitag[2] and Grogan[3] suggested that watermelon mosaic virus can infect the plants of other families also including Leguminoceae, Malvaceae and Umbelliferae.

On the basis of host range studies Webb and Scott[4] divided watermelon mosaic virus complex into two groups : WMV–1 limited to Cucurbitaceae only and WMV–2 infecting plants of other families also. Milne and Grogan[5] indicated them to be the different strains of the same virus.

In the present study, the virus isolate was obtained from naturally infected plants of *Trichosanthes dioica* Linn. The host range studies were carried out with twenty-three plants belonging to eleven different families. The virus was recovered by back inoculation from *Zinnia elegans* Jacq. only. The virus was recovered by insect transmission also using *Aphis gossypii* as vector. Detailed studies made on the physical properties, insect transmission, particle morphology and symptoms induced in cucurbits indicated it to be a strain of watermelon mosaic virus, Bhargava and Tewari[6].

This report is the first record in this plant as a symptomless carrier for watermelon mosaic virus and hence an indication of the important host for perpetuation of the virus.

Grateful thanks are due to Prof. K. S. Bhargava, Head, Department of Botany, Gorakhpur University, for guidance and to CSIR, New Delhi, for financial assistance.

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