effect obviously points to gross changes in the molecular organisation of the compound as the result of irradiation at the higher doses.

This fact received further corroboration from the results of the IR absorption studies. It was observed that the samples irradiated at 5-and 10-m-rad doses gave IR spectra identical with the non-irradiated compound, whereas the sample irradiated at 15 m-rad dose resulted in a curve with non-resolution appearance of IR spectra. It indicates that a complex mixture has been formed. Apparently there are pronounced changes produced at 1 or more of the 4 asymmetric centres said to be responsible for the activity of tetracycline molecule[11] when irradiation is done at 15 m-rad dose.

A more detailed chemical investigation of the 15-m-rad-irradiated sample is in progress. However, it can safely be recommended that for sterilization of oxytetracycline in the solid state, the gamma-radiations used should be below 10 m-rad-dose in order to preserve its antibiotic activity intact.

*Zusammenfassung.* Nachweis, dass die Bestrahlung von Oxytetracyclin mit Cobalt-60-Gammastrahlen, in Abhängigkeit von der Strahlendosierung, zu einem Wirksamkeitsverlust des Antibiotikums führt.

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## Association of *Candida tropicalis* with Maize Stalk Rot[1]

*Candida tropicalis* (Cast.) Berkhout frequently occurs as a commensal and occasionally as a pathogen in man and animals (Kawabita and Van Uden[2]; Hurley[3]; Gentles and La Touche[4]; Thirumalachar[5]). It has also been reported from soil (Gugnani and Shrivastava[6]). So far as is known, this fungus has not been found to be associated with plant disease, although it has been recovered from plant or vegetable materials such as rotten pine apples (Lodder and Kreger Van-Rij[7]), Sauerkraut, Sakura-miso, blackstrap molasses, kefyr, etc. (Miranda, personal communication). A stalk rot disease of maize was observed in February–March, 1971, at Hyderabad and in August, 1971, at Udaipur from which a yeast-like fungus was isolated. Again in 1972 the same fungus was recovered from maize stalk rot samples collected from Jullundur.

*Material and methods.* Stalk rot material collected from Hyderabad and Udaipur was plated on potato-dextrose agar. The resulting growth was purified by single sporing. For inoculations, the suspension of fungus growth was prepared and syringe inoculated in nodes and internodes. The approximate density of propagules was $10^5$/ml. The punctures were sealed with wax or grease. Cultural, biochemical and physiological characters were determined in accordance with the methods described by Lodder and Kreger Van-Rij[7].

*Results and discussion.* Colonies on glucose-yeast-extract and peptone agars creamish or slightly dull white, opaque, raised with crenate margins, pellicle on potato-dextrose broth with sedimentation. Cells of yeast-phase subglobose to short ovoid or ovoid, occasionally sausage-shaped, rarely cylindrical, $10–14 \times 5–8$ µm; pseudomycelium consists of ramified chains of pseudohyphae on which clusters or chains of globose to ovoid or slightly elongate, acro-pleurogenous blastospores with rounded ends are produced (Figures 4 and 5); true mycelium is also present.

Within the stalk the fungus was found in the filamentous mycelial phase intracellularly in the pith parenchyma (Figure 6). 'Control' stalk injected with sterile water did

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Pathogenicity tests with 2 isolates of *Candida tropicalis* on maize

| | Host cultivar | Age of plants (days) | No. of plants inoculated | No. of plants whith disease | Period after disease appeared (days) |
|---|---|---|---|---|---|
| In field | Composite opaque (Shakti) | 40 | 2 | 2 | 10 |
| | Ganga 5 | 70 | 23 | 5 | 25 |
| In glass house | Basi (local) | 30 | 4 | 3 | 20 |
| | | 60 | 4 | 4 | 10 |
| | | 40 | 10 | 5 | 25 |
| Cut stalk | Kisan composite | 60 | 4 | 4 | 6 |
| | Kisan | 50 | 4 | 4 | 6 |
| | Ganga 5 | 60 | 7 | 7 | 5 |

not show presence of any kind of mycelium or yeast cells in the pith.

Fermentation. Glucose, galactose, sucrose, maltose, trehalose are fermented; lactose, cellobiose, melibiose, raffinose, melezitose, inulin and starch are not.

Assimilation of carbon compounds. Glucose, galactose, L-sorbose, sucrose, maltose, trehalose, L-xylose, ethanol, glycerol, L-methyl D-glucoside are assimilated; cellobiose, lactose, melibiose, raffinose, inulin, L-arabinose, D-arabinose, D-ribose, L-rhamnose, erythrotol, galacitol, salicin, DL-lactic acid, citric acid and inositol are not assimilated.

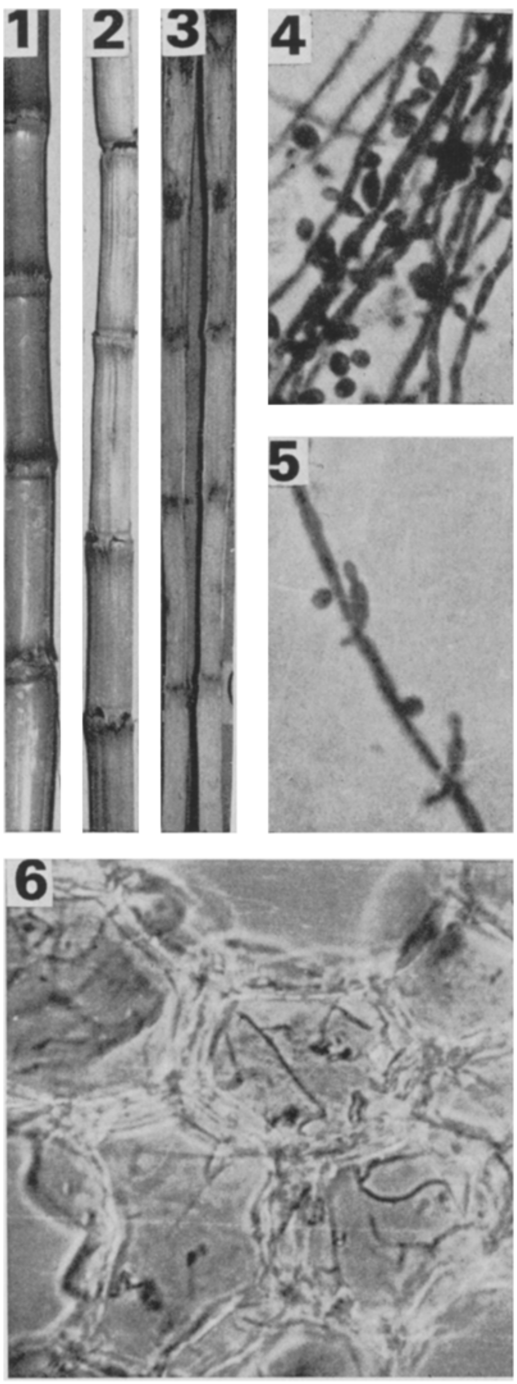
Development of pseudomycelium on cornmeal agar with blastospore production in verticels, inability of the fungus to assimilate potassium nitrate and inability to ferment or assimilate lactose are characters which suggest its identity to *C. tropicalis*. Both the isolates were kindly identified as *C. tropicalis* by Dr. L. RODRIGUES DE MIRANDA, Centraalbureau voor Schimmelcultures.

Stalk rot pathogens in maize incite disease usually by entry in the host through wounds, injuries, cracks, etc. (KOEHLER[8]; CHRISTENSEN and WILCOXSON[9]). This is so in case of *C. tropicalis* also. It differs from other fungal stalk rot pathogens in being able to cause disease by entry in nodal as well as internodal areas of stalk. A peculiar feature of this pathogen is that immediately on infection it causes pronounced yellowing of leaf sheaths. Severe disease develops only under hot humid atmosphere. Experiments have also suggested that 40–60-day-old plants are more prone to the disease. Thus infection under a combination of favourable host and environmental factors can lead to disease development.

Dr. M. J. THIRUMALACHAR (personal correspondence) was successful in inducing wilting of tomato shoots in cultural filtrates of this pathogen indicating that it elaborates some kind of toxin. These 2 isolates of *C. tropicalis* were also found to be pathogenic to white mice killing 50–60% of them receiving intravenous inoculation of $10^{5-6}$ cells/ml.

*C. tropicalis* isolated from diseased maize stalks, in view of its pathogenicity on mice, can be considered as a 'biopathogen' – an organism capable of inciting disease or disorder in both plants and animals. A similar example is that of *Geotrichum candidum* Link which causes sour rot of fruits and vegetables and is also pathogenic to animals such as turtle (SINCLAIR and EL-TOBSHY[10]). Several species of *Candida*, including *C. tropicalis*, have been implicated in human candidiasis, although the more frequently associated species is *C. albicans*.

The fungus has been found to be pathogenic on maize. The Table shows a summary of inoculation work carried out so far with pure cultures of Hyderabad and Udaipur isolates. The first sign of disease in inoculated plants appears in the form of chlorosis or yellowing of leaf sheaths within 4 days. The discoloration later progresses to the rind of affected internodes. The latter also lose their normal stiffness and become soft (Figures 2 and 3). Although the pith inside becomes soft and disorganised, the vascular elements of the stalk remain more or less unaffected. The



Figs 1 and 2. Healthy and diseased stalks; note wrinkling and shrinkage of rind in the latter.

Fig. 3. Diseased stalk showing discoloured pith and also darkened nodes.

Fig. 4. Pseudomycelium mat with blastospores. ×480.

Fig. 5. Single hypha showing blastospores. ×480.

Fig. 6. T.S. of inoculated stalk showing intracellular mycelium. ×480.

| | |
|---|---|
| Assimilation of potassium nitrate | Negative |
| Sodium chloride tolerance | 7% (W/V) |
| Growth on 50% (W/V) glucose yeast extract agar | Positive |
| Maximum temperature of growth | 42 °C |
| Starch formation | Negative |
| Urea hydrolysis | Negative |

Isolated from rotten maize stalks; Hyderabad, February-March, 1971; Udaipur, August, 1971. Cultures deposited at Centraalbureau voor Schimmelcultures, Yeast Division, Delft, The Netherlands.

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stalk girth diminishes with the result that the rind begins to show wrinkling and shrinkage effects (Figure 2). Healthy stalk is shown in Figure 1 for comparison. Chlorosis from leaf sheaths advances to leaf blades. In advanced state of infection, leaves appear blanched; under hot humid conditions (i.e. temperature above 30 °C and relative humidity above 80%), symptoms such as wilting or pre-mature drying of leaves are observed to occur. This is based on observations made on field-inoculated plants. When these conditions are not available, even in artificially inoculated plants rot does not spread extensively.

In nature, chlorosis of leaves may or may not occur. Pronounced ill effects such as wilting may develop in a small proportion of plants under conditions of high humidity and high temperatures (around 30 °C). The basal 2 or 3 internodes show either wet rot with some pith softening or shrinkage with discoloration and wrinkling on the rind. Although a complete collapse of the stalk occurs but rarely, a partial disorganisation of the stalk elements certainly develops[11].

*Zusammenfassung. Candida tropicalis,* ein bekannter Pilz bei Mensch und Tier, wurde auch bei Mais-Stengelnekrose gefunden. Die Pathogenitätsprüfungen mit Pilz-Reinkultur (Biopathogene) war bei Mais und weissen Mäusen positiv.

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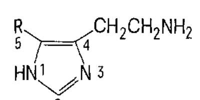
TERMINOLOGIA

## Naming of Substituted Histamines

Histamine is the trivial name for 4 (or 5)-(2-aminoethyl) imidazole, represented structurally by either formula I or II (R = H). Although derivatives of this compound can be named systematically and unambiguously using the accepted IUPAC nomenclature[1] for substituted imidazoles this gives rise to names which are cumbersome and often uninformative to biologists. Physiologists and pharmacologists prefer that derivatives should be identified by a system of trivial names based on histamine rather than by formal ones based on imidazole. However, we have found no authoritative directive for such a system – only diversity and confusion. Consider, for example, the methyl-substituted compounds represented by structures I–IV.

Compound I (R = $CH_3$) has been variously called: 4(or 5)-methyl-5-(or 4)-$\beta$-aminoethylglyoxaline[2], 4(5)-methylhistamine[3,4], 4(5)-methyl-5(4)-aminoethylimidazole[5], 5-methylhistamine[6], 4-methylhistamine[7,8], 2-(5-methyl-4-imidazolyl) ethylamine[9]. Ambiguity arises because the compound is tautomeric and can be represented by an alternative structure II (R = $CH_3$); using the IUPAC rule that the nitrogen carrying the hydrogen atom is named position 1, this compound can be legitimately numbered in two ways. Compound III was originally named as 1-methyl-4-$\beta$-aminoethylglyoxaline[10], and became 1-methyl-4-$\beta$-aminoethylimidazole[11]. Subsequently Schayer and Karjala[12] devised a histamine nomenclature which identified it as 1,4-methylhistamine. However, others have described it simply as methylhistamine, 1-methyl-histamine[13–15], or 3-methylhistamine[16,7,8]. A different kind of ambiguity arises now because compound III may be confused with another ring-N methyl deriva-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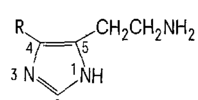
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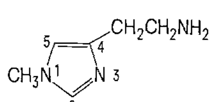
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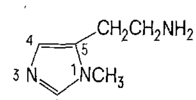
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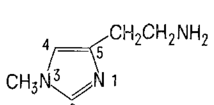
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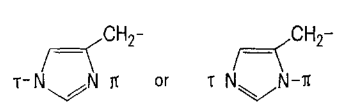
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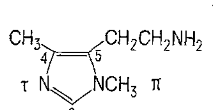
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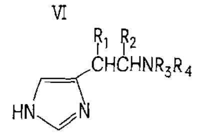
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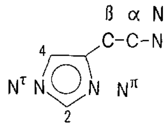
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