failed to induce shoot morphogenesis in callus, and it would appear that the latter may as well be influenced by a multiplicity of factors and points to the fact that there may as yet be unappreciated factors that are involved in shoot induction or shoot recalcitrance.

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1. Mohan Ram, H. Y. and Steward, F. C., *Can. J. Bot.*, 1964, **42**, 1569.
2. Dore Swamy, R., Srinivasa Rao, N. K. and Chacko, E. K., Abstract, Symp. plant tissue culture, genetic manipulation and somatic hybridization of plant cells, 1980, Bhabha Atomic Research Centre, Bombay, p. 27.
3. Ma, S. S. and Shii, C. T., *J. Hort. Soc., China*, 1972, **18**, 135.
4. Murashige, T. and Skoog, F., *Physiol. Plant*, 1962, **15**, 473.

SPIROPES GUAREICOLA (STEV.) CIF. CAUSING A NEW STORAGE DISEASE OF ORANGES

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DURING a recent survey of the markets at Bangalore, a diseased fruit of loose jacket orange (*Citrus aurantifolia* Sw.) with dark spots was collected. The disease was characterised by the presence of circular to irregular dark patches scattered irregularly on the surface of fruit. On incubation in a moist chamber maintained at 80% R.H. and 30° C, these spots enlarged and covered a large surface of the rind.

On examination, the infected spots were found to contain two fungi closely associated with each other. Spreading on the surface with thick dark mycelia was the "sooty mould"—*Meliola* sp. and overgrowing this was the fungus which was identified as *Spiropes guareicola* (Stev.) Cif., a Hyphomycete. Small portions from the infected spots were transferred to healthy oranges, surface-sterilised with 95% alcohol and washed with sterile water. Infection was established and discernible black spots appeared within five days, proving the pathogenicity. After repeated transfer on to healthy fruits and microscopic examinations of the infected spots, it was clear that the two fungi were consistently associated with each other, apparently showing the hyperparasitism of *Spiropes guareicola* on *Meliola* sp. Reference has been made earlier[1] to the parasitism of *Spiropes guareicola* on *Meliola*.

Citrus aurantifolia Sw. is a new unreported host for *Spiropes guareicola*. *Meliola* sp. has been reported earlier[2,3] on *Citrus aurantifolia* leaves but not on fruits.

The distinct symptoms on *Citrus aurantifolia* fruits caused by the combination of *Spiropes guareicola* and *Meliola* sp. are reported here and constitute a new storage disease.

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1. Ellis, M. B., *Dematiaceous Hyphomycetes*, Commonwealth Mycological Institute, Kew, Surrey, England, 1971, p. 608.
2. Anonymous, *Indian J. Agri. Sci.*, 1950, **20**, 107.
3. Bilgrami, K. S., Jamaluddin and Rizwi, M. A., *Fungi of India*, Today and Tommorrow's Printers and Publishers, New Delhi, 1979, p. 467.

TWO MOST SUITABLE INDICES OF LODGING FOR WHEAT

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THE problem of lodging has received the attention of several breeders in crop plants. Lodging is of uncertain occurrence and also differs in intensity when it occurs. This necessitated the evolution of indices of lodging in crop plants such as barley, wheat, maize, etc. With the discovery of the association of plant characters with lodging many plant characters such as root weight and plant height have been suggested as indices of lodging resistance. However, no plant character gave consistent assessment and some mechanical devices, such as breaking strength of the lowest internode, pulling resistance, were introduced. But these too are not dependable at times.

Malkani and Vaidya[1] proposed that lodging occurs due to root system being unable to sustain the load of the above ground parts and also due to the inability of the lowest internode to support the weight of the shoot. They proposed that shoot/root ratio and breaking strength/mothershoot weight ratios be used as indices of lodging resistance. Later, Vaidya and Bhag Singh[2] discovered one more index *viz.* breaking strength/height of the shoot, which proved to be the most important among these three ratio indices. The data of Vaidya and Bhag Singh[2] were further analysed and two, 3-character indices *viz.* shoot × height/root

and breaking strength/height × mothershoot were recommended for detailed study.

The controversy over the lodging indices, is due to the fact that a narrow spectrum of genetically varying material was studied by different workers including Vaidya and Bhag Singh[2]. A study of lodging resistance in wheat with 34 widely differing varieties for two years and three locations was, therefore, undertaken at the Indian Agricultural Research Institute in 1967. The 34 varieties studied included 3 old Pusa varieties, 2 varieties from 700 series, 5 varieties from recently developed 800 series, 3 Punjab varieties, 7 recent semi-dwarf varieties, 3 durum varieties used in breeding and 2 durum varities recommended for cultivation, 2 lodging resistant varieties from abroad, 5 varieties from different States of India and 2-three gene dwarfs. This study revealed the following relationship between different ratio indices and lodging resistance. Correlation coefficient of lodging with....

1. Shoot/root ratio	+ 0.570†
2. Shoot × height/root ratio	+ 0.829†
3. Breaking strength/height ratio	− 0.493†
4. Breaking strength/mothershoot ratio	+ 0.024
5. Breaking strength/height mothershoot ratio	− 0.659†

It was thus seen that two, 3-character lodging indices were better indicative of lodging resistance than the other 2-character ratios. Shoot × height/root can be taken to indicate the balance at the root level while breaking strengh/height × mothershoot indicate the balance at the lowest internode. These results are in conformity with those reported earlier.

Further study of these ratios indicated that the three, 2-character ratios, shoot/root, breaking strength/height and breaking strength/mothershoot, together accounted for 53.5% of lodging resistance ($R = 0.731$) whereas the two, 3-character ratios together accounted for 70.3% of lodging resistance ($R = 0.837$). Another interesting fact was that even in the absence of differences in breaking strength/height × mothershoot, shoot × height/root showed a correlation coefficient of + 0.690† with lodging; whereas in the absence of differences in shoot × height/root ratio, the breaking strength/height × mothershoot gave a non-significant correlation coefficient of − 0.221. This meant that lodging in wheat occurs primarily due to loss of balance at root level indicated by shoot × height/root ratio and is further aggravated if the loss of balance also occurs at the lowest internode level as indicated by breaking strength/height × mothershoot ratio. An additional proof of the relatively higher dependability on shoot × height/root index was given by path coefficient for this index (+ 0.481) as compared to − 0.263 for breaking strength/height × mothershoot ratio.

Theoretically, lodging in plants such as wheat, barley or oats, occurs at one or two levels *viz.* at the root (soil) level and/or at the lowest internode level. The above data showed that the two, 3-character ratio indices are highly efficient in expressing this loss of balance. Since the study was based on genetically widely varying material and was conducted for two years at three lacations, these two, 3-character ratio indices *viz.* shoot × height/root and breaking strength/ height × mothershoot, should be taken as the most suitable indices of lodging resistance in wheat.

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† Statistical significance.

1. Malkani, T. J. and Vaidya, S. M., *Indian J. Genet.*, 1956, **16**, 121.
2. Vaidya, S. M. and Bhag Singh, *Sci. Cult.*, 1963, **29**, 247.

METABOLIC DEPRESSION IN THE FRESHWATER TELEOST, *CYPRINUS CARPIO* EXPOSED TO AN ORGANOPHOSPHATE PESTICIDE

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ORGANOPHOSPHATE (OP) pesticides extensively used during public health operations to eradicate disease vectors inhabiting aquatic ecosystems, are known to cause respiratory distress in non-target aquatic biota like fish[1,2] which would create a physiological imbalance. The rate of oxygen consumption in fish is considered as a reflection of the total metabolism and hence the metabolic state of the fish. In the present investigation effect of methylparathion, an OP pesticide, widely used in this area has been studied on the rate of the whole animal oxygen consumption of the fish, *Cyprinus carpio*.

Details of maintenance of fish, *Cyprinus carpio* and computation of lethal concentration (LC) were previously described and the calculated LC_{50}/48 hr was 12 mg/litre[3]. Whole animal oxygen consumption was measured in the fish exposed to lethal concentration (12 mg/litre) after 1, 3, 6, 12, 24 and 48 hr of lethal exposure by adopting Winkler's *iodimetry*[4,5] and in each experimental group fish with a mean body weight of 35 ± 1 g are used to avoid the differences in oxygen uptake due to differences in body weight.

The results presented in table 1 indicate steady decline in the rate of oxygen uptake by the fish