Letters to the Editor

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THE EXOCUTURAL UREASE IN RICE ROOTS

Several workers1-3,5 have reported the occurrence of free exocutural enzymes in soils which can solubilize macromolecular constituents of organic soils permitting uptake and utilization of the resultant low molecular weight organic compounds by the plants. But the exocutural accumulation and nature of urease (EC 3.5.1.5) in the rice root tips has not so far been reported. The present work deals with the exocutural accumulation of urease, in 5 high yielding varieties of rice. The distinction has been made between (A) urease apparently bound to the root surface, (B) exocutural urease released into the culture medium.

Improved varieties of rice (Oryza sativa L. var. Ratna, Kaberi, CO-13, TN-1 and MTU-17) were soaked in water for 12 hrs followed by surface sterilization with a soak in 0.1% mercuric chloride solution for 15 minutes and finally washed several times with sterile distilled water. The soaked seeds were germinated in a sterile moist chamber at room temperature and used at an age of 4 to 5 days when the roots of the seedlings were ca. 50 mm in length. The inorganic nutrient solution was prepared as described by Yoshida et al.6.

Two incubation methods were followed. For method (A), 8 intact seedlings each ca. 50 mm in length, were incubated at 27°C with 2 ml of 10% urea and 13 ml of inorganic nutrient solution. At 3, 6, 9, 12 hours intervals one ml of the reaction mixture was removed and the amount of urea hydrolyzed was determined by the standard method. In the second method (B) the eight seedlings were suspended in tubes containing 13 ml of inorganic nutrient solution. Samples of 1 ml of the nutrient were removed from the tubes at 3, 6, 9, 12 hours intervals and incubated with 2 ml of 10% urea solution. Rates of the reaction were determined as per method (A) above.

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ad 37·5 μ, separabiles. Contextus succulentus, albus, et hypsis tenues marum intereuntur constantibus.

Lamelleae discreteae, albae, eubescentes, ad 4 mm latae. Lamelleae ad 4·5 cm longae, uniformiter crescentiae, glabae. Ipse-olue (5A2), ad croceo-olue (5A2), cyaneo-collae, solidos, sinea annulo. Psororhiza ad 2·5 cm longa. Tramna hypsidiarum regularia, hypsis tenues marum paralellum ad septa conficiernae, constantia. Basidia 20·0-22·0 μ, 6·0-9·0 μ, clavata, 4 sterigmatu, et cheliocystidia et pleurocystidia nulla. Spores 6·0-9·0 μ, ellipsoidae, laeves, submicroscopio hyaline, non amyloideae. Fibulae nulla.


Pileus up to 3·5 cm in diameter, convex, becoming plane convex to plane with a prominent spineform percurrent, surface orange white (5A2) becoming orange grey (5B2) when mature, smooth. The centre of the pileus in the region of percurrent vandyke brown (6F6) in colour. Pileus surface an epicutis, consisting of radially arranged repent hyphae 1·5-4·0 μ wide. The context is separable from the epicutis by a layer of inflated thin walled hyaline hyphae which are up to 37·5 μ. Context fleshy, white, consisting of thin walled interwoven hyphae. Lamellae free, white, becoming pink, up to 4 mm broad. Lamellulae present. Stipe up to 4·5 cm long and 5 mm broad, uniformly thick, glabrous, yellow white (4A2) to orange white (5A2), cylindrical, solid and without annulus. Pseudorhiza present, up to 2·5 cm long. Hyposphoral trama regular, consisting of thin walled parallel hyphae, constricted at septa. Basidia 20·0-22·0 μ, 6·0-9·0 μ, clavata, bearing 4 sterigmata. Both cheliocystidia and pleurocystidia absent. Spores 6·0-9·0 μ, ellipsoid, smooth, hyaline under the microscope, non-amyloid, clamp connections absent.


The presence of a dark coloured spiniform percurrent and a short pseudorhiza and absence of pleurocystidia and cheliocystidia differentiate this species from other species of the genera Praetermitomyces like T. microcarpus,5 T. medius6, T. orientalis6, T. narobiensis6, T. tylariana5, T. badius5 and T. indicus6.

This species which occur in abundant quantities is edible.

Thanks are due to Rev. Fr. K. M. Matthew S.J., St. Joseph’s College, Tiruchirappalli, for correcting the Latin diagnosis and to Dr. E. Horak, ETH, Institut für Spezielle Botanik, Zürich, for his valuable comments.

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One urease number is defined as that amount of enzyme which liberates 1 mg of nitrogen as ammonia from urea under the assay conditions described above. Multiplication of the urease No. by 0.32 is expressed as the urease unit.

The roots of intact rice seedlings were tested for their ability to hydrolyse urea. Table I presents urease activities as determined by both the

**Table I**

(A) Exocellular enzymes bound to root surface and
(B) Exocellular enzymes released to nutrient solution.

Data expressed as urease units

<table>
<thead>
<tr>
<th>Variety</th>
<th>Method</th>
<th>Incubation period (hrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Ratna</td>
<td>A</td>
<td>7·36</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0·19</td>
</tr>
<tr>
<td>-Co-13</td>
<td>A</td>
<td>6·72</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>0·16</td>
</tr>
<tr>
<td>Kaberi</td>
<td>A</td>
<td>3·20</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>..</td>
</tr>
<tr>
<td>TN-1</td>
<td>A</td>
<td>4·48</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>..</td>
</tr>
<tr>
<td>MTU-17</td>
<td>A</td>
<td>2·88</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>..</td>
</tr>
</tbody>
</table>

methods A and B. As can be seen urease activity could be detected when the roots of the seedlings were in contact with the substrate (Method A). Low urease activity was also found in the root culture medium (method B). The reaction rate for urease activity, as measured by procedure A, is essentially a linear function of time. In the case of activities measured by procedure B, the rate of release of enzyme into the nutrient immersing the roots, is again almost a linear function of time. The urease activity is high in varieties Ratna and CO-13, medium in varieties Kaberi and TN-1 and low in MTU-17.

These results suggest that exocellular urease associated with the rice roots may hydrolyze organic soil substances independent of soil microbial activity.

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**CHROMOSOME ANALYSIS OF TWO SPECIES OF LOBULARIA (CRUCIFERAE)**

Lobularia belongs to the tribe Alysseae of Cruciferae. Two species of the genus, namely, *L. libyca* (Viv.) Meissn. and *L. maritima* (L.) Desv. were studied for an analysis of karyotype details.

Figs. 1-6. Figs. 1, 1 a and 2. Lobularia libyca, 1 and 1 a, Somatic metaphase with 2n = 22 chromosomes and its ideogram. 2. Metaphase II of meiosis showing 11 chromosomes in a nucleus. Figs. 3, 3 a, 4 and 5. Lobularia maritima. 3 and 3 a, Somatic metaphase with 2n = 24 chromosomes and its ideogram. 4 and 5, Metaphase I and II showing 12 bivalents and 12 chromosomes respectively. Fig. 6. Histogram showing the total amount of chromatin matter in length of the haploid complements of the two species of Lobularia.

**Materials and Methods**

Seeds of the two species were obtained through the courtesy of Hortus Botanicus Hauniensis,