FRUIT PRODUCTION AND BIOCHEMICAL ASPECTS OF SEEDS OF
Euryale ferox Salisb. UNDER EX-SITU CONDITIONS

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Abstract

Ex-situ culture studies of Euryale ferox Salisb. using fresh mature seeds were carried out in an
arboretum. Production of fresh fruit has been estimated to be 3.05 t/ha. Biochemical analysis of the seeds
revealed 61% carbohydrate, 15.6% protein, 12.1% moisture, 7.6% fibre, 1.8% ash and 1.35%
fat. The seeds
were found to contain 12 amino acids, which are histidine, leucine, isoleucine, glutamic acid, lysine, tyrosine,
valine, aspartic, threonine, alanine, methionine and arginine.

Introduction

Seeds of Euryale ferox Salisb. is eaten raw in many parts of Bangladesh as well as in some
other countries of South East Asia. Fruits of E. ferox are known as 'Makhna' in Bangladesh. Haor
basins of Kishoreganj, Maulvi Bazar and Sylhet districts and in some parts of Naogaon district
of Bangladesh are the areas of large scale production. Poor residents of the Haor basin are dependent
fully on the natural production of Makhna fruits. But no effort was taken to cultivate Makhna ex-
situ or to analyse the contents of its seeds in terms of protein, carbohydrate, fats, etc. (Majid 1986,
Irfanullah 2002).

In the present study, an ex-situ culture of E. ferox for the production of Makhna fruits, and
also biochemical contents of seeds produced have been investigated.

Materials and Methods

Euryale ferox Salisb. was propagated via seeds. Fresh and mature fruits of E. ferox were
collected on April 26, 2002 from a local market of Dhaka metropolis where the item is regularly
sold. After the fruits were brought to the laboratory it was incised and the seeds were taken out
and set for germination. The germination was carried out in an earthen bin. It had a diameter of 77
and a depth of 40 cm and buried on the ground in such a way that the rim remains 6 cm above.
Nearly one third of the volume of the bin was filled with 10 kg loam mixed with composted cow
dung (1 : 1) and then it was filled with tap water. At the end of April 2002, a perforated poly-bag
containing 30 healthy seeds of E. ferox were sown in the soft and submerged mud of the bin. At
the time of germination following environmental factors such as air temp. (31ºC), water temp.
(33ºC), pH (7.17), TDS (302 mg/l), conductivity of water (664 μS/cm, alkalinity (3.15 meq/l), and
DO (12.20 mg/l) were recorded. After a period of three - four weeks, 14 seeds germinated. The
seedlings were transferred after a month to another smaller shallow concrete tank situated at
the Botanical garden, Department of Botany, University of Dhaka. In June, the plantlets grew up to 30
- 40 cm in height, and the plantlets were transferred to a concrete cistern of 90 cm wide and 200
cm long, where the bottom was filled with composted cow dung mixed with loam up to 30 cm
height. Immediately after transplantation tap water was added in the cistern in such a way that
only the leaves of the plants remained afloat. The water surface was adjusted every day as per
growth of plants.

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Fresh seeds obtained from 36 mature fruits of *E. ferox* were crushed in a mortar with a pestle. The crushed material was used to determine the amount of protein, ash, fat, moisture, fibre and carbohydrate content (Nat. Inst. Nutrn. 1976). Moisture content was determined with the help of a moisture meter (IB-30, Brand Chyo) and protein was determined by Microkjeldhal method. The ash content was determined in a Muffle furnace (Carbolite RHF-1600).

For analysis of amino acids, seeds were crushed and a fine paste was made by mortar and pestle and transferred in 250 ml round bottom flask placed in a heating mantle at 110°C for 24 h with 6N HCl. The solution obtained was kept in an evaporating dish to evaporate HCl on water bath. It was then filtered to 25 ml volumetric flask through Whatman No. 9 filter paper and columned with 0.1N HCl. The solution was run through an Amino acid analyser (Schimadzu, Japan). The analyser showed the standard curve for standard solution and another curve for sample solution. By comparing the two curves the amount of amino acids was calculated.

**Results and Discussion**

*E. ferox* is a hermaphrodite plant having small violet-blue flowers, with petals paling to white in the centre, and up to 4 - 5 cm long. The flowers remain just above the water during the summer and short lived. The rounded dark purple fruits were 5 - 10 cm in diameter and contain 78.4 ± 30.8 round black seeds and 6 - 10 mm in diameter (Fig. 1). Fresh weight of each seed is 0.97 g. *E. ferox* produces 8 - 25 fruits per year per plant and the mean fresh weight of each fruit is about 157.3 g. A production of 3.05 ton/ha of fresh fruit could be achieved by applying the present culture technique.

![Images of *Euryale ferox* fruits and seeds](image_url)
During the present investigation, biochemical analyses of seeds of *E. ferox* showed that seeds are extremely nutritious, containing 61.2% carbohydrate, 15.6% protein, 1.3% fat, 7.6% fibre, 1.8% ash and 12.5% moisture. The food value of 100 g of seeds is equal to the same amount of fish. Read (1946) reported biochemical composition of *E. ferox* and found to be composed of carbohydrate (75.7%), protein (9.9%), fat (0.3%), and ash (0.6%). In the present material protein content was 1.6 times higher while fat content was about 5 times higher than that reported by Read (1946).

Table 1. Amino acids in the seeds of *Euryale ferox*.

<table>
<thead>
<tr>
<th>Amino acid</th>
<th>% of dry weight</th>
<th>Amino acid</th>
<th>% of dry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aspartic acid</td>
<td>0.33</td>
<td>Isoleucine</td>
<td>1.07</td>
</tr>
<tr>
<td>Threonine</td>
<td>0.60</td>
<td>Leucine</td>
<td>1.44</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>0.92</td>
<td>Tyrosine</td>
<td>0.83</td>
</tr>
<tr>
<td>Alanine</td>
<td>0.46</td>
<td>Histidine</td>
<td>1.60</td>
</tr>
<tr>
<td>Valine</td>
<td>0.82</td>
<td>Lysine</td>
<td>0.88</td>
</tr>
<tr>
<td>Methionine</td>
<td>0.36</td>
<td>Arginine</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Thus seeds of *E. ferox* during present investigation contained a total of 12 amino acids (Table 1). Das et al. (2006) reported cardioprotective properties of *E. ferox* and suggested that such cardioprotective properties may be linked with the ability of *E. ferox* to induce thioredoxin-related protein-32 (TRP32) and thioredoxin-1 (Trx-1) proteins and to scavenge reactive oxygen species (ROS). The seeds are also of great traditional medicinal value. According to Phang (2002) protein of *Arthrospira (=Spirulina)*, a non-conventional aquatic source of nutrition contains isoleucine (3.5 - 4.1%), leucine (5.4 - 5.8%), lysine (2.9 - 4.0%), methionine (3.5 - 4.1%), phenylalanine (2.8 - 4.0%), threonine (3.2 - 4.2%), tryptophan (0.91-1.1%) and valine (4.0-6.0%). It appeared that the contents of different amino acids in the seeds of *E. ferox* (Table 1) is low compared to those of *Arthrospira*. However, the carbohydrate content of the *E. ferox* (61.2%) is higher than that of *Spirulina* (13 - 25%).

References


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