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NOTE

Composition of *Egeria densa*

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INTRODUCTION

Brazilian elodea or egeria (*Egeria densa* Planch.) is a submersed, perennial, monocot that has been reported as a nuisance species in the United States and other parts of the world (Mitchell, 1974, Bowmer *et al.*, 1979, Roach, 1977). Egeria reproduces only asexually in this country, but is spread rapidly by stem fragmentation (Getsinger and Dillon, 1984), and, by virtue of its competitive superiority (Hough, 1979), displaces native species. Widespread growth of this aquatic weed seriously impairs the multiple uses of surface water and promotes eutrophication (Mulligan, 1969; Roach, 1977). Numerous, largely unsuccessful, attempts have been made to control egeria infestation by chemical means. High costs, public concern for phytotoxic concentrations of chemicals in water and other environmental considerations have sometimes limited or precluded the use of herbicides (Bowmer *et al.*, 1979; Sculthorpe, 1967). Removal of the plants by mechanical harvesting may be feasible if the lake or pond basin is conducive to that type of activity and may be preferred if the plant has economic value.

An awareness of the food situation in the world today prompts interest in the possibility of developing unconventional feeds or feed ingredients from aquatic plants (Boyd, 1968, 1970a; National Academy of Sciences, 1976) to offset or supplement deficiencies in conventional agriculture. Pirie (1980) showed that some aquatics are a source for feed and fertilizer and Boyd (1970b) early showed that they may be used to strip nutrients from the water.

Because egeria is a nuisance plant in South Carolina, specifically in the Santee-Cooper Reservoir (Roach, 1977) and in other sites, a study was undertaken to investigate the potential, economic value of the plant as a feed ingredient. That study resulted in a paper describing the chemical composition of a meal produced from the sun dried plant and the effects on growth when the meal was fed to broiler chicks (Maurice *et al.*, 1984). Because the paper was published in a journal not likely to be accessed by students of aquatic plants, the results of the chemical analyses of the plant are given here.

MATERIALS AND METHODS

Egeria used in the study was obtained from the Santee-Cooper Reservoir through the courtesy of Mr. Howard Roach of the Santee-Cooper Public Service Authority. Monchks Corner, SC. Approximately two tons (1814+ kg) of the plant were hand harvested in September and trucked to the Clemson campus. The material was sun-dried on an asphalt slab, crushed in a hammer mill and ground to a meal in a Wiley mill. Proximate analysis of the meal was accomplished by the methods of the Association of Official Analytical Chemists (1975). Acid-detergent fiber was determined by the method of Goering and Van Soest (1970). Caloric value was determined with an adiabatic bomb calorimeter (Parr Instrument Co. Model 1241). The egeria meal was prepared for elemental analysis by wet digestion. Approximately .5 *g* of dried sample with 10 *ml* 16 *M* nitric acid was heated at 100 C for 4 *h*. Ten milliters of 30% perchloric acid was added to the digestate and samples heated for 30 *min*. The samples were brought to a total volume of 5 *ml* with distilled water. The accuracy of the method was tested with NBS-SRM 1577 bovine liver. The egeria meal, elemental profile was determined by plasma emission spectrometry (Jarrell-Ash Atomcomp Model 750) and the level of copper, zinc, manganese, lead, etc. by atomic absorption spectrophotometry (Perkin-Elmer Model 503). Amino acids, except for tryptophan, were determined by ion exchange chromatography (Spackman *et al.*, 1958) using an automatic amino acid analyzer (Model K-8000 VG, Phoenis Precision Instrument Co.) after reflux hydrolysis under nitrogen in 6 *M* hydrochloric acid. Cystine and methionine were determined from performic acid oxidation (Moore, 1963).

RESULTS AND DISCUSSION

Except to say that egeria meal may be used as an unconventional, low-cost,feed ingredient in broiler diets at 5% of total diet, with no adverse effects on growth and efficiency, the results of the rather extensive feeding experiments will not be given here, but may be obtained from Maurice *et. al.*, (1984).

The proximate analyses, amino acid, elemental profile, and caloric value of the sun-dried meal are given in Table 1. When compared to corn and other cereals (NRC 1977), the meal contained considerably more lysine and glycine and was superior to both corn and soybean meal with respect to calcium, phosphorus, and trace elements, particularly iron, manganese, and potassium. The potassium content of the meal was higher than the values reported for all feed ingredients (NRC, 1977) except for beet molasses (4.38%).

The proximate analyses generally agree with those reported by Boyd (1968). The sample of egeria used in our study was lower in crude protein and contained a higher amount of ether extract than values Boyd reported. Such differences may be brought about by sampling method or by environmental influences. Boyd (1970c) and Best (1977)

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TABLE 1. CHEMICAL COMPOSITION OF SUN-DRIED EGERIA PREPARED AS A MEAL.

Component	%	Component	%
Crude protein[2]	13.00	Ash	20.20
Lysine	.51	Calcium	1.39
Histidine	.28	Phosphorus	1.39
Arginine	.68	Potasium	3.28
Aspartic acid	1.28	Magnesium	.53
Threonine	.46	Iron	1.93
Serine	.58	Manganese	.53
Glutamic acid	1.02	Sopdium	.69
Proline	.52	Aluminum	.15
Glycine	1.01	Copper, ppm	39
Alanine	.59	Zinc, ppm	157
Cystine	.06	Cobalt, ppm	60
Valine	.44	Chromium, ppm	13
Methionine	.10	Nickel, ppm	4
Isoleucine	.36	Lead, ppm	127
Leucine	.76	Cadmium, ppm	8
Tyrosine	.48	Strontium, ppm	8
Phenylalanine	.44	Barium, ppm	508
Ether extract	10.20		
Acid detergent fiber	25.90		
Gross energy kcal/g	2.91		

[1]Based on sun-dried egeria meal containing 12.3% moisture.
[2]Amino acid values reported as percentage of the original sample.

showed that nutrient concentration in aquatic macrophytes is influenced by both physiological and environmental factors and further, Boyd (1979, 1970c,d) showed a wide variation in nutrient profiles, including the amino acid and mineral content. The amino acids in our egeria sample accounted for approximately 76% of crude protein which is in general agreement with Boyd (1979) who found recovery values in the range of 73 to 83%. Though not determined in our study, Boyd (1968) found that egeria had the lowest tannin content (0.08%) of 32 hydrophytes surveyed.

Sculthorpe (1967) addresses the fact that many genera of the Hydrocharitaceae (to which egeria belongs) serve as important food sources for wildfowl. Our own superficial surveys of wild duck crops indicate that egeria is taken fairly freely and copiously. From that standpoint, it is interesting to speculate on the dietary effect on wildfowl, of lead in the sample, as implied by the effect on poultry. At 127 ppm sample, the concentration is insufficient to suppress weight gain in domestic chicks, suppression occurring at 1000 and 2000 ppm/chick (Domron *et al.,* 1969); however, lead concentrations as low as 10 ppm caused an increase in egg fragility for laying hens (Whisenhunt and Maurice, 1981). Juxtaposed is the especially high manganese levels in the sample, high levels of which have been shown to decrease shell breakage in laying hens (Whisenhunt and Maurice, 1985). Wildfowl possibly receive a greater proportion of any trace element depending on the proportion of total diet comprised by the plant. In these poultry studies, egeria comprised only 5-10% of the total diet.

This study did confirm suggestions (Boyd, 1970a, Pirie, 1980) that aquatic weeds may be used as feed ingredients. No adverse effects were seen in fast growing broiler chicks up to 7 weeks of age, when egeria was included as a meal at 5% on a nutrient basis. At this level, nutrients in the dried plant were well utilized as suggested by the performance in all trials.

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