Viable Algal Cells from the Gut of the Gizzard Shad *Dorosoma cepedianum* (LeSueur)[1]

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Tiffany (1921, 1922) apparently was the first to make a careful analysis of the food of the gizzard shad. He identified 150 species and varieties of algae from only a few shad, which caused him to refer to this fish as "about the most wonderful tow net that one could desire."

In June 1962 I attempted to determine the viability of algae removed from various positions in the guts of three gizzard shad from Lake Texoma: two adult fish that weighed about 300 grams each, and one young-of-year fish that weighed 4 grams. The adults were captured in a trap net set about 20 feet deep. The trap was emptied once each day and therefore any fish in it could have been there as long as 24 hours. The small shad was seined in shallow water and used within a few hours after capture.

At least two similar studies of algal viability had been made prior to this. Valasquez (1939) inoculated various culture media with the contents of different regions of the guts of several gizzard shad. In these cultures he found 49 species and varieties of algae representing 27 genera. His best cultures were developed in Detmer's solution, a culture medium composed mainly of calcium nitrate in tap water. Lefevre (1940) found that numerous species of algae remained viable after passage through the guts of three fishes, *Cyprinus carpio, Gordonus rustilus,* and *Brama brama.* Feces of these fishes were used to inoculate culture media.

I attempted to culture algae in a medium consisting of a distilled water extract of soil. Approximately 1 tablespoon full of subsoil which was apparently free of organic matter was placed in each of six 250 ml Erlenmeyer flasks along with 200 ml distilled water. These flasks were capped with aluminum foil and sterilized in a pressure cooker. During this time six 500 ml Erlenmeyer flasks had been stoppered with cotton and heated overnight in an oven at 110 C. When these and the 250 ml culture flasks had cooled, a portion of the hind gut of each of the larger shad was removed near the anus and the contents stripped with forceps into the 500 ml flasks. Then the soil extract was decanted into the 500 ml

[1]Contribution of the University of Oklahoma Biological Station, Lake Texoma.

flasks, leaving most of the soil in the small vessels. In addition to this the gizzards of the larger fish were cut open and their contents transferred to other culture flasks with a sterile bacteriological loop.

Because of the small size of the intestine and gizzard of the smaller shad a portion of the intestine and the entire gizzard were teased apart on separate microscope slides with a small amount of culture medium and then washed into their respective culture vessels.

All of the 500 ml cotton stoppered culture flasks were then placed in a north window of the algology laboratory of the University of Oklahoma Biological Station from July 4 until the cultures were examined, beginning on July 26 and continuing until July 29. Room temperature during this period varied from the mid 80's to the high 90's.

A portion of the gut contents of one of the large shad was preserved in formalin for miscroscopic examination and comparison with any algae obtained from cultures from the same gut. The algal contents of the gizzards and hind guts of two additional gizzard shad of comparable size were also examined fresh for comparative purposes.

Twenty-two days after the cultures were started the examinations began. Each culture was put through a Forset plankton centrifuge to reduce the volume to 10 to 20 ml. Several portions of each culture were examined miscroscopically with great care and the algae identified to genus using keys in Prescott (1954) and Smith (1950). Identifications were verified by Dr. William C. Vinyard. No attempt was made to identify the diatoms.

A total of 33 genera of algae were identified in the cultures and in the contents of fresh and preserved guts and gizzards (Table I). Cultures from hind guts and gizzards contained 26 and 21 genera respectively; uncultured gut and gizzard contents included 19 and 8 genera respectively. Eleven genera found in cultures from the hind guts were not found in uncultured gut contents, whereas only four genera found in uncultured gut contents were not in the cultures from the hind guts. Three of these four were represented by a single cell or colony. Sixteen genera found in cultures from gizzards were not found in uncultured gizzard contents, whereas only three genera found in uncultured gizzard contents were not in cultures from the gizzards.

Of the twenty-seven genera of algae reported by Valasquez (1939) to have remained viable after passing through the gut of the gizzard shad, I found eleven. Nineteen additional genera were present in my cultures, bringing the total number of genera of algae known to pass through the gut of the gizzard shad in a viable condition to 46.

The greater variety of identifiable algae in the cultures strongly indicates the advantage of the culturing technique over mere examination of the gut contents in making a complete and careful determination of the algal food of fishes and other animals. The technique would be equally useful in studies of the algal flora of bodies of water, supplementing the more conventional techniques.

TABLE I. GENERA OF ALGAE IDENTIFIED FROM THE CONTENTS OF GIZZARDS AND HINDGUTS AND FROM CULTURES OF THE CONTENTS OF GIZZARDS AND HINDGUTS OF THE GIZZARD SHAD.

		Cultures from gizzards	Cultures from hindguts	Uncultured gut contents	Uncultured gizzard contents
EUGLENOPHYTA	*Euglena*	X	X	X	
	Lepocinclis	X	X		
	Phacus	X	X	X	
PYRRHOPHYTA	*Ceratium*	X			
	Gymnodinium			X*	X*
CHRYSOPHYTA	*Ophiocytium*		X		
	Diatoms	X	X	X	X
CYANOPHYTA	*Anabaena*	X	X		
	Aphanothece		X		
	Chroococcus	X	X	X	X
	Fremyella	X	X		
	Lyngbya		X	X	X
	Merismopedia		X	X	
	Microcystis	X	X	X	?
	Oscillatoria	X	X		
CHLOROPHYTA	*Ankistrodesmus*	X	X		
	Chlamydomonas	X	X		
	Chlorella		X		
	Closterium	X		X	X
	Coelastrum	X	X	X	
	Cosmarium	X			X
	Crucigenia	X	X	X	
	Eudorina			X*	
	Mougeotia		X		
	Oedogonium		X	X	
	Oocystis		X	X	
	Pandorina	X	X	X*	
	Pediastrum	X	X	X	
	Platydorina			X*	
	Pleodorina	X			
	Scenedesmus	X	X	X	X
	Spirogyra				X*
	Staurastrum	X	X	X	
	Tetraedron		X		
		21	26	19	8

*Only one cell or colony representing these genera was found in the samples examined.

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