Food Preferences Of Yearling Hybrid Carp

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ABSTRACT

Studies of food habits of yearling hybrid carp (*Ctenopharyngodon idella* Val. X *Cyprinus carpio* L.) revealed a preference for plant species, but 11% utilized green sunfish (*Lepomis cyanellus* Raf.) advanced fry after 3 wk without plant food. Thirty aquatic plant species were ranked according to the degree each was utilized as food by the hybrid carp. Feeding trials in which six hybrid carp were offered three plant species for five 10-hr periods were used. Fine-textured plant species, such as water meal (*Wolffia columbiana* Karst.), chara (*Chara vulgaris* L.), southern naiad (*Najas guadalupensis* (Spreng.) Magnus), and pithophora (*Pithophora* sp. L.) were preferred to species with coarse vegetative parts. Species not utilized by the hybrid carp included waterhyacinth (*Eichhornia crassipes* (Mart.) Solms.), alligatorweed (*Alternanthera philoxeroides* (Mart.) Griseb.), and egeria (*Egeria densa* Planch.). Hybrid carp were found to have food habits similar to the white amur (*Ctenopharyngodon idella* Val.).

INTRODUCTION

A primary thrust in aquatic weed research during the past decade has been evaluation of a variety of organisms as potential biological control agents, including pathogenic bacteria and fungi, insects, and herbivorous fishes. Two extensively studied fishes, Israeli carp (*Cyprinus carpio* L.) and white amur have been shown to effectively control aquatic vegetation. Israeli carp were effective only in controlling filamentous algae (1, 6, 8, 11). White amur were less specific and effectively controlled many species of aquatic plants (1, 4, 7). As a result, white amur have been released for weed control purposes in some areas of the United States (2, 5).

Many fisheries biologists have protested the release of white amur into native waters. In 1972, the Louisiana Wildlife and Fisheries Commission banned the introduction of white amur into Louisiana due to its potential threat to the marsh ecosystem, and to the crayfish (*Procambarus clarkii* Girard), fur, and rice industries. A major concern was that wild white amur would successfully reproduce and reach harmful population levels. A fish was needed which possessed food habits of white amur but lacked breeding potential. Hybrid carp, resulting from a white amur male and Israeli carp female cross, were spawned in May 1972 at the United States Department of Interior Fish Farming Experiment Station in Stuttgart, Arkansas by Jon Stanley. The hybrid carp were thought to be sterile due to differences in chromosomal complements of the parent fish (2N = 48 in white amur and 2N = 102 in Israeli carp). Objectives of this study were: 1) to determine general food habits of yearling hybrid carp; 2) to rank 30 species of aquatic plants found in Louisiana in order of preference as food for hybrid carp; and 3) to compare aquatic plant preferences of hybrid carp with those of the white amur parent.

METHODS AND MATERIALS

The Louisiana Wildlife and Fisheries Commission obtained 1400 hybrid carp on 24 April 1973. One hundred yearling fish were sent to Northwestern State University, and the remainder were kept in ponds on the Louisiana State University campus. Fish used in this study were acclimated in a tank at 20 C for 2 wk prior to initiation of the feeding trials. The hybrid carp had only been fed commercial catfish pellets after hatching, and a preliminary objective was to determine if the fish would eat vegetation at all. Twelve aquatic plant species were individually introduced into an aquarium with six randomly-selected fish, and the hybrid carp fed on each species.

Plant Preference Study. Each of three 84.5-liter aquaria were divided into three compartments by two screen wire partitions extending 8 cm below the water surface to separate plants used in feeding trials but allow fish equal access to each plant species. Three feeding trials, each consisting of offering 10 g of each of three plant species to six hybrid carp daily for five 10-hr feeding periods, were conducted weekly. The aquarium used for each trial and the compartment to receive a particular plant species was selected randomly each day. Fish used in trials were selected randomly and changed weekly. Plant species used each week were immersed in water, removed, centrifuged for 2 min at 1200 rpm, and weighed. Plant tissue remaining after 10 hr was removed and treated as above. Differences in plant weights before and after feeding trials represented consumption by the hybrid carp.

Controls for each plant species were determined by placing 10 g of plant tissue into an aquarium without fish for five 10-hr periods. Average weight change was determined using the same procedure as in feeding trials. The average weight change was appropriately added to or subtracted from daily consumption of each plant species, and adjusted mean daily consumption values were used in statistical analysis of data.

Analysis of variance of each trial, in which three plant species were treatments and 5 days were replications,

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was used to determine whether treatment means varied significantly. An LSD test (Least Significant Difference) was then used to determine which treatment means varied significantly in trials where the F value was significant at the .05 probability level (10).

It was assumed that a preference list of 30 plant species could be constructed without using all possible trial combinations. The preferred species of a trial was tested in combination with preferred species of two other trials. If species *A* was preferred to species *B* and *C* in one trial, and species *D* was later determined to be preferred to species *A*, then species *D* was considered to be preferred to species *B* and *C*. Trials were continued until all species were ranked according to their preference as food for hybrid carp. In trials where no species was preferred, the species eaten to the greatest extent was used in subsequent trials, and the other two species were ranked adjacent to the advanced species when its position in the list was determined.

Fry Study. An experiment was conducted to determine the extent to which hybrid carp would utilize fry of other fish as food. Each of three 84.5-liter aquaria containing six hybrid carp (averaging 50 g) and 25 green sunfish advanced fry were monitored daily for 3 wk. No other food was available to the carp, and the experiment was designed to continue until the carp either starved or began eating fry. The experiment was terminated when the number of fry remaining in one aquarium was noticeably reduced. Additional experiments were used to determine the percentage of hybrid carp which were feeding on green sunfish fry. Hybrid carp known to take fry were then offered hydrilla and green sunfish fry for 1 wk.

RESULTS AND DISCUSSION

Plant Preference Study. A list of plant food preferences and mean daily consumption of hybrid carp is presented in Table 1. Not all species are significantly different from each other, but must be considered as five major preference groups. Water meal is preferred over all other species. Group II consists of chara and duckweed. Species within a group are ranked according to mean daily consumption by the hybrid carp. Group III (species 4 to 11) includes southern naiad, pithophora, eastern bladderwort, southern water grass, slender spikerush, snailseed pondweed, and slender pondweed. Considerable amounts of these species are consumed in trials not involving species of groups I and II. Group IV (species 11 to 20) includes eurasian watermilfoil, hydrilla, watershield, and cabomba, among others. These species are sparingly chosen as food by the carp only in trials involving species 20 through 30, which comprise Group V. Important aquatic weed species not utilized by yearling hybrid carp include water lettuce, parrotfeather, floating bladderwort, waterhyacinth, alligatorweed, and egeria. However, no trials were conducted in which any of these species was the only food available to the carp.

Plant species in groups I through III are fine-textured with smaller plant parts than most species in groups IV and V. The relatively small size of the hybrid carp prevented utilization of plant species with large vegetative structures, such as egeria, waterhyacinth, and alligatorweed. Larger fish, capable of ingesting large vegetative structures, would not be limited to fine-textured species.

By comparison to food habits of 12 to 16 inch white amur (1), chara, southern naiad, and slender spikerush ranked 1-2-3 on a list of plant species common to both studies. Chara was also utilized extensively in studies conducted by Penzes and Tolg (7). The similar results indicate that hybrid carp have some food preferences of white amur. However, significant utilization of pithophora by hybrid carp suggests that they have some of the food habits of Israeli carp (11). Sills (9) noted that white amur will feed on filamentous algae, but prefer macrophytes. Utilization of pithophora by the hybrids could be of significance in management of farm ponds where pithophora is often a serious problem.

Fry Study. Some hybrid carp were found to utilize green sunfish advanced fry after 3 wks without plant food. The number of fry in one of three aquaria decreased from 25 to 5, while only one or two fry were missing from the other two aquaria. The presence of bones and scales of green sunfish in hybrid carp fecal pellets and the observation of a hybrid carp in the act of taking a fry were evidences supporting the conclusion that the hybrid carp in one aquarium were utilizing green sunfish as an alternative food supply.

The six hybrid carp from the aquarium where green

TABLE 1. PLANT SPECIES PREFERENCE LIST AND MEAN DAILY CONSUMPTION FOR HYBRID CARP.

SPECIES	COMMON NAME	CONSUMPTION[a]
1. *Wolffia columbiana* Karst[b]	Water Meal	7.2
2. *Chara vulgaris* L.	Chara	3.2
3. *Lemna Minor* L.	Duckweed	2.4
4. *Najas guadalupensis* (Spreng.) Magnus	Southern Naiad	2.9
5. *Pithophora* sp. L.	Pithophora	2.0
6. *Utricularia gibba* L.	Eastern Bladderwort	2.0
7. *Hydrochloa carolinensis* Beauv.	Southern Water Grass	1.2
8. *Eleocharis acicularis* (L.) R. & S.	Slender Spikerush	1.1
9. *Potamogeton pusillus* L.	Snailseed Pondweed	1.2
10. *Potamogeton capillaceus* Poir.	Slender Pondweed	0.9
11. *Limnobium spongia* (Bosc.) Steud.	Frogbit	0.7
12. *Myriophyllum spicatum* L.	Eurasian Watermilfoil	0.6
13. *Potamogeton nodosus* Poir.	Longleaf Pondweed	0.5
14. *Heteranthera dubia* (Jacq.) MacM.	Water Star Grass	0.5
15. *Juncus repens* Michx.	Creeping Rush	0.4
16. *Hydrilla verticillata* Royle	Hydrilla	0.3
17. *Brasenia schreberi* J. F. Gmel.	Water-Shield	0.2
18. *Nelumbo lutea* (Willd.) Pers.	American Lotus	0.2
19. *Cabomba caroliniana* Gray	Cabomba	0.1
20. *Ceratophyllum demersum* L.	Coontail	0.7
21. *Pistia stratiotes* L.	Water Lettuce	0.5
22. *Sagittaria subulata* (L.) Buchenau	Arrowhead	0.4
23. *Myriophyllum brasiliense* Camb.	Parrotfeather	0.1
24. *Nymphaea odorata* Ait.	White Water-Lily	0.1
25. *Utricularia inflata* Walt.	Floating Bladderwort	0.1
26. *Ludwigia repens* Forst.	Water Primrose	0.0
27. *Myriophyllum heterophyllum* Michx.	Variable Leaf Milfoil	0.0
28. *Eichhornia crassipes* (Mart.) Solms.	Waterhyacinth	−0.4
29. *Alternanthera philoxeroides* (Mart.) Griseb.	Alligatorweed	−0.8
30. *Egeria densa* Planch.	Egeria	−0.8

[a] Mean adjusted daily consumption (g) for all trials involving the species.
[b] Scientific nomenclature follows Correll and Correll (3).

sunfish fry had been utilized as food were separated in pairs, and one green sunfish was offered to each pair of hybrid carp. Fry in two aquaria were consumed on three consecutive days. Further separation and feeding trials led to the conclusion that only two hybrid carp were utilizing green sunfish fry. This represents only 11% of the total number of hybrid carp which were originally included in the study. The hybrid carp which had taken the green sunfish fry did not feed on fry when hydrilla was placed in an aquarium containing the hybrid carp and 25 green sunfish fry. After 1 wk, the hydrilla had been eaten and all fry were still alive. Although some hybrid carp utilized animal tissues when present as the only source of food, plants were preferred when both plants and animals were offered at the same time.

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Determination Of The Feeding Mechanism Of The Waterhyacinth Mite[1,2]

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ABSTRACT

The waterhyacinth mite (*Orthogalumna terebrantis* Wallwork) is often found feeding on waterhyacinth [*Eichhornia crassipes* (Mart.) Solms] in wounds created by other animals. A radioisotope, ^{134}Cs, was used to determine the relative feeding of this mite on injured and uninjured waterhyacinth. No difference in feeding by mites was noted between injured and uninjured waterhyacinth pseudolaminae after the first 2 weeks. It was determined that the mite can enter waterhyacinth with its mouthparts, although it will use any damage on the pseudolaminae for feeding initiation.

INTRODUCTION

The waterhyacinth mite is one of more than 70 species of arthropods that attack waterhyacinth (3). Although it has apparently been present in the United States and South America for many years, it was not described as a new species until 1965 (4). Its biology and specificity have been studied (3) as has its ovipositional specificity and feeding habits (1, 2). Cordo and De Loach (1) commented that waterhyacinth mite adults fed little or not at all on an unbroken surface of a waterhyacinth pseudolamina, but they could readily penetrate the pseudolaminae for oviposition.

[1]Acarina: Galumnidae

[2]Cooperative research conducted in Gainesville by Agricultural Research Service, U.S. Department of Agriculture and the University of Florida, Gainesville, Florida. Approved as Journal Series No. 5733.