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OCCURRENCE AND COMPOSITION OF PHYTOPLANKTON IN STOMACHS OF NILE TILAPIA (*OREOCHROMIS NILOTICUS* L.) CULTURED IN PONDS RECEIVED INORGANIC FERTILIZERS

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Abstract

Occurrence and composition of phytoplankton in stomachs of Nile tilapia (*Oreochromis niloticus* L.) in ponds received inorganic fertilizer (20:20:5 N:P:K) at different doses were studied. The doses were 0, 20, 40, 60 and 100 kg/feddan/month. It was found that, *O.niloticus* consume phytoplankton, detritus and zooplankton with different composition. The main items found in fish stomach were phytoplankton and detritus. Zooplankton was occasionally found and not exceeding 1.5% of total stomach contents. The main species of algae found in fish stomach belonged to *Cyanophyta, Chlorophyta, Bacillariophyta* and *Euglenophyta*. Detritus consisted mainly of scraps of macrophytes and mud. The most frequently species represented in fish stomach in all treatments were *Anabaena sp, Merismopedia eleganse, Microcystis aeruginose, Nodularia harveyana* and *Oscillatoria sp* (*Cyanophyta*), *Cerasterias sp, Chlorella spp, Crucigenia sp, Pediastrum spp., Scenedesmus spp.* and *Tetraedron sp.* (*Chlorophyta*), *Amphora ovalis, Cocconeis placentula, Cymatopleura solsa, Cymbella cistula, Gyrosigma attenuatum, Melosira granulata, Navicula spp., Nitzschia spp. Pinnularia spp., Serurella sp.* and *Synedra sp.* (*Bacillariophyta*) and *Euglena* and *Phacus spp.* (*Euglenophyta*). Results revealed that, *O.niloticus* could select *Cyanophyta* during the investigation period and sometimes select *Bacillariophyta* and *Euglenophyta*.

INTRODUCTION

Nile tilapia (*Oreochromis niloticus*) is one of the best known members of the tropical and subtropical freshwater fish, and is now globally distributed because of its importance in aquaculture. Some investigators reported that, *O.niloticus* is phytoplanktivorous and a facultative detritivoure (Fish, 1955, Lowe-McConnell, 1958, Tudorancea *et al.*, 1988). Others reported that, it has also a very diversified diet with a dominant vegetable component (epilithic, epiphytic and filamentous algae, phytoplankon, vegetable debris and fine sediments), as well as, animal component (insect larvae, crustaceans and small fish) (Philippart and Ruwet, 1982, Onyari, 1983). That wide dietary breadth could have made it a more adaptable species in eutrophic environment (Kaufman, 1992, Hecky, 1993, Gophen *et al.*, 1993).

Organic and/or inorganic fertilizers are usually added to fishponds to stimulate and maintain the production of natural food (phytoplankton and zooplankton) (McIntire and bond, 1962). Phytoplankton was increased with increasing the applied doses of chemical fertilizer because of the increase of nutrients as a result of fertilizer increasing (Hickling, 1962, Hall *et al.,* 1970, Boyd, 1976, Abdel-Tawwab, 1994). The increase in fish production in fertilized ponds has been attributed to an increase in primary productivity (Melack, 1976, Almazan and Boyd, 1978, Boyd, 1990).

The work was carried out to study the occurrence and composition of phytoplankton in stomachs of Nile tilapia (*O.niloticus*) in fishponds received only inorganic fertilizer (20:20:5 N:P:K) at different doses in Abbassa fishponds.

MATERIALS AND METHODS

Eight earthen ponds (155m^2) at Central Laboratory of Aquaculture Research, Abbassa, Sharkia, were used for studying the food habit of Nile tilapia in fishponds received different doses of inorganic fertilizer (20:20:5 N:P:K). The ponds had been drained, cleaned and refilled with new freshwater from El-Wadi Canal derived from El-Ismailia Canal. The water level was adjusted at 80cm depth. Each application was represented by two replicates. The experiment started on 3 July and continued to 6 Nov. 1992.

The fertilizers were weekly applied to the ponds throughout the experimental period. The ingredient sources of fertilizer were urea (46.5% N), monosuperphosphate (15.5% P_2O_5) and potassium chloride (63.1% K_2O). These applied doses were 0,20,40,60 and 100 kg/feddan/month (kg/f/m). The fertilizer was dissolved and splashed on the water surface of fishponds according to Davidson and Boyd (1981). Nile tilapia was stocked at a rate of 150 fish/pond average initial weight of 15-20 g/ fish.

Twenty fish were monthly collected from each treatment for examination, using pure seines. The specimens were immediately placed in 10% formalin. The length of each fish and elementary canal was measured and the ratio of length was calculated. The degree of fullness was estimated according to Abdelghany (1993). Numerical count of organisms was carried out with Sedgwick Rafter counting cell (Boyd, 1984). Selectivity value for different components of the food was calculated according to Ivlev (1961). Statistical analysis was conducted following Snedecor and Cochran (1971) and Duncan's (1955) multipe range test.

RESULTS AND DISCUSSION

The average weight of fish samples in Fig.1 shows that, fish growth was linearly increased by time till the end of experiment, and also, significantly ($P<0.05$) increased with increasing fertilizer doses, except that of 60 and 100 kg/f/m. This growth was due to fish activity in plankton grazing, since artificial feed was not used. These results are in agreement with those reported by Hepher (1962), and Schroeder (1974) who stated that, fish yield of fertilized fishpond was greater than that of unfertilized ponds. Furthermor, Hall *et al.* (1970), Batterson *et al.* (1989) and Diana *et al.* (1991) reported that, the yield of cultured fish was linearly increased with increasing the applied fertilizer. It is worth mentioning that, phytoplankton flourishing and blooming at the dose 100 kg/f/m interfered with fish production and became limiting factor in fishponds causing problems with water quality.

Moreover, Melack (1976), Almazan and Boyd (1978) and Boyd (1990) found that, the increase in fish production in fertilized ponds has been attributed to the primary productivity. Subsequently, the deposition of nutrients in fish tissues was achieved through fish grazing and accumulation of phytoplankton.

The analysis of stomach contents of *O.niloticus* showed great diversity in the found forms. Fig.2 shows that, phytoplankton was the more abundant category in stomach, followed by detritus and their percentages were little varied during the investigation period in all treatments. The main species of algae found in fish stomach were belonging to *Cyanophyta, Chlorophyta, Bacillariophyta* and *Euglenophyta* (Fig.3 and Table 1). Detritus consisted mainly of scraps of macrophytes and mud. Zooplankton was occasionally found and did not exceed 1.5% of the total components in fish stomach. It consisted of parts of animals especially *Cladocera, Copepoda* and *Rotatoria.* These results were in concomitant with Fish (1955), Lowe-McConnell (1958) and Tudorancea *et al.* (1988) who reported that, *O.niloticus* is phytoplanktivorous and a facultative detritivour fish. Contrary results were obtained by Moriarty (1973) and Northcott *et al.* (1991) who stated that, insects and crustaceans could also comprise a large portion of the diet of *O.niloticus.* Moreover, it has the ability to feed on either small or bulky particles in Lake Victoria, and also, is the most efficient filter feeder and it could utilize a broad range of particle sizes (Batjakas *et al.,* 1997). The variation of fish stomach contents is depending on numerous factors such as fish size, stocking, availability of different food items, light intensity and water temperature.

Fig. 3 shows the occurrence of phytoplankton divisions, which were fluctuated from treatment to another. *Bacillariophyta* followed by *Cyanophyta* were dominant in fish stomach at control and 20 Kg/f/m, while, *Euglenophyta* was dominant at 100 kg/f/m during the investigation period. On the other hand, *Cyanophyta, Chlorophyta* and *Bacillariophyta* were dominant in some months at 40 and 60 kg/f/m. These results indicated that, phytoplankton cropping depended on fish weight and its availability in pond water. Moreover, phytophagous fish consume great amounts of food, and the intensity of feeding is affected by the filtration rate of food components, which depends on the density of phytoplankton in the water mass (Gajevskaja, 1958) and the condition of fish (Nikolski, 1963).

The most frequently species represented in fish stomach in all treatments were *Anabaena sp., Mersimopedia eleganse, Microcystis aeruginosa, Nodularia harveyana* and *Oscillatoria* sp. (*Cyanophyta*), *Cerasterias* sp., *Chlorella spp., Crucigenia sp., Pediastrum spp., Scenedesmus spp.* and *Tetraedron sp.* (*Chlorophyta*), *Amphora ovalis, Cocconeis placentula, Cymatopleura solsa, Cymbella cistula, Gyrosigma attenuatum, Melosira granulata, Navicula spp., Nitzschia* spp., *Pinnularia spp., Serurella sp.* and *Synedra sp.* (*Bacillariophyta*) and *Euglena spp.* and *Phacus spp.* (*Euglenophyta*), (Table1).

Regarding the complex nature of the feeding habits of *O.niloticus* in Abbassa fishponds, it has been necessary to calculate the selective index, which might throw some light on fish food preference. According to Ivlev's equation (Ivlev, 1961), values of selectivity index are between +1 and -1. Positive values indicate a positive selectivity of a certain kind of food, while, negative ones indicate a negative selectivity. Data in Fig.4 show that, *O.niloticus* selected *Cyanophyta* at all treatments during the investigation period. It also selected *Bacillariophyta* at all treatments during the investigation period, except Oct. at 40 and 60 Kg/f/m and July at 100 Kg/f/m. The fish did not select *Chlorophyta*, but it occurred incidentally in the stomach when it was mechanically swallowed together with other foodstuff. This result indicated that, Nile tilapia does not consume food at random, but is able to select and choose the preferred foodstuff.

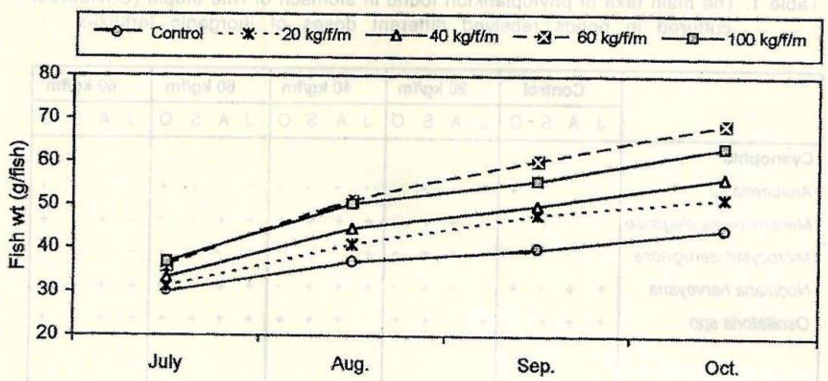

Fig.1. Average weight of Nile tilapia (*O.niloticus)* cultured in ponds received different doses of inorganic fertilizer.

Table 1. The main taxa of phytoplankton found in stomach of Nile tilapia (*O.niloticus*) cultured in ponds received different doses of inorganic fertilizer.

	Control				20 kg/fm				40 kg/fm				60 kg/fm				60 kg/fm			
	J	A	S	O	J	A	S	O	J	A	S	O	J	A	S	O	J	A	S	O
Cyanophta																				
Anabaena sp	-	-	-	+	+	-	-	-	-	-	-	-	-	-	+	+	-	-	+	+
Merismopedia eleganse	-	-	+	-	-	+	+	+	+	+	+	+	+	+	-	-	-	+	-	+
Microcystis aeruginosa	-	-	-	-	-	+	+	-	+	-	+	-	+	-	-	-	-	-	-	-
Nodularia harveyana	+	+	-	+	-	+	+	-	+	+	+	-	+	+	-	-	+	+	+	-
Oscillatoria spp	+	+	+	-	+	-	+	+	-	+	+	+	+	+	+	+	+	+	+	+
Chlorophyta																				
Cerasterias sp	-	-	-	-	+	+	+	+	-	-	-	-	+	-	-	+	-	-	+	-
Chlorella spp	+	+	+	-	-	+	+	+	-	+	+	+	-	+	-	+	+	-	+	+
Crucigenia sp	+	-	-	-	-	-	-	-	-	+	-	+	-	+	-	+	-	-	-	-
Pediastrum spp	+	+	-	+	+	+	+	+	+	+	-	+	+	+	-	+	+	+	+	+
Scenedesmus spp	+	+	-	+	+	+	+	+	+	+	+	-	+	+	+	+	+	+	+	+
Tetraedron sp	+	+	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-
Bacillariophyta																				
Amphora ovalis	-	-	+	+	+	-	-	-	+	-	-	-	-	-	-	-	+	-	-	+
Cocconeis placentula	+	+	+	+	-	+	+	+	-	+	-	+	-	+	+	-	+	+	+	+
Cymatopleura solsa	+	-	-	+	+	+	+	+	+	+	-	-	+	+	+	+	-	-	+	-
Cymbella cistula	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	+	+
Gyrosigma attenuatum	-	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
Melosira granulata	-	-	-	-	+	-	+	+	+	-	-	-	+	-	+	-	-	+	-	-
Navicula spp	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+
Nitzschia spp	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+	-	-	+
Pinnularia sp	+	+	+	+	+	+	-	-	+	+	-	+	+	-	+	-	-	+	+	+
Serurella sp	-	-	+	+	+	-	-	-	+	+	-	-	+	-	-	-	-	+	-	-
Synedra sp	-	-	-	+	+	+	+	+	+	-	+	-	+	-	+	+	-	-	-	-
Euglenophyta																				
Euglena spp	+	+	-	+	-	-	+	+	+	-	+	+	+	+	+	+	+	+	+	+
Phacus spp	+	+	-	+	+	-	+	+	-	+	+	-	-	+	+	+	+	+	+	+

+ Present - absent

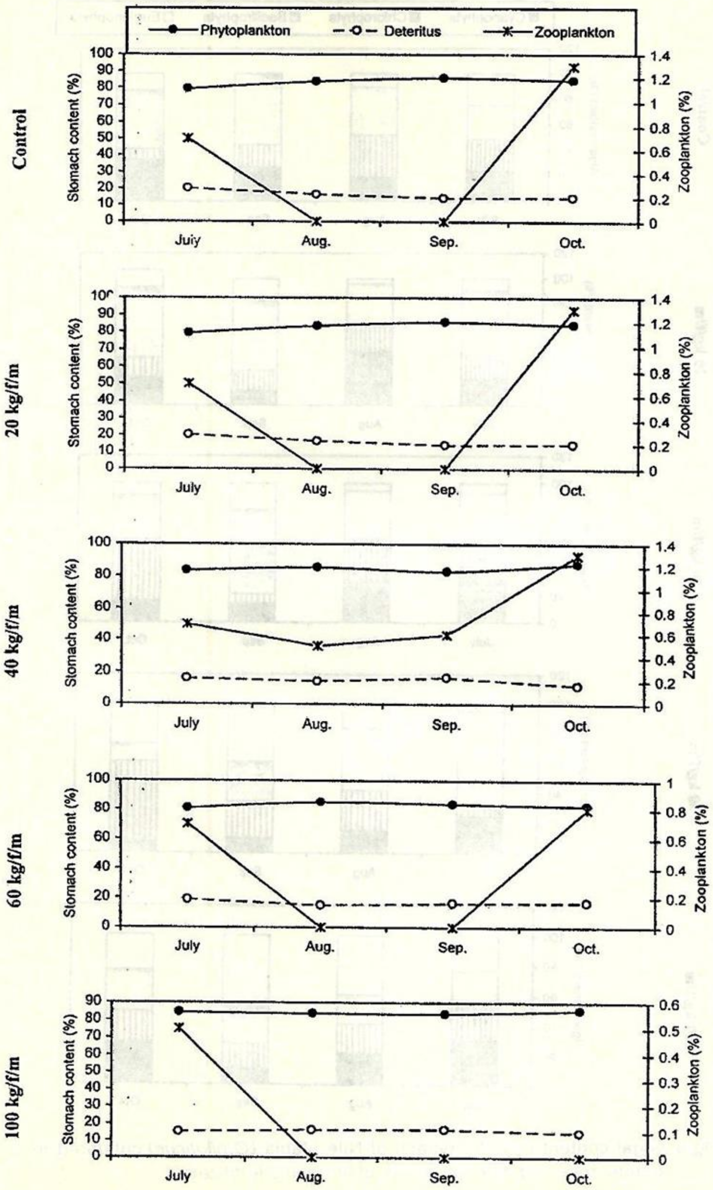

Fig.2. Stomach contents of Nile tilapia (*O.niloticus)* cultured in ponds received different doses of inorganic fertilizer.

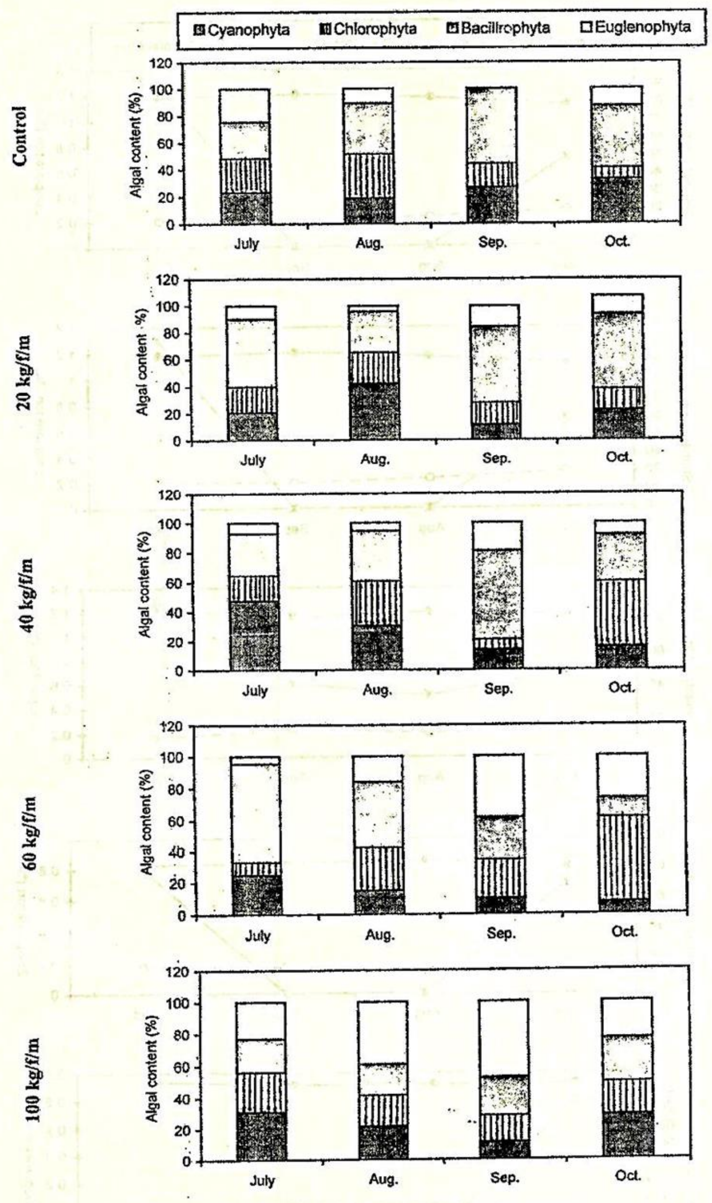

Fig.3. Algal content (%) of stomach of Nile tilapia (*O.niloticus*) cultuured in ponds received different doses of inorganic fertilizer.

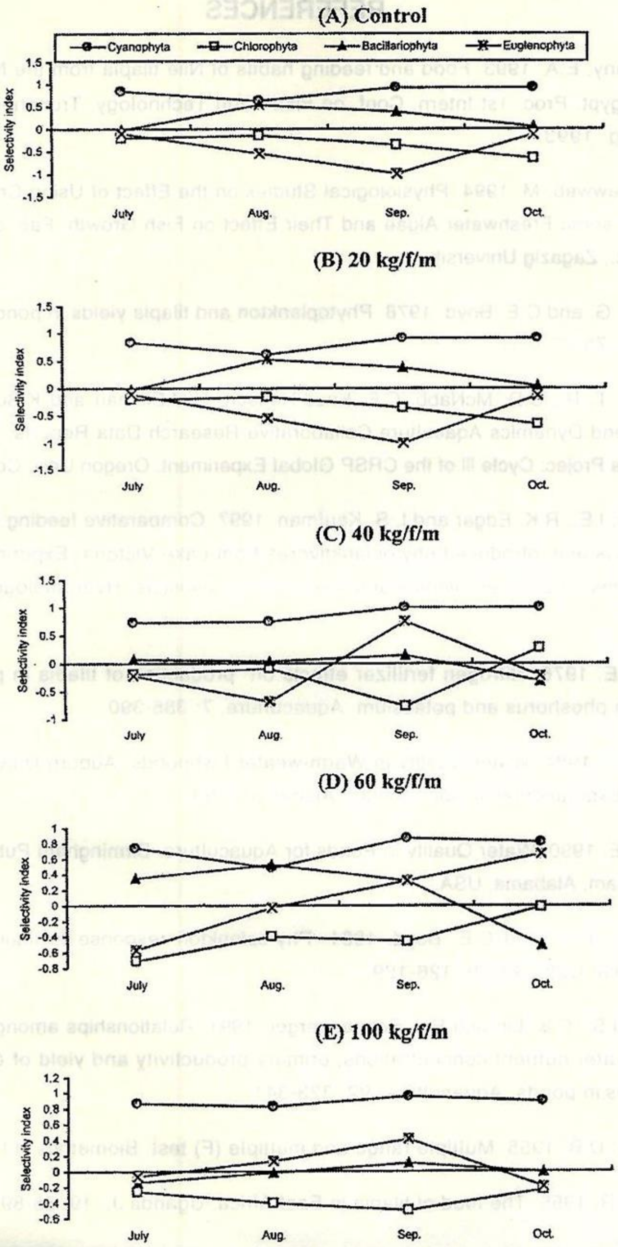

Fig.4. Selectivity index of Nile tilapia (*O.niloticus)* for phytoplankton groups at the application of different doses of inorganic fertilizer in fishponds.

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التواجد الطحلبى فى معدات البلطى النيلى *Oreochromis niloticus* المستزرع تحت كميات مختلفة من التسميد الغير العضوى فى الأحواض السمكية

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أجرى هذا البحث بغرض دراسة التواجد الطحلبى فى معدات البلطى النيلى *O.niloticus* تحت تأثير كميات مختلفة من التسميد الغير العضوى فى أحواض سمكية ترابية .

أظهرت نتائج فحص المحتوى الغذائى لمعدات سمك البلطى النيلى أنه يتغذى بشكل رئيسى على الهائمات النباتية (الفيتوبلانكتون) ثم المواد العضوية المتحللة (detritus) بينما كانت الهائمات الحيوانية (الزووبلانكتون) قليلة ولاتزيد عن ١,٥٪ من المحتوى الكلى لمعدات السمك التى فحصت .

كانت أهم الأجناس الطحلبية المتواجدة في معدات السمك هي *Anabaena,* *Merismopedia, Microcystis, Nodularia, Oscillatoria, Spirulina* وهي تتبع الطحالب الخضراء المزرقة والأجناس *Crucigenia,* ،*Chlorella* ،*Cerasterias* *Tetraedron* & ،Scenedesmus. Pediastrum وهى تتبع الطحالب الخضراء . والأجناس *Melosira* ،*Gyrosigma* ،*Cymbella* ،*Cymatopleura* ،*Cocconeis* ،*Navicula* ،*Nitzscha* ،*Pinnularia* & *Synedra* وهى تتبع الدياتومات. والأجناس *Amorpha*، Euglena & Phacus، وهى تتبع الطحالب اليوجلينية.

أظهرت النتائج أيضا أن سمك البلطى النيلى له القدرة علي اختيار غذائه حيث أنه اختار الطحالب الخضراء المزرقة طوال فترة التجربة بينما اختار الدياتومات والطحالب اليوجلينية شهور التجربة ولم يختر الطحالب الخضراء مطلقا.