

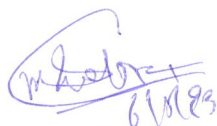
**Studies on the Efficiency of Culture Media Prepared by
Using Fertilizers (Cow-Dung, Salts and Yeast) in the
Production of Microzooplanktons and in Promoting
Fish Growth (Fingerlings of Tilapia Mossambica)
Under Laboratory Conditions**

By

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A THESIS SUBMITTED TO THE AVINASHILINGAM INSTITUTE FOR HOME SCIENCE
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Introduction

I. INTRODUCTION

Water plays several important roles in the ecological relations of plants and animals. With the passing of times, man realised the inherent mysteries of aquatic phenomenon and that water is the basis for all life activities. Animals cannot live without fresh water. Discovery of simple and compound microscopes gave a fresh stimulation to the study of aquatic organisms, opening this so far concealed world for scientific investigations.

Realisation of the significance of plankton, elucidation of the factors controlling their growth, their importance to the other inhabitants has further coordinated and integrated the study of the fresh water organisms and productivity of fresh water bodies. Accumulation of these vague observations gave birth to a new branch of science, the fresh water biology and limnology, Tonapi (1980).

Yet our knowledge is very meagre and most of the available data are not satisfactory for understanding processes in fresh water ecosystem. Thus an understanding of a fresh water ecosystem dynamics will be of greater significance in determining its productivity and utility.

In ponds, animals that either live at the bottom or among the aquatic plants are the most characteristic inhabitants.

inhabitants. Many minute, microscopic animals which are able to spend their whole life floating in the water are called microzooplanktons.

'Plankton' is a term used for that section of aquatic life which drifts at the mercy of the water movements or currents. It is a term which has been coined by Victor Hensen (1887). Planktons are supposed to be a biological wealth of water for fishes.

Plankton consisting animal part is called as zooplankton and plant part is called as phytoplankton. The plankton can also be classified according to size of the constituents. The smallest planktonic animals and plants are called micro plankton.

Microplankton includes large number of zooplanktonic organisms like protozoa, Rotifers, crustaceans such as cladocerans, copepods and ostracods. It includes phytoplankton like diatoms and dinoflagellates. Microplanktons having diameter less than 60 micra are called nanoplankton.

The largest planktonic forms are known as macroplankton, which includes Corethra, Euphausiids, Mysids and various invertebrate larva. Planktons are not uniformly distributed, even within small distances, from place to place.

Several numerical feature of three dimensional dynamic system (phyto plankton, zooplankton, and organic phosphorus) in a lake environment was revealed by Arnold and Voss (1981).

Hutchinson (1967) reviewed on diurnal and seasonal variation of zooplankton of fresh water ponds of many countries.

The seasonal variation in the complexes of ecological factors directly or indirectly influence the zooplankton population in fresh water pond Nasar, (1977).

Fresh water fishes constitute the most conspicuous component of inland aquatic fauna. These cold blooded gnathostome vertebrates are perpetually chained to an underwater existence and occur in all kinds of hydrographic media. Fishes are the first vertebrate animals which truly adapted to live throughout their life in water.

Pisces are divided into four classes : Elasmobranchii, Holocephali, Teleostomi and Dipnoi. Only the latter two include almost all the fresh water genera.

Fresh water fishes includes *Tilapia mossambica*, *channa striatus*, *cyprinus carpio* var, *cirrhina mrigala*, *lepidoccephalus thermalis* etc. *Tilapia mossambica* includes

the order perciformes and the family cichlidae. It grows to about 35 cm like pearlspots it can be cultivated without much difficulty in small tanks and ponds by farmers. It is extensively tried in Kerala and is a valuable source of proteins to its people who are predominantly rice-eaters.

Bardach et al., (1972) reported that food is an important environmental factor which influences the growth of fishes nature of fishery, shoaling, migratory behaviour and feeding preferences.

The studies of Rao and Rao (1957) indicated that the food requirement of a fish varied depending on the exigencies of environmental conditions the availability of food its seasonal variation, feeding in relation to plankton and sexual condition of fish have been investigated (Sarojini, 1954; Karekar and Bal 1958; Benson 1964).

In *Sardinella longiceps*, Benson (1964) observed that the juveniles of carnivores and the adults are plankton feeders. According to Pillay (1953) fish may consume large organisms at earlier stage and smaller organisms during later stage. The above difference in the mode of feeding between juveniles and adults is related to the structural variations of the gill - rakers.

The term aquaculture means the growing of aquatic organisms under controlled conditions, can make a unique contribution to nutrition in many parts of the world by virtue both of its extremely high productivity in many situations and the fact that the aquatic crops are primarily. Protein crops rather than sources of starch staple food (Bardach, et al., 1972), whereas many existing aquaculture enterprises, including some of the most successful, rely on supplying high protein to produce a luxury product for human consumption.

Aquaculture has the potential of producing large quantities of lower cost protein rich food. The rapid strides made by biotechnology in agriculture and animal and human health care management are just beginning to be seen in aquaculture. There is much scope for exploiting the vast aquatic resources available in India by the application of modern biotechnological approaches.

The most culture methods, food for very young fry produced with in the pond by fertilization and rather than being introduced by the culturist (Bardach et al., 1972)

Artificial feed along with the natural food enhance the growth and survival of fish considerably. In

order to meet the increased food requirement agriculture and aquaculture have been modernised by latest scientific technology. The aim of aquaculture is to attain the maximum yield by employing modern scientific management techniques.

One of the main aspects in fisheries research is the study of food and feeding habits of fishes along with breeding and growth studies.

Dass (1976) observed in grey mullet, *Mugil cephalus* fingerlings the feed preference when they are reared in the laboratory. They preferred groundnut oil cake than the other type of food. The maximum growth rate in mullet fingerlings was observed by the above author when they were feed on a mixture of groundnut oil cake and coconut oil cake. According to Paul et al., (1977) zooplankton and boiled egg were more effective for the survival of the spawn of *Anabas testudineus* than other artificial feed like wheat flour, rice bran, soyabean. Powder and prawn powder.

The relationship between planktons and fishes is of commercial value. The landings of fish are directly proportional to the quantity of plankton (Chidambaram and Menon 1945).

In general, the planktons play a prominent role in providing the fishes with food. Zooplanktons animals and phytoplanktons (plants) are both important groups of planktons for the benefit of fishes. It is a term which has been coined by Victor Henson (1887) planktons are supposed to be a biological wealth of water for fishes. In a broad sense plankton is considered as an index of fertility (Prasad, 1969).

It is well known fact that when any water body is manured it results in the production of a rich crop of both micro plankton and macroplankton. Thus an understanding of a freshwater ecosystem dynamics will be of greater significance in determining its productivity and utility.

If it is possible to increase the crop of microzooplankton then the macrozooplanktonic forms which feed on the microzooplankton would grow well and in turn form the food of fishes, thus increasing the productivity of the water body.

Alikunhi (1957) suggests that cowdung is one of the best easily available organic manures and heavy manuring with cowdung results in thick swarms of macrozooplankton. Along with cowdung yeast and salts were added with tap and pond water for producing zooplanktons.

Hence the present work was undertaken to increase the natural feed (microplankton) of fishes and to enhance fresh water fishculture, as fishes form good sources of protein food and a good supplement to agricultural produce.

Review of Literature

II. REVIEW OF LITERATURE

Unicellular organisms play a considerable role in the lives of fishes. Many fishes in the early stages of their lives eat various protozoa, particularly infusoria. Organic manures are extremely beneficial in multiplying aquatic fauna. The objective of fertilization is to increase the small beneficial microscopic life (Phytoplankton and zooplankton). Which in turn increases turbidity of water so that light penetration through the water is reduced.

II.1 Culture medium Definition

Any nutrient material used for the growth and cultivation of micro organisms of any kind may be called a culture medium. Culture media were prepared to increase the productivity of microzooplankton. By using natural manure such as cowdung, yeast and salts, the productivity of any water body may be increased. Feed which is not consumed decomposes and turns into organic manure which favours the development of abundant planktons.

II.2 Plankton Productivity

Planktons are unable to move rapidly and also unable to determine the direction of their movements. Their movement occurs due to the physical movement of their

environment. One of the major characteristic features of running water is the relative absence of plankton. Planktons are responsible for colour of water, protozans, rotifers and many crustaceans show compact "winter" forms and attenuated or spinose "summer" forms, a phenomenon known as cyclomor phosis. Planktons are not uniformly distributed even within small distances from place to place. In the temperate regions, the zooplanktons are found in abundance in summer months. Growth of planktons is proportional to the climate of a particular zone.

Alikunhi (1957) suggests that cowdung is one of the best easily available organic manures and heavy manuring with cowdung results in thick swarms of macrozooplanktons. zooplankton is a special interest in the aquatic production cycle because it includes a large proportion of the grazing animals that feed on plant material. These are the larval and older forms that are either small enough to subsist by eating individual phytoplankton cells or possessed of a filter apparatus that will retain large numbers of phytoplankton.

Brotsky (1931) and Robertson (1932) have shown important plankton elements in the food of the cod fish.

Detailed studies on the food of plankton eating fishes have been made by Jespersen (1932), Seavage (1937) and Manteufel (1941).

According to Jhingran (1982) the food items selected should not duplicate the contributions of natural food but should compensate for nutrients which are in short supply.

Brett (1979) and Brett and Groves (1979) studied the influence of biotic (stocking density, age, sex, state of health) and abiotic (salinity, temperature and dissolved oxygen etc), factors on food consumption, conversion efficiency and growth rate in fish.

Werner (1972) observed that in any species of fish bigger individual eat bigger prey and small individuals of a species eat more restricted range of prey sizes in accordance with the morphology of their mouth.

It is further reported by Hopher et al (1971); Chakraborty et al (1973); Das (1976) and Mann (1978) that the feed preference of fish depends on the nature of environment, availability of food, size of food, visibility and nutritional state of the food. Artificial feed along with the natural food enhance the growth and survival of fish (Bardach et al., (1972).

The fresh water resources of temperate countries have received much more attention, while our knowledge on tropical fresh waters, is still limited. Also literature pertaining to the relationship between the chemical composition and the seasonal variations of plankton in fresh water bodies is rather scanty in India.

Hutchinson (1967) reviewed on diurnal and seasonal variations of zooplanktons of freshwater ponds of many countries.

The primary productivity and physico-chemical factors in a two fresh water ponds in West Bengal was clearly pointed out by Mandal (1976).

The seasonal variation in the complexes of ecological factors directly or indirectly influences the zooplankton population in fresh water pond, Nasar (1977).

Kamal (1969) studied the age and growth of *Cirrhina mrigala* (Hamilton) from the River Yamuna at Allahabad. Narasimhan (1970) analysed on the length weight relationship and relative condition in *Trichiurus lepturus*. The length weight relationship in *tutianus kasmira* (Forsk) was studied by Rangarajan (1973).

Parameswaran and Selvaraj (1974) analysed the length-weight relationship in *Labeogorius* length-weight relationship of males and females of the fresh water teleost, *ophiocephalus gachuva* and observed that analysis of co-variance of 2 regressions showed no significant difference in the slopes. Fish weight has a linear relationship with its length (Matha and Bapat, 1977). The growth in length of *Sarotherodon galilaeu* was studied by Lauzanne (1978) from the lake Chael Apica.

Fishes are one of the major sources of protein which is deficient in our food. Efforts are being made all over the world to exploit both the marine and fresh water bodies for fish production.

Hora and Pillay (1962), Shell (1967), Hickling (1971) and Sneed et al., (1972), suggested the following criterial for a good artificial feed; 1) Ready acceptability; 2) easy digestability 3) high conversion value; 4) abundant availability, 5) high keeping quality and 6) low cost.

Brett (1979) reported that the biotic and abiotic environments influence fish activity and growth through metabolism.

Accordin to Gerking (1966) in natural environment food selection by fish is based on the availability or

intrinsic preferences and not on the nutritive value. Allen (1971) and Viola and Arieli (1982) studied forage ratio based on the relationship between the availability and consumption.

Factors such as the feeding rate, nutrient level in the diet, fish size and water temperature may alter the quantities assimilated. According to Brett (1971) food consumption, digestion and absorption are three factors important for fish growth.

According to Pyke et al (1977) the economics of feeding contributes to a better understanding of the factors that influence growth. The work of Paloheimo and Dickie (1969) supports the above author that the type of food bears the greatest potential effect on food consumption and growth efficiency curves of fishes.

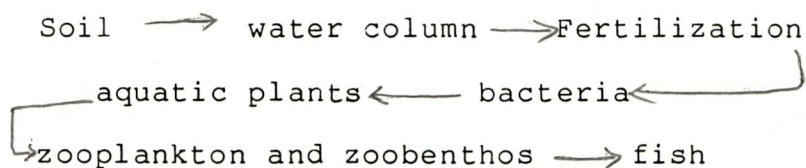
According to Pitcher and Hart (1982) proteins are necessary to maintain and repair tissues wear and tear to allow reconstruction of depleted tissues and allow growth to take place by the addition of new proteins.

Several workers have demonstrated that just as many fish can be produced with organic fertilizers as with chemical fertilizers. Hickling (1962) reported that the

application of 15,000 kg/ha of cow manure resulted in an average fish yield of 300 kg/ha while the control ponds averaged 97/kg/ha of fish.

Collis and Smitherman (1978) obtained an average Tilapia yield of 1,646 kg/ha in ponds treated with cattle manure twice daily.

The primary purpose of manuring ponds is to create conditions which facilitate an increase in the stocks of good quality nature foods, thereby increasing fish production. In ponds the complex process of conversion of assimilable chemical biogenic substances in the presence of CO₂, water, light and heat contributes to the organic matter of green plants, plankton and benthos which are consumed by fish. "Ultimately the growth of fish is the result of this system.



Bacteria play an important role as a direct source of nutrition of zooplankton and zoobenthos in the conversion processes.

For the nutrition of tilapia an abundance of plankton algae and other pond organisms is essential. It is necessary to stimulate their growth by manuring. Inorganic manuring eg. super Phosphate in South Africa, but more often organic manuring, such as domestic effluent in South-East Asia is used. Vegetable by-products are used when tilapia are given supplementary food. For examples are rice bran, broken rice, oil cake, rotten fruit kitchen refuse etc. These in turn also contribute to the manuring, giving additional stimulation to pond food production.

Recently, rearing techniques for various kinds of fish, and methods for the mass production of living feeds have advanced markedly and partly as a consequence, the number of fish species in commercial production increases every year. However, very few fundamental studies have been carried out on the nutritional value of living feeds used in the production of juvenile fish. Among various species of zooplankton, the rotifer, *Brachionus plicatilis*, has been used most extensively as a live food for rearing various kinds of small marine and fresh water larval fishes. The use of rotifers was pioneered by Japanese workers sometime ago (Ito, 1960). The most suitable diets for various developmental stages of some fish, according to our present knowledge are outlined below (Fujita, 1973, 1979). Brine shrimp, *Artemia Salina* distributed commercially are very frequently used as a food for larvae of many marine fishes when there is a shortage of marine copepods.

Rotifers have been used most extensively and are very important as the initial live food for rearing larval fish. At present, without the mass culture of rotifers larval rearing of marine fishes would be virtually impossible. Thus, this important organism, systematically mass produced has made fish larval production possible.

Rotifers were mass cultured by using marine chlorella as a feed organism, until baker's yeast, *Saccharomyces cerevisiae* was also found to be very suitable for this purpose. (Nozawa et al., 1972; Ohara et al., 1974). When baker's yeast was used as a food for rotifers, the culture density of the rotifers reached about 10 times that obtained by using marine Chlorella. Thus, recently, the using yeast increasingly as the food for rotifers as the production of juvenile fish has increased progressively in Japan from year to year.

However, the rotifers cultured with yeast frequently resulted in sudden heavy losses of larval fish (Kitajima, 1977; Kitajima; 1976; Fujita, 1979) It was found that high mortalities could be prevented by culturing the rotifers with both yeast and marine chlorella, or by culturing rotifers with yeast and then feeding them on marine chlorella secondarily before feeding them to fish (Kitajima and Koda, 1976; Fukusho; 1977; Kitajima et al.,

1979). This was one of the most important findings in the mass production of juvenile fish.

The recent investigation on the relationship between the nutritional quality of living feeds and the culture organisms used has demonstrated that the content of essential fatty acids in the living feeds is the principal factor in their dietary value.

The nutritional quality of living organisms as protein sources was investigated by determining their aminoacid composition, digestibility, protein efficiency ratio (PER), and net protein utilization (NPU) (Watanabe et al., 1978b) Shrimp are rich in all essential aminoacids (Stults, 1974; Gallagher, Brown, 1975; Claus et al., 1979) The fatty acid spectrum of Daphnia also makes it a suitable food for fish from the view point of essential fattyacids.

ROTIFERS

The relationship between nutritional quality of rotifers as a living food and their culture organism, eg baker's yeast or Chlorella, was investigated from the view point of essential fatty acids for fish (Watanabe et al., 1978c) Rotifers cultured with marine Chlorella were found to contain a high amount of 20: 5 ω 3 which is one of the essential fatty acid for marine fish (Yone and Fujii,

1975b). The rotifers fed on both yeast and chlorella showed average values. These rotifers were used in the production of juvenile Sweet fish (ayu) *plecoglossus altivelis*.

Chlorella should be used as culture organisms for rotifers intended as a living feed in the production of juvenile marine fish (Watanabe et al., 1978c). Commercial spray dried fresh water chlorella was found to be suitable as a food for rotifers (Hirayama and Nakamura 1976).

Based upon these results, a new kind of yeast has been developed as a culture organism for rotifers in order to improve upon the nutritional value for fish larvae of rotifers cultured on baker's yeast (Imada et al., 1979). The dietary value of the rotifers to fish larvae was significantly improved, compared to that of rotifers cultured on marine chlorella. (Kitajima et al., 1980a; 1980b; Oka et al., 1980). Arakawa et al., (1979) also found that rotifers grown on yeast had a superior food value for larval puffer, *Fugu rubripes*. The nauplii of *Artemia Salina* have been widely used as a food in the production of juvenile marine fish (Morris, 1956; Kurata, 1959; Fujita, 1962; Hirano and Ohshima, 1963; Riley, 1966).

Recent work indicates that fish may be capable of utilising some trace elements from water (Meske and Pfeffer, 1979).

Materials and Methods

III. MATERIALS AND METHODS

To stimulate the growth of planktons manuring is essential. By using natural manure such as cow dung, yeast the productivity of any water body may be increased. Feed which is not consumed decomposes and turns into organic manure which favours the development of abundant planktons. To find out which medium is (suitable for fish culture) able to produce more microplanktons in the laboratory, conditions and whether the particular medium is able to promote fish growth in terms of body weight is the point for investigation.

III.1 Reason for choosing this topic

1. To take up an investigation which has social relevance especially in fish culture.
2. To find out ways to promote fish culture in small scale and in the laboratory conditions.
3. To increase the natural feed (microplanktons) of fishes and to enhance fresh water fish culture, as fishes form good supplement to agricultural produce.
4. As the fingerlings of fish prefer micro organisms as their food than any other food.

5. Therefore this research work was undertaken to find ways and means; to promote the development of micro-organisms in the laboratory conditions by using cow dung, yeasts, salts etc.

III.2 Selection of animals

Belonging to the perciformes and to the cichlidae family, Tilapia forms a genus of fish found in the intertropical waters of Africa, has been selected for this study. Tilapia are robust fish, they withstand high water temperature well and are warm water fish. Tilapia mossambica are above all plankton eaters.

III.3 Reason for choosing the fish

The fish that is chosen for the study is Tilapia mossambica because of the following reasons:

1. Edible variety forming the major part of protein
2. Lives in water of varying salinities
3. It can survive on a variety of food
4. Easily adoptable.
5. Available in various levels of growth and size.
6. It can be cultivated without much difficulty in small tanks and ponds by farmers.

III.6 Steps taken to prepare the media

1. Pond water was collected from Ukadam pond and the organisms which present in the water were analysed (Paramecium, few volvox could be seen under microscope).
2. Cowdung which has been collected from a cow was examined (few nematode worms were seen).
3. Along with the cowdung, pond water, yeast and salts such as sodium acetate, ammonium chloride, disodium hydrogen phosphate and magnesium sulphate were used to prepare the following media.

III.7 Types of Culture Media

- I. Tap water + Cowdung 5 gms
(1 litre)
- II. 1 litre tap water + 5 gms cow dung + 100 ml. pond water.
- III. Tap water 1 litre + 5 gms cowdung + 100 ml. pond water + 50 mg. yeast.
- IV. 1 litre pond water + 5 gms. cow dung + 50 mg yeast.
- V. 1 litre tap water + 100 ml pond water + 5 gms cow dung + 50 mg yeast + salts (50 mg of each salt)
Another set of the same media were prepared to which prepared food was added. (VI - X)
- XI. Hay culture media + 100ml Pond water.

III.4 Acclimatization of fishes

Healthy fingerlings were collected from pond (Ukadam) kept in cement tanks for few days, then transferred to the medium.

III.5 Planktons form food of fishes

The planktons play a prominent role in providing the fishes with food. Zooplanktons (animals) and phytoplanktons (plants) are both important groups of planktons for the benefit of fishes.

If it is possible to increase the crop of microzooplankton then the macrozooplankton forms which feed on the microzooplankton would grow well and in turn form, the food of fishes.

In *Sardinella longiceps*, Bensam (1964) observed that the juveniles are carnivores and the adults are plankton feeders. According to Pillay (1953) fish may consume large organisms at earlier stage and smaller organisms during later stage.

Tilapia mossambica are omnivorous and all plankton eaters. *Tilapia macrochir* is a fish which feeds off small microorganisms and essentially at all ages, plankton and biological over.

III.8 Test of productivity

These media were arranged in such a manner that they received equal amount of light. Care was taken to see that they were not exposed to direct sunlight. These media were allowed to produce the microplanktons. 1. The efficiency of each medium in the production of microplanktons were examined daily.

2. The organisms were observed under the microscope before introducing the fish into all these media, protein level of all media were calculated by Oliver. Lowery et al., method.

The hydrobiological features like salinity, temperature; P^H and oxygen content of the media were determined for each set of experiments as these factors have significant influence on the behaviour and metabolic activities of the test fish.

III.9 Determination of Protein content

Reagents

Reagent A 2% sodium carbonate in 0.1 N sodium hydroxide in 100 ml. distilled water.

Reagent B : 0.5% $CUSO_4$ in 1% sodium potassium tartarate.

Reagent C : Mix 50 ml of reagent A with 1.0 ml of reagent B.
discard after one day.

Folin Phenol Reagent

Transferred 100 g. of sodium tungstate and 25 g. sodium molybdate together with 700 ml of water to 1500 ml florent flask. Added 50 ml of 85% phosphoric acid and 100 ml of concentrated HCL connected it with a reflux condenser and boiled gently for 10 hours. At the end of the boiling period added 100 g of lethiam sulphate, 50 ml of water and a few drops of liquid bromine, cooled diluted to one litre and filtered. The finished reagent should not have any greenish tint as this means . The presence of blue reduction products which will lessen the range of trice proportionalists between the different small amounts of tyrosine and tryptophan. This reagent should be kept well protected from dust as organic materials will produce reduction.

Reagent E :

Diluted Folin phenolreagent with IN sodium hydroxide the phenolphthalein and point. On the basis of filtration diluted the folin phenol reagent about 2 fold to make it.

Standard Albumin

A standard albumin solution was prepared by weighing 50 mg and made upto 100 ml with 0.9% saline.

Procedure

Into a series of test tubes pipetted out 0.2 to 1.0 ml of standard albumin solution. Made up to 1.0 ml with distilled water and then added 5.0 ml of reagent C. Mixed well and allowed to stand for 15 minutes. Then added 0.5 ml of 1 N folin phenol reagent 0.1 ml of the enzyme solution was also taken for the experiment. Allowed the colour to develop for 30 minutes, the blue colour developed was read against a reagent blank using red filter at 660 ml. A graph was drawn by plotting the concentration of protein on the 'X' axis and the colorimeter readings of the 'Y' axis. From this graph the protein content of media was calculated.

III.10 Introducing fish into the media

The biometric measurements were noted (Weight and length) Then fingerlings were introduced into the two sets of media prepared in different compositions. In the first set of media the microorganisms formed the food for the fingerlings and in set 2 other than micro-organisms prepared feed (oil cake and wheat bran) formed the food for the fingerlings. After every seven days, body weight and body length were recorded for the fingerlings in set 1 and 2 for the fingerling in Hay culture.

Results and Discussion

IV. RESULTS AND DISCUSSION

4.1. THE COMPOSITION OF DIFFERENT CULTURE MEDIA :

Table - I shows the composition of different culture media prepared for the present study. The control which contains tapwater alone, whereas set 1 culture media contain microorganisms as food for the experimental fish and set 2 culture media which contain microorganisms as well as the prepared food that form food for the fish. Finally medium XI is the Hay culture medium which contains microorganisms which form food for the fish.

DISCUSSION:

It is clear from the above result that the set 1 contains microorganisms alone as food. In the set 1, there are 5 media which are indicated in the table-I. Medium I contains cowdung with tap water. The cowdung is used as fertilizer. In the second medium in addition to the tap water and cowdung, pond water was added whereas in the medium III along with the medium II yeast has been added. Yeast is used for the enhanced growth of bacteria which in turn promotes the growth of microorganisms. In the medium IV,

with pond water cowdung and yeast were added. Medium V contained pond water, Tap water, cowdung, yeast and salts (as micronutrients). Micronutrients are used as added factors for promoting growth of microorganisms. But in the experimental setup set-2 having these 5 media which contained microorganisms and prepared food such as oil cake and wheat bran mix XIth medium is Hay culture with pond water which contains microorganisms.

4.2. ORGANISMS OBSERVED IN THE DIFFERENT CULTURE MEDIA :

Microplanktons such as paramecia and vorticella found in the collected pond water grow and multiply in the culture medium. The other microplanktons such as Daphnids and cyclops the arthropods survive in the culture media.

Table II shows the microzooplanktons observed in the different culture media. In the medium I only paramecium and vorticella were abundant whereas in the media, II, III and IV in addition to the paramecia and vorticella planktons like Daphnids, Rotifers and volvox were seen. When compared with all media, microzooplanktons were more in the medium V. This is due to the presence of yeast, pond water, cowdung and micronutrients.

DISCUSSION:

According to Alikunhi (1957) cowdung is one of the best easily available organic manures and heavy manuring with cowdung results in thick swarms of macrozooplankton. In most culture methods, food for very young fry produced within the pond by fertilization and rather than being introduced by the culturist (Bardach et al., 1972).

Artificial feeding is a supplement to naturally available food and food organisms produced by the fertilization of water. Jhingran (1982). According to the above author, the food items selected should not duplicate the contribution of natural food but should compensate for nutrients which are in short supply.

4.3. LEVEL OF PROTEIN IN ALL DIFFERENT MEDIA :

Fig.I Table IV shows the level of protein in different media. From this table and figure we can assume that the protein level is very high (peak) in the medium V. This is due to the fertility of medium and also the presence of the abundance of zooplanktons in the medium V.

DISCUSSION :

According to Victor Hensen (1887) planktons are supposed to be a biological wealth of water for fishes. In a broad sense plankton is considered as an index of fertility Prasad (1969). Accumulation of planktons, their importance to the other inhabitants has further coordinated and integrated the study of the fresh water organisms and productivity of fresh water bodies Tonapi (1980).

Artemia, Tigriopus, Moina and Daphnia were 70-80% of those obtained with casein, indicating that these living organisms have a high feed value as protein in sources for fish. These results agree well with the conclusion of Ogino (1963) that various kinds of natural zooplankton are valuable protein sources judging from their aminoacid compositions.

The term aquaculture means the growing of aquatic organisms under controlled conditions can make a unique contribution to nutrition in many parts of the world by virtue both of its extremely high productivity in many situations and the fact that the aquatic crops are primarily protein crops rather than sources of starchy staple foods Bardach et al., (1972) Whereas many existing aquaculture enterprises, including some of the most successful rely on supplying high protein to produce a luxury product for human consumption.

The productivity of each medium is also found out from the growth rate of fingerlings. Aquaculture has the potential of producing large quantities of low cost protein rich food.

4.4. CHANGES IN THE BIOMETRIC MEASUREMENTS OF FINGERLINGS: (TILAPIA MOSSAMBICA) :

Table V, Fig II, III, IV, V and VI show the increase of body weight in different media for every seven days. Fig II shows highest increase of body growth both in medium V and X when compared to that of other media. This is due to the increased level of protein in both medium V and X and also the presence of microzooplanktons in those media. Fig IV, V and VI, Table V show the highest level of body growth in the Xth medium while comparing with all other media. This is because of the food in the form of the microorganisms as well as prepared food which is added to the medium. Fig VII gives the increased level of body weight both in the medium V and XI when compared to that of other media. Because of the increased level of protein in those media, the growth of the fish also is very high whereas in the media I, II, III and IV show low growth while comparing with media V and XI, Because the protein level is very low in those media, the growth also is very low. Fig IX shows

the highest level of body growth in the Xth medium when compared to that of other media. This is also due to the presence of more zooplanktons and the added food and also very high protein level in that medium.

Table VI Fig X shows the increased level of protein content in the media of both V and X. Similar to this, the increased body growth (Weight) is also the highest in the medium X when compared to all other media. Plankton feeding fishes appear to show higher protein values than fishes feeding otherwise (Marinkovic and Zei, 1959).

Table VI Fig XI indicates the increased level of body length in Xth medium. Observe the increased level of protein both in media V and X when compared to that of other media. Because of the presence of fertilizers such as yeast, micronutrients, cowdung and pond water the more microzooplanktons are formed in these media. They form the food supply for growing fish in these media.

DISCUSSION:

According to Bardach et al., (1972) food is an important environmental factor which influences the growth of fishes, nature of fishery, shoaling, migratory behaviour

and feeding preferences. In *sardinella longiceps*, Bensam (1964) observed that the juveniles are carnivores and the adults are plankton feeders. According to pillay (1953) fish may consume large organisms at earlier stage and smaller organisms at later stage.

The relationship between plankton and fishes is of commercial value. The landings of fish are directly proportional to the quantity of plankton (Chidambaram and Menon 1945). In general the planktons play a prominent role in providing the fishes with food. Zooplanktons and phytoplanktons are both important groups of plankton for the benefit of fishes. Brett (1979) reported that the biotic and abiotic environments influence fish activity and growth through metabolism.

The work of paloheimo and Dickie (1969) supports that the type of food bears the greatest potential effect on food consumption and growth efficiency curves of fishes. According to Ognio (1963) the rotifers were used in the production of juvenile sweet fish (*ayu*) *plecoglossus altivelis*.

From the above results, the level of protein and organisms (microzooplankton) are rich in the media V and X and growth of fish in body weight and body length are also more in these two media while comparing these two media,

medium X promotes the highest growth in weight and length than medium V. Artificial feed along with the natural food enhance the growth and survival of fish (Bardach et al., 1972).

When control, Set 1, Set 2 and Hay culture media were compared, the fish growth is more in the set 2 (that is medium X). This is because of microorganism and ad libitum feeding with oil cake and wheat bran mix. In the control the microzooplanktons are absent. Because of the absence of micro organisms though the fish in the control are given ad libitum feeding with the oil cake and wheat bran and that is the media I, II, III, IV and V which contain only microorganisms and the additional food is not given. In the set 1 the growth rate is higher than the control but little lower than the set 2. So this set 1 media is better than the control.

Hay culture medium (medium XI) shows higher rate growth than the control and media I, II, III, IV, VI and VII. But the growth rate is less while comparing with that of media V and X. So the best medium selected from the above point is the medium X because the growth rate is the highest in this medium while comparing with that of all other media which have been used for this study.

TABLE - I

TABLE SHOWING THE COMPOSITION OF DIFFERENT MEDIA

Medium	Composition
Control	Tap water
I	Tap water + cow dung
II	Tap water + cow dung + Pond water
III	Tap water + cow dung + Pond water + yeast
IV	Pond water + cow dung + yeast
V	Tap water + Pond water + cow dung + yeast + salts
VI	Medium I + prepared food (Oil cake and wheat bran)
VII	Medium II + prepared food
VIII	Medium III + prepared food
IX	Medium IV + prepared food
X	Medium V + prepared food
XI	Hay culture + Pond water

TABLE - II

TABLE SHOWING THE MICROZOOPLANKTONS PRESENT IN THE MEDIA

Media	Organisms
I, VI & XI	Paramecium, Vorticella
II & VII	Volvox, Vorticella, Paramecium
III & VIII	Rotifers, Volvox, cyclops, Paramecium, vorticella,
IV & IX	Paramecium, volvox, vorticella, cyclops, Rotifers
V & X	Volvox, cyclops, paramecium, Vorticella, Lacrimaria, colpes hirtus, Rotifers, chlamydomonas

TABLE - III

TABLE SHOWING THE HYDROBIOLOGICAL FEATURES OF THE MEDIA

Medium	p ^H	Oxygen content ml/lr	Salinity ‰	Temperature (°C)
Control	7.5	5.3	1.3	27
I	8.5	1.4	1.2	27
II	8.7	2.0	1.4	27
III	9.0	1.7	1.4	27
IV	9.0	1.9	1.0	26
V	9.0	2.3	1.4	27
XI	9.0	2.0	2.2	27

TABLE - IV

TABLE SHOWING THE LEVEL OF PROTEIN PRESENT IN THE MEDIA

Medium	Protein content mg/ml
Control	--
I	20
II	20
III	25
IV	30
V	37.5
XI	30

TABLE - V

TABLE SHOWING INCREASE IN BODY WEIGHT IN DIFFERENT MEDIA AFTER EVERY 7 DAYS

Nature of food	Fishes	Initial weight (mg)	7th day	Increase in weight (mg)	14th day	Increase in weight	21st day	Increase in weight	28th day	Increase in weight	35th day	Increase in weight
Prepared food only	control	0.680	0.750	.070	0.810	0.060	0.870	0.060	0.910	0.040	0.940	0.030
Micro-organisms as food	Medium I	2.040	2.100	0.060	2.150	0.050	2.200	0.050	2.230	0.030	2.250	0.020
	II	2.430	2.500	0.070	2.560	0.060	2.600	0.040	2.640	0.040	2.665	0.025
	III	2.120	2.200	0.080	2.270	0.070	2.335	0.065	2.380	0.045	2.415	0.035
	IV	0.670	0.750	0.080	0.820	0.070	0.890	0.070	0.940	0.050	0.970	0.030
	V	3.410	3.500	0.090	3.580	0.080	3.650	0.070	3.710	0.060	3.750	0.040
Prepared food with Micro-organisms	VI	2.540	2.600	0.060	2.660	0.060	2.720	0.060	2.760	0.040	2.780	0.020
	VII	2.430	2.500	0.070	2.570	0.070	2.635	0.065	2.685	0.050	2.710	0.025
	VIII	3.280	3.350	0.070	3.430	0.080	3.500	0.070	3.550	0.050	3.575	0.025
	IX	3.120	3.200	0.080	3.280	0.080	3.350	0.070	3.405	0.055	3.435	0.030
	X	1.560	1.650	0.090	1.740	0.090	1.815	0.075	1.880	0.065	1.930	0.050
May culture Micro-organisms	XI	0.880	0.960	0.080	1.050	0.090	1.120	0.070	1.180	0.060	1.220	0.040

TABLE - VI

TABLE SHOWING THE INCREASE IN THE LENGTH AND WEIGHT OF THE BODY IN DIFFERENT MEDIA AFTER 35 DAYS

Nature of food	Fishes	Length (in cm)		Increased length (in cm)	Weight (in gm)		Increased weight (in mg)
		Initial	Final		Initial	Final	
Prepared food only	Control	3.1	3.3	.2	0.680	0.940	.260
Microorganisms as food	Medium I	3.5	3.7	.2	2.040	2.250	.210
	II	3.4	3.6	.2	2.430	2.665	.235
	III	3.0	3.4	.4	2.120	2.415	.295
	IV	2.5	3.0	.5	0.670	0.970	.300
	V	4.8	5.5	.7	3.410	3.750	.340
Microorganisms + prepared food	VI	3.4	3.6	.2	2.540	2.780	.240
	VII	3.3	3.5	.2	2.430	2.710	.280
	VIII	4.7	5.1	.4	3.280	3.575	.295
	IX	4.1	4.6	.5	3.120	3.435	.315
	X	4.1	4.9	.8	1.560	1.930	.370
Hay culture Microorganisms	XI	3.6	4.1	.5	0.880	1.220	.300

Fig - I Protein level in different media.

Note increase level of protein in the medium V.

Fig - II Increase in body weight in different media in the first week.

Observe the increased level of body growth both in medium V and medium X when compared is that of other media.

- | | | |
|---------|---|-----------------------------------|
| Control | - | Tap water. |
| Set 1 | - | Microorganisms as food |
| Set 2 | - | Microorganisms with prepared food |

Fig.1 Protein level in different Media

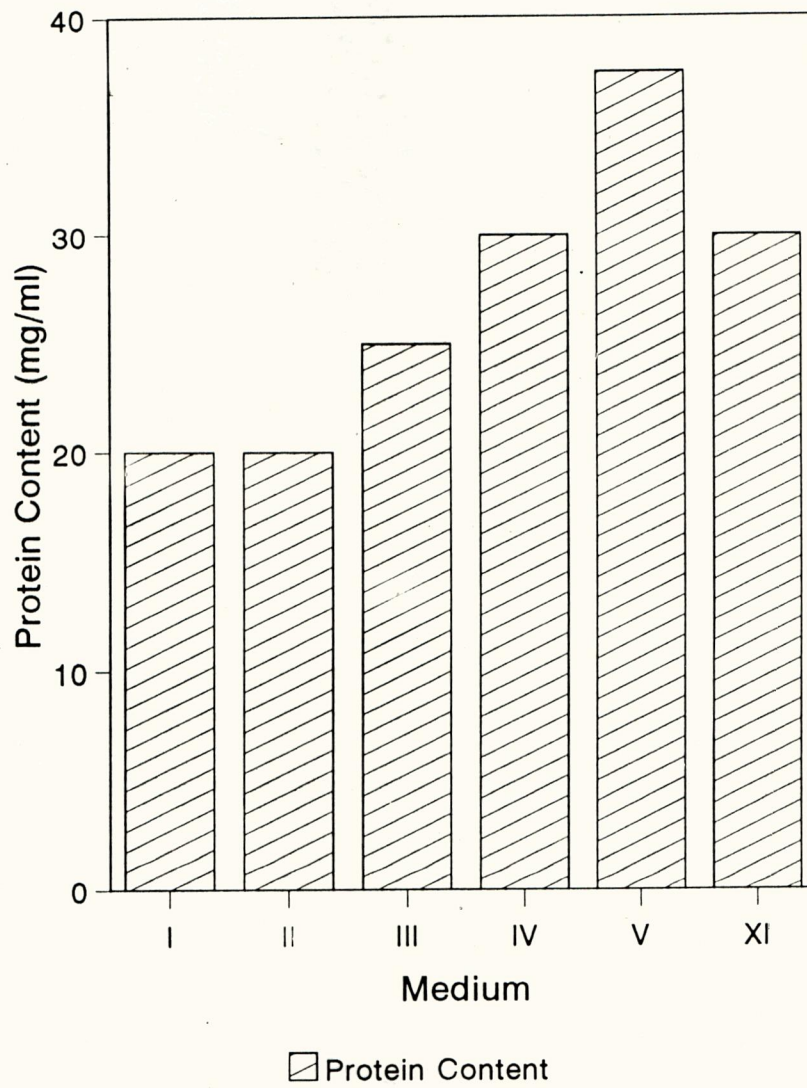


Fig.2 Increase in Body Weight in different Media in the First week

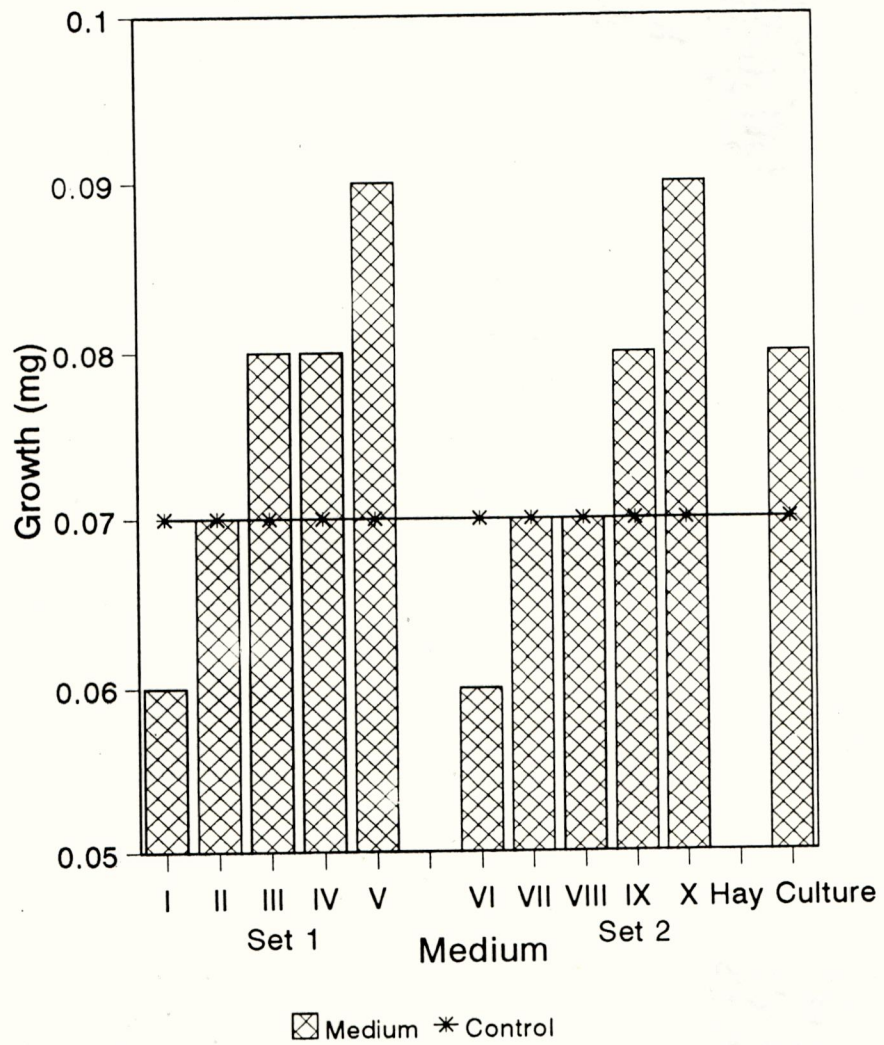


Fig - III Increase in body weight in different media in the second week.

Note the increased level of body growth both in medium X and XI while comparing to that of the media.

Medium XI - Hay culture

Fig.3 Increase in Body Weight in different Media in the Second Week

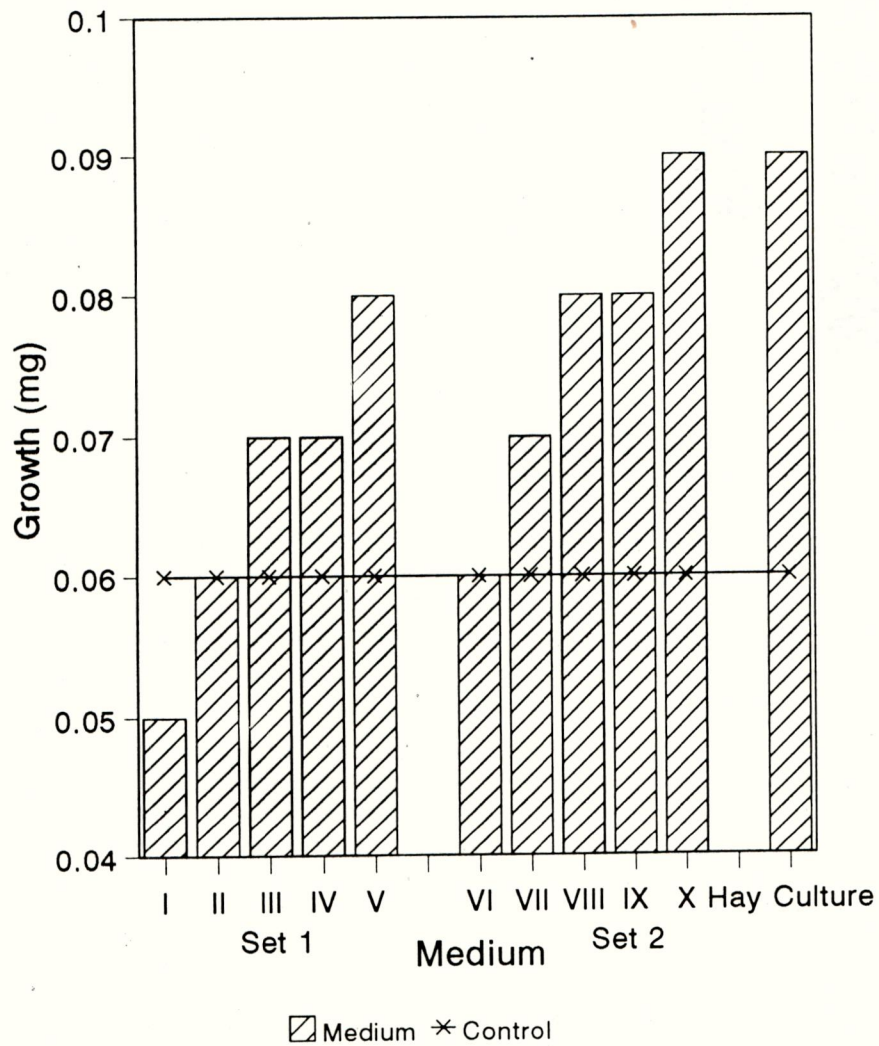


Fig - IV Increase in body weight in different media in the third week.

Note the highest level of body growth in the Xth medium.

Fig.4 Increase in Body Weight in different Media in the Third Week

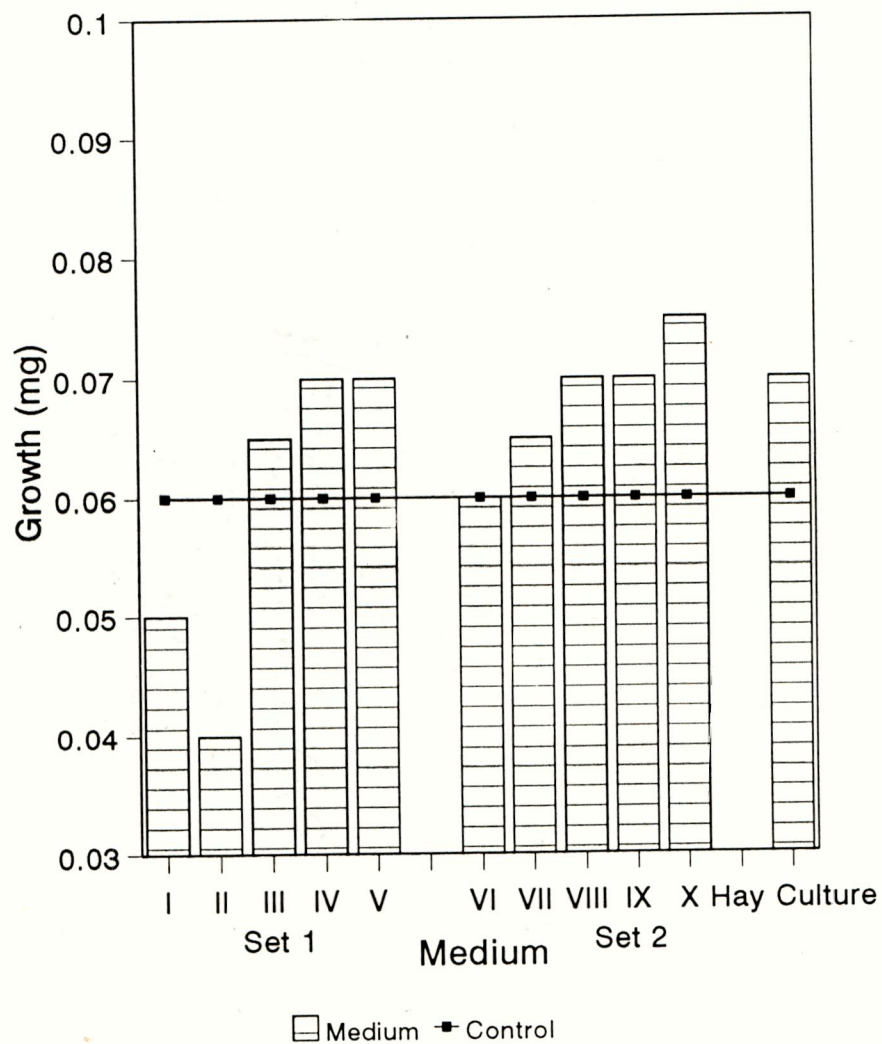


Fig.5 Increase in Body Weight in different Media in the Fourth Week

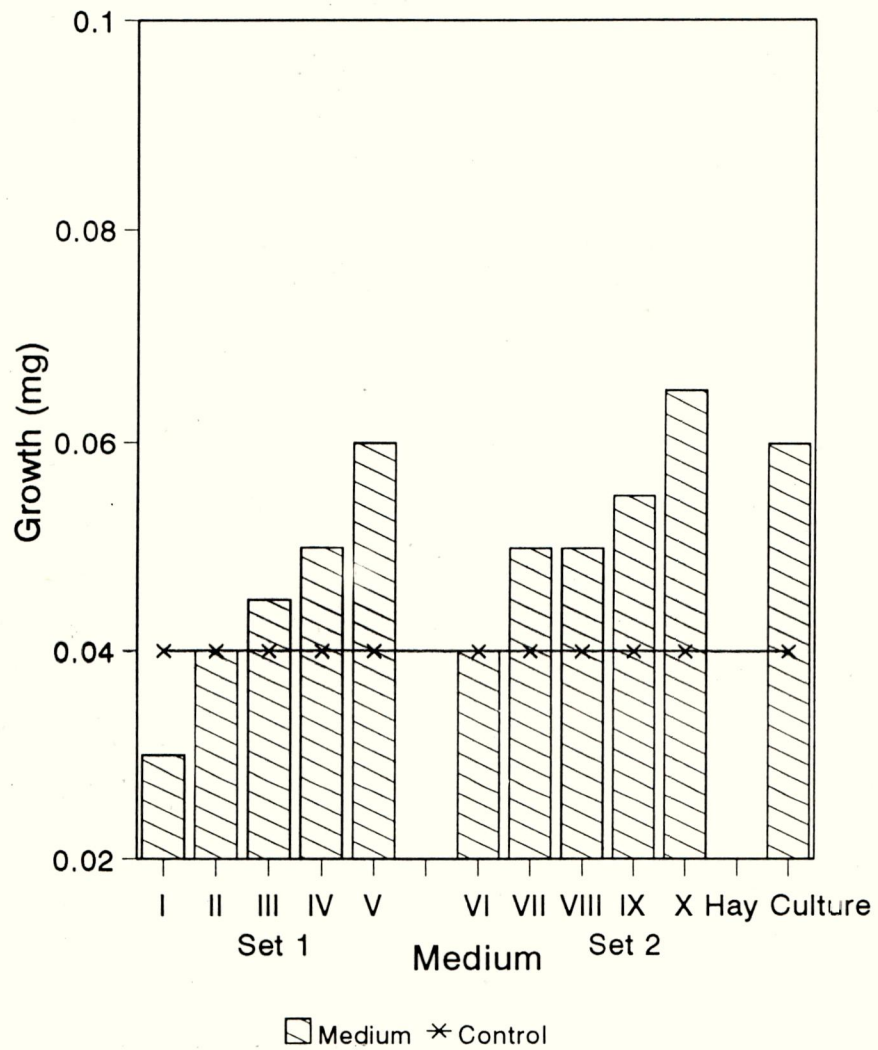


Fig - VI Increase in body weight in different media in the fifth week.

Observe the highest level of body growth in the Xth medium when compared to that of other media.

Fig - V Increase in body weight in different media in the fourth week.

Note the highest level of body growth in the Xth medium when compared to that of other media.

Fig.6 Increase in Body Weight in different Media in the Fifth Week

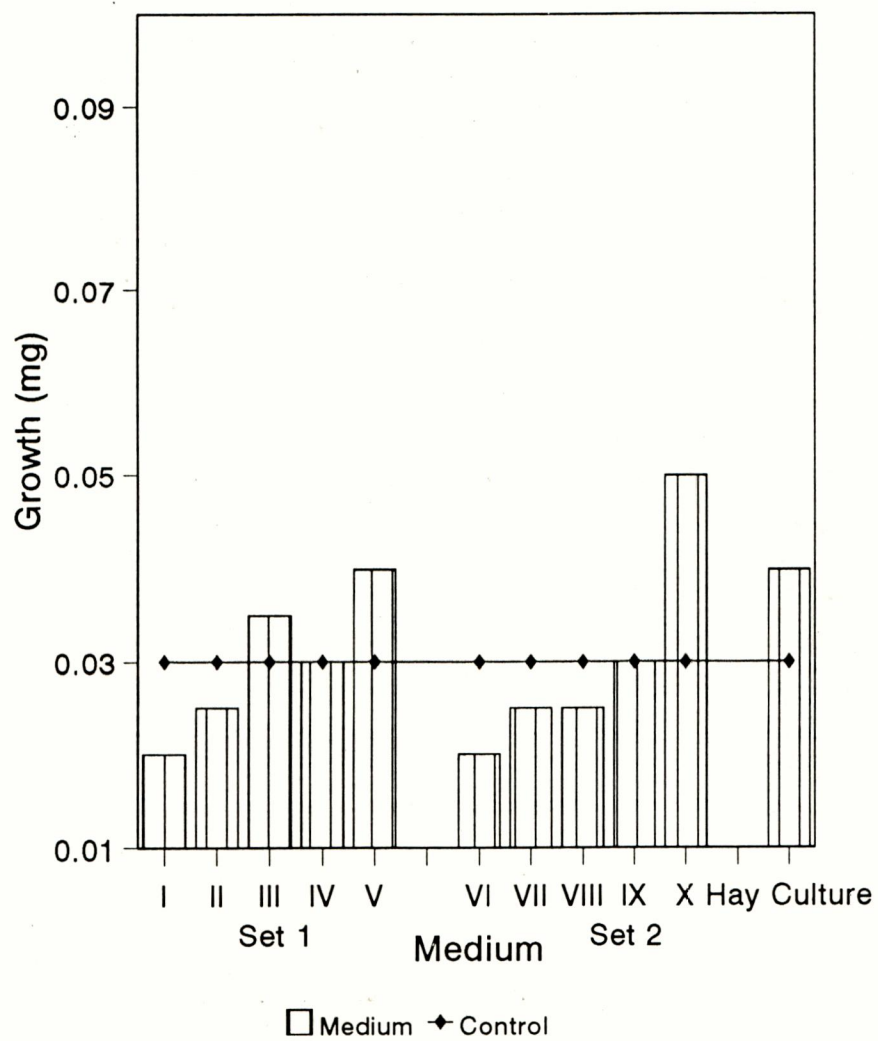


Fig.7 Increase in Body Weight after every seven days in different media with Micro organisms as food

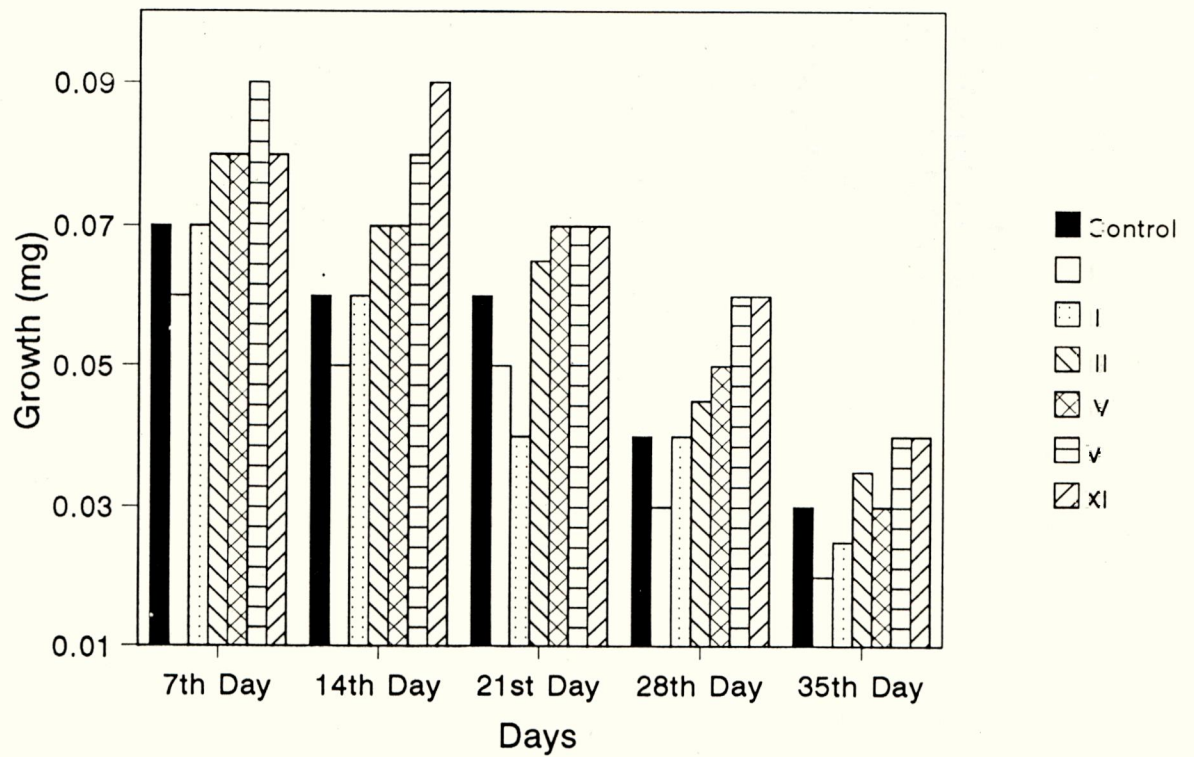


Fig - VII Increase in body weight after every 7 days in different media with microorganisms as food.

Observed the increased level of body growth both in the medium V and XI when compared to that of other media.

Medium V - Set 1

Medium XI - Hay culture

In the First (1) set of media the microorganisms formed the food for the fingerlings.

Fig - VIII Increase in body weight after every 7 days in different media with microorganisms and with prepared food.

Note the increased value for total body growth in the medium X when compared to that of other media.

In set 2 other than microorganisms, prepared feed (oil cake, wheat bran) formed the food for the fingerlings.

Fig.8 Increase in Body Weight after every seven days in different media with Micro organisms and prepared food

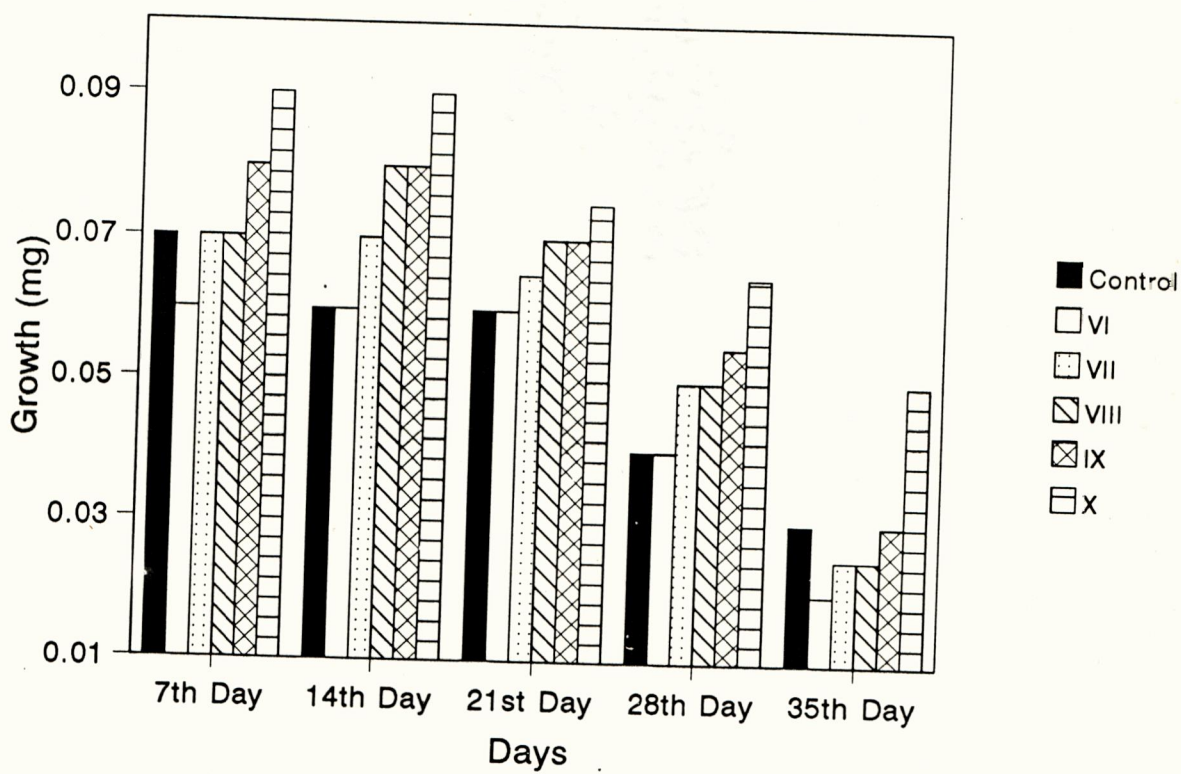


Fig - IX Increase in body length in different media after 35 days.

Observe the highest level of body growth in the Xth medium when compared to that of other media.

Fig.9 Increase in Body Length in different Media After 35 days

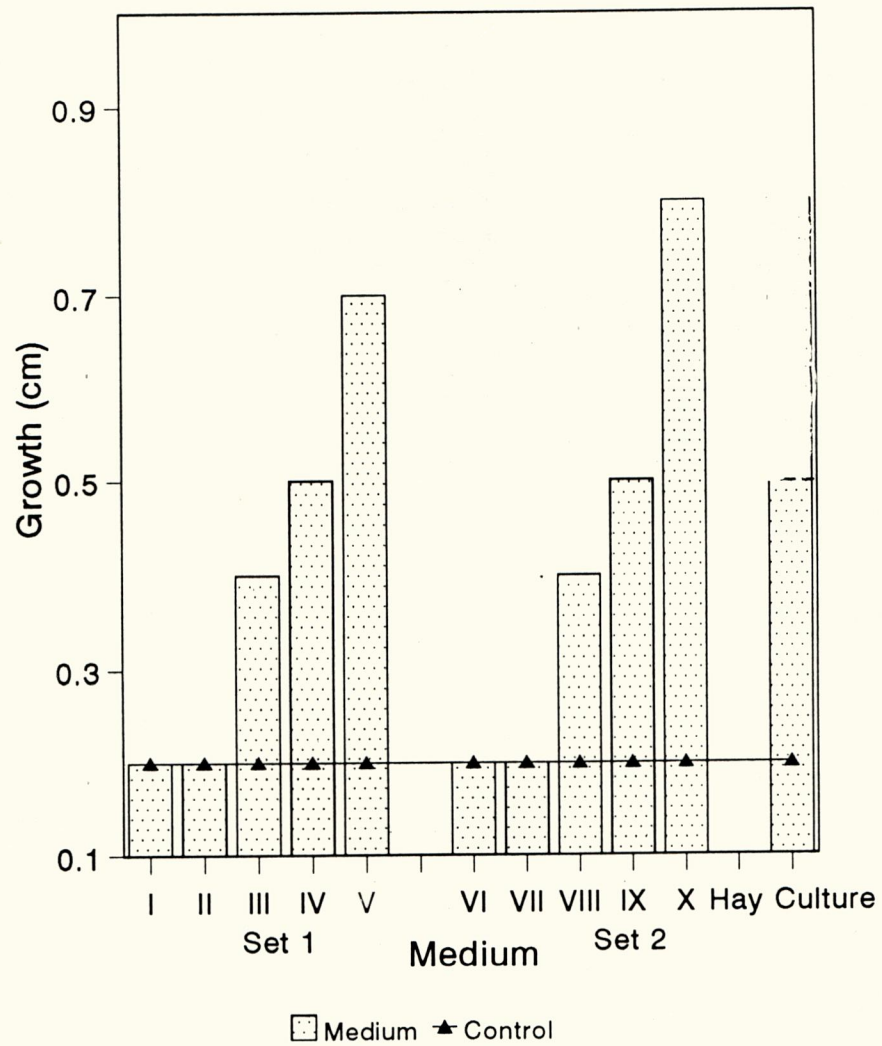


Fig - X Protein content and increase in body weight of different media after 35 days.

Note the increased value of protein content in the media of both V and X. While comparing all media, the Xth medium shows greatest level of body growth.

Fig.10 Protein content and increase in Body Weight in Different Media after 35 Days

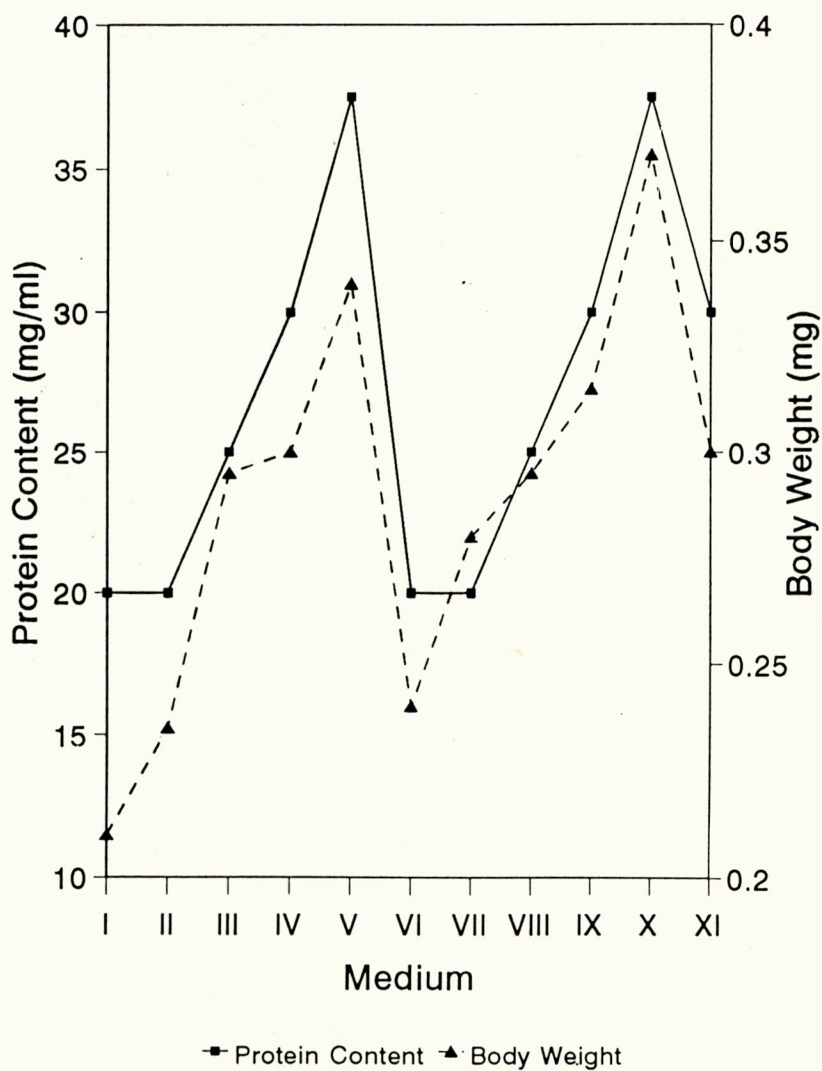


Fig - XI Protein content and increase in body length of different media after 35 days.

Observe the increased value of protein content in the media of both V and X. Note the increased level of body length in the Xth medium.

Fig.11 Protein content and increase in Body Length in Different Media after 35 Days

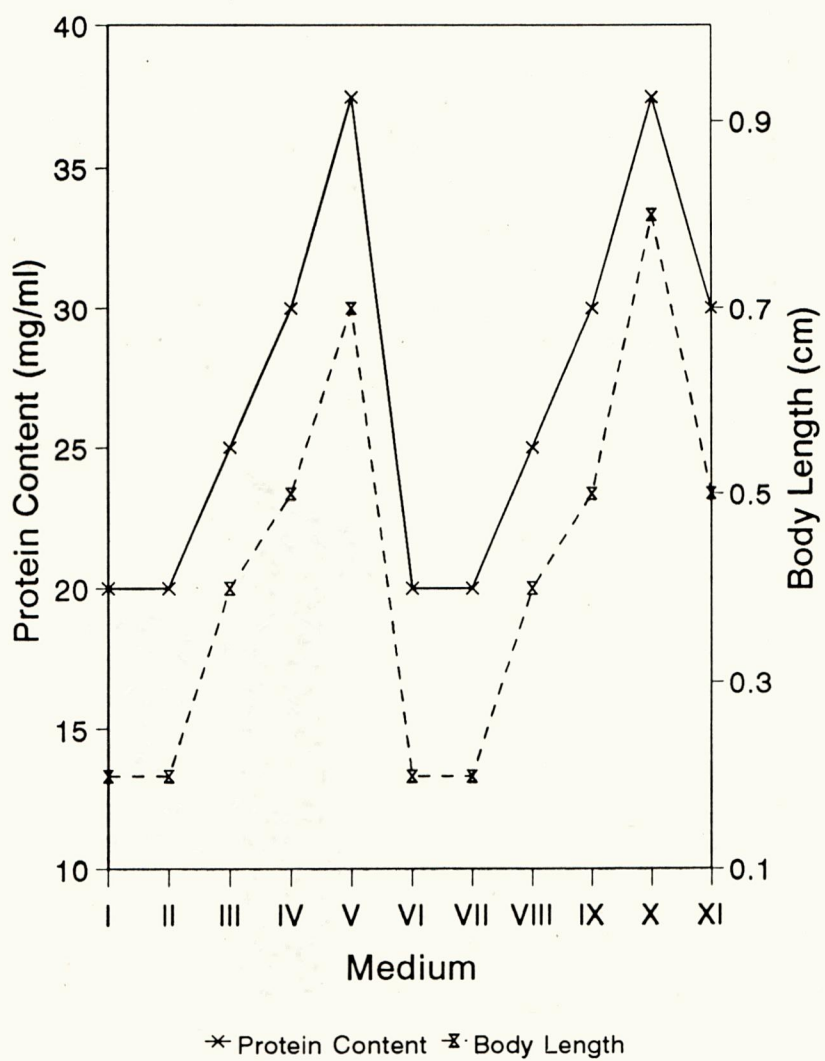


FIG - 12 CULTURE MEDIA WITH MICROORGANISMS



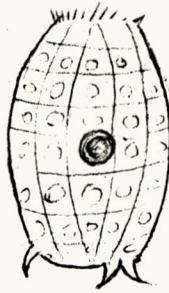
PROTOZOANS

CILIATES

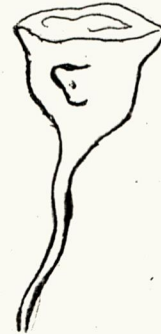
PARAMECIUM CAUDATUM



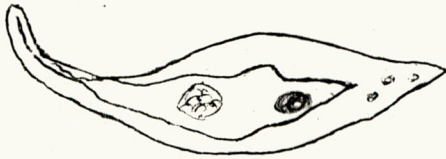
COLPES HIRTUS



VORTICELLA COMPANULA



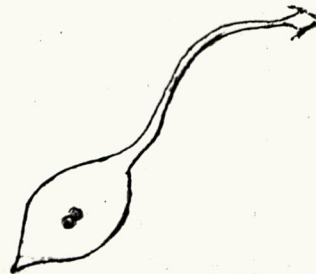
LIONOTUS FASCIOLA



DILEPTUS AMERICANUS

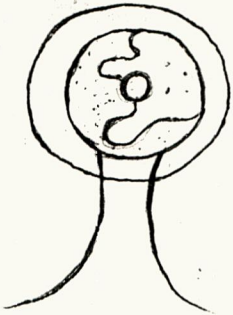


LACRIMARIA OLOR



FLAGELLATES

CHLAMYDOMONAS



VOLVOX GLOBATOR



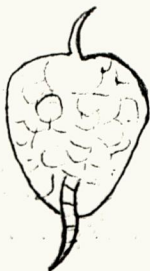
ROTIFER

BRACHIONUS ENTZII Ir.



ARTHROPODS

MESOCYCLOPS LEUCKART



SIMOCEPHALUS [DAPHNIDS]

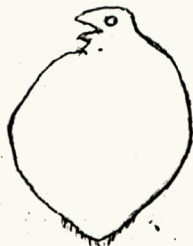


FIG - 14 MICROORGANISMS OF CULTURE MEDIA

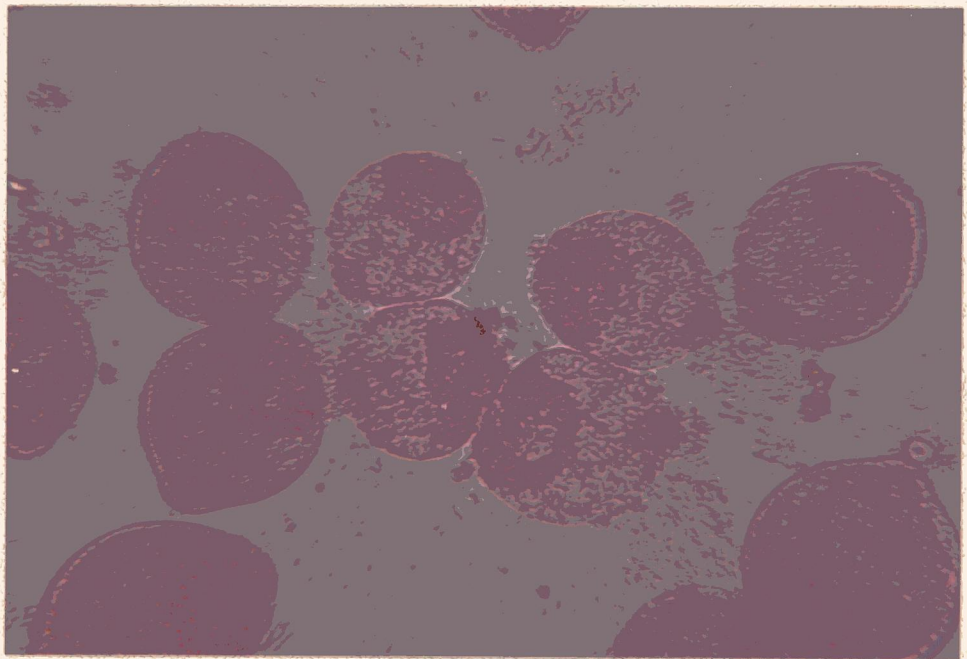
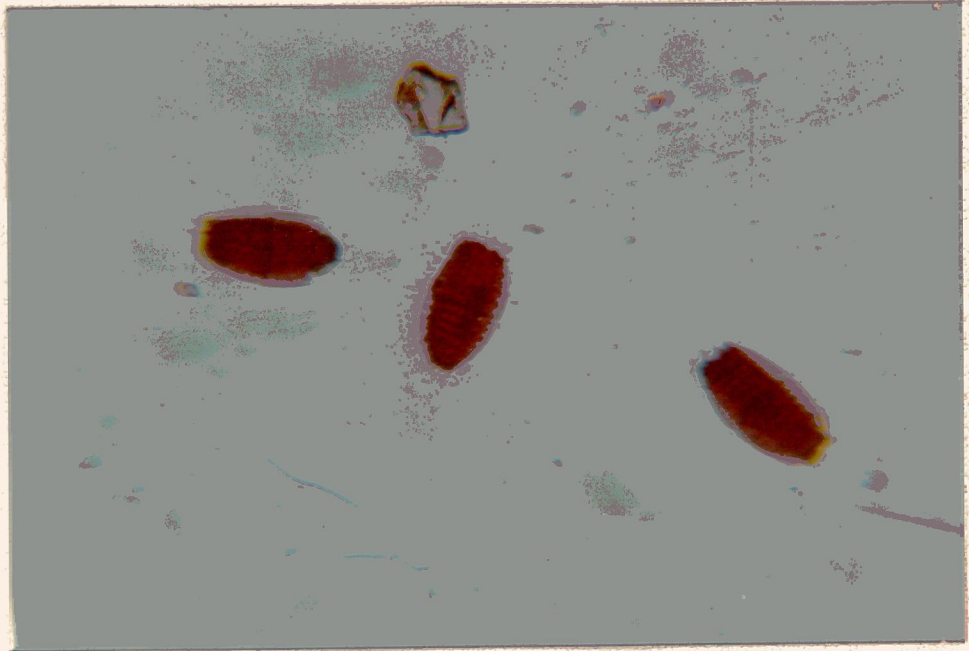


FIG - 15 YOUNG TILAPIA USED FOR EXPERIMENTAL STUDY



FIG - 16 CULTURE MEDIA GROWN FISH



FIG - 17 CULTURE MEDIA CONTAINING MICROORGANISMS AND FISH

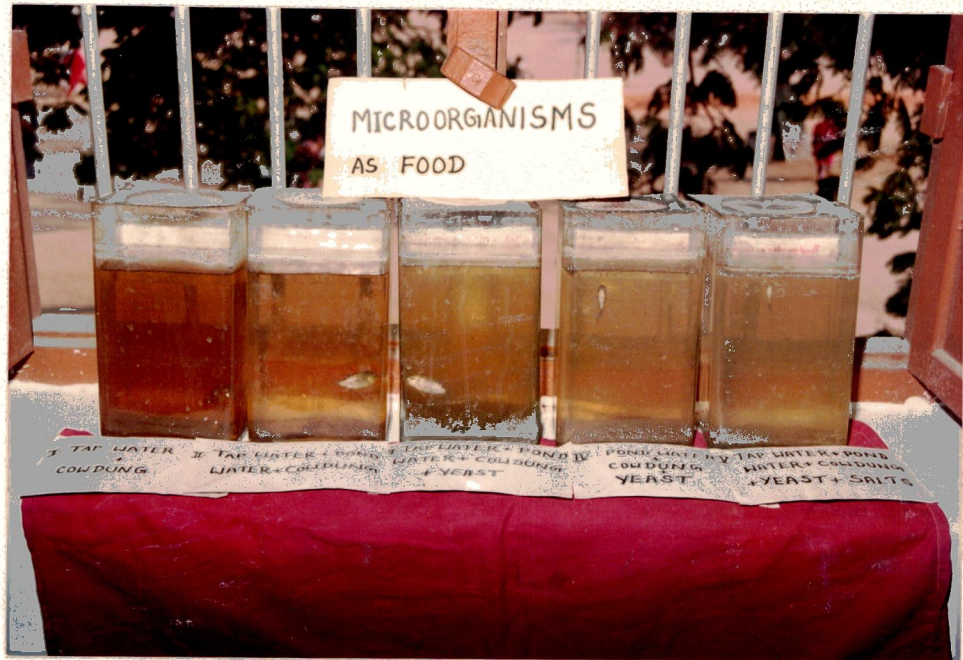


FIG - 18 FISH IN THE CONTROL





FIG - 20

CULTURE MEDIA CONTAINING ORGANISMS AND ADDED FOOD



Summary and Conclusion

V. SUMMARY AND CONCLUSION

SUMMARY

1. The present study was an attempt to find out the suitable or the best medium for culturing microplanktons and to promote the growth of fish *Tilapia mossambica* under laboratory conditions.
2. The pond water was collected from Ukkadam and was examined under the microscope, the organisms such as paramecium, *Vorticella* were seen under the microscope.
3. Cowdung was collected and analysed, few nematode worms were seen.
4. Dried baker's yeast was used to promote the growth of microplanktons.
5. Micronutrients like sodium acetate, Ammonium Chloride, Disodium hydrogen phosphate and Magnesium Sulphate were used for promoting the growth of microplanktons.
6. Various media with different compositions were prepared for growth of microorganisms in the laboratory conditions.

7. Cowdung, Yeast, Salts were used as fertilizers.
8. The protein content of each media was found out which ranged from 20 to 37.5 mg/ml.
9. The hydrobiological features such as P^H , Temperature, Salinity and Oxygen content were determined for each medium.
10. The P^H of different culture media ranged from 7.5 to 9.
11. The temperature of different media ranged from 26 to 27°C.
12. The oxygen content of the various media ranged from 1.4 to 5.34 ml/litre.
13. Likewise the salinity of all media were determined which ranged from 1.0 to 1.4‰.
14. Fingerlings of *Tilapia mossambica* were introduced after noting initial weight and length.
15. Weight was taken after every seven days. The weight taken after every seven days indicated the growth of fish.
16. The media V and X were able to produce more microplanktons such as paramecium, Vorticella, Lacrymaria, Volvox, Dileptus, Daphnids, Rotifers, Colpes hirtus etc.
17. Growth of fish were recorded in all the media after every 7 days and upto 35 days.

18. Medium X recorded the highest growth of fish owing to the fact this medium contained plenty of microorganisms. In addition to that supplementary food in the form of oil cake and wheat bran was added.

C O N C L U S I O N

The present work indicates that the productivity of any water body by manuring will increase the level of zooplanktons. This enhanced production of microorganisms will increase the protein content of the medium and growth of fish.

The significance of the present work is that the fingerlings of *Tilapia mossambica* showed greatest growth rate in the medium which had the prepared food with microorganisms. From this view point, this work proves that for increasing the body growth of fish both natural food as well as supplementary food is necessary.

The findings of the work that is preparing culture media, increasing the fertility of the water with cowdung, Yeast, micronutrients for microplankton production which in turn enhance the growth of young fish, all these may help in the fish culture aspects.

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