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Effect of Fruit of *Solanum xanthocarpum* as Immuno Stimulant on Fish *Channa striatus*

M. Rajakumari
Assistant Professor, V.V. Vanniaperumal College for Women, Virudhunagar, Tamil Nadu, India
K. Kalai Selvi
Student, Department of Bio-chemistry, V V V College for Women, Virudhunagar, Tamil Nadu, India

Abstract:
The fruit of Kantankattari(Solanum xanthocarpum) was used for screening of Phytochemical, Antioxidant, Antimiccrobial properties, and the powder of same fruit was also incorporated with fish feed. The fish Channa striatus was fed with Control and test (Solanum xanthocarpum) diet for 30 days. After 30 days of experiment Haematological parameters were analysed.It is also interesting to find out that in all the groups of Channa striatus the growth rate was increased gradually in the test than control for the period of 30 days. After 30 days of experiment the collected fish blood was subjected to Haematological parameters such as WBC, RBC, Differential count, platelet count, Haemoglobin concentration, Macrophage count, phagocytic count. Almost all the haematological parameters gradually increased in test animal after 30 days of treatment period than Control. Protein profile of serum on SDS PAGE indicated that there was an increased number of protein fractions were observed in the test fish than Control for the period of 30 days of experiment.

Keywords: *Solanum xanthocarpum, Channa striatus, Haematology, SDS PAGE.*

1. Introduction

In recent years, there has growing interest in field of herbal medicines research and search for promising potential area of investigating of immunomodulatory agents from natural products. The immune system designed to protect the host from invading pathogen and to eliminate disease. Plants are the essential and integral part in Complementary and Alternative medicine and due to this they develop the ability for the formation of secondary metabolites like proteins, flavonoids, alkaloids, steroids and phenolic substances which are in turn used to restore health and heal many diseases. Herbal drugs are believed to enhance the natural resistance of the body against infection and their immunodulatory activities have been reported in numerous plants. (Atal CK*, et al* 1986).

The concept of immunomodulation relates to nonspecific activation of the function and efficiency of macrophages, granulocytes, complement, natural killer cells and lymphocytes and also the production of various effector molecules generated by activated cells. It is expected that these nonspecific effects give protection against different pathogens including bacteria, viruses, fungi etc. and constitute an alternative to conventional chemotherapy. Heamatologicalparameter such as Total RBC, WBC, Haemoglobin and neutrophil constitutes the key components of the immune system. A rise or fall in the concentration of these cells affects the health/immune constitution of the body as they are known to recognize the foreign antigens and mount an immune response. (Mofizur Rahman *et al.,* 2011)

Immunomodulant which include both synthetic and biological substances perform different stimulating functions.(Huxley *et al.,* 1996).The addition of immunomodulants to fish feed to stimulate the immune system is becoming very fashionable. When used in the correct circumstances can be a very useful management tool for the fishery managers. The technology has been transferred from the commercial world of aquaculture and the keeping of valuable *Channa striatus* fish (Scang *et al*., 1994). Fish are cold blooded and as such as their biological systems are temperatures dependent. At low temperatures, around 10° C the immune system in fish is virtually inactive. The metabolism is so slow at these temperatures that there is effectively very little immune system response when the fish is challenged by a pathogen or environmental stressor (Anderson *et al.,*1993).

The immune system is the body's best defense mechanism against disease (Soderhall *et al.,* 1992). The best method to ensure a healthy immune system is to provide a stress – free environment and quality nutrition (Sakai *et al.,*1999).

Prepared diets not `only provide the essential nutrients that are required for normal physiological functioning, but also may serve as a medium by which fish can receive other components that may affect their health. (Gatlin *et al.,* 2002) The fish feed composed of soya been, rice bran, groundnut oil cake, tapioca, some vitamins and probiotics. Immunomodulator such as medicinal plant like S*olanum xanthocarpum* was also added to it. It enhances not only growth rate but also can positively stimulate the nonspecific defense mechanism of fish. (Gullian.M *et al.,* 2004).

Probiotic have profound effect on potentiating both arms of immune response i.e. Cell mediated immunity and humoral immunity. Commercial probiotics are added to the feed for *Solanum xanthocarpum channa striatus* fish. This feed stimulates the growth rate and immune system. (Naidu*et al.,* 1999)

The immunomodulation effect of *Solanum xanthocarpum* as feed additives for *Channa striatus* fish. The influence of such additives on the hematological parameters, nonspecific immune response of fish and their disease resistance abilities will be evaluated. (Dem LW *et al.,* 1986)

Solanum xanthocarpum is known as Indian shade or yellow berried night shade plant. *Solanum xanthocarpum* is known by different name in various languages in India viz. Kantkari (Sanskrit), kateri (Hindi), Bhoringni (Gujarati), Kantankattiri (Tamil), Kantkriccunta (Malayalam), vakudu (Telugu), Nelagulle (kannad).(Sch. Acad. J. Pharm *et al* 2014). The common name is kantankattiri Synonym *Solanum surrattense* and it belongs to family Solanaceae. It plays an important place among medicinal herbs, (especially, for the treatment of cough) in Indiasince ancient times. The plant found well versed in India, often in waste places, on roadsides and in open space. It is usually spreading or diffused perennial, woody at base, 2- 3m in height. The branches are densely covered with star shaped hairs. The zig- zag branches, and covered with yellow, sharp, shining prickles. The leaves are up to 10 cm in length, their midribs and other nerves with sharp yellow prickles. The flowers are purple in nature, about 2 cm long, found has small bunch opposite to the leaves. The fruits are glabrous, globular drooping berries, 1.5 to2 cm, yellow or white with green veins, surrounded by enlarged calyx. (Sivakumar et al*.,* 2014) Kantankattiri is bitter and pungent in taste and has not potency. It possesses light and dry attributes. Kantankattiri is useful in wide range of diseases. It is more commonly used in the diseases like bronchial asthma, cough, worms, etc., The fruits facilitate the seminal ejaculation, alleviate worms, itching, and fever and reduce fats. (Kiritikar KR *et al*., 2005) The fruits are known for several medicinal uses like anti – oxidant, anti – asthmatic, antipyretic, laxative, and anti – inflammatory activities. (Vijayanarayana.k *et al.,* 2013)

The whole plant is used for medicinal purpose including of fruits and roots. The powder form of kantankattiri with oils is mixed well and used externally to alleviate nasal disorders. And also, nasal administration of kantankattiri is beneficial in migraine, and headache. The dried fruits are smoked in the form of cigarette andthe smoke held up in the mouth cavity for some time ameliorates the dental infections. The fumigation of kantankattiri is helpful in piles. The paste applied on swollen effectively (Kar DM *et al.,* 2006). To the best of our knowledge there was lack of scientific reports available in support of its traditional claim of hepatoprotective potentials (Sivakumar *et al.,* 2014). The family Solanaceae comprises about 80 genera and 3000 species, from which 1500 belong to the genus Solanum. This genus is widespread over the world although it is concentrated mainly in tropics and subtropics. The genus has toxic alkaloids which are distributed in all parts of the plant (Cronquist A *et al.,* 1981). Several Solanum species contain free and glycosilated alkaloids, important substrates for the synthesis of steroidal hormones (Lewis D C *et al.,* 1970) thus making these species very important economically. Solanaceae species play an important role by favouring the colonization of open areas and consequently in forest regeneration processes. (srinivasan *et al.,*2012)

Since the plant *(Solanum xanthocarpum)* contains phytosteroids such as sitosterol, carpsterol, and other sterols and phenolic substances and it extensively used in the treatment of sexual debility, facilitating conception, gonorrhea. It possesses estrogenic activity, but no scientific data is available on the endocrine effects of this plant. (Qumre Alem *et al.,* 2012)

Herbal drugs or their extracts are prescribed widely by the experts, even when their biological active compounds are unknown (Akinmoladun *et al.,* 2007). Secondary metabolites (alkaloids, essential oils, flavanoids, tannins, terpenoids, saponins, phenolic compounds, cardiac glycosides etc.,) Form the backbone of modern medicine (Gupta *et al.,* 2006) and play an important role in plant defense against herbivory and other interspecies defenses. Humans use secondary metabolites as medicines, flavorings and recreational drugs. (Ganesh*, et al.,* 2014.)

Initial screening of plants for possible antimicrobial activities typically begin by using crude aqueous or alcohol extraction methods and can be followed by various organic extraction methods. Since nearly all of the identified components from plants active against microorganisms are aromatic or saturated organic compounds, they are often obtained through in aqueous or ethyl acetate extraction. (Hussin,*et al.,* 2013)

The plants usually possess antimicrobial sub-stances for their own protection from microbial infection and deterioration; that ís why they are being used for the conservation and safety of food products (Ushimaru *et al*., 2011) assessed the antimicrobial activity of aqueous and ethanol extracts of nine Nigerian species against four nutrient borne bacteria for checking their pharmacological activity in the direction of formulating new anti-abscessedagent (Khizar abbas *et., al* 2014).

2. Materials and Methods

2.1. Collection of Sample

Solanum xanthocarpum fruits was collected from the Viruthunagar (district). The extract was used for phytochemical and anti-oxidant activity.

2.2. Preparation of the Plant Extract

Extract have been prepared by using fresh plant of *Solanum xanthocarpum* weighing 50grams. Washed thoroughly in running tap water to remove debris and dust particles and then rinsed in distilled water, shade dried, coarsely powdered and stored in an air tight container for further use.

2.3. Selection of Suitable Medical Plant

Medicinal plant which are having the active principles such as growth promoter, nervine, tonic, antistress, appetizer, and immunomodulants.

The important medicinal plant was selected for the present study is *Solanum xanthocarpum* (Kantankattiri).

Figure 1: Systematic Classification of Medicinal Plant
Solanum xanthocarpum (kantankattiri)

- Kingdom : Plantae
- Order : Solanales
- Family : Solanaceae
- Genus : Solanum
- Species : *Solanum xanthocarpum*
- Tamil name : Kantankattiri
- English name : Yellow berried night shade
- Parts used : *Solanum xanthocarpum*(Fruits)

Uses:

- The whole plant is used for medicinal purpose including of fruits and roots.
- The fruits facilitate the seminal ejaculation, alleviate worms, itching, and fever, and reduce fats.
- The powder form of kantankattiri with oils is mixed well and used externally to alleviate nasal disorder. And also, nasal administration of kantankattiri is beneficial in migraine, and headache. The fumigation of kantankattiri is helpful in piles. The paste applied on swollen and painful joints in arthritis, reduces the pain and swelling effectively.

2.4. Antimicrobial Activity

The plant extracts were screened against five bacterial pathogens. Antimicrobial activity was carried out using well diffusion method. The bacterial strains were inoculated in Nutrient broth and incubated for 24 hours before used in antibacterial assay. Sterile Muller Hinton Agar plates were prepared and allowed to set. The cultures to be screened were swabbed on tap of the solidified media. Well impregnated with the plant extract were placed on the swabbed plate. The plates were incubated at 37ºc for 24 hours. After incubation, the inhibition zone was measured. Zone of inhibition was measured from the edge of the well to the clear zone in millimeter.

2.5. Phytochemical Analysis of Solanum xanthocarpum

2.5.1. Test for Tannins

Take 1ml of the fruit extract and add 2 drops of 5 % ferric chloride solutions. Dirty green precipitate indicates the presence of tannin.

2.5.2. Test for Flavonoids

Lead acetate test: The extract (50 mg) was dissolved in distilled water and 3ml of lead acetate solution was added. A bulky white Lead precipitate indicated the test is positive.

2.5.3. Test for Alkaloid
The given sample was added with Mayer's reagent (0.68g of mercuric chloride in 30ml of distilled water, 2.5g of potassium iodide in 5ml of distilled water) solution. Formation of whitish yellow (or) cream coloured precipitate.

2.5.4. Test for Phenols
Various extracts (1ml) were dissolved in 5ml of alcohol was treated separately with a few drops of neutral ferric chloride (ammonium hydroxide + $FeCl_2$) solution change in colour indicated the presence of phenols.

2.5.5. Test for Protein
Two drops of Ninhydrin solution (10 mg of Ninhydrin in 200ml of acetone) were added to 2ml of aqueous filtrate. A characteristic purple colour indicated the presence of amino acid.

2.5.6. Test for Carbohydrate

- IODINE TEST

Crude extract was mixed with 2ml of iodine solution. A dark blue or purple coloration indicated the presence of the carbohydrate.
Few drops of leaves extract were mixed with 2ml of Molisch's reagent and shaken well. Then 2ml of concentrated sulphuric acid poured along the sides of the test tube. Appearance of violet colour indicated the presence of carbohydrates.

2.5.7. Test for terpenoid
The extractwas treated with chloroform and dilute sulphuric acid. Red violet colour is observed for terpenoids.

2.5.8. Test for Glycosides
2ml of glacial acetic acid containing one drop of ferric chloride solution was added to 5ml of the extract. 1ml of concentrated sulphuric acid was poured along the sides of the tube. Formation of a brown ring at the interface indicates the presence of glycosides.

2.5.9. Test for Quinones
Crude extract was mixed with 2ml of concentrated HCl and heated gently. A yellow coloration indicated the presence of the quinines.

2.5.10. Test for Anthraquinone
0.5 g of the extract was boiled with 10ml of sulphuric acid and filtered while hot. The filtrate was shaken with 5ml of chloroform. The chloroform layer was pipetted into another test tube. The resulting solution was observed for colour changes to violet indicating the presence of anthraquinone.

3. Antioxidant Activity

3.1. 2, 2 – Diphenyl—1 – Picryhydrazyl Radical (DPPH) Inhibition System:
The free radical scavenging activity of the extracts and the ascorbic acid (standard) were determined according to the DPPH free radical scavenging assay described by Tang et.al, 2002. 100 µl of vegetable extract at a concentration of 1 mg / ml or standard was added to 1 ml of 0.2 Mm DPPH in methanol. The mixture was then shaken vigorously and kept to stand in the dark room for 30 minutes at room temperature. The absorbance was read at 517 nm with deionised as blank. The readings were compared with the controls which contained 100 µl of 70% methanol and 1 mlDPPH served as the control. The radical scavenging activity (%) was calculated according to the equation as follows.

3.2. Super oxide free radical scavenging activity:
100 µl of riboflavin solution (20 mg), 200 µl EDTA solution (12mM),200 µl methanol and 100 µl NBT (Nitro-blue tetrazolium) solution (0.1 mg) were mixed in test tube and reaction mixture was diluted up to 3 ml with phosphate buffer (50 mM). The absorbance of solution was measured at 590nm using phosphate buffer as blank after illumination for 5 min. This is taken as control.50 µl of different concentrations of extracts as well as standard preparation were taken and diluted up to 100 µl with methanol. To each of these, 100 µl Riboflavin,200 µl EDTA,200 µl methanol and 100 µl NBT was mixed in test tubes and further diluted up to 3 ml with phosphate buffer. Absorbance was measured after illumination for 5 minutes at 590 nm on uv visible spectrometer (Valentao p et.al, 2002).

3.3. Nitric oxide radical scavenging activity:
1 ml Sodium nitroprusside (10Mm) in phosphate buffered saline was mixed with different concentration of 1 ml extract dissolved in methanol and incubated at room temperature for 180 minutes.The same reaction mixture without the extract of the sample but with equivalent amount of phosphate buffer served as the control. After incubation period 1 ml Griess reagent (1 % sulphanilamide, 2% H_3PO_4 and 0.1% N – napthyl ethylenediamine hydrochloride (NEDA) was added to equivalent amount of sample. The absorbance of chromophore formed during diazotization of nitrite with sulphanilamide and a subsequent coupling with NEDA was measured at 546 nm for the determination. The scavenging activity (%) was calculated according to the equation as follows.

4. Reducing Power Assay

The reducing power of the extract was determined according to the method of extract (1 mg/ml) in 1.0 ml of deionized water were mixed with phosphate buffer (2.5 ml, 0.2M, p^H 6.6) and 1% potassium ferricyanide (2.5 ml). The mixture was incubated at 50° C for 20 minutes. Aliquots of trichloroacetic acid (2.5 ml,10 %) were added to the mixture, which was then centrifuged at for 10 minutes. The upper layer of solution (2.5 ml) was mixed with distilled water (2.5 ml) and a freshly prepared Ferric chloride solution (0.5 ml, 1 %). The absorbance was measured at 700 nm. Increased absorbance of the reaction mixture indicated increased reducing power. These reducing powers of extracts are compared with standard ascorbic acid.

5. Biochemical Analysis

The serum of *Channa striatus* fish was Subjected to analyzing the biochemical parameter such as protein by SDS-PAGE.

5.1. Collection of Experimental Fish

The experimental animal *Channa striatus* fish, was collected from aquarium, Virudhunagar. The collected fish were taken to the laboratory and were stocked in recirculating water tanks. They were acclimatized to the ambient laboratory condition prior to starting the experiment.

Figure 2: Scientific classification

- Kingdom : Animalia
- Phylum : Chordate
- Class : Actinoperygil
- Order : Perciformes
- Family : Chanaidae
- Species : *Channa striatus*

Nutrients	Control	Test
Ground nut oil cake	400g	400g
Soya bean	200g	200g
Rice bran	330g	330g
Tapioca	50g	50g
Vitamin A & B	20g	20g
Probiotics	1g	1g
***Solanum xanthocarpum* Powder**	-	**2.5g**

Table 1: Preparation of Feed

The control, test diet was prepared by mixing rice bran 330g, ground nut oil cake 400g, soya bean 200g, tapioca 50g. It was cooked in pressure cooker for 30 minutes and cooled. Then 20g of vitamins B Complex and vitamin A was added. After cooling vitamins and minerals were mixed with these feed thoroughly. The feed was divided into two equal parts, one part was served as control and remaining parts were incorporated with immunomodulant (Test1gProbiotics 2.5g *Solanum xanthocarpum*) and it was made in the form of noodles. The noodles were sun dried till the moisture content was reduced to less than 10% and were broken manually into very small pieces. The dried noodles were stored in plastic box and used for the present study.

The fishes were primarily divided into 2 experimental groups. The experimental group 1 was kept as control group which were fed with control diet. The experimental group 2 was fed with test diet for 30 days.

The experimental fish *Channa striatus* were purchased from local fish farm and allowed to accumulate in the laboratory condition for 30 days. Then the fishes were weighed individually in mono balance. The initial weight of the fishes was ranged from 30g to 50g.

Figure 3: Control FishFigure 4: Test Fish

6. Haematological Studies

6.1. Fish Blood Sampling

Blood was obtained from the gills using a 20-gauge needle.

1. Red blood cells counting:

$$\text{RBC} = \frac{\text{Number of cell counted x dilution}}{\text{Area counted x depth of fluid}}$$

$$\frac{\text{Dilution}}{\text{Area counted x depth of fluid}} = \frac{201}{0.2 \times 0.1}$$

White blood cells counting:

$$\text{WBC} = \frac{\text{No of cells x Dilution Factor}}{\text{Volume of fluids}}$$

Platelet Counting:

$$\text{Platelet} = \frac{\text{No. of cell x dilution fluid x 1}}{\text{Volume of fluid (0.1)}}$$

Differential counting:

$$\text{Neutrophil} = \frac{\text{No. of specific WBC}}{100} \times 100$$

Eosinophil = N x 3.12

Haemoglobulin concentration: (Sahli Method)

Phagocytic cells counting:

$$\text{Phagocytic cell} = \frac{\text{No.of phagocytic counting x 100}}{200}$$

Macrophage Counting

7. Results

7.1. Phytochemical Analysis

The results on phytochemical screening of the plant extract *Solanum xanthocarpum* revealed the presence of flavonoids, proteins, alkaloids, phenols, carbohydrate and terpenoids. Alkaloids have been associated with medicinal uses and it is one of the common biological properties with antimicrobial activity.

Figure 5

S. No	Phytochemical Tests	Ethyl acetate extract
1	Flavonoid	Positive
2	Protein	Positive
3	Tannin	Positive
4	Alkaloid	Positive
5	Phenol	Positive
6	Carbohydrate	Positive
7	Quinone	Positive
8	Terpenoid	Positive
9	Glycoside	Positive
10	Anthraquinone	Negative

Table 1: phytochemical Analysis of the Plant Extract solanum xanthocarpum with Ethyl Acetate Solvent

The phytochemical screening of plants studied showed the presence of maximum of nine phytochemicals in the ethyl acetate extract namely steroids, glycosides, quinines, anthroquinnones, alkaloids, phenols, flavonoids, proteins, carbohydrates, and tannins, whereas only one compound was absent in ethyl acetate extract.

7.2. Antimicrobial Activity

An antimicrobial activity of fruits of *Solanum xanthocarpum* was observed by agar well diffusion method and by measuring the diameter of zone of inhibition (in mm). 100 µg of extract was loaded on the well and tested against 5 different microbes. Significant increase in the zone of inhibition was observed on increasing the concentration of extracts. Ampilicilin was used as standard and respective solvents were used as control.

The antimicrobial activity was performed with five different microbial pathogens *Escherichia coli, Pseudomonas aeruginosa, Micrococcus species, Bacillus cereus, proteus*vulgaris *using* well diffusion method. *Solanum xanthocarpum*has best antimicrobial activity which exhibited a maximum zone of1.5 mm in diameter.

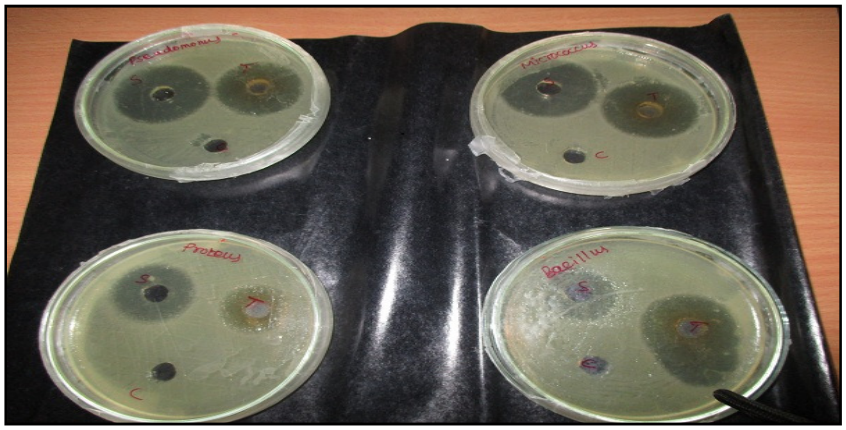

Figure 6: Antimicrobial activity against microbial pathogen in mm

7.3. Antioxidant Activity

In the present investigations antioxidant activity of *solanum xanthocarpum* showed appreciable activity against the DPPH, Nitric oxide, Super oxide, and reducing power assay.

Methods	Control (%)	Test (%)
DPPH	64	69
Reducing power assay	57	79
Nitric oxide radical	58	75
Super oxide radical	64	81

Table 2: Antioxidant Activity of the Plant Extract of solanum xanthocarpum with ethyl Acetate Solvent

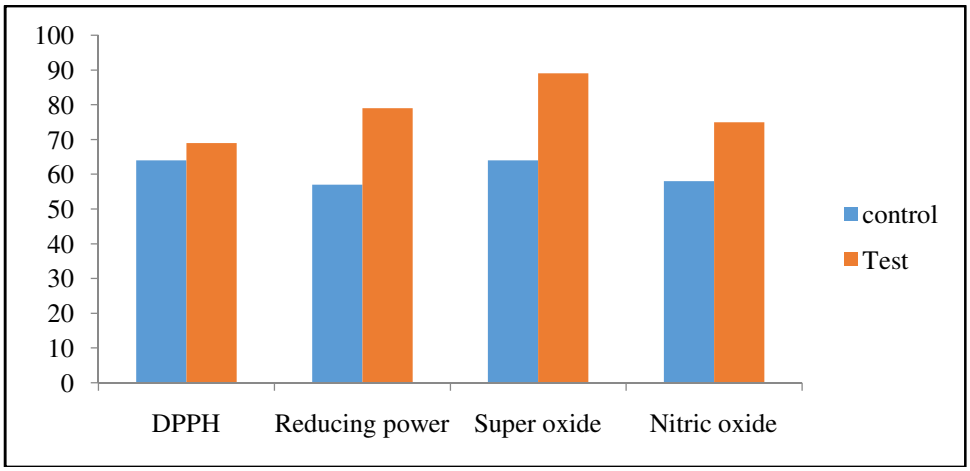

Figure 7

7.3.1. Effect of immunomodulant on Growth Rate

In the present investigation fishes were exposed to control and test diet, when compared to control the Growth rate was increased gradually in test animal for the period of 30 days.A significant increase in all the haematological parameters indicates that, *Solanum xanthocarpum* as one of the best immunomodulator on fish *(Channa striatus)*. ZX

S. No	Parameters	Control	Test
1	WBC (10^4 x µl)	5.2	6.2
2	RBC (106x µl)	2.6	3.7
3	Platelet (10^6x µl)	9.6	1.4
4	Eosinophil (cells/cumm)	140.4	150
5	Neutrophil (cells/ cumm)	5481	9984
6	Basophil (cells/cumm)	71.76	106
7	Phagocytic cell (cells/ cumm)	41.5	44.5
8	Haemoglobulin	14	16
9	Macrophage (cells/cumm)	14616	18531

Table 3: Effect of Immunomodulant on Haematological parameters of Channa striatus

In the present study, all the haematological parameters (WBC, RBC, Haemoglobulin, differential count, phagocytic cell, macrophage, and platelet) were increased gradually for the period of 30 days in the test animal than control.

7.3.2. Effect of immunomodulant on SDS- PAGE

The experimental fishes Serum was subjected to SDS PAGE after 30 days. The changes in the protein profile was recorded as follows.The protein profile of *Channa striatus* fish after exposing the Control and test diet, the protein fractions were increased gradually in test animal than control.

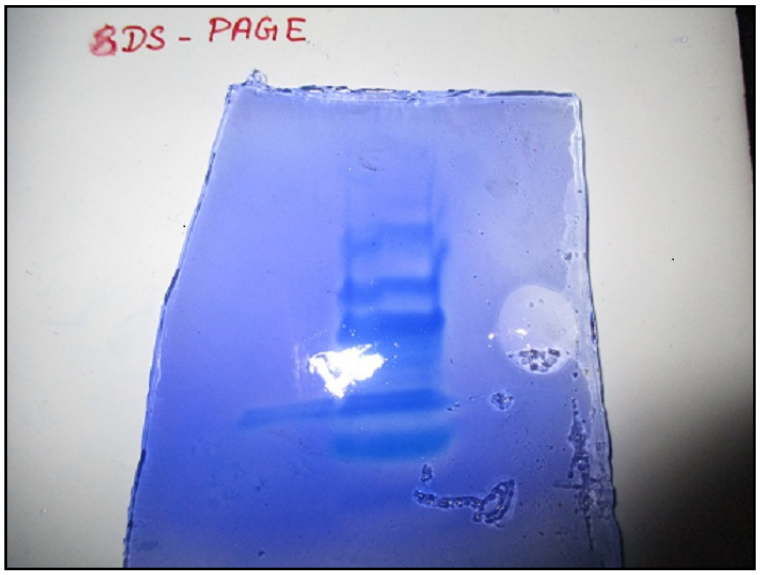

Figure 8

8. Discussion

The Phytochemical screening of plants studied showed the presence of saponin and tannin only in yellow berried night shade where as they are absent in Makoy. The presence of these tests in the plants in likely to be responsible for the free radical scavenging effects observed. (Sudhanshu *et al*., 2012)

The phytochemical screening of ethyl acetate of fruits of *Solanum xanthocarpum* Showed the presence of alkaloid, triterpenoid, phenols, tannins, flavanoids, carbohydrates, phytosterols, and fats. The result indicates that Solanum xanthocarpum fruit possess maximum bioactive compounds.

Antioxidant activity of *Solanum xanthocarpum* showed appreciable activity against the DPPH assay method where the regression line clear cut showed the effectiveness of it as it' s has potential which are comparable to ascorbic acid. The antioxidant activity of *Solanum xanthocarpum* in ethyl acetate extract using DPPH assay method shows appreciable activity comparable to standard ascorbic acid. (Tahao *et al.,* 1994).

There is a strong need for effective antioxidants from natural sources as alternatives to synthetic antioxidant in order to prevent the free radical which can have serious effects on the cardiovascular system, either the physical and chemical investigation of ethyl acetate of fruits of *solanum xanthocarpum* was carried out. By phytochemical screening the presence of alkaloid, triterpenoid, phenols, tannins, flavanoids, carbohydrates, phytosterols, and fats confirmed rough lipid per oxidation or vasoconstriction. Therefore, in this study, the antioxidant properties of the methanol extracts of leaves and stems of *Solanum xanthocarpum* DPPH radical scavenging activity according to the method described and the result of the screening.In particular, leaves (ethanol extract) of *Solanum xanthocarpum* displayed the highest activities as antioxidant activity as removal of the stable radical DPPH and the lowest activity were found in ccl4 extract of stem. *(Dinanath D Patil et al., 2013)*

In the present study, antioxidant property of ethyl acetate extract of fruit of *Solanum xanthocarpum* was carried out. It showed good % DPPH radical scavenging activity. It also showed good percentage of Reducing power, Nitric oxide and Superoxide radicals. plant source possibly will get innovative innate commodities into pharmaceutical, cosmetic as well as food production. In the current work, the antioxidant capacity of ethyl acetate extract of fruit of *Solanum xanthocarpum* recommend that it may possibly play a function in preventing human diseases in which free radicals are concerned, such as cancer, ageing along with cardiovascular diseases.

The antibacterial activity tested with plant extracts *Solanum xanthocarpum* against revealed 28mm in diameter which is considered to be the best result with the plant extract. It is followed by *Pseudomonas* exhibiting a zone of inhibition of 26 min in diameter. The above organisms showed a remarkable activity with the plant extract. Our results coincide with the findings of Garima *et al.,* (2009)wherein they reported that *Solanum xanthocarpun* extracts was found to be inhibitory effect against both gram positive and gram negative bacterial pathogens

In the present investigation, the result of antimicrobial activity showed maximum zone of inhibition exhibited in the test *(Solanum xanthocarpum)* than control. The result implies the fruit of *Solanum xanthocarpum* may be a great natural source for the development of new drugs.

Thereductions in haemoglobulin percentage and red blood cell count of the fish *Anabas scandens* treated with mercury. Decrease in haemoglobulin, red blood cell count and HCl was observed in *Tinca tinca* exposed to mercuric chloride and lead. (Shah *et al*., 2004)
The reduction of RBC is mainly due to development of hypoxic condition during the treatment which inturn leads to increase in destruction of RBC or decrease in rate of formation of RBC due to non-availability of Hb content in cellular medium *(*Yin *et al*.,2007).
The result of the present investigation showed that the *Solanum xanthocarpum* fruit treatment increased the total count of RBC.
The immunomodulant has been already reported for glucon, lactoferin, chitoson in fishes (Saakai *et al*., 1999) his method is non-stressful and allows mass administration regardless of the size of the fish.
In the present study, the dietary administration of *Solanum xanthocarpum* was fed to *Channa striatus* to access their impact on growth and haematological studies.In the present study, the result showed that, the Growth rate was significantly increased in the test fish than control.
White blood cellof fish play a crucial role in the cellular immunity and resistance to infectious disease.The significant increase In WBC counts in fish feed with the nigella or combination diets may be due to the activation of the hamopoietic tissues by the black cumin (SC. Nair *et al*., 1991). In the present study, WBC *and RBC* count were increased in test animalthan control. There was a significant increase in Differential count was also observed in test than control.
The time dependent effects in ethanolic extract of salmonalla treatment, changes of macrophage in mice showed significant increase in the number of macrophage cells on the 15 day of drug administration thus it significantly activated macrophage and enhanced their function as compared to control (RV. Savadi*et al.,* 2005)
In the present study, the fishes were exposed to Control and test diet. After the 30 days of experiment the Phagocytic cells were gradually increased in the test fish than Control. The plant extract of *Solanum xanthocarpum* treatment on functional changes of macrophages in fish showed significant increase in the number of macrophage cells on the 30 days when compared to control.
The effect of cypermethrin on the haematological parameters of *Cirrhinus mirgala* fish were subjected to haematological investigation. The haematological analysis showed that the RBC, HB, PCV, Platelet count were significantly increased in the fish *Cirrhinus mrigala, Cardiospermum halicacabum* plant supplementary fed influence the immunological effects. (*M. Meenambicai et al., 2007)*
In the present study, the result showed that the Platelet count was increased gradually in test animal when compared with control for the period of 30 to days.
The proteins display an unexpectedly wider range of behaviors in buffers containing moderate capillary electrophoresis provides a convenient method of examining these behaviors. Examination of the dynamkcs of the response of proteins to SDS offers a way to differentiate and characterize proteins. Based a survey of 18 different proteins, result showed that protein differ in the concentrations of SDS at which they denature, in the rates of unfolding in SDS, and in the profiles of the denaturation pathways. (Katherine. L *et al.,* 1998)
The protein profile of *Channa striatus* after exposing the control and test diet, the protein fractions were increased gradually in test fish than control for the period of 30 days.

9. Summary

The fruit of Kantankattari(*Solanum xanthocarpum) was* used for screening of Phytochemical, Antioxidant, Antimicrobial properties, and the powder of same fruit was also incorporated with fish feed. The fish *Channa striatus* was fed with Control and test (*Solanum xanthocarpum)* diet for 30 days. After 30 days of experiment Haematological parameters were analysed.

- Phytochemical screening showed the presence of a maximum of nine phytochemicals in the ethyl acetate extracts of *Solanum xanthocarpum.*
- Antimicrobial activity by agar well diffusion method revealed that aqueous extract of *Solanum xanthocarpum* showed maximum inhibitory activity against the selected microorganisms.
- Antioxidant activities of *Solanum xanthocarpum* was estimated by four different assays. The result showed that fruit of *Solanum xanthocarpum* possesses best antioxidant property.
- The fishes were obtained from Virudhunagar aquarium and exposed to control and test diet. It is also interesting to find out that in all the groups of *Channa striatus* the growth rate was increased gradually in the test than control for the period of 30 days.
- After 30 days of experiment the collected fish blood was subjected to Haematological parameters such as WBC, RBC, Differential count, platelet count, Haemoglobin concentration, Macrophage count, phagocytic count. Almost all the haematological parameters gradually increased in test animal after 30 days of treatment period than Control.
- Protein profile of serum on SDS PAGE indicated that there was an increased number of protein fractions were observed in the test fish than Control for the period of 30 days of experiment.

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