Millennium Zoology

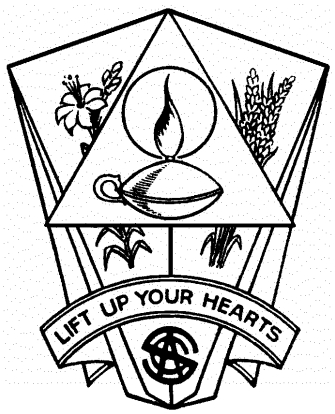
www.millenniumzoology.com

RNI. Reg.No. KERENG/2001/6034 ISSN No. 0973-1946

A National Peer Reviewed Journal Published Annually to Foster Study and Research in Zoology

by the Dept. of Zoology, St. Aloysius College, Elthuruth,

Thrissur, Kerala, 680611, India



Vol. 17 **November 2016** **No. 1**

RNI. Reg.No. KERENG/2001/6034 **ISSN No. 0973-1946**

Millennium Zoology

Address for communication

Editor, Millennium Zoology, Dept.of Zoology, St.Aloysius College, Elthuruth, Thrissur Kerala, 680611, India,Tel:(0487)2360748; Email:millenniumzoology@gmail.com

www. millenniumzoology.com

Copies are available from

Current Books, Thrissur

ISSN 0973 - 1946

EDITORIAL

It may sound like science fiction, but wastewater treatment plants across the world may one day turn ordinary sewage into biocrude oil, thanks to new research achievements.

The technology, hydrothermal liquefaction, mimics the geological conditions Earth uses to create crude oil, using high pressure and temperature to achieve in minutes something that takes Mother Nature millions of years. The resulting material is similar to petroleum pumped out of the ground, with a small amount of water and oxygen mixed in. This biocrude can then be refined using conventional petroleum refining operations

Wastewater treatment plants across the world treat trillions of gallons of sewage every day. That amount could produce the equivalent of up to approximately one tenth of oil per year. It is estimated that a single person could generate two to three gallons of biocrude per year.

Using hydrothermal liquefaction, organic matter such as human waste also can be broken down to simpler chemical compounds. The material is pressurized to 3,000 pounds per square inch — nearly one hundred times that of a car tire. Pressurized sludge then goes into a reactor system operating at about 660 degrees Fahrenheit. The heat and pressure cause the cells of the waste material to break down into different fractions — biocrude and an aqueous liquid phase.

There is plenty of carbon in waste water sludge and interestingly, there are also fats. The fats or lipids appear to facilitate the conversion of other materials in the wastewater such as toilet paper, keep the sludge moving through the reactor, and produce a very high quality biocrude that, when refined, yields fuels such as gasoline, diesel and jet fuels.

In addition to the biocrude, the liquid phase can be treated with a catalyst to create other fuels and chemical products. A small amount of solid material is also generated, which contains important nutrients. For example, early efforts have demonstrated the ability to recover phosphorus, which can replace phosphorus ore used in fertilizer production.

If this emerging technology is a success, a future production facility could lead the way for wastewater operation to meet its sustainability objectives of zero net energy, zero odours and zero residuals.

Editor

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1. Gaston, K.J., 1991.The magnitude of global insect species richness. *Conservation Biology*,5:283-296.

2. Norse, E. A. and R. E. McManus, 1980. Ecology and living resources: Biological diversity. In: Environmental Quality 1980: the Eleventh Annual Report of the Council on Environmental Quality, Washington, DC. pp. 31-80

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The contents should be related to the syllabi of any one of the courses in Zoology offered by various Universities in Kerala. The articles should function as an additional reading material to the graduate and post- graduate students as well as their teachers. We request the Zoology faculty in various colleges and Universities in Kerala to contribute their articles. Scientists of various Biological Research Centers and Teachers in related disciplines are also welcome to contribute. Articles from students will also be considered on merit. Manuscripts should be typed copies of about 3-4 pages. The deadline for receiving articles will be **30st October** of every year. We suggest no definite format. However, contributors may confirm to the current practices of various journals. An editorial board of experts will select the articles.

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Thrissur, Kerala, 680611, India, Tel: 0 9388 555 738; Email: millenniumzoology@gmail.com

Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

MANGROVES AND ITS MACROFAUNAL ASSOCIATES AT PUDUVYPIN, KOCHI

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ABSTRACT

Six distinct mangrove zones dominated by *Rhizophora mucronata, Avicennia officinalis*, *Bruguiera gymnorrhiza*, *Acanthus illicifolius*, *Derris trifoliata*, and *Acrostichum aureum* are identified at Puduvypin. The present study focus on the relationship between the structural and ecological characteristics of mangrove ecosystem and macrobenthic communities. The faunal density and diversity recorded and analysed with appropriate field sampling techniques differed according to the mangrove zonation, the physico-chemical parameters and sediment texture.

KEY WORDS: Mangrove zone, Macrobenthos, Sediment characteristics

INTRODUCTION

The mangrove forest floors harbour a diverse and distinct assemblage of benthic organisms. The distribution, abundance, and diversity of these benthic invertebrates and their relationships to environmental conditions are important parts of understanding the structure and function of mangrove ecosystems. As a detritus based ecosystem, leaf litter from the mangroves provides the basis for adjacent aquatic and terrestrial food webs where the macrobenthos typically occupy the second and third trophic levels (Keshavarz, 2012). The variations in the distribution and abundance of epibenthos of the mangrove area relate positively to variations in the quantity of exported detritus. Polychaetes, gastropods, and crustaceans are regarded to be the major macrobenthic organisms in the mangrove sediment. Macrobenthic assemblage structure is influenced by local environmental conditions, such as hydroperiod, organic matter availability, and sediment characteristics (Lee, 2008).

Since these detritus rich mangrove areas are used by valued table fishes, prawns, crabs and oysters for their reproduction or growth, such swamps are considered of great economic importance for capture as well as captive fisheries. The use of mangrove forests as sites of human settlements and reclamation for other conversion purposes has been a persistent danger to the existence of the said forest along the Indian coast. With the rapid development of industries and increase in population stress, the mangroves have become a major victim of exploitation. Though intense interdisciplinary work on this problem is in progress, further research needs to be undertaken to provide the scientific basis for the proper management of this valuable natural resource.

MATERIALS AND METHODS

Puduvypin (9°58' to 10°12' N and 76°10' to 76°12' E) is a naturally accreted wetland at the southwestern tip of Vypin island. The almost 400 hectares area accreted so far is exclusively marshy with lot of mangrove vegetation with a depth of about 1 to 1.5m, a width ranging from 40 to 50m and about a kilometer along the north south axis. Mangroves of Puduvypin are denser and dominated by *Rhizophora mucronata, R. apiculata, Exoecaria agallocha, Avicennia officinalis, Bruguiera gymnorrhiza, Acanthusillicifolius, Derristrifoliata* and *Acrostichum aureum* and according to the dominance of these species; the sampling sites were divided into 6 different zones.

Duplicate sediment samples were collected using a van Veen grab (0.048m^2). Sediments were sieved through a 500 µ mesh and preserved in 5% neutral formalin mixed with rose bengal stain for subsequent identification (Birkett & McIntyre, 1971). The actual numbers of organisms counted were converted to No./m^2. The biomass values were expressed as wet weight in g/m^2. Grain size and

organic matter were determined following standard methods (Krumbein and Petti John, 1938; El Wakeel and Riley, 1957 and Trask, 1939).

RESULTS AND DISCUSSION

In the present study, 6 species of true mangroves (*Rhizophora mucronata, R. apiculata, Exoecaria agallocha, Avicennia officinalis, Bruguiera gymnorrhiza,* and *Acanthus illicifolius)* and 2 species of semi mangroves (*Derris trifoliata* and *Acrostichum aureum*) were identified along with some species of associate plants. The pattern of distribution of these species on all the stations were discontinuous and in patches of varying extent. The total and percentage abundance of the infauna and epifauna recorded in the 6 mangrove zones were calculated separately.

The variation of temperature, salinity, organic matter content, sand %, silt % and clay %, between the 6 mangrove zones were analyzed (Table – 1). Spatial variation in temperature was very low and the values fluctuated between 26.5 and 33.0. The salinity values varied between 22.3 and 30.7. The spatial variation in salinity was not pronounced since the stations are close. Well-oxygenated condition prevailed in the study area throughout the period and all the dissolved oxygen values were above 2ml/l.

The substratum characteristics of the study area showed temporal and spatial variations. The sediment composition such as clayey sand, silty clay, clayey, and silty clay were noticed during the study period. The organic matter content was high at all zones throughout the investigation period and the values ranged from 5.3 to 6.78.

Table . 1 Variation of temperature, salinity, dissolved oxygen and sediment characteristics

Floral Zones	Temperature °C	Salinity	Dissolved Oxygen (ml/l)	Sand %	Silt %	Clay %	Organic Matter %
Rhizophora mucronata	33	30.7	7.52	60.5	14	25.5	5.3
Avicennia officinalis	26.5	30.2	6	1.54	44.96	53.5	5.71
Bruguiera gymnorrhiza	26.7	29	5.31	3	7	90	5.91
Acanthus illicifolius	30	26	3.3	1.6	6.1	92.3	6.78
Derris trifoliata	29.9	23.2	3.2	26.15	32.35	41.5	5.47
Acrostichum aureum	31	22.3	2.13	23.15	34.35	42.5	6.15

Table . 2 Variation in Benthic Biomass (g/m^2) and Benthic Density ($No./m^2$)

Floral Zones	Benthic Biomass (g/m^2)	Benthic Density ($No./m^2$)
Rhizophora mucronata	23.73	7917
Avicennia officinalis	13.51	1219
Bruguiera gymnorrhiza	10.11	670
Acanthus illicifolius	13.64	2723
Derris trifoliata	25.74	3563
Acrostichum aureum	24.03	5334

Bottom fauna - Standing stock and community Structure

The density (No./m^2) and biomass (g/m^2) is given in Table – 2. Ten faunal groups were noticed at zones dominated by *Rhizophora mucronata* and *Acanthus illicifolius* Zone, followed by nine at *Acrostichum aureum* dominated area, eight at *Derris trifoliata* Zone, seven at *Bruguiera gymnorrhiza* zone and six at *Avicennia officinalis* zone.

The species encountered from different zones during the study included 8 species of polychaetes (*Lycastis indica*,*Dendronereis aestuarina, Perenereis cavifrons*, *Glycera longipinnis, Prionospio pinnata, Prionospio polybranchiata, Capitella capitata* and *Sternaspis scutata),* 3 species of amphipods (*Melita Zeylancia, Grandidierella gilesi* and *Quadrivisio bengalensis*), 2 species of Tanaidaceans (*Apseudes chilkensis* and *Apseudes gymnophobium*), decapods comprising Penaeid prawn and Crab, one species of isopod *(Asellus* sp.), mysids, gastropods including *Littorina littorea* and *Dentalium* sp., bivalves with *Cavolina* sp. and *Cardium* sp., Water beetle, Chironomid, Juvenile fishes and Foraminifera.

The study revealed that there is a distinct mangrove zonation in this mangrove forest, where *Rhizophora* sp. occupied the estuarine water frontage; *Avicennia* sp. and *Bruguiera* sp. dominated in between the estuarine and landward region and *Derris sp., Acanthus sp. and Acrostichum sp*. towards the landward region. The macrobenthic distribution varied according to the changes in the physicochemical parameters, sediment texture, carbon content of the soil and floral characteristics of mangroves (Joshi and Ghose, 2003).

In the present study, starting from the margin of the estuary towards more landward side, it was found that salinity and percentage of sand and moisture content of the soil decreased while the organic matter content and percentage of silt and clay increased which is comparable with almost all the mangrove forests in the world (Kathiresan and Bingham, 2001). *Rhizophora* zone experiences the tidal inundation with O_2 saturated estuarine water twice a day resulted with increased the moisture content in the soil. This zone also contained a high amount of sand and silt.

A frequent water logged condition was observed in the *Avicennia* zone. The area showed poor anoxic state. The low O_2 concentration decreases the aerobic decomposition of organic matter and promotes anaerobic decomposition (Reef et.al, 2010) and produces gases such as H_2S. The soil in the other zones has high clay content.

The species diversity and abundance in this mangrove benthic environment were found to be very low compared to other ecosystems and this may be due to the harsh environmental conditions prevailing within the mangrove sedimentary environment. The overall distribution and diversity of epifauna was high in the *Rhizophora* zone. As it is the zone at the land water interface, true estuarine species may find this zone a better refuge from the open estuary. Availability of detritus food and also the adequate safety can be the factors that govern the high number of epifaunal diversity here. Gastropods have high distribution in the mangrove forests probably due to their mobile characteristic, while bivalves are often confined to a narrow seaward zone, due to feeding, larval settlement restrictions and sediment texture such as low pH and high organic matter. The abundance, biomass, and diversity of molluscs within mangrove communities are likely to be influenced by physical structure of the mangrove forest and sediment textures with enriched organic carbon, higher salinities and smaller median grain size. In general, this study revealed that even relatively small-scale modifications to the structure of mangrove ecosystems can lead to significant effects on the macrobenthic diversity and abundance in these habitats.

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Statement about the Ownership and Other Particulars of Millennium Zoology Annual

1.	Place of Publication	Elthuruth, Thrissur
2.	Periodicity of Publication	Annual
3.	Printers name	Tomy Francis
	Whether Citizen of India	Indian
	Address	Dept. of Zoology, St.Aloysius College, Elthuruth
4.	Publishers name	Tomy Francis
	Whether Citizen of India	Indian
	Address	Dept. of Zoology, St.Aloysius College, Elthuruth
5.	Editors name	Tomy Francis
6.	Name and address of the Individuals who own the newspaper and the partners or the Shareholders holding more than one percent of total capital	Dept. of Zoology, St.Aloysius College, Elthuruth

I, Tomy Francis, hereby declare that the particulars given above are true to the best of my knowledge and belief

Date: 20.11.2016

sd/- Signature of the Publisher

Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

CONSERVATION NEEDS OF VELLAYANI FRESHWATER LAKE, KERALA WITH REFERENCE TO THE ASSESSMENT OF PRODUCTIVITY

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ABSTRACT.

The Vellayani Freshwater Lake is the second largest freshwater lakes in Kerala. The Lake is extensively used for the irrigation and as a major source of drinking water for the five panchayats surrounding the lake. Laundry, bathing, dumping the animal wastes, suspended wastes, agricultural fertilizers and cattle wading are the main anthropogenic activities in this lake. The Primary Productivity was measured by Dark and Light Bottle method . The lake is eutrophicated in the last monsoon season. So the Conservation of this aquatic biodiversity is very essential.

KEY WORDS: Algal blooms, Eutrophication, Conservation, Productivity

INTRODUCTION

Water is the essential and principal component of living body and also vital for life. Freshwater is a finite resource (Vijayakumar, 2005). Vellayani Lake, Thiruvananthapuram is a freshwater lake, well studied in the past for its biodiversity and water quality parameters. It is the largest freshwater lake in Thiruvananthapuram and the second largest freshwater lake and one of the three rain-fed fresh water lakes in Kerala.

In some stations of this lake algal blooms were found and it leading to the Eutrophication. Eutrophication is one of the most common water quality problems in lakes worldwide. This study helped to understand the productivity of water in this lake and its conservation needs.

MATERIALS AND METHODS

The Vellayani Freshwater Lake (8° 24' 09"- 8° 26' 30" N and 76° 59' 08"- 76° 59' 47" E) Thiruvananthapuram is the present study area. It is about 19 km away from the Thiruvananthapuram city. It is situated 29 meters above mean sea level with a length of 3.15 km and width of 1km. The depth of the lake varies from 2 to 6 m. The lake is replenished by 64 rivulets, permitting easy drainage through the Madhupalam spillway near Thiruvallam, which empties into the Karamana River. The lake is a rich repository of flora and fauna which support the livelihood of local people around it. The lake is extensively used for irrigation and as a major source of drinking water for the five panchayats surrounding the lake - Thiruvallam, Kalliyoor, Venganoor, Nemom and Kovalam.

During the study period (June 2013 to May 2014), three stations (S_1, S_2 and S_3) were identified for sampling; namely Panangodu, Kakkamoola and Ookkod representing different regions of the lake with varying depths and anthropogenic activities.

Water samples were collected seasonally, using sample bottles with the necessary precautions. The Productivity was estimated by dark and light bottle method (Gaardner and Gran, 1927).

RESULTS AND DISCUSSIONS

Based on the intensity and duration of rainfall the period of study was divided into three seasons. Pre monsoon - February to May, Monsoon - June to September and Post monsoon - October to January.

Table. 1. Seasonal and Stational variations of Dissolved Oxygen and Productivity of Vellayani freshwater lake.

Dissolved Oxygen And Primary Productivity (Mg/L)									
Season	**Pre Monsoon**			**Monsoon**			**Post Monsoon**		
Station	S_1	S_2	S_3	S_1	S_2	S_3	S_1	S_2	S_3
NPP	0.182	0.272	0.362	0.181	0.181	0.272	0.362	0.453	0.544
GPP	0.454	0.724	1.087	0.453	0.456	0.543	0.634	0.726	0.815

The Gross Primary Productivity is high in pre monsoon (0.45 to 1.08mg/L), lower in monsoon (0.45 to 0.54 mg/L) and moderate values in post monsoon (0.634 to 0.815 mg/L). The profile of the productivity shows pre monsoon > Post monsoon > Monsoon for the seasons. There was a gradual increase in Primary Productivity from station I to station III in all seasons.

Productivity measures the ability of an area to support a biological population and sustain a level of growth and respiration. Gross Primary Productivity is the rate at which solar energy is stored as organic molecules by plants in an ecosystem. Net Primary Productivity is the energy that is used by plants as they carry out respiration, and is calculated by subtracting the amount of respiration from the Gross Primary Productivity (Mandal, O.P, 2004.). The present investigation of the productivity shows the profile for the seasons pre monsoon > Post monsoon > Monsoon.

During summer season, in the highly productive station, Panangodu will become eutrophicated. High values of nitrate in monsoon may be due to the high anthropogenic influences (animal wastes and waste from poultry farms). High concentration of phosphate and sulphate may be due to the high anthropogenic activities like bathing, washing, cattle wading and dumping of wastes. High phosphate content in the lake water may be due to the land adjoining this station used for raising different types of vegetable crops and the continuous use of fertilizers and agricultural runoff from there.

Algae or microscopic plants proliferate rapidly causing algal blooms. Although the algae photosynthesise and therefore release some oxygen into the water, by blanketing the surface they severely reduced the amount of light which reaches the lower depths and this reduces the number of larger plants (macrophytes).

Zooplankton (Microscopic fauna) use microphytes to escape predation by fish so as microphytes numbers decrease more zooplankton are eaten so their numbers decrease. As zooplankton numbers decrease, fewer algae are eaten so algal numbers increase further. Algae have a high turnover rate (Productivity and death rate are both high). Dead algae are broken down by aerobic bacteria which use up much of the oxygen in the water. Declining oxygen levels lead to the death of many aerobes (both plants and animals). Many food chains will be collapse. Dead algae and zooplankton increase the turbidity of water. The detritus forms sediment. It leads to eutrophication of the lakes.

Eutrophication is the enrichment of fresh water by excess nutrients, usually nitrogen and phosphorus. It is a natural process which means humans have greately accelerated. The nutrient status of lakes increases naturally as sediment constantly reaches it in streams or through direct soil erosion. Thus an oligotrophic (low nutrient, low productivity) lake will inevitably change into a eutrophic one. The direct

consequence is an excess of oxygen consumption near the bottom of the water body. The mechanisms that lead to eutrophication, to this new status of the aquatic environment, that is complex and interlinked. The additional factors supporting this process can be divided into two categories depending on whether they are linked to the nutrient dispersion and the phytoplankton growth, or to the oxygen cycle near the bottom of the water body. Various effects can be observed depending upon the severity of the eutrophication.

Accelerated eutrophication has occurred as a result of the increased use of phosphate containing detergents, increased leaching and run – off from agricultural land, drainage or washings from intensive animal units and increased soil erosion . This results the excess growth of plants and it leads to eutrophication.

At the station Panangodu, accelerated eutrophication has occurred as a result of the increased use of phosphate containing detergents, increased leaching and run off from the surrounding agricultural land, drainage or washings from the homes and the intensive animal units and increased soil erosion. As a result of anthropogenic changes in the watershed, the lake changed from a mesotrophic system dominated by diatoms, to a eutrophic system dominated by blue-green algae. Primary productivity and algal biomass also increased since 1970s, accompanied by a shift in algal species composition. The change in trophic status was accompanied by a decrease in water transparency (Biju Kumar *et. al*., 2013).

When these dense algal blooms eventually die, microbial decomposition severely depletes dissolved oxygen, creating a hypoxic or anoxic 'dead zone' lacking sufficient oxygen to support most organisms. Dead zones are found in many freshwater lakes including the Laurentian Great Lakes during the summer (Arend *et al.* 2011).

The indirect benefits of such as provision of drinking water and support to tourism not withstanding, Vellayani Lake and associated wetland ecosystems supports a large human population that derives its income directly from the activities like fishing, floriculture and agricultural production. The livelihood of about 100 traditional fishermen depends on the fish resources of the lake. About 42 species of freshwater fishes have been documented from the lake by various authors, primarily from the Department of Aquatic Biology and Fisheries, University of Kerala (Biju Kumar *et. al.*, 2013). About five species of shrimps or prawns, two species of turtles and above 150 species of birds have been also collected from this lake. Bunds were constructed along long stretches to carve up the water body and facilitate easy drainage.The deterioration of watersheds in corporation area Kalliyoor and Venganoor Grama Panchayaths have considerably reduced recharge of lake by the drying up and or filling up of rivulets (Biju Kumar *et. al*., 2013). As a result of the increased use of phosphate containing detergents, increased leaching and run off from agricultural land, drainage or washings from intensive animal units, increased soil erosion and land reclamation, the biodiversity of Vellayani freshwater lake facing a very huge threat to its existence.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

STUDIES ON THE EFFECT OF ENDOCRINE DISRUPTOR CHEMICAL TRICLOSAN ON THE TOTAL PROTEIN CONTENT IN FRESH WATER FISH ANABAS TESTUDINEUS

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ABSTRACT

Triclosan(2,4,4'- trichloro -2'hydroxy diphenyl ether) is a chlorinated aromatic compound widely used as an anti microbial agent. Being a lipophilic compound it tends to accumulate in the adipose tissues of animals. Objective of the study was to find out sub lethal effects of Triclosan on *Anabas testudineus.* The live fishes were sacrificed after 96 hours and total protein content was analyzed from four different tissues such as, liver, kidney, gill and muscle. The experimental fishes were divided into four groups- control, low (0.1 ppm), medium (0.3 ppm) and high (0.6 ppm) concentrations and are exposed to technical grade Triclosan for 96 hrs.The total protein content was maximum in liver and the total protein content was minimum in kidney. The depletion in the total protein content may be due to proteolysis, the proteins were utilized to meet the excess energy demands imposed by the toxic stress. The result indicates that triclosan is highly toxic to organisms.

KEYWORDS: Triclosan, Antimicrobial agent *Anabas testudineus,* Proteolysis

INTRODUCTION

Environmental impacts caused by trace organic pollutants such as poly chlorinated biphenyls and polycyclic aromatic hydrocarbons have received increasing attention due to their persistency and tendency to bio accumulate through the food chains.

Triclosan (TCS) is an antimicrobial agent that targets both gram-positive and gram-negative bacteria as well as some fungi. TCS is commonly used in the following products: soaps, hand sanitizer, dish detergent, laundry detergent, toothpaste, mouthwash, deodorant, antiperspirants, cosmetics, shaving cream, face washes, shampoo, conditioners etc boards, trash bags and many others. With TCS levels in the environment so prevalent there is concern about the impact of TCS on human health and the environment. Scientists have always been concerned that TCS is leading to increased antibiotic resistance in bacteria. Beyond potentially eliminating the most sensitive, TCS is also toxic to larger aquatic organisms. Studies have shown that triclosan has a significant biocidal activity. It has been shown to be effective in healthcare settings (Halden 2014) in hospital studies at reducing the risk of infection from methicillin-resistant *Staphylococcus aureus* (Russell, 2000).

Triclosan provided a sustained antibacterial effect against plaque in contrast to other dentifrices. Triclosan can be transformed into potentially more toxic and persistent compounds, such as chlorinated phenols and biphenyl ethers after chlorination, methyl triclosan after biological methylation and chlorinated dibenzodioxins after photooxidation. Methyl triclosan is actually more lipophilic than its parent compound, and thus more persistent, bioaccumulative in wildlife and human. Studies have found that methyl triclosan has concentrated in the fatty tissue of fish, and to a greater degree in algae.

MATERIALS AND METHODS

The test material selected for this experiment is triclosan, a synthetic biocide. It was used for analysis. As Triclosan is a chlorinated aromatic compound and it is insoluble in water, a stock solution was prepared by dissolving 400 mg triclosan in 40 ml absolute alcohol and later it was used to get required dilutions in water.

Estimation of Total Protein Content

Total protein content was estimated by the method Lowry *et al*., (1951). 100 mg of tissue was homogenized in 5 ml of distilled water. And 5ml 30%

Trichloro Acetic acid (TCA) was added to it. The precipitate was collected by centrifugation at 3000 rpm for 15 minutes. The supernatant was discarded. Protein was redissolved in 0.1 N NaOH and estimated by this method. 0.5 mL of the solution was transferred in to a test tube and 4 mL of alkaline copper sulphate (50 ml of 2% Na2CO3 and 1ml of 0.5% CuSO4.5H2O in 1% sodium potassium tartrate) reagent was added followed by 0.4 mL of diluted commercial Folin's reagent (diluted with distilled water in 1:1 ratio). The optical density of blue color developed was read at 750 nm after 30 minutes of addition of the reagent using a spectrophotometer. Bovine serum albumin was used as standard. The protein content in the tissue was expressed milligram/gram wet weight of the tissue.

Table.1 Levels of Protein in different tissues of Anabas testudineus after treatment with three concentrations of Triclosan for 96 hours

Tissue	Control	Concentration of Triclosan		
		0.625 ppm	0.3125 ppm	0.1562 ppm
Muscle	11.11±0.28	5.53±0.37	6.03±0.48	8.85±0.51
Liver	10.51±0.21	4.20±0.31	5.21±0.36	7.81±0.46
Gill	8.57±0.28	3.45±0.32	4.03±0.51	5.57±0.28
Kidney	4.45±0.44	1.49±0.56	2.32±0.36	3.64±0.35

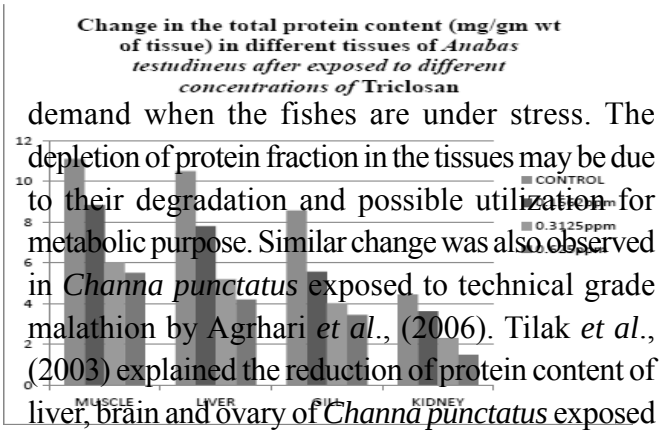
RESULTS AND DISCUSSION

Protein is most characteristic organic compound found in the living cell while the protoplasm of the cell is composed of protein. They play vital role in the process of interaction of cellular medium.

The total proteins were found progressively depleted in all the tissues throughout the exposure period. The progressive drop in the protein content in the present study may be on account of cumulative effects of triclosan on the proteolytic enzymes in the tissues.

The persistent and cumulative effects of triclosan on the proteolytic enymes results in progressive protein depletion. The drop in the protein content could also be attributed to an imbalance between protein synthesis and proteolysis. The present study revealed the reduction in protein levels in the tissues of the fresh water fish, *Anabas testudineus* by following acute exposure of toxicant Triclosan. It was evident from the experiment that, as the concentration of Triclosan is increased, the levels of Protein content in the tissue decreased considerably

The reduction of protein may be due to proteolysis and increased metabolism under toxicant stress . It was reported that reduction in protein content could be due to its utilization to mitigate the energy



demand when the fishes are under stress. The depletion of protein fraction in the tissues may be due to their degradation and possible utilization for metabolic purpose. Similar change was also observed in *Channa punctatus* exposed to technical grade malathion by Agrhari *et al*., (2006). Tilak *et al*., (2003) explained the reduction of protein content of liver, brain and ovary of *Channa punctatus* exposed to toxicant, fenvalerate. Based on these investigations, the changes and decrease in protein levels was also due to inhibition of metabolizing enzymes after exposure of *Anabas testudineus* to Triclosan.

The present study revealed that there was significant change in the protein content of vital organs in *Anabas testudineus* which are brought about by exposure to Triclosan. Triclosan is affecting fresh water organisms even at very low concentrations of 0.1 ppm. Triclosan is affecting fresh water organisms even at

very low concentrations of 0.1 ppm. The ubiquitous use of triclosan and its consequent entry into the environment is of concern due to the effects it could produce if no regulations prevent its accumulation during the next decades. It and its derivatives are already present in measurable quantities, which may potentially affect water quality, impact on ecosystem and human health. Contamination of TCS has been detected in different environmental matrices including terrestrial, aquatic and biosolids. TCS has also been found in drinking waters. There are concerns that the widespread use of TCS in various applications might lead to a preferential selection for microbial resistance to antibiotics. Taking into consideration the environmental and health concerns of TCS, more efforts need to be carried out for the understanding of their distribution and fate in various environmental compartments, in particular, wastewater treatment plants and sediments which are the final sinks. The effects of these deleterious chemical goes unnoticed because most of the changes occurring in the body of the fish are minute and if the indiscriminate usage of Triclosan continues it will become irreparable when it gets accumulated and spread through aquatic and terrestrial food webs.

Triclosan is contaminating our terrestrial environment, particularly through the application of sewage sludge to land where these chemicals are entering into animal feed and crops destined for human consumption. Triclosan is toxic to aquatic bacteria at levels found in the environment. It is highly toxic to various types of algae and has the potential to affect the structure of algal communities, particularly immediately downstream of effluents from wastewater treatment facilities that treat household wastewaters. Triclosan has been observed in multiple organisms, including algae aquatic blackworms, fish and dolphins. It has also been found in land animals including earthworms and species higher up the food chain. It may lead to eutrophication and thus the chemical can be transferred to higher trophic levels through food chains. They may show deleterious effects on humans as well as other higher organisms.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

HUMAN ELEPHANT CONFLICT IN THE IVTH WARD OF VENGOOR GRAM PANCHAYATH

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ABSTRACT

The current case study attempted at examining the effect of human- elephant conflict (HEC) on socio-economic vulnerability of Munippara ward of Vengoor Grama Panchayath located in Kottappara forest reserve of Malayatoor forest division. Human- elephant conflict equally affected the population & cultivation of the area, direct and indirect costs associated both with elephant damage and reducing the risk of elephant presence in the area. Moreover, it is noted that existing mechanism for compensating households affected by elephants only covers a fraction of the damage while it totally neglects the farmer costs associated with risk reduction such as investment in guarding crops and property. The varied approaches for conflict resilience brings direct and indirect financial benefits for the affected and vulnerable farmers.

KEYWORDS: Human- elephant conflict, Kottappara forest division

INTRODUCTION

Conflicts between humans and wild life is not only a local or regional issue, but must be considered as a global raising issue. According to WWF, Human-wild life conflict is defined as any interaction between humans and wildlife that results a negative impacts on human social, economic or cultural life, on the conservation of wild life populations, or on the environment. (Welleme*tal.,*1998). Human and elephant conflict is a very common problem in many tropical and subtropical regions due to forest resources insufficiency(deSilva and deSilva,2007*).*

The study was done in the area near the Kottapara forest reserve of Malayattoor forest division which is included in the Anamalais -Nelliampathi-High Range Landscape. Under the Mekkappala forest division there is 2170 hectors of forest area. Major part of this forest is dominated by Acacia plantation; *Acasia magium* by the forest department and *Acasia auriculiformis* by the Hindustan Newsprint Limited (HNL).

Human elephant conflict (HEC) is a major problem in the Munippara ward of Vengoor Grama Panchayath. Munippara ward includes most areas near to the Kottappara forest reserve.

Almost all the areas under Munippara ward is facing HEC, among which the most affected areas are Kaituva, Pezhad & Kumbalamthod, and the present study is focused on these areas.

There were no Elephants found in the Kottappara forest till 2008. About 75 years ago there were all kinds of animals including Elephant, tiger etc. After the human entry, animals move to the nearest forest division, the Perumthod forest. These two divisions separated by the river Periyar. During the tear 2008-2009, Elephants came into the Kottappara forest. This may be because of the lack of resources or due to hunters. The local people also said that the smell of 'wash' which is prepared to make the illegal alcohol cause the entry of Elephant. Construction of a large canal along the side of the river Periyar block the return of the Elephants once entered in the Kottappara forest. Now there are about 30-40 Elephants present in the forest.

The main purpose of the study is to understand the human-elephant conflict in Munippara ward of Vengoor grama panchayath and its impacts, preventive measures taken by the farmers and its effectiveness, cooperation from the forest department and panchayath officials to overcome the problem.

MATERIALS AND METHODS

This is a qualitative study done with semi-structured interviews, which means that the interviews do not follow a structured scheme, but instead some main questions and follow-up questions with open answers are used. This was the most efficient way to collect the type of data needed and given the time frame it was not possible to get enough answers to get statistically significant results from a quantitative study (Linnea ,2014). A weekly survey was done for a period of two months from November to December. A number of respondents were included to increase the validity of the study and thereby increasing the possibility to make accurate inferences from the results.

RESULTS AND DISCUSSION

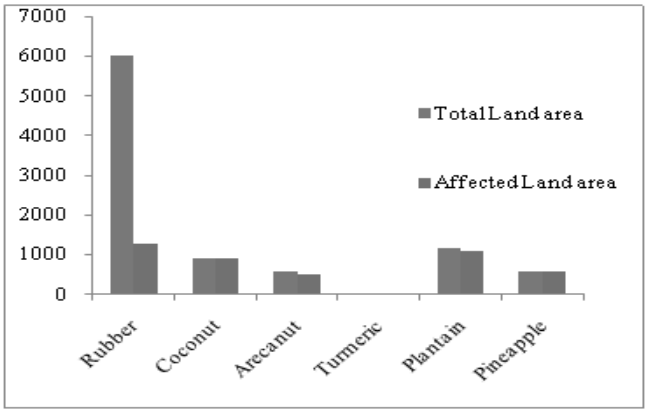


Fig 1. Showing which crop is most affected by HEC

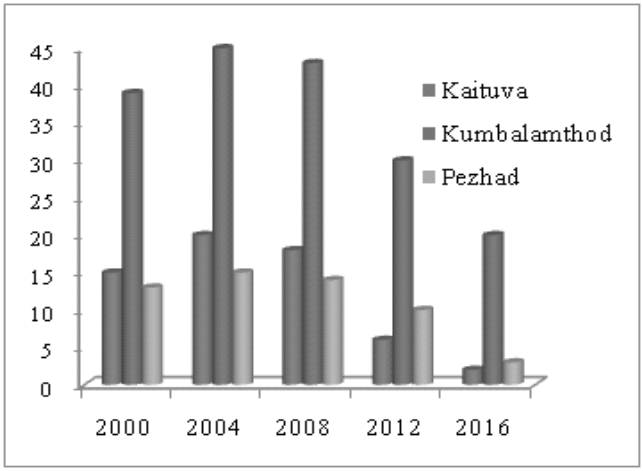
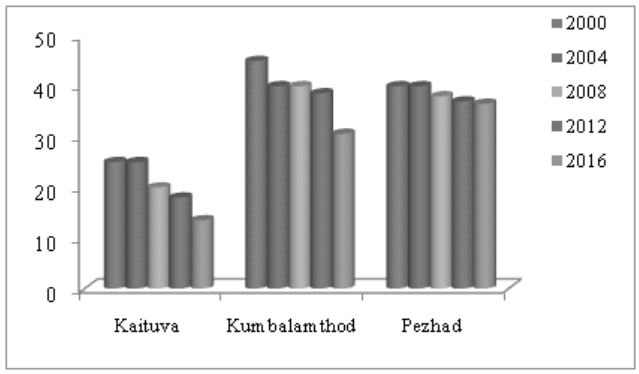


Fig 2. Showing population decline of three areas

The most affected crops were coconut, arecanut , plantain and pineapple as compared with other crops like rubber and turmeric. Turmeric is the least affected crop. Due to the disturbance of Elephant to the people in these areas, it is observed that the population was declining from 2008 onwards due to the outward migration (Fig.2). These were highly populated area till 2008. Elephant came to the forest from the nearest Perumthod forest division during the year 2008-2009. Now only a few families residing there.

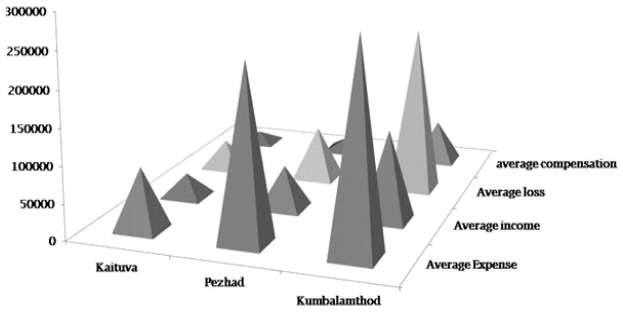
The cultivation also declined from the year 2008 onwards due to the Human- Elephant Conflict (Fig.3). Munippara ward is solely depending on farming for their livelihood.

Fig 3 showing cultivation decline in the three areas



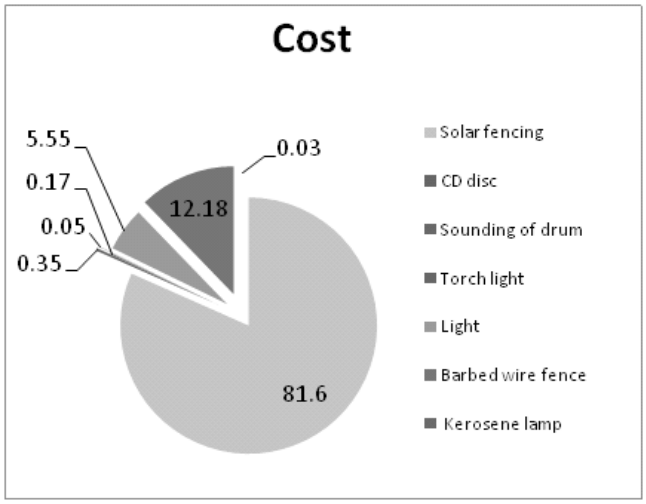
Annual income loss of people due to crop raiding by the Elephant was studied and noted (Fig.4). The compensation given by the Government is not enough for them to sustain. Average loss is somewhat similar to average expense.

Fig 4. Showing the annual income loss of the farmers in the three area



The following mitigation measures were taken towards HEC namely installation of solar fencing, fixing of the CD disk, Sounding of the drum, Usage of Torch light ,Electric light and kerosene lamp, and the construction of Barbed wire fencing and its cost were studied(Fig.6). It was observed that maximum cost was for solar fencing and the least cost for kerosene lamp and others in between. The most effective way to prevent Elephant .attack is the installation of solar fencing. For 1 km about160000 will be the expense and because of this huge amount only few families are able to install solar fencing.

Fig 5. Showing the cost incurred for various mitigation measures



CONCLUSION AND RECOMMENDATIONS

Human elephant conflict intensity has gone out of the level of tolerance in the ward iv of Vengoor Gram Panchayath. When attacks by elephants on humans occurs the victim families demand compensation from the nearby forest department. But the compensation provided will not be enough to sustain. Various mitigation measures were adopted in order to solve the Human Elephant Conflict namely, solar fencing, barbed wire fence, torch light, CD disc. Farming crops that are not predated by elephants and erecting solar fences to protect farm plots and home from elephants and make efforts from the side of authorities to move back the elephants into the Perumthod forest and raising conservation awareness among the community.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

ASSESSMENT OF WATER QUALITY OF AYIROOR RIVER IN KERALA, USING MACRO INVERTEBRATES AS BIOLOGICAL INDICATORS

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ABSTRACT: Biomonitoring is a valuable assessment tool in water quality monitoring programs. The present study was undertaken to identify the freshwater benthic macro-invertebrates and to find out the biological water quality. A total of 789 individuals belonging to 4 taxa were collected from the three stations of the River Ayiroor during pre monsoon, monsoon and post monsoon periods .*Chironomus larvae,* a pollution tolerant species were present in all the stations showing high degree of organic pollution. The water quality of Ayiroor river was deteriorated by sewage effluents and agricultural activities, diminishing the abundance of benthic macro-invertebrates.

KEY WORDS: Biomonitoring, *Chironomous larvae*, Ayiroor River.

INTRODUCTION

Biomonitoring is the use of biological response to assess changes in the environment, generally changes due to anthropogenic causes (Ramakrishnan N, 2003). Benthic macro- invertebrates are the most popular and commonly used group of fresh water organisms in assessing water quality (Sultana *et al.*, 2012). They have sensitive life stages that respond to stress and integrate effects of both short-term and long-term environmental stressors . The benthic macro invertebrate population may vary in time and space and their diversity within a certain area are clearly related to fertility and productivity of overlying water (Latha, 2010).

Ayiroor river is the smallest river in Southern Kerala, origin at Navayikulam, flowing through Thiruvananthapuram district and draining into the Edava-Nadayara Kayal. In its course it receives a variety of domestic wastes and agricultural effluents which may lead to deterioration in water quality .In this study, the biomonitoring of water quality using benthic macro invertebrates is the first attempt carried out, since there is no available research done in this area.

MATERIALS AND METHODS

Based on the intensity and duration of rainfall the period of study was divided into three seasons (Pre monsoon, Monsoon and Post monsoon), and three stations (Station1-Panayara, Station2-Ayiroor and Station3-Nadayara) were selected from upstream to downstream for the present study.

Sediment sampling: Sediment samples were collected from the stations using a polythene cover of length 25cm and 7.5cm diameter. Sediment samples for the analysis of fauna were transferred to clean polythene bags preserved with sufficient quantity of 4% formalin

Analysis of fauna: The sediment samples preserved in 4% formalin were sieved through 0.5 mm mesh. The organisms visible to the naked eye were sorted and counted during the initial washing. The fauna retained in the sieve were preserved in 5% formalin, stained with Rose Bengal, and were identified to major taxonomic groups using appropriate keys (Pennak, 1978 and Olomukoro, 1996)). The abundance of these organisms were calculated as No/Sq. m

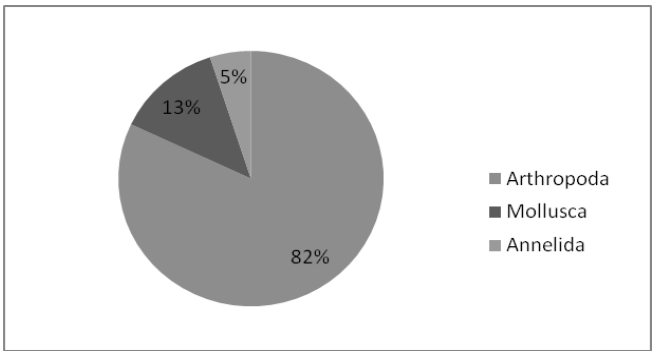
RESULTS AND DISCUSSION

Faunal composition

Four taxa of benthic macro invertebrate fauna (Insecta, Gastropods, Bivalves, Polychaetes) belonging to three major phyla (Arthropoda, Annelida and Mollusca) were recorded during the study period. Phylum Arthropoda dominated with class Insecta represented by 12 species from six orders (Diptera, Ephemeroptera, Odonata, Trichoptera, Coeloptera, and Plecoptera).The dominant group Insecta was followed by three species of Gastropods and two species of bivalves from phylum Mollusca and one species of Oligocheates from phylum Annelida.

A total of 645 individuals were included in phylum Arthropoda with 82%, followed by 105 individuals in Phylum Mollusca with 13% and 39 individuals in phylum Annelida with 5%. Class Insecta were found to be the most dominant group of the total composition of the benthic macro invertebrate taxa followed by Gastropods, Bivalves and Oligocheates.

Fig.1. Percentage composition (%) of benthic macro invertebrate phyla



Abundance (id/m^2) of benthic macro invertebrate taxa:

A total of 789 individuals were recorded from the 3 stations of the river with highest abundance during pre monsoon (324 ind/m^2) and lowest during monsoon (216 ind/m^2). The seasonal abundance of benthic macro invertebrate taxa was maximum at Station1 (306 ind/m^2) and minimum at Station3 (204 ind/m$^{2)}$. The average of seasonal abundance of Insecta was maximum at all the stations (85±27.60 id/m^2 at S1, 62±25.92 id/m^2 at S2 and 68±19.60 id/m^2 at S3). The abundance of Oligocheates was maximum at Station 3 (6±4.24) and that of Gastropods (10±8.83) and Bivalves (7±2.45) at Station2.

During the present study the highest abundance of benthic macro invertebrates were noticed during pre monsoon and lowest during monsoon. Increased discharge of domestic effluents, fertilizers and water turbulence decreases the abundance of benthos during monsoon. During pre monsoon, increase in the decaying matter, low flow rate and water depth enhances the growth of benthic macro invertebrates. The presence of Chironomous species is an indication of the deteriorating water quality. The macro benthic composition and abundance varied among stations and had a decreasing trend from upstream to downstream. This may be due to the low velocity of water flow and water depth in the upstream region and increased anthropogenic activities in the downstream region.

Table. 1 Seasonal diversity and distribution of benthic macro invertebrates in Ayiroor River

Phylum	Class	Benthic macro invertebrate species	Seasons								
			Pre monsoon			Monsoon			Post monsoon		
			S1	S2	S3	S1	S2	S3	S1	S2	S3
		Chironomous larvae	+	+	+	+	+	+	+	+	+
		Dragon fly larvae	-	+	+	+	-	+	+	+	+
		Damselfly nymph	+	+	+	+	+	+	+	+	+
		Caddis fly larvae	+	+	+	+	+	-	+	-	+
Arthropoda	Insecta	Potamia species	+	+	+	+	-	+	+	+	+
		Polymorphan species	-	+	+	+	-	+	+	+	-
		Baetis tricaudatus	+	-	+	-	+	-	+	+	+
		Habrophlebiodes species	+	+	+	+	+	+	+	-	+
		Megaglena species	+	+	+	+	-	+	+	+	+
		Mayfly nymphs	+	-	+	+	-	+	+	+	-
		Stonefly nymph	+	+	+	+	+	+	+	-	+
		Dryops larvae	+	+	+	+	+	+	+	+	+
Annelida	Oligocheates	Tubifex tubifex	+	+	+	-	+	+	+	+	+
Mollusca	Gastropods	Viviparous bengalensis	+	+	+	+	+	-	+	-	+
		Melania tuberculata	+	-	-	-	-	-	+	+	-
		Umbonium vestarium	-	+	+	+	+	-	+	-	-
	Bivalves	Villorita cyprinoids	+	+	-	+	+	+	+	+	-
		Lamellidens marginalis	+	-	-	+	-	-	+	+	-

Table.2 Abundance (id/m^2) of benthic macro invertebrate taxa in Ayiroor River Thiruvananthapuram,

Taxa	Station.1					Station.2					Station.3				
	Pre	M	Post	Total	Av+SD	Pre	M	Post	Total	Av+SD	Pre	M	Post	Total	Av+SD
Insecta	105	66	84	255	85±27.60	78	42	66	186	62±25.92	84	60	60	204	68±19.60
Oligocheates	3	0	6	9	3±4.24	3	6	3	12	4±2.45	9	6	3	18	6±4.24
Gastropods	9	6	9	24	8±2.45	12	15	3	30	10±8.83	6	0	3	9	3±4.24
Bivalves	9	6	3	18	6±4.24	6	6	9	21	7±2.45	0	3	0	3	1±2.45

CONCLUSION

The study provides an information data to understand the current status of water quality of Ayiroor River. The benthic fauna gradually decreased from upstream to downstream due to low flow rate and water depth in the upstream region. The pollution indicator species like *Chironomous larvae* and *Tubifex tubifex* showed water is polluted, but not too much extent because of their low number in the study area. It is concluded that the water quality of Ayiroor river appears to have deteriorated as a result of various local

anthropogenic activities and agricultural runoff. As the anthropogenic activities continue, it will contribute significantly towards the process of river degradation. The result of the study reveals that the quality of water is though fit for domestic purpose, need treatments to minimize the contaminations. This study of the macro benthic fauna gives an insight in to the health of the river and appends the knowledge and understanding of the management strategies involving bio monitoring as a significant tool in the river restoration studies.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

SEASONAL VARIATIONS IN THE DIET OF A PONY FISH *Secutor insidiator* WITH SPECIAL REFERENCE TO FEEDING APPARATUS

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ABSTRACT : Diet components of the silverbelly *Secutor insidiator* from the fishing grounds of Kerala was studied. It is a planktophagus and benthophagus column feeder. The diet of *S. insidiator* constituted crustaceans (copepods, *Mysis*, *Lucifer* and *Sagitta)* cladocerans, amphipodes (*Eriopisa sp.*), Microphytoplankton (*Pleurosigma* sp. and *Nitzchia* sp.) and miscellaneous prey types. There was no significant seasonal variations in the trophic spectrum of the fish.

KEYWORDS: *Secutor insidiator*, planktophagus, benthophagus

INTRODUCTION

Information on the dietary composition of marine fishes is necessary for understanding community ecology, structure and stability of food webs, trophodynamics, resource partitioning, functional role of different fishes in aquatic ecosystems and ecological energetics. Study on diet of leiognathids is scanty from Kerala coast. Brief description on the diet of S. *insidiator* from the South- East coast of India was given by Jayabalan and Ramamoorthi (1985). The present work investigate the diet of *S. insidiator* from Kerala coast.

MATERIALS AND METHODS

Fortnightly collections of *S. insidiator* were made from fish landings at Ambalapuzha (Alleppey), Thoppumpady (Cochin), Azhikode and Chettuva (Thrissur). 734 specimens (males and females) in the length range of 54.5mm to 134.6 mm were analysed. Both qualitative and quantitative analyses of diet were carried out. By empting stomach contents into a petridish and examined under a binocular microscope (Jimmy *et al*., 2003). Food items were identified up to the the possible taxonomic level depending on the state of digestion (Fischer and Bianchi, 1984). Since food items of silverbellies were minute in size, weight and volume displaced by each food item was negligible. For gut content analysis, the method of Platell and Potter (2001) was employed. Analysis was done using frequency of occurrence and numerical methods as described by Hyslop (1980). Seasonal variation in the diet was studied by compiling the months of the study period into the following three seasons: pre-monsoon, monsoon and post-monsoon. The data were statistically tested using two way contingency table by Chi-square test (Sokal and Rohlf, 1981).

RESULTS AND DISCUSSION

Qualitative and quantitative estimation of diet of *Secutor insidiator:* The diet of *S. insidiator* constituted by 15 prey types; crustaceans (copepods, *Mysis*, *Lucifer* and *Sagitta),* cladocerans, amphipodes (*Eriopisa sp.*), Microphytoplankton (*Pleurosigma* sp. and *Nitzchia* sp.) and sand, detritus, foraminiferans, *Coscinodiscus*, fish scales, *Nereis*, diatoms, fish egg, amphipods – *Eriopisa* sp., cladocerans and *Fragilaria* sp. constituted the miscellaneous lot in the diet of both sexes.

Copepods and semidigested matter occupied the first and second position in the trophic spectrum of fish. Among copepods, *Calanus* sp., *Eucalanus* sp., *Acartia* sp., *and Oithona* sp. dominated in the diet of the fish. The highest numerical percentage of mysis was in April-May (27.8). The highest N% of *Lucifer* was in September (13.4). Microphytoplankton formed only a minor portion of their diet and constituted less than 10 N% of the total number of items, however, its occurrence was reported in more than 90% of the individuals. There was no significant seasonal variation in the prey types consumed by fish (Table 1). Monthly numerical percentage (N%) and frequency of occurrence (F%) of prey items of the fish is shown in Table 2.

Table 1. Two way contingency table analysis of seasonal variation of five prey categories of *S. insidiator* (Values are number of prey items obtained in each season)

Prey items	Pre-monsoon	Monsoon	Post-monsoon	N_i
Copepods	21	18	20	59
Mysis	11	10	12	33
Lucifer	12	13	14	39
Sagitta	10	12	11	33
Microphytoplankton	8	9	8	25
Nj	62	62	65	189
Chi-square value			12.85	

Ni = row total, Nj= column total, Not significant (table value = 15.53)

Table 2. Monthly numerical percentage (N %) and frequency of occurrence (F %) of various food items

Month	n	Copepods		Semi digested matter		*Mysis*		*Lucifer*		*Sagitta*		Microphyto plankton		Miscellaneous	
		N%	F%	N%	F%	N%	F%	N%	F%	N%	F%	N%	F%	N%	F%
Mar	102	34.8	98.2	28.9	56.2	26.7	85.1	8.8	82.1	7.6	92.1	4.1	95.6	4.3	100
Apr	52	35.0	92.0	30.0	65.5	27.0	75.1	10.5	67.3	05.9	65.1	4.7	90.2	3.1	90.1
May	55	33.1	90.1	32.2	75.2	27.8	78.2	8.2	92.1	5.6	75.4	4.1	92.3	3.2	92.1
June	58	34.3	92.3	28.9	65.4	26.5	85.6	8.6	90.1	8.8	85.2	5.8	96.3	1.9	92.4
July	50	38.4	96.3	22.5	56.6	25.4	82.1	6.3	91.2	6.9	80.1	6.3	95.2	8.8	100
Aug	60	36.8	91.0	24.1	54.1	25.5	82.3	11.7	86.0	5.6	75.0	4.3	93.3	6.3	90.1
Sept	48	35.0	97.5	23.0	55.3	24.5	80.1	13.4	82.0	6.4	76.2	5.4	91.0	5.5	89.1
Oct	54	32.8	88.2	26.5	72.1	24.8	90.2	10.4	84.3	7.7	68.9	6.0	95.2	6.1	99.3
Nov	75	32.5	96.3	23.8	71.2	24.0	65.2	11.0	86.1	7.8	69.1	8.2	98.3	4.9	93.2
Dec	53	33.7	99.2	24.0	76.2	24.4	78.5	11.9	75.5	09.5	75.1	6.3	96.3	3.1	98.3
Jan	52	33.4	98.9	26.0	75.5	24.7	86.3	12.9	89.0	10.1	86.3	5.3	91.4	2.4	93.1
Feb	75	32.9	97.2	23.2	65.1	23.8	81.2	11.9	45.2	10.8	85.1	6.3	90.2	3.8	100
Avg.		34.4	96.3	26.1	65.7	25.4	80.8	10.5	80.9	7.7	77.8	5.6	93.1	4.4	94.8

S. insidiator is a planktophagus omnivore mainly feeds on phyoplankton and zooplankton which together constituted more than 80% of the diet. Copepods formed the most important zooplankoton encountered in the stomach of the fish agreeing essentially with the observation of Kuthalingam *et al.*, (1978) reported the plankophagus behavior of this fish from the Malabar and Neendakara coasts of Kerala. Among planktonic crustaceans, copepods formed favourite food followed by amphipods. This is in agreement with diet analysis studies in similar silverbelly species *Leiognathus splendens* and *L. blochii* from east coast of India. There was no significant seasonal variation in the prey types consumed by the fish which is in agreement with the finding of James and Badrudeen (1975) in *L. brevirostris* from Palk Bay and Gulf of Mannar.

The highest degree of jaw protrusion in an upward direction and smallest mouth tube opening in *S. insidiator* is associated with planktivorous diet. *S. insidiator* has very small weak or rudimentary teeth. Their planktivorous diet does not require the presence of well developed teeth, since they do not need structures to ingest or hold the food. In the present study, it was observed that the type of food ingested is related to the number of gill rakers. *S.insidiator* has numerous gill rakers which facilitates consumption of plankton. Numerous closely placed rakers on the first branchial arch prevent the loss of food through the gill opening.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

FECUNDITY PARAMETERS OF *PUNTIUS SARANA SUBNASUTUS*

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ABSTRACT

A fecundity study has been undertaken for *Puntius sarana subnasutus* in Chalakudy river area. In *P. sarana subnasutus.* fecundity varied from 24970 to 87894 in individuals of total length from 179 mm to 234 mm, whole body weight between 75.842 g m and 216.743 gm, ovary weight between 11.098 gm to 40.276 gm. The mean fecundity was 39575. The maximum fecundity was 87874 for a female fish of length 234 mm, weight 216.743 gm and ovary weight 40.276 gm. Average fecundity per gram body weight was 384 and per 0. 1g ovary weight was 237. The fecundity tends to increase along with an increase in total body weight and ovary weight.

KEYWORDS: *Puntius sarana subnasutus*, fecundity, Relative fecundity

INTRODUCTION

Puntius sarana subnasutus is a common fresh water fish found in ponds and rivers of Kerala. Even though it is popular as a food fish, its candidature as an ornamental fish is gaining attention in recent years only. Like many commercially important indigenous fish species *puntius sarana subnasutus* needs urgent attention from conservation angle as the populations of the species is reported to drastic decline. Even the success or failure of a fish species largely depends upon its spawning potential, the knowledge of fecundity become extremely important from the viewpoint of successful management and exploitation of its fishery.

Fecundity is the number of eggs produced by an individual fish in its life time. Fecundity estimates are generally evaluated on the basis of absolute and relative fecundity. The absolute fecundity is defined as the number of eggs in a female fish prior to spawning and the relative fecundity as the number of eggs per 1g of female. Both estimates depend largely on the egg size. Knowledge about fecundity of a fish is essential for evaluating the commercial potentialities of its stock, life history, practical culture and actual management of the fishery .

Fecundity is often correlated with length weight and age of fish and also with the length and weight and volume of ovary. The relationship between length and fecundity differ in different species of fish.

MATERIALS AND METHODS

The fish samples were collected fortnightly and they were brought to the lab and freeze. After removing the moisture, the total length, standard length and weight of each individual fish was noted in fresh condition. The potential fecundity or the number of eggs available to be spawned in a single breeding season was estimated from ovaries of fishes in late mature stage and early ripe stage. The ovaries were weighed in a mono pan electronic balance and then a small portion of ovary was separated and weighed to the nearest 0.001 g. The sampled portion was placed on a micro slide and ova were teased out and these ova were then transferred to a measuring cylinder containing a known volume of water and the total number of ova in the sample was counted. The fecundity was estimated by employing the formula.

$$F = (n / v) V$$

Where n = number of ova in the sub sample. V = volume to which the total number of ova is made up and 'v' volume of sub sample.

The relationship between fecundity and different variables like fish length, fish weight, and ovary weight was worked out by the least square method.

$$F = a x^{b}$$

Where F = fecundity, x = fish length or fish weight or ovary weight, a = constant and b = regression

RESULTS AND DISCUSSION

As is true in most teleosts, ovaries of *Puntius sarana subnasutus* were paired and of the 'cystovarian' type, which have coelom derived ovarian lumen (ovocoel) continuous with the oviduct. Fecundity is generally regarded as the number of ova in an organism which has the potential to give rise to the offspring thus the reproductive potential is a function of the fecundity of fish.

and 216.743 g, ovary weight between 11.098 gm to 40.276 g. The mean fecundity was 39575. The maximum fecundity was 87874 for a female fish of length 234 mm, weight 216.743 gm and ovary weight 40.276 g Table 1) Average fecundity per gram body weight was 384 and per 0. 1g ovary weight was 237. The fecundity tends to increase along with an increase in total body weight and ovary weight.

Table1. variation of Fecundity with body lengh, body weight and ovary weight of *Puntius sarana subnasutus*

Sl.No	Total Length(cm)	Body weight(g)	Ovary weight(g)	Fecundity
1	176-180	75.842	11.098	24970
2	181-185	79.221	12.114	27118
3	186-190	87.551	12.335	27204
4	191-195	98.368	21.112	55479
5	196-200	104.456	22.45	56002
6	201-205	94.921	22.903	62587
7	206-210	97.876	18.664	58890
8	211-215	121.675	19.333	47658
9	216-220	121.598	16.809	39876
10	221-225	150.809	17.801	42519

Fecundity varies both within and between fish population and numerous factors such as nutritional state, time of sampling, maturity stage racial characteristics and environmental conditions such as rainfall and salinity (Joshy and Khanna, 1980) have been proposed to explain such variations.

Fecundity estimates were based on the enumeration of mature eggs from 24 specimens of each species with mature or ripe ovaries. The present study revealed that the average relative fecundity of *Puntius sarana subnasutus* was 384. (Table1).

These values are high, when compared to the fecundity estimates of 252 ova in *Labeo calbasu* by Pathak and Jhingran (1977) and 256 ova in *Labeo rohitha* by Varghese (1973). Fecundity varied from 24970 to 87894 in individuals of total length from 179 mm to 234 mm, whole body weight between 75.842g

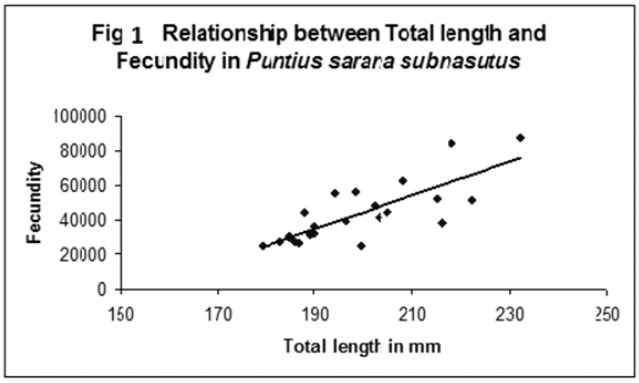
Fecundity is often correlated with length weight and age of fish and also with the length and weight and volume of ovary. The relationship between length and fecundity differ in different species of fish. Many authors have supported Simpson's view of fecundity being related to fish length by a factor close to the cube. (Kurup, 1994). In the present study the exponential value of *Puntius sarana subnasutus* was observed to be 3.1557 which did not deviate significantly from the value of "3" and this finding is in total agreement with the above reports.

Relation between fecundity and total length

To find out this relationship, the absolute fecundities estimated for the 24 fish were plotted against their total lengths (Fig 1).The relationship was calculated by the least square method .The logarithmic values based on the formula

$$\text{Log } F = 1.005 + 3.1557 \log L \; (r = 0.6309)$$

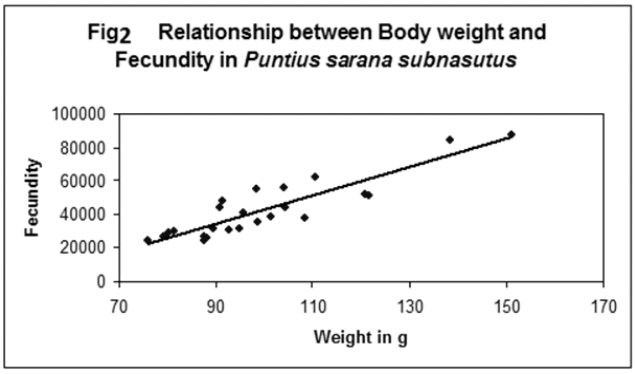
Table 1.Variation of total length,body weight ,ovary weight with fecundity



Relation between fecundity and total weight

The fecundities of the 24 fish were plotted against the total weight of these fish.(Fig 2).A. regression line was fitted to the data, which gave a linear relationship according to the formula

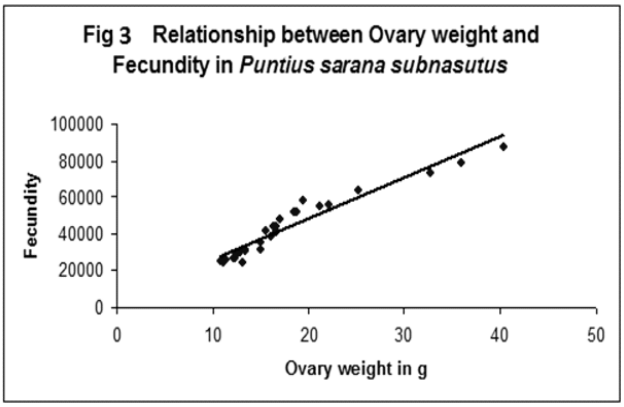
Log F = 8.0245 + 1.8568 log W (r = 0.7716)



Relation between fecundity and ovary weight

For this study, fecundity of the 24 fish were plotted against their ovary weight (fig .3).A regression line was fitted using the formula

Log F = 1.739+ 1.1252 log O. W. (r = 0.9192)



The coefficient of correlation of the various statistical relationships derived between fecundity, body length, body weight, ovary weight revealed significant relation between fecundity and the body parameters. In *Puntius sarana subnasutus* the highest degree of correlation was seen between fecundity and ovary weight. It is well known that the weight of ovaries of a fish is mainly influenced by the ova contained in them. The 'r' value between ovary weight and body length and ovary weight and body weight exhibited a fair correlation between the variables. But body weight was more closely related to ovary weight than length, as observed in *L.dussumieri* by Kurup (1994).

From the multi variant analysis, ovary weight was identified as the most appropriate predictor of ovarian egg count. In this species, near 96 % of the variation in fecundity being explained by the changes in ovary weight. But it is undesirable to sacrifice the fish to determine the gonad weight . Fish length, being easier to measure in the field is more suitable to make prediction of fecundity when large samples are to be dealt with within limited time. Fecundity in *Puntius sarana subnasutus* were found to be almost close to the cube of length and directly proportional to the fish weight and these results would be is valuable in enumerating the fecundity without sacrificing the specimens.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

ANTIBACTERIAL AND ANTIFUNGAL ACTIVITY OF DASAPUSHPAM

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ABSTRACT

Ten herbs that were screened for their antibacterial and antifungal properties against five species of pathogenic bacteria and six species of pathogenic fungi. The invitro study of antimicrobial effect of Dasapushpam shows that most of them have antibacterial effect but antifungal effect is mostly towards *Aspergillus.niger*. A critical analysis of the results of bioassays shows that all the ten herbs inhibited the proliferation of one pathogen or the other with which they tested with. Results shows that the herbal extracts involved are more effective against pathogenic fungi than pathogenic bacteria and throws light on the future prospect of plants as sources of potential antibiotics.

KEY WORDS: Dasapushpam, Ayurveda, Crude extracts, secondary metabolites.

INTRODUCTION

Allopathic medicine have a dual type of action includes short term effect like pain, inflammation, heat, swelling and redness and long term effects damages the whole body. Hence people are turning towards the alternative methods of which Ayurveda has gained more popularity. Various medicinal properties of plants have been proved beyond doubt by ancient rishies and modern Ayurvedic systems of which Dasapushpam has been emphasized in this project. Dasapushpam constitute a group of ten potential herbs which are culturally and medicinally significant to the people of Kerala in India. They are used effectively in home remedies because of their medicinal properties and their ability to cure in a natural way.

The aim of the study is to find the Antibacterial and Antifungal activity of Dasapushpam like Cheroola (*Aervalanata*), Mukkutty(*Biophytumsensitivum*), Valliya uzhinja (*Cardiospermumhalicacabum*), Nilapana (*Curculigo orchioides*), Karuka (*Cynodondactylon*), Kayyonni (*Ecliptaalba*), Muyal cheviyan (*Emiliasonchifolia),* Vishnukranthi (*Evolvulusalsinoides*), Thiru thali(*Ipomoeasepiaria*), Puvankurunthal (*Vernonia cinerea*) against five pathogenic bacterial strains are *E. coli, Bacillus sp, S. aureus, Pseudomonas sp* and *Klebsiella* and against 6 pathogenic fungal strains which are *Fusarium, Mucor, A.niger, Rhizopus, Penicillium* and *A. flavus* using Kirby Bauer Disc Diffusion Method.

MATERIALS AND METHODS

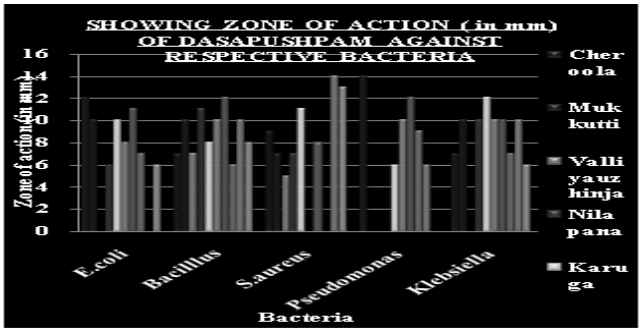
The specimens were identified in the College Lab. Photo documentation of all plants was done. Specimens were shade dried in the hot air oven for two days, cut into small pieces, powdered in an electric mixer and weighed. Powdered plant materials were kept in separate vials and labelled. 20ml of Acetone was added to every 5 g, shaken well, kept undisturbed at room temperature for seven days.

On the eight day, contents were shaken well and acetone solution thus obtained were concentrated by keeping the vials exposed to air. Each extract thus obtained were taken separately in a petridish and marked for identification. Bacterial stock cultures includes *E. coli, Bacillus sp, S.aureus, Pseudomonassp,* and *Klebsiella*. Fungal stock cultures includes *Fusarium, Mucor, Aspergillus niger, Rhizopus, Penicillium* and *Aspergillus flavus.* The antimicrobial activity against specific pathogens were determined using Kirby Bauer disc diffusion method.

RESULTS AND DISCUSSION

The results obtained are represented in below tables and figures. The first step of experiment (table 1) was done on *E.coli* using ten dasapushpam extracts, among these *E.coli* showed the highest sensitivity towards Cheroola which was demonstrated by a clear zone around the disc with an average inhibitory zone of 12mm. But *E.coli* were found to be resistant towards Valliyauzhinja and thiruthali which was

confirmed by the absence of inhibitory zone around the filter paper. In the second set, *Bacillus* shows sensitivity towards almost all the Dasapushpas, the highest sensitivity is towards Muyalcheviyan with an inhibitory zone of 12mm. In the third set, *S.aureus* showed the highest sensitivity towards Thiruthali with an average inhibitory zone of 14mm and found to be resistant towards Kayyonni and Vishnukranthi. In the fourth set, *Pseudomonas* showed the highest sensitivity towards Cheroola which was demonstrated by a clear zone around the disc with an average inhibitory zone of 14mm and were found to be resistant towards Mukkutty,Valliyauzhinja Nilapana, Kayyonni and which was confirmed by the absence of inhibitory zone around the filter paper. In the fifth set, *Klebsiella* only maximum sensitivity is shown by the Vishnukranthi with an average inhibitory zone of 7mm. All other dasapushpas showed complete resistance without forming any clear zone around the filter paper.



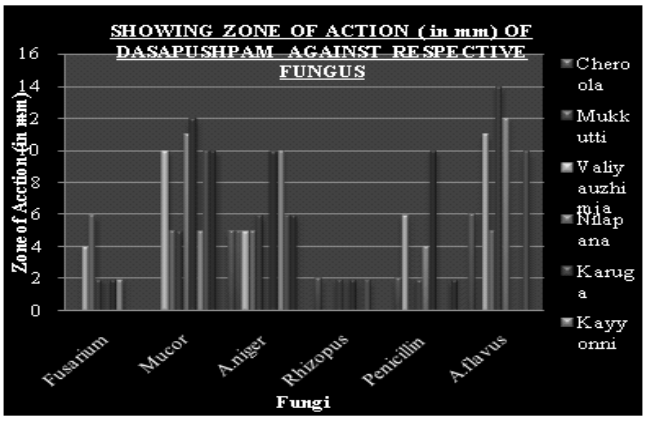
The second step of experiment (table 2) was done on *Fusarium*, showed the highest sensitivity towards Nilapana with an average inhibitory zone of 6mm. But *Fusarium* were found to be resistant towards Cheroola, Mukkutty, Kayyonni, Thiruthali and Puvankurunthal which was confirmed by the absence of inhibitory zone around the filter paper. *Mucor* showed the highest sensitivity towards Muyalcheviyan with an average inhibitory zone of 12mm and were found to be resistant towards Cheroola, Mukkutty. *A. niger* is the only fungus that shows sensitivity towards almost all the Dasapushpas. *Rhizopus* showed highest sensitivity towards Thiruthali with an inhibitory zone of 12mm. *Penicillium* showedshowed the highest sensitivity towards Muyalcheviyan with an average inhibitory zone of 10mm and were found to be resistant towards Cheroola, Nilapana, Vishnukranthi and Thiruthali. *A. flavus* showed the highest sensitivity towards Karuka with an average inhibitory zone of 14mm and were found to be resistant towards Mukkutty, Muyalcheviyan, Vishnukranthi and Puvankurunthal.

Table 1. Effect of Dashapushpam on Bacteria

Dasapushpam	**Bacteria**				
	E.coli	*Bacillus*	*S.aureus*	*Pseudomonas*	*Klebsiella*
Cheroola	12	7	9	14	0
Mukkutty	10	10	7	0	0
Valliyauzhinja	0	7	5	0	0
Nilapana	6	11	7	0	0
Karuka	10	8	11	6	0
Kayyonni	8	10	0	0	0
Muyal cheviyan	11	12	8	12	0
Vishnukranthi	7	6	0	9	7
Thiruthali	0	10	14	6	0
Puvankurunthal	6	8	13	0	0

Table 2. Effect of Dashapushpam on Fungi *Aspergillus niger.*

Dasapushpam	Fungi					
	Fusarium	*Mucor*	*A.niger*	*Rhizopus*	*Penicillium*	*A.flavus*
Cheroola	0	0	5	0	0	6
Mukkutty	0	0	5	2	2	0
Valliyauzhinja	4	10	5	0	6	11
Nilapana	6	5	5	0	0	5
Karuka	2	5	6	2	2	14
Kayyonni	2	11	0	0	4	12
Muyal cheviyan	2	12	10	2	0	0
Vishnukranthi	2	5	10	0	10	0
Thiruthali	0	10	6	2	0	10
Puvankurunthal	2	10	6	0	2	0



Dasapushpam has greater antifungal properties than antibacterial as it showed maximum zone of inhibition against *A. niger*. The antibacterial activity was also noticed in small amounts. The zone of inhibition against bacteria was minimal like 6mm, 7mm etc. According to the references Dasapushpam have both antifungal and antibacterial effect but it is less toxic when compared to the synthetic antibiotics. According to the observation, Cheroola shows antibacterial activity against all pathogenic bacteria and antifungal activity against *A. niger* and *A. flavus*. Both Mukkutty and Cheroola shows antibacterial activity against urinary tract infection causing organisms and uropathogens (Vijaykumar., 2013). Cheroola can be used as therapeutic agents as it posses antimicrobial activity. According to the observations, Mukkutty shows antibacterial activity against *E.coli, Bacillus* and *S. aureus* and antifungal towards *A. niger, Rhizopus* and *Pencillium*.

The plant extract showed the presence of bioactive compounds like flavonoids, tannins etc.The whole plant showed antimicrobial activity due to the presence of phytochemicals like biflavones etc. (Anil Pawar.,1992). Owing to the widespread ability of flavonoids to inhibit spore germination of plant pathogens, they have been proposed for use against fungal pathogens of man. According to the observations, Valliyauzhinja, shows antibacterial activity against *Bacillus* and *S.aureus* and antifungal activity towards *Fusarium, mucor, A.niger, A. flavus* and *Penicillium*. In contrast their leaves and callus in ethanol showed high degree of activity against both negative and positive bacteria (Girish,2008).

Phytochemical studies indicates that presence of secondary metabolites from the leaf and stem is necessary for the activity. Seeds of Valliyauzhinga contain myristic acid that can act against *A.niger*, *E.coli* etc. According to the observations, Nilapana shows antibacterial activity against E.coli, *Bacillus, S.aureus* and antifungal activity towards *Fusarium, mucor, A. niger* and *A. flavus*. Steam distilled aqueous extract of the rhizomes of Nilapana is effective against pathogenic bacteria and the roots exhibit antimicrobial properties. A peptide, Curculin

C containing amino acids been isolated from the fruit (Misra *et al.*,1990). According to the observations, Karuka, shows antibacterial activity against *Bacillus* and *S.aureus* and antifungal activity towards all pathogenic fungi.

The phytochemicals has got antifungal properties by liquid chromatography mass spectroscopy. The presence of broad spectrum helps penetrate and inhibit the growth of microorganisms. (Dessai seema., 2008). According to the observations, Kayonni, shows antibacterial activity against *Bacillus* and *E.coli* and antifungal activity towards Mucor, *A.flavus* and *Penicillium*. Wedelolactone is a naturally occuring coumestan isolated from aerial parts (Dalal.,2008). The antimicrobial compounds present may serve as an affordable and new sources for the treatment of infectious diseases.

Due to the presence of phytochemicals in possess antimicrobial activity. According to the observations, Muyalcheviyan, shows antibacterial activity against *Bacillus* and *E.coli* and antifungal activity towards all pathogenic fungi except *A. flavus*. Leaves of this plant is used in ethnomedicines for the treatment of various diseases and secondary metabolites were screened.Contains an alkaloid called Beta Shankpushpine induces antibacterial activity (Nwadingiwe., 2001).

According to the observations, Vishnukranthi, shows antibacterial activity against all pathogenic bacteria except *S. aureus* and antifungal activity towards *mucor, A. flavus* and *Fusarium. E. alsinoides contains alkaloids like* evolvine (Singh, 2008) which may be responsible for the antimicrobial activity.Used in forgetfulness, uterine bleeding, internal haemorrhages(Singh.,2008). According to the observations, Thiruthali, shows antibacterial activity against *Bacillus* and *E.coli* and antifungal activity towards *Fusarium* and *Penicillium*. Roots are used in the treatment of leucorrhoea because of the antifungal properties. The chemical composition also constitutes the phytochemical conditions owning for the antimicrobial activity (Ashok B.,2008). According to the observations, Puvankurunthal shows antibacterial activity against *Bacillus* and *E.coli* and antifungal activity towards mucor, *A.flavus* and *Penicillium*. It has got antioxidant properties (Gunjan Guha.,2011). Wide spectrum of antimicrobial activity is due to the bioactive compounds like carotenes, phenol compounds etc.In vitro studies with callus and cell suspension record alkaloid production (Priti Maheshwari., 2007). This justifies the wide spectrum antibiotic properties of *Vernonia cinerea.*

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

BUTTERFLIES AND DRAGONFLIES OF KULAKKADU AREA IN TIRUVALLA MUNICIPALITY OF SOUTHERN KERALA

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ABSTRACT
A total of 29 species of butterflies and 11 species of dragonflies were reported from the Kulakkadu area of Tiruvalla muncipality in Pathanamthitta district. Among these three butterflies and two dragonflies are very rare.
KEYWORDS: butterflies, Dragonflies, *Tirumala septentriosis*, *Danaus chrysippus, Micronia aculeate*

INTRODUCTION
Butterflies and dragonflies are suitable for biodiversity studies. India has around 1501 species of butterflies, out of which 334 are reported from the Western Ghats (Larsen,1988). Dragonflies and damselflies are large, diurnal and active predatory insects. Nearly 6000 species are known all over the world. India is highly diverse with more than 474 species and 50 sub species. They are considered to be an important bio-control agent of harmful insects like mosquitoes and noxious flies. They indirectly influence the trophic level balance of lake ecosystem (Subramanian,2009). Parandhaman *et al.* (2012) reported a total of 29 species of butterflies from southern Western Ghats which includes 17 endemic ones. Aneesh and Nameer (2013) listed 139 species of butterflies belonging to six familes from Kerala Agricultural University Campus. Karthika and Krishna (2014) studied the dragonflies of Chinnar wildlife sanctuary and reported 11 species. Thirty one species of dragonflies and 17 species of damselflies were identified from Chinnar wildlife sanctuary by Adarsh *et al.*(2015).

MATERIALS AND METHODS
The study was conducted in Kulakkadu region of Tiruvalla in Pathanamthitta district of Kerala. It extends from $9^0$22' N latitude to $76^0$92' E longitude. The habitat includes agricultural lands surrounded by a stream. The area has a tropical climate with temperature ranged from 18.5 to 34.40 C^0.

The field survey was carried out from July 2015 to January 2016. Data were recorded on the basis of weekly observation carried during 7:00 am to 1:00 pm. The butterfly and dragonfly specimens were identified by following various field guides and internet sources.

RESULT AND DISCUSSION
A total of 29 species of butterflies belonging to 22 genera and six families; and 11 species of dragonflies belonging to 10 genera and two families were recorded from the study area. Systematic list and abundance of butterflies and dragonflies are summarized in table 1.

The result showed that the Kulakkadu region of Tiruvalla muncipality is very rich in butterflies and dragonflies. Out of the 29 species of butterflies, three species are very rare (*Tirumala septentriosis*, *Danaus chrysippus* and *Micronia aculeate*). *Brachydiplax sobrina* and *Orthetrum sabina* are the two very rare dragonflies.

ACKNOWLEDGEMENTS
The authors are thankful to Dr. K.Jacob, Principal., Prof. Letha P. Cherian, Head of the Department of Zoology, Mar Thoma Collage, Tiruvalla for encouragements.

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Table 1: Systematic list and abundance of butterflies and dragonflies collected from the study area.

	Systematic list	Abundance		Systematic list	Abundance
I ORDER : Lepidoptera					
Family 1. Nymphalidae				**Family 2. Hesperiidae**	
1.	*Cupa erymanthis*	+ +	16.	*Tagiades litigiosa*	++
2.	*Elymnias hypernestra*	+ +	17.	*T. japetus*	++
3.	*Tirumala septentriosis*	+	18.	*Peloidas mathais*	+++
4.	*Ypthima baldus*	+ + +	19.	*Hylephila phyleus*	+++
5.	*Y. huebneri*	+ + +	20.	*Ochlodes venatus*	
				Family 3. Papillionidae	+++
6.	*Euploe core*	+ +	21.	*Papillio polymenestra*	++++
7.	*E. klugii*	+ +	22.	*P. helenus*	++++
8.	*Neptis jumbah*	+ +	23.	*P. polytes*	
				Family 4. Pieriidae	++++
9.	*N. hyla*	+ +	24.	*Catopsilia pamona*	++++
10.	*Melantis leda*	+ + +	25.	*Eurema blanda*	++++
11.	*Danaus chrysippus*	+	26.	*Leptosia nina*	
				Family 5. Lycaenidae	++++
12.	*Orsotriena medus*	+++	27.	*Rathinda amor*	+++
13.	*O. medus cinera*	+++	28.	*Jamides celeno*	
				Family 6. Uranidae	+++
14.	*Euthalia aconthe*	+++	29.	*Micronia acueate*	+
15.	*Hypolimnas bolina*	++			
II Order : Odonates					
Family 7. Libellulidae					
30.	*Aethriamanta brevipennis*	+++	36.	*Crocothemis erytheaea*	++
31.	*Neurothemis tullia*	++	37.	*Rhyothemis variegate*	+++
32.	*Bradimopyga germinate*	++	38.	*Pantala fluvescens*	
				Family 8. Coenagrionidae	+++
33.	*Brachydiplax sobrina*	+	39.	*Ceriagrion cerinorubellum*	++
34.	*Brachythemis contaminate*	++	40.	*C. coromandelianum*	++
35.	*Orthetrum sabina*	+			

+ = Very Rare, ++ = Rare,+++ = Common, ++++ = Very Common

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

THE TROOP STRUCTURE OF NILGIRI LANGUR (*Trachypithecus johnii,* Fischer, 1829) AN ENDEMIC SPECIES IN THE RAIN FORESTS OF WESTERN GHATS, INDIA

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ABSTRACT

The troop size of the Nilgiri Langur in the study area varied from 8-27. The size of the group often changed by emigration, immigration, natality and mortality. Each langur troop had a wide home range and a smaller territory. Births were noticed almost throughout the year. The interval between two gestation period of an individual female is calculated to be about two years. An all-male group was found during the study period.

KEYWORDS: Nilgiri langur, *Trachypithecus johnii,* Western Ghats, Troop structure

INTRODUCTION

Nilgiri langur *Trachypithecus johnii,* is an endemic species to the Western Ghats. It once enjoyed wide distribution in the Western Ghats. (Daniel, 1967 and Kannan, 1975), but has become an endangered species now due to hunting, habitat destruction and conversion of forest lands. The beauty of its fur and supposed medicinal value of its blood, organs have caused them to be hunted more than any other species of Indian monkeys.

Several studies have been conducted on the ecology and social behaviour of Nilgiri langur (Poirier 1968 , 1970a, 1970b) at the Anamalis where the habitat is moist deciduous. But the information on the troop size and composition were not known in detail, but some studies were conducted in Periyar by Tanaka (1965) and Horwich (1972). Study on the Nilgiri langur in Periyar was started with a view to compare troop size, composition and territory of the species here with previous studies to find out changes if any occurred.

MATERIALS AND METHODS

Intensive studies were centered in and around the tourism zone of Periyar Tiger Reserve as the troops are slightly habituated to human beings here. When the study was started troops were wary and cautious about the observer. It took about two months for them to become familiarized with the presence of the observer. Troops were followed and observed with binoculars. Observations were carried out on five troops of the Nilgiri langur in the study area. Composition of the troop with regard to age, sex and changes taking place due to natality and mortality were recorded.

RESULTS AND DISCUSSION

Troopsize of the Nilgiri Langur in Periyar varied from 8-27 in the study area. Of the five troops intensively studied two are unimale, heterosexual groups, two are multimale heterosexual troops arid one an all male group . In the troops studied, the following proportion of various age classes are observed. Adult male 9.8% ,adult female 38% , sub adult male 18.3% sub adult female 14% , juvenile 14% and infants 5.6%. The home range of the Langur in the Thekkady area is small in size when compared to that in the other areas of the reserve. The troop size also varies with areas, troops with large number of individuals were seen in the tourism zone and in the protected inner areas of the core zone and with small number of individuals are seen in the boarder areas of the reserve areas. Size of the troop seems to be related to the quality of the habitat.

The territories of adjacent langur troops often overlapped. The male langur actively defends his territory against adjacent troops. Defense of territories was noted on many occasions. Only the single adult male of each troop directly involves in this defense. Each of these males would sit on a tall branch of a tree, open his mouth , exposing his lower incisors arid emit a continual low-pitched sound. Some times sound may be produced by biting the teeth. This would be answered by the opponent male. The males may be

also quickly move the head upwards while keeping their mouth open and closing it slightly as if biting the air. Similar behaviour is exhibited by both males and females toward human intruders. The male would then run toward the other, often giving whoops , grunts and often 'hoho' calls. One male would chase the other into its territory only to be chased immediately back to its own territory. After the confrontation , the troops moved in opposite directions to their respective territories.

New births were noticed in almost all months of the year .except in November and DecemberThe infants are reddish brown and the colour changes to jet black within three months . There is a considerable degree of infant transfer among females of a group, but no suckling by the foster mothers. The interval between two gestation period in two identifiable individual females, is calculated to be about two years.

No natural deaths are reported during the study period. Three individuals were electrocuted. One sub adult male from the stump tailed female troop fell down and died, while jumping from one tree to another, across the Kumily- Thekkady road.

Several curious behaviour patterns were met within this all-male troop. They didn't have a well defined home range. They roam about and frequent conflicts with adjacent troops due to trespassing to estab1ished territories are usual. Their movements are faster when compared to that of other troops. While crossing the road, they prefer walk or run along the road. They are found tolerating human presence to a great extent when compared to the other troops of the area. Playing and mounting activities are maximum in this troop.

CONCLUSION

The Nilgiri Langur enjoys a wide distribution in Periyar. This Langur is a threatened species even in Periyar.They are shot by poachers in the bordering area of the reserve and by the gunja cultivators in the interior part of the reserve. The troop size of the species tend to be smaller in the border areas as well as at Methakanam and Mavady, where it is larger in the tourist zone as they are well protected here. But the Nilgiri langur in the tourist zone also faces problems from the electric wires and from the increasing road traffic. The increasing gap in the canopy, over the road make them difficult to jump from one side of the road to the other. The Nilgiri langur in Periyar feeds on a variety of fruits, flowers, buds and tender leaves. There is a seasonal variation in the food habits of the species. The size of the Nilgiri langur in the study area varied from 8-27. The size of the group often changed by emigration, immigration, natality and mortality. Each Langur troop had a wide home range and a smaller territory. Births were noticed almost throughout the year. The interval between two gestation period of an individual female is calculated to be about two years. An all-male group was found during the study period.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

OCCURRENCE OF CANCER IN ADICHANALLOR PANCHAYATH OF KOLLAM DISTRICT AND KANJIKUZHY PANCHAYATH OF ALAPPUZHA DISTRICT

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Introduction

Cancer is a diseased condition of abnormal growth of cells in tissues or organs which spreads to other parts of the body. Cancers are classified mainly into sarcomas, carcinomas and lymphomas. The most common site of cancer in male are throat, lung, prostate, colorectal, stomach and in females are breast, colorectal, lung and cervix.Cancers,cardiac diseases, diabetes, kidney diseases and motor vehicle accidents due to substance abuse are the chief reasons of death in Kerala. Cancer is common among people of Kerala as we are open to carcinogens in food, water and air. According to the statistics of Regional Cancer Centre, Thiruvananthapuram, fourteen percent increase of cancer patients was reported from Kerala (Sudha, 2015). Hence, a survey had been conducted in Adichanellooor Panchayath of Kollam district and KanjikuzhyPanchayath of Alappuzha district to study the occurrence of cancer disease in Kerala. Types of cancer, the effect of stress on patients and their life are discussed.

Several aspects of cancer has been studied by various experts like Doll *et al*, (1981)studied about causes of cancer; quality of life in breast cancer patients(Ali, 1974); Goodwin *etal*(1981) conducted measurement of health related quality of life in randomized trials in breast cancer patient;Bottomley*et al*(1995) studied the quality of life in patient undergoing systemic therapy for advanced breast cancer. Harry (2007)studied the management of metastatic cervical cancer;Harrop(2009) reported the cancer survivorships. Camille (2010) reviewed metabolic genes and cancer in populations of African and American men; Marc (2012) analyzed the active surveillance for prostate cancer. In Kerala the cancer patients below poverty line suffer much. The present study attempts to learn about the stress, survival and marriages of cancer patients.

Materials And Methods

The places of survey selected were Adichanalloor Panchayath in Kollam district and Kanjikuzhi Panchayath in Alappuzha district. The survey was conducted during March to May 2015 as an informal interview among people of AdichanalloorPanchayath covering two hundred and fifty houses and KanjikuzhiyPanchayath encompassing one hundred and fifty houses. Data collected includes, the number of cancer patients in two panchayaths, types of cancer and class of people affected and a directory of cancer patients in the study area were created in order to help the local bodies to find out those who needs immediate help.

Fig.: 1Map of AdichanalloorPanchayath in Kollam district.

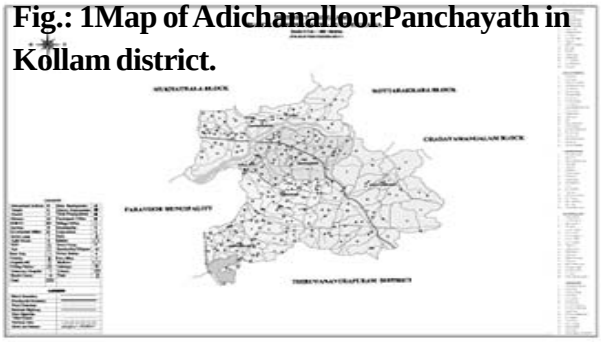
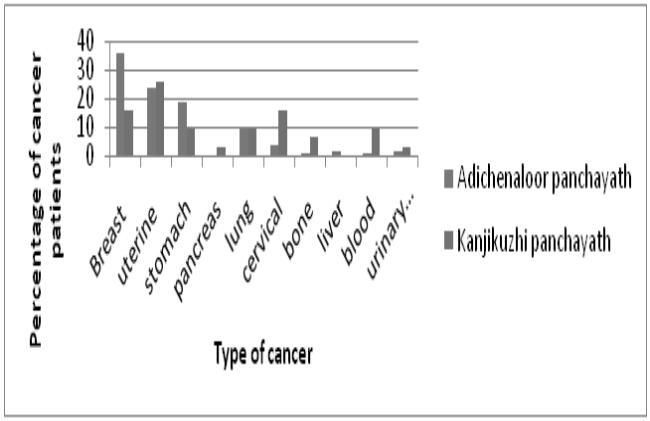


Fig.: 2Map of KanjikuzhyPanchayath in Alappuzha district.

Result And Discussion

In AdichanalloorPanchayath two hundred and fifty houses were surveyed and the results were shocking. One hundred and twelve people were identified with cancer in which breast cancerwas predominant among female population. Forty one breast cancer patients identified belongs to age group of thirty five and sixty five. The risk of breast cancer increases by three percent, for each year older the woman is. Other type of cancer seen in this panchayath includes blood, bone, stomach, pancreas, small intestine, gallbladder, cervical, urinary bladder, liver and lungs. In KanjikuzhyPanchayath of Alappuzha district one hundred and fifty homes were surveyed, thirty one cancer patients were found. Among thoseuterine cancer predominated. Other types included were breast, blood, bone, stomach, pancreas, gallbladder, urinary bladder, liver and lungs.

Graph showing percentage of cancer patients and types of cancer in Adichanalloorand KanjikuzhiPanchayath



Results of the present investigation revealed that among cancer patients number of females affected were more than males. In Adichanalloor Panchayath breast cancer and uterine cancer showed in more number, as reported, by (Ali 1974), on health related quality of life. Majority identified as breast cancer patients worked in cashew factories. These laborers works with nuts heat treated and in shell nuts are bleached using a dilute solution of sodium hypochlorite. Constant use of sodium hypochlorite created allergies among laborers. Also the pesticides in cashew nuts while farming and ingredients used for preserving nuts at the time of packing create risk of the disease. Regular consumption of cashew nuts and badams also leads to breast as well as pancreatic cancers, which point the fact that the preservative factors used to protect these costly food items causes, harm to the users.Obesity, hormonal factors influenced by lifestyle also add riskto the disease. Food plays a significant role in prevention, treatment and management of cancer. As per the study breast cancers were common in elderly women which show that the older woman has high risk of developing breast cancer since age is a risk factor. Over eighty percentage of breast cancer patients were aged fifty or above. Issues related to the disease, its treatment, side effects and symptoms, and sexual functioning should receive more attention when studying quality of life in breast cancer patients, supports the suggestions of Bottemley*et al* 1995.

Among the two Panchayath taken for study uterine, cervical and breast cancer were common in KanjikuzhyPanchayath.While comparing the age,the middle age women are the victims of cervical cancer.

Tableshowing percentage of cancer patients and types of cancer in Adichanalloor and KanjikuzhiPanchayath

Panchayath	Type of cancer and Percentage of cancer patients									
	Breast	Uterine	Stomach	Pancreas	Lung	Cervical	Bone	Liver	Blood	Urinary bladder
Adichanalloor	36.60	24.11	18.75	0	9.8	3.57	.89	1.78	.89	1.78
Kanjikuzhi	16.13	25.87	9.67	3.2	9.67	16.13	6.45	0	9.67	3.2

Cervical cancer is caused mainly by human papilloma virus through sexual contact, having multiple sex partners, greater sexual freedom, use of oral contraceptives, long term mental stress, giving birth at a very young age, more number of pregnancies, smoking cigarettes etc. Kanjikuzhy is an underprivileged area with poor quality of water available for cleansing body and clothes. In this area woman usually undertakes manual jobs have unhygienic toilets facilities and shows least interest in caring their body is one of the reason for having higher rates of uterine and cervical cancer. Increase in the incidence of life style related cancers such as breast cancers and uterine cancers can be prevented by stopping substance abuse, consuming vegetables and fruits, being vaccinated against certain infectious disease and avoiding junk foods. The life of the cancer patients is affected more in families below poverty line where children discontinues their studies, due to treatment and stress faced many of them cannot compete with others in carriers, getting a partner in life becomes difficult for them, but marital relations among survivors are seen in this area. Conceiving while undergoing the treatment is also a hurdle in their life.

Conclusion

The survey was conducted to learn more about the effect of stress, marriage of breast cancer and cervical cancer survivors. The results of the present study showed that more women than men were diagnosed with cancer.The breast cancer patients present were about 36.6% and cervical cancer around 3.57% in AdichanalloorPanchayath. In Kanjikuzhipanchayath 25.87% of uterine cancer predominated, cervical cancer contributed to 16.13% and breast cancer to 16.13%. Breast and cervical cancer predominated in the women folk may be due to the impact of hormones and life style practices. Rest of the type of cancer was seen in men. Next affected cancers are stomach and lung, in both the panchayaths. Men have oral and lung cancers due to excessive use of tobacco. Women while caring their family and kids, neglect their own health pertaining to the deficiency of vitamins, lack of diagnosis and treatment will leads to their death.The causes for cervical cancers might be multiple sex partners, early marriage or early sex, certain genetic factors, long term mental stress, giving birth at a very young age and several pregencies. The reasons for breast cancer may be hereditary, obesity, alcohol consumption, Sedentary mode of life due to lack of exercises, excessive food etc.

Poisoned vegetables and fruits from other states is the key reason for the Keralites to become cancer patients. People of other state are unaware of the consequences of using toxic pesticides, in long run will reach the ground and drinking water sources which leads them to severe physical ailments in near future. Persistent association of radiation from mobile phones, towers and radiating light from TV and computers may also contribute to the disease. Temperature rise had also contributed to proliferation of disease causing pathogens and added environmental stimulus for sexual urge and indulgence and suppression of it could develop as reasons for prostrate enlargement in males and breast cancers in femalesdue to hormonal imbalances.

Cancer diagnosis create impact on patients and their families and the resultantstress in cancer patients leads to emotional depreviation such as depression, anxiety and worries. Due to stress faced, people have a tendency to hide the disease from society affects their treatment as well as life. Depression, anxiety, fears are very common responses which changes their life. Family members are afraid of losing their loved ones. They feel distressed of thinking of the reocurrence of cancer even if treated and cured. Patients with more social support tend to feel less anxious and depressed and lead a better quality of life. Support of family members and friends reduces patient's distress. A person with cancer can recover from disease by being cheerful and happyall the time. Marital relations among survivors are seen in Adichanellorpanchayath,rectifies their maritalproblems to an extent emotionally.

Awareness programme should be conducted among common people to prevent cancer. Cost of treatment should be addressed by Government and money for their treatment should be collected from multimillionaires as sponsors or by collecting fund from them. Government hospitals should have centers for detection of cancer and chance of survival depends on early detection and stage of detection of disease. Numbers of patients visiting cancer centers are huge and the centers provided by government are not enough now days. Even though the cancer is detected early, patients have to wait for their turn for surgery, radiation, cheamotherapy; will lead them to an advanced stage, which cannot be cured. Medical lobby attacking the diseased persons and their family members with differently rated drugs should also be tackled by Government by distributing the needed drugs free of cost or in less amounts affordable to people below poverty line. Providing the treatment centers without profit oriented is a challenge for the government. A treatment policy should be taken by government and should implement the same where the beneficieries should be the most needed one.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

ANTIBACTERIAL EFFECT OF FEW NATURAL PRODUCTS ON THREE STRAINS OF ORAL BACTERIA

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ABSTRACT

The study was done to find out the antibacterial property of some of the natural products like clove, lemon, mango leaf, salt and turmeric and ummikari on oral bacteria like *Moraxella catarrhalis*, *Staphylococcus aureus* and *Streptococcus viridians.* Kirby- Bauer's disc diffusion technique was adopted to estimate the antibacterial properties of the natural products. The results indicated that clove, lemon and salt and turmeric are effective antibacterial agents with lemon showing maximum activity. Mango leaf and ummikari does not have any effect on bacteria. *Moraxella catarrhalis* was the most sensitive oral bacteria.

KEY WORDS: Antibacterial property, Oral bacteria, Kirby- Bauer's disc diffusion technique.

INTRODUCTION

Health of the mouth mirrors the conditions of the body as a whole. Maintaining good oral hygiene is one of the most important things can do for teeth and gums. But like any other part of body, mouth is also teeming with bacteria. Without proper oral hygiene, these bacteria can reach levels that might lead to oral infections, such as tooth decay and gum disease. Such diseases can be caused due to a number of bacteria and viruses like *Candida albicans*, *Streptococcus sanguis*, *Papilloma* virus etc. Since most of the oral diseases can be prevented by daily brushing and flossing, many products have emerged in the market that help us to do so, like toothpastes and mouth washes. Apart from these toothpastes and mouth washes, natural products can also be used to clean our mouth. During ancient times, mainly in India, people used natural products instead of toothpastes and mouth washes to clean their mouth. They used clove, salt, mango leaves etc. to clean their mouth.

The natural products that are used in this study include clove, lemon juice, mango leaf extract, salt and turmeric mixture and ummikari. These products were tested on oral bacteria to analyse their antibacterial action. Oral bacteria that are used include *Moraxella catarrhalis, Staphylococcus aurens* and *Streptococcus viridans.*

MATERIALS AND METHODS

Kirby- Bauer's disc diffusion technique was adopted to carry out the study. Nutrient agar medium was prepared, sterilised and was poured into petri-plates. The medium was allowed to solidify and was inoculated with one-day old bacterial strain. Natural product extracts and infusions (10^{-1}dilution) were prepared and filter paper discs impregnated with the natural products were kept on the inoculated plates. This was incubated for 24 hours. After 24 hours, the results were noted by examining the zone of inhibition around the filter paper disc.

RESULT AND DISCUSSION

Lemon extracts were found to have most effective antibacterial property against *Moraxella catarrhalis* (1cm) and least effective against *Staphylococcus aureus* (1cm). It showed an intermediate action on *Streptococcus viridians*. A similar result was found in the study carried out by Pande *et.al*. (2011), where the Zone of Inhibition of lemon extract was as high as 2.5cm and 2.8cm against *Staphy-lococcus aureus* and *Pseudomonas aeruginosa* respectively, but it was only 1cm in the present study. In the study by Viuda-Martos *et.al*. (2008) using lemon extract and in experiments by Miyake *et.al.*, 2011 using lemon peel, similar results were obtained. Antibacterial activity of lemon is due to the presence 8 - geranyloxypsolaren, phlorin, flavanones etc. (Miyake *et.al.*, 2011).

Antibacterial activity of clove is due to eugenol, oleic acid and lipids present in their extracts. In the present study, aqueous clove extract showed a zone of inhibition of 0.6cm against *Staphylococcus aureus.*

Table 1. Effect of undiluted natural product extracts on Oral bacteria.

Natural Product	Radius of Zone of Inhibition (cm)		
	Moraxella catarrhalis	*Staphylococcus aureus*	*Streptococcus viridans*
Clove	1	0.5	0.5
Lemon	1	0.6	0.8
Mango leaf	Nil	Nil	Nil
Salt & Turmeric	1	0.5	0.4
Ummikari	Nil	Nil	Nil

Table 2. Effect of diluted (10^{-1}) natural product infusion on Oral bacteria.

Natural Product	Radius of Zone of Inhibition (cm)		
	Moraxella catarrhalis	*Staphylococcus aureus*	*Streptococcusviridans*
Clove	0.5	0.25	0.2
Lemon	0.5	0.3	0.3
Mango leaf	Nil	Nil	Nil
Salt & Turmeric	0.5	0.3	0.2
Ummikari	Nil	Nil	Nil

But Sharma *et.al*. (2014) reported that 50% aqueous clove extract exhibited maximum inhibition against *Streptococcus mutans* with a radius of 0.45cm which was lower than the present result (0.5cm).

Investigations by Gupta *et.al*. (2008) concluded that clove oil was effective against *Staphylococcus epidermidis* (2cm). But he also found that, only clove extract was effective against *Staphylococcus aureus* with a Zone of Inhibition of radius 2.6cm. This value greatly differs from the value obtained in the present study. In the current study, *Staphylococcus aureus* only showed a zone of inhibition of radius 0.6cm against clove extract. This difference in Zone of Inhibition may be due to the differences in the medium used for the preparation of the clove extract. Ethanol, which was used by Gupta *et.al*. (2008) has an antibacterial property of its own, whereas aqueous extract was prepared using distilled water in the present study.

Salt is a very common substance used for preservation of food because of its ability to prevent bacterial growth. In the present study, it was observed that, salt along with turmeric exhibited a maximum Zone of Inhibition of radius 1cm against *Moraxella catarrhalis* and minimum against *Streptococcus viridians*. Similar results have not been found, but reasons for antibacterial activity of salt have been proved. Bacterial metabolism is sensitive to salt, because of its specific ionic and water binding properties.

Previous reports (Neysens *et.al*., 2002) have revealed that sodium chloride interferes both with cell growth and with bacteriocin production. Bacteriocin is an antibacterial protein produced by bacteria which inhibit the growth of other bacteria. In the presence of sodium chloride, bacteriocin is not produced and as a result, one bacterium gets attacked by another, finally causing death of both bacteria.

Alkaloids, flavanoids and glycosides present in turmeric are responsible for its antibacterial action. A mixture of salt and turmeric exhibited a maximum zone of inhibition against *Moraxella catarrhalis* (1cm) and minimum against *Streptococcus viridians.* Methanol extract of turmeric was also found to be effective against *Bacillus subtilis* and *Staphylococcus aureus* (Wilson *et.al*., 2005). It was found that the

growth of *Staphylococcus aureus* was inhibited only by one species of turmeric i.e.(*Curcuma malabarica*) but not by another species (*Curcuma zedoaria*).

Both salt and turmeric are effective antibacterial agents. When both these products are mixed together, it should have increased the antibacterial effect. But this was not found in the present study.

Mango leaves (*Mangifera indica*) and rice bran (ummikari) have shown antibacterial properties in many of the previous studies. But this is because the extracts were prepared using ethanol or methanol, both of which have its own antibacterial property. Rice bran exhibits antibacterial property due to the presence of oryzanol and flavanoids present in them. Mango leaf and ummikari were unable to inhibit the growth of bacteria but they are both effective cleansing agents. Therefore, in ancient times, people might have used them for cleaning their teeth and removing residual materials rather than removing bacteria.

CONCLUSION

The results of the study have clearly indicated that clove, lemon, salt and turmeric are effective antibacterial agents. Among the three, lemon has the best antibacterial activity against the three strains of bacteria used for the study. Mango leaf and ummikari does not have any effect on bacteriaof present study. Variations in antibacterial action may be due to the differential chemical composition of each oral bacterium. *Moraxella catarrhalis* was the most sensitive oral bacteria.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

ROLE AND INTERACTION OF INSECT PESTS IN MANGROVE VEGETATIONS OF KERALA

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ABSTRACT

The order Hymenoptera (Insecta) of mangrove ecosystem is economically important because they are pollinators, predators, and Phytophagous and parasitic species. Destructive insects are classified and surveyed in Kerala are mainly under Plant borers and Fruit borers. They enormously damaging the plants and reducing the leaf falling. Coleopterans and termites are also destructive in nature. Leaf miners and borers destroy xylem, phloem and epidermal layers of the leaves. This reduces rate of photosynthetic activity, leaf defoliation, thus leads to the death of the plants. They may enormously damage the vegetation so that preventive measures should be taken for the healthy growth and development of the unique Ecosystem.

KEYWORDS: Mangrove Vegetation, Heart wood borers, Sapwood borers, Stem borers, Seedling borers and Fruit borers.

INTRODUCTION

Mangroves are the most productive ecosystems, which can fertilize the sea, potentially protect the coastal zone and serve as the breeding, feeding and nesting ground for many animals. The Indian mangroves support rich faunal resources. Mangrove vegetation of Kerala is distributed in nine coastal districts. The study area comprises 14 species of true mangroves and 8 species of associated mangroves. Mangrove associated insects mostly include variety of insect species includes Mosquitoes, Gall forming insects, Coccids, Biting insects etc. Destructive insects are classified and surveyed in Kerala are mainly under Plant borers and Fruit borers. They enormously damaging the plants and reducing the leaf falling.

MATERIALS AND METHODS

Mangrove vegetation of Kerala is distributed in nine coastal districts. Study area includes four coastal districts of Kerala. They are Kadalundi (Malappuram), Puthuvypu (Ernamkulam) Chettuvai (Thrissur) Dharmadam (Kannur), Kunjhimangalam (Kannur).

The entire area was surveyed. Intensive and extensive collections of insects were done from the study area. All the species were collected by using sweeping net, hand net specially made for the purpose. Light traps, screens were used for the specimen collection. The preserved specimens will be kept in specially made insect boxes using Asta insect pins (38 x 0.5 mm). Taxonomic identification of the specimens was carried out with the help of experts done by wide stereo zoom microscope. The figures were drawn using Camera Lucida. A check list of insect of study area was prepared.

RESULTS AND DISCUSSION

During the course of the study, the insect pests are classified according to the mode action, are mainly boring insects. They are broadly classified into heart wood borers, sapwood borers, stem borers, seedling borers and fruit borers. The present study shows 18species, 8 orders and 11 families of insects were generally affects mangrove vegetation .These insects are very seriously affecting the vitality of plant, growth and photosynthetic activity. They may also seriously damage the different parts of the plant including the roots. In site 1 (Chettuvai, Thrissur), the growth of the plant were seriously affected by insect pests. But in site II (Kunjhimangalam, Kannur), insects are mainly in stem borers and leaf miners. (Das and Roy,1984) Maximum gall causing plants were reported from Dharmadam.The destruction of the insect pattern and infestation is almost common in all fields. The severe destruction reported from Kunjhimangalam (Kannur) and least from Puthuvypu (Ernakulum). The host plant of maximum infestation reported in *Rhizophora*

Table 1. Major Insects in Study area

Sl.No	Scientific name of Insect	Occurrence	Host plant
1	*Papilio polyxenes*	+++	*Acanthus illicifolius*
2	*Tirumala septentrionis*	++	*Avicennia officinalis*
3	*Plocaoderus obseus*	++	*Avicennia marina*
4	*Apis mellifera*	+	*Rhizophora mucronata*
5	*Apis florae*	++	*Excoecaria agallocha*
6	*Danaus chrysippus*	+	*Kandelia candel*
7	*Oecophylla smaragdina*	+++	*Sonneratia alba*
8	*Amegilla cingulata*	++	*Rhizophora apiculata*
9	*Brachycyttarus subteralbata*	++	*Bruguiera cylindrica*
10	*Belionota prasina Thunberg*	+	*Kandelia candel*
11	*Calosoma scrutator Fabr.*	+	*Acanthus illicifolius*
12	*Ceresium flavipes (Fabr.)*	+	*Bruguiera gymnorrhiza*
13	*Macrotoma plagiata Lameree*	++	*Sonneratia alba*
14	*Saperda calcarata Say.*	++	*Excoecaria agallocha*
15	*Dicladispa armigera (Fabr.)*	++	*Kandelia candel*
16	*Coccinella septempunctata*	+++	*Excoecaria agallocha*
17	*Epilachna sp. Excoecaria sp*	++	*Sonneratia alba*
18	*Photinus pyralis L.*	+	*Acanthus illicifolius*
19	*Mylabris pustulata Thunberg*	++	*Avicennia officinalis*
20	*Oryctes rhinoceros (L.)*	++	*Bruguiera gymnorrhiza*
21	*Macrodactylus subspinosus*	+	*Avicennia officinalis*
22	*Amarygmus cuprarius Web.*	+	
23	*Gonocephalum hofmanseggi*	++	*Acanthus illicifolius*
24	*Aedes albopictus (Skuse*	++	*Sonneratia alba*
25	*Aedes albopictus (Skuse)*	++	*Excoecaria agallocha*
26	*Anopheles sp.*	+	*Avicennia officinalis*
27	*Culex sp.*	+++	*Bruguiera parviflora*
28	*Tabanus striatus Fabr.*	+	*Avicennia officinalis*
29	*Limoria sp.*	+	*Avicennia officinalis*
30	*Aleurodicus dispersus Russell*	++	*Rhizophora mucronata*
31	*Aspidiotus destructor*	++	*Kandelia candel*
32	*Enicocephalus basalis Westwood*	++	*Excoecaria agallocha*
33	*Apis dorsata Fabr.*	+++	*Rhizophora mucronata*
34	*Chalcis sp.*	+	*Avicennia officinalis*
35	*Eurytoma agalica Narendran*	++	*Acanthus illicifolius*
36	*Iridomyrmex humilis (Mayr)*	+	*Avicennia officinalis*
37	*Oecophylla sp.*	+++	*Excoecaria agallocha*

+++ Major, ++ Moderate, + Less frequent

mucronata and *Bruguiera cylindrica* in all field area. The present study shows that Mangrove ecosystems in Kerala have a potential threat by insect pests; especially by boring insects. They may enormously damage the vegetation so that preventive measures should be taken for the healthy growth and development of the unique ecosystem (Jain. J Therattil 2008).

CONCLUSION

Mangrove ecosystems have a potential threat by insect pests; especially by boring insects. They may enormously damage the vegetation so that preventive measures should be taken for the healthy growth and development of the unique Ecosystem. Invasion of the islands by encroachers made extensive clearing and degradation of many areas. Any damage or destruction to this ecosystem can destroy 'coastal balance' of the nature.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

ESTIMATION OF VITAMIN C CONTENT AND ANTIBACTERIAL EFFECT OF VARIOUS CITRUS FRUITS ON VARIOUS STRAINS OF GASTROINTESTINAL BACTERIA

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ABSTRACT

The study was carried out to estimate the Vitamin C content in various citrus fruits and co-relate it with the antibacterial property shown by these citrus fruit extracts. The estimation of Vitamin C i.e. ascorbic acid content in different citrus fruits was done by carrying out titration experiments against standardised 2, 4-indophenol dichlorophenol dye. For determination of the Antibacterial effect, Kirby- Bauer's disc diffusion technique was adopted. Among the seven fruits used, lemon produced the highest effect of inhibition against all three strains of bacteria used in the study viz. *Klebsiellapneumoniae*, *Enterococcus faecalis* and *Escherichia coli*. From the observations it became clear that lemon is as effective as synthetic Vitamin C in its antibacterial property. The antibacterial property may be partly because of the anti-oxidant nature of Vitamin C in these fruits. Among the three strains of bacteria used, *E.coli* was found to exhibit the greatest sensitivity since it gave zone of inhibition with all undiluted fruit extracts and *Kelbsiellapneumoniae* was found to exhibit the lowest sensitivity.

KEY WORDS: Antibacterial property, Kirby- Bauer's disc diffusion technique, Vitamin C.

INTRODUCTION

Citrus fruits belong to the family Ructaceae that are grown all over the world and have numerous therapeutic properties like anticancer, anti-tumour and anti-inflammatory. These properties are due to the phyto-vitamins and nutrients present in the citrus fruits. Citrus species also have an important role in herbal medicine. Citrus fruits are low in fats and proteins, but supply carbohydrates (sucrose, fructose, glucose) .Fresh citrus fruits act as rich source of dietary fibre. Vitamin C, Beta -carotene, flavonoid, folic acid and dietary fibre are important bioactive components found in these species. They are also rich in flavonoids that improve blood circulation and also demonstrate anti-cancer properties.Citrus fruits also help in the prevention of certain diseases.

Vitamin C also known as Ascorbic acid is a water soluble vitamin. And unlike most animals, humans do not have the ability to synthesize Vitamin C within the body itself. Hence it is an essential nutrient and should be supplemented through diet in regulated quantities.

MATERIALS AND METHODS

For estimation of Vitamin C content, titration of the solution fruit juice extract in ortho phosphoric acid against standardised 2,4 dichlorophenol indophenol was carried out. Kirby- Bauer's disc diffusion technique was adopted to carry out the antibiotic sensitivity test. Nutrient agar medium was prepared, sterilised and was poured into petri-plates. The medium was allowed to solidify and was inoculated with one-day old bacterial strain. Natural product extracts and infusions (10^{-1} dilution) were prepared and filter paper discs impregnated with the natural products were kept on the inoculated plates. This was incubated for 24 hours. After 24 hours, the results were noted by examining the zone of inhibition around the filter paper disc.

RESULT AND DISCUSSION

In the present study, *Citrus limon* (Lemon) is found to be the strongest antibacterial agent. It gave the lowest value of DIZ in the case of *Klebsiella pneumoniae* and *Enterococcus faecalis* of 1.8 cm. The DIZ for *E.coli* was 2 cm. Similar results were obtained in a study by Aveen *et al*. (2015). It was observed that *Citrus lemon* showed highest inhibitory effect (2.2 cm) against *Staphylococcus auricularis* followed by *Staphylococcus aureus* and *Escherichia coli*

(2 cm). *Klebsiella pneumoniae*gave a DIZ of 1.6 cm. The effect was much more pronounced in the case where the peel and juice extracts were used as a mixture. Also *Citrus sinensis* (Orange) showed no effect in the study they conducted which is confirmatory with the results of the present study.

In the present study *Enterococcus faecalis* shows moderate sensitivity towards the citrus fruit extracts that were used. The largest inhibitory zone was for *Citrus limon*(Lemon extract) and it gave no inhibitory zones for *Citrus sinensis* (orange) and *Punicagranatum* (pomegranate). The trend here seems to be highly dependent on the pH of the extract as orange and pomegranate possess the lowest pH.

Table 1. Vitamin C content of various fruit extracts.

Fruit	***Amount of ascorbic acid (mg) /100ml***
Lemon	38.96
Orange	30.306
Mosambi	25.106
Pomegranate	17.306
Wild lemon	12.986
Gooseberry	88.3
Averrhoabilimbi (Puli)	5.19

Table 2. pH corresponding to various fruit extracts.

Fruit	**p^H**
Lemon	1
Wild lemon	1
Averrhoabilimbii	1.5
Mosambi	3
Orange	4
Pomegranate	3
Gooseberry	2
Vitamin C tablet	1

Investigations by Ehigbai *et al*. (2015) show results similar to the results obtained in the present study. 200 microgram/ml concentration of citrus fruit extracts gave a 1.0 cm diameter inhibitory zone for *Enterococcus faecalis* and a 1.2 cm diameter for *E.coli*. This trend is typical of the present study, where *E.coli* even though is s gram negative strain; it shows greater sensitivity to the extracts than *Enterococcus faecalis* which is gram positive.

Mizbah *et al*. (2015) studied the antibacterial effect of various concentrations of citrus fruits on *Escherichia coli*. The mean value of inhibition zone, 50% extract concentration had (0.58 cm) inhibition zone, 75% extract concentration had (0.66 cm) inhibition zone, 100% extract concentration had (0.54 cm) inhibition zone. The maximum inhibition was observed in 75% concentration with (.66 cm) inhibition zone. The results obtained in the present study indicate a much higher inhibition factor. The diameter of the zone obtained for *E.coli* in the present study is 2 cm. Investigations of Amit Pandey *et al*. (2011) gave results that are similar to the results of the present study. Hot water extract of lemon peel produced an inhibitory zone of size 2 cm in *E.coli* which is the same as the result got in this experiment.

As can been seen from the observations, it is not possible to say that the antibacterial activity of a citrus fruit is directly or linearly related to the Vitamin C content in it. This is clear from the fact that Wild lemon seems to have a smaller amount of Vitamin C but still capable of showing greater antibacterial effect than orange which is richer in ascorbic acid content.

In this study almost all the fruit extract seem to be effective against *E.coli*. This can be explained by the fact that the *Klebsiella pneumoniae* species are surrounded by a capsule which increases its virulence by acting as a physical barrier to evade host immune response. The *Enterococcus faecalis* bacteria are known to survive the harshest of conditions due to its ability to acquire antibiotic resistance relatively easily as explained earlier. Thus making the two strains less sensitive to the fruit extracts in comparison to *E.coli*.

Table 3. Antibacterial effect of citrus fruit extracts on *Klebsiella pneumoniae.*

Sl no	Bacterial Strain	Citrus Fruit	Concentration	Diameter Of The Zone Formed (cm)
1.	*Klebsiella*	Orange	Undiluted	Nil
		Orange	Diluted	Nil
2.	*Klebsiella*	Lemon	Undiluted	1.8
		Lemon	Diluted	Nil
3.	*Klebsiella*	Wild Lemon	Undiluted	1.6
		Wild Lemon	Diluted	Nil
4.	*Klebsiella*	Pomegranate	Undiluted	Nil
		Pomegranate	Diluted	Nil
5.	*Klebsiella*	Mosambi	Undiluted	Nil
		Mosambi	Diluted	Nil
6.	*Klebsiella*	Puli	Undiluted	0.7
		Puli	Diluted	Nil
7.	*Klebsiella*	Gooseberry	Undiluted	1
		Gooseberry	Diluted	Nil
8.	*Klebsiella*	Vitamin C Tablet		1.8

Table 4. Antibacterial effect of citrus fruit extracts on *Enterococcusfaecalis.*

Sl no	Bacterial Strain	Citrus Fruit	Concentration	Diameter of The Zone Formed
1.	*Enterococcus*	Orange	Undiluted	Nil
		Orange	Diluted	Nil
2.	*Enterococcus*	Lemon	Undiluted	1.8
		Lemon	Diluted	Nil
3.	*Enterococcus*	Wild Lemon	Undiluted	1.7
		Wild Lemon	Diluted	Nil
4.	*Enterococcus*	Pomegranate	Undiluted	Nil
		Pomegranate	Diluted	Nil
5.	*Enterococcus*	Mosambi	Undiluted	0.7
		Mosambi	Diluted	Nil
6.	*Enterococcus*	Puli	Undiluted	1.7
		Puli	Diluted	Nil
7.	*Enterococcus*	Gooseberry	Undiluted	1.2
		Gooseberry	Diluted	Nil
8.	*Enterococcus*	Vitamin C		1.5

Table 5. Antibacterial effect of citrus fruit extracts on *Escherichiacoli.*

Sl no	Bacterial Strain	Citrus Fruit	Concentration	Diameter of The Zone Formed
1.	*E. Coli*	Orange	Undiluted	0.7
		Orange	Diluted	Nil
2.	*E. Coli*	Lemon	Undiluted	2
		Lemon	Diluted	Nil
3.	*E. Coli*	Wild Lemon	Undiluted	1.9
		Wild Lemon	Diluted	Nil
4.	*E. Coli*	Pomegranate	Undiluted	0.9
		Pomegranate	Diluted	Nil
5.	*E. Coli*	Musambi	Undiluted	0.8
		Musambi	Diluted	Nil
6.	*E. Coli*	Puli	Undiluted	1
		Puli	Diluted	Nil
7.	*E. Coli*	Gooseberry	Undiluted	0.9
		Gooseberry	Diluted	Nil
8.	*E. Coli*	Vitamin C		1.8

In the works of Bansode. *et al*. (2012) the antibacterial activity of lemon extract was comparative to that of the antibiotic ampicillin in *Shigellasonnei*, *Sal.para. B* and *E.coli*. Both showed an inhibition zone radius of 6 mm in *Shigellasonnei*.

The phytochemical analysis of the lemon extract showed the presence of phenols, flavonoids, glycosides, steroid, saponin and reducing sugar. These phyto-chemical compounds may be the compounds responsible for the bioactivity and can be used as drug for diseases. These results are in correlation with the results obtained in this study as the fruit extracts which showed higher Vitamin C content need not produce greater antibacterial activity. Gooseberry has higher Vitamin C content than lemon, but lemon shows greater antibacterial activity. Thus antibacterial activity is majorly dependent on the phytochemicals like flavonoids, glycosides present in the fruit. Vitamin C enhances the activity of these compounds and also in addition exhibits antibacterial property of its own. Hence the use of Vitamin C in combination with antibiotics can increase their efficacy.

The fruits which had a lower pH showed greater antibacterial activity when compared to fruits which had higher pH but also greater Vitamin C content. An example would be that of Wild lemon and orange/ mosambi. The latter two have a much higher Vitamin C content and also higher p^H. Wild lemon with a pH almost similar to lemon and a much lower Vitamin C content than the other two showed greater antibacterial activity. Between lemon and Wild lemon, lemon extract show greater activity and it also has a significantly higher Vitamin C content. Thus the antibacterial activity is p^H dependent.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

STUDY ON THE BIODIVERSITY OF BIVALVE MOLLUSCS OF VYPIN –CHERAI BEACH, KERALA

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ABSTRACT

The diversity of bivalve molluscs in Vypin –Cherai beach was assessed. The samples were collected once in every month for a period of four months (December-March) from two sampling sites and species diversity were analyzed. A total of 25 species of bivalve molluscs belonging to five different orders were identified. They are Veneroida (16 species), Arcoida (5 species), Mytiloida (2 species), Ostreoida, (1 species) and Pterioida (1species). Among this, dominant taxon was order Veneroida and site wise dominance was maximum in Vypin area. Majority of the species identified belonged to sand dwelling or bottom dwelling category. The bottom trawling affects the natural habitat of bivalves and also inversely affects the diversity of bivalve fauna. A perfect understanding of the bivalve diversity of the coastal system is an essential prerequisite for implementation of sustainable utilization bivalve resources.

KEY WORDS: Taxon, Trawl bycatch, Bivalve molluscs, Sand dwelling, Bottom dwelling

INTRODUCTION

The Class Bivalvia with about 7500 species, includes animals such as mussels, oysters, scallops and clams. Bivalves have long been a part of the diet of coastal human populations. Bivalves accumulate high levels of pesticides, heavy metals, and hydrocarbons from contaminated water It is for this reason that bivalves, particularly mussels, are used as sentinel organisms in environmental monitoring programmes.

An understanding of the diversity of bivalve molluscs assumes paramount importance in conservation and biodiversity. Although considerable effort has been invested in recording diversity in different habitats, there are no relevant studies about bivalve molluscs of Kerala. Bivalves constitute an important component of many benthic ecological habitats. In estuaries, intertidal zones and near shore coastal areas of Kerala, they are well distributed. (Kripa V, 2005). The Bivalvia would comprise about 14% of the total and the other five classes less than 2% of the living molluscs (Nicol and David,1969). A series of survey done along from the coastal habitats of India have recorded high diversity and abuandance of bivalves (Alagarswami and Narasimham, 1973; Kripa and Mathew Joseph, 1993). In India, studies on species diversity are very few; Appukuttan, 2008; Fred Pinn, 1990). The diversity of bivalves at the Neendakara fishing harbor, altogether 46 species of bivalves were recorded belong to 13orders, 16 families and 27 genera. The collection represented the economically important species such as *Perna viridis, Perna perna, Anadara indica, Anadara inequialis and Anadara gibbosa.* (Souji. S, 2006).

METERIALS AND METHODS

Bivalve molluscs were collected by simple random method from the beach. Monthly observations were made from two selected stations (S1- Vypin Beach and S2- Cherai Beach) in the beach. The samples (Shells and whole specimens) were collected by hand picking. Fresh specimens were preserved in formalin and brought to the laboratory for identification. The bivalves were sorted out and identified upto species level mainly based on the shell morphology with reference to taxonomic keys and with the help of available literature (Modayil Joseph Mohan, 2007).

RESULTS AND DISCUSSION

The bivalves are abundantly seen in the Indian coastal waters. In the present study, 25 varieties of bivalve molluscs were collected and identified fromVypin – Cherai beach.

Table 1. Check list of Bivalve Molluscs

Name of Order	Name of the Species
I.Order-veneroida	
	1.Semele crenulata
	2.Donax scortum
	3.Donax pulchella Hanley
	4.Mactra achatina Holten
	5.Mactrinula plicataria
	6.Donacilla cornea
	7.Paphia gallus
	8.Paphia textile
	9.Ruditapes bruguieri
	10.Sunetta donacina
	11.Sunetta solanderi
	12.Katelysia marmorta
	13.Timoclea costillifera
	14.Sunetta menstrualis
	15.Sunetta scripta
	16.Mactra luzonica Reeve
II.Order-Arcoida	
	17.Anadara Formosa
	18.Scapharca deyrollei
	19.Anadara granosa
	20.Noetia gambiensis
	21.Striarca tenebrica
III.Order-Mytiloida	
	22.Perna viridis
	23.Perna indicus
IV.Order- Pterioida	
	24.Pinctada fucata
V.Order-Osteroida	
	25.Crassostrea madrasensis Preston

Table 2. Bivalve molluscs collected from Vypeen - Cherai beach

Site	Arcoida	Mytiloida	Pterioida	Osteroida	Veneroida	Total
Site-1 Vypeen	4	2	1	1	14	22
Site-2 Cherai	1	2	0	1	7	11

They fall under five different orders. Maximum number of species identified belongs to order Veneroida(16 species),followed by order Arcoida (5 species) Mytiloida (2 species) pterioida and osteroida(1 species each). The maximum number of specimens were collected from site I, which is adjacent to Cochin bar mouth area and molluscan shells were abundant in almost all months. The present study reports more number of bivalve species which directly indicates the increased exploitation of this fauna and their species diversity.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

USE AND MISUSE OF PESTICIDES IN KUTTANAD

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ABSTRACT

Kainakary and Champakkulam panchayath of Kuttanad taluk, 'the rice bowl of Kerala' is in Alappuzha District. It is an ecologically sensitive area which is subjected to study the pesticide usage. Primary data were collected from the farmers using pre tested survey questionnaire, during March to June 2016, the Punja season, had been used to assess the pesticide usage in the area.

KEY WORDS: pesticides, toxicity, chemical group, LD50 value.

INTRODUCTION

Pesticides are major water pollutants and some pesticides are persistent organic pollutants contaminating soil which reduces biodiversity, contributes to pollination decline, destroys habitat and threatens endangered species. Pests also develop resistance to pesticides, necessitating a new pesticide. Greater dose of the pesticide application counteract the resistance and will leads to environmental deterioration. Several banned pesticides are still widely used in the agricultural fields. Seventy two pesticides were banned in India as "high acute toxicity, possible carcinogen, long residual effects and reproductive and fetotoxic effects".

Rice cultivation in Kuttanad is intensive while comparing other parts of the state. Nearly 90% of the farmers sow high-yielding varieties necessitating high level of chemical inputs. In addition, the area is prone to pests such as Brown Plant Hopper. The Kerala Agricultural University restricted the use of Methyl parathion and BHC for rice cultivation in the area (Indiradevi, 2007). Interestingly the most commonly used chemicals in the region were Methyl parathion, followed by Monocrotophos. Some of the chemicals used are not among the recommended chemicals Hence the study aimed to identify the types of pesticides used and misused in Kainakary and Champakkulam panchayath of Kuttanad and to identify the banned pesticides used in Kuttanad.

MATERIALS AND METHODS

Primary data were collected from fourty six farmers of Kainakary and Champakkulam Panchayath using pre tested survey questionnaire, during March to June 2016, Punja season had been used to assess the pesticide usage in the area. The results were illustrated using statistical tools such as pie and column diagram and the data were compared on the basis of category and chemical group of pesticides.

RESULTS AND DISCUSSION

Data availed from the farmers had been sorted according to their toxicity and chemical group.

Comparison of pesticides used according to their toxicity.

Comparison of pesticides used according to their chemical group.

Comparison of pesticide used in Kainakary and Champakulam panchayath.

Two banned pesticide identified from Kainakary region were Monocrotophos (insecticide) marked Red which is extremely toxic and the other one is Paraquat (herbicide) marked yellow which is highly toxic.

Results of the study proved, among fourty six farmers about 61% of them used highly toxic insecticides which comes under the Yellow category and according to the farmer's opinion these were effective to control pests. In case of fungicides about 89% of them used Blue category which are moderately toxic while in the case of herbicides 39% of farmers used Yellow category. The existing fact is that, two strictly banned pesticides identified from the Kainakary area were insecticide named as Monocrotophos, which is extremely toxic coming under red category and other one is the herbicide named Paraquat, which is highly toxic coming under the yellow category. According to the chemical composition of insecticides, among fourty six farmers, 44% used organophosphate compounds, 22% used synthetic pyrethroids and 17% of farmers used neonicotinoid and remaining 17% used other insecticides. Insecticidal properties of organophosphate compounds attracted the farmers for using such compounds. In the case of fungicides 50% farmers used triazole groups, 13% of farmers used organophosphate compounds and remaining 37% used other fungicides coming under various categories.

Two banned pesticides identified from Kainakary region are Monocrotophos and Paraquat are widely used and the bottles are found carelessly thrown into the water bodies, created high risk to the environment. According to the report of World Health Organization in 2001, insecticides are mostly used by developing countries. The present study confirms the report because highly toxic insecticides were widely used in the study area. According to lndiradevi (2009), the frequency of chemical usage is 21%, 51.25%, 22.55% in the case of extremely toxic, highly toxic and moderately toxic respectively, while rest of them are comparatively safe chemicals in the Kuttanad area. Present study revealed majority of people used highly toxic chemicals and also two restricted pesticides were identified from the study area emphazise the findings of Indira devi (2009).

CONCLUSION

Pesticide usage in Kainakary and Champakulam panchayath of Kuttanad region from March to June 2016 had been assessed. Findings highlighted that majority of farmers use highly toxic insecticides such as Monophos, Classic, Sakthi, Cartox, Rogor, Confidor and Ekalux labelled as Yellow. In the case of fungicides, majority of farmers use moderately toxic chemical labeled as Blue. In the case of herbicides most of the farmers use Blue category chemicals. On the basis of chemical group most of farmers use organophosphate compounds; in the case of fungicides most of them use triazoles compounds. Insecticides and herbicides used in the area are organophosphate compounds. Two banned pesticides identified in the Kainakary panchayat were Monocrotophos (insecticide) and Paraquat (herbicide) and these toxic chemicals are carelessly thrown in the waterbodies and fields, especially the residues will be accumulated in running water bodies. Ultimately it reaches the drinking water sources and supplies as carcinogens to human being and other organisims. Hence it is high time from the part of the authority to monitor and prevent the

further usage and supply of these chemicals, if not, it will lead to dire ending of human beings.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

ANTIBIOTIC SENSITIVITY PATTERN IN *E.COLI*

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ABSTRACT

Antibiotic sensitivity pattern in *Escherichia coli* was studied to analyse sensitivity pattern of *E.coli* from clinical specimens. A total of 10 *E.coli* samples were subjected to antibiotic sensitivity test by Kirby-Bauer disc diffusion method. The antibiotics used were Streptomycin , Trimethoprim , Lincomycin and Cephoxitin The study showed multi drug resistance in *E.coli* strains. Antibiotic resistance shown by microorganisms may be due to the inappropriate use of antibiotics as medicine by humans, use of antibiotic in agriculture and use in farm animals as sub therapeutic agents.

KEYWORDS: Antibiotic sensitivity, Kirby-Bauer disc diffusion, *E.coli.* Resistance, Microorganisms

INTRODUCTION

Escherichia coli is a gram negative bacterium that continues to be a major cause of opportunistic nosocomial infections. Nosocomial infections caused by this organism are often hard to treat because the increased resistance acquired by the organism due to heavy use of antibiotics. According to Duredoh Free man George and *et al*, most of the *E.coli* isolates from the hospitals exhibited multidrug resistance. About 90% of *E.coli* isolates exhibited resistance to ampicillin, 78.4% were resistance to cotrimoxazole (Tri methoprim-sulpha methoxazole).

A large proportion of multidrug resistance isolates were recovered from animals than humans. Concurrent resistance to tetracycline and streptomycin was the most common to resistance phenotype. More than 80% of the isolates were resistant to various antibiotics including cephoxitin and streptomycin. Animal *E.coli* shows an increasing resistance trend to 11 antimicrobial agents including trimethoprim / sulfamethoxazole. There was no monotonic resistance trend for trimethoprim and cephoxitin. Resistance to amoxicilon has been established for years, and resistance to trimethoprim/sulfamethoxazloe has emerged more recently with rates of >20% in some areas.

The re-emergence of *E.coli* sensitivity is probably due to non usage of the drug, nitrofurantion for a long period of time. Another study conducted among 119 *E.coli* isolates from urine samples of inpatients, 76.5% are multidrug resistant. The study showed high resistance among uropathogenic *E.coli* to Ampicillin, Cephalosporin and fluroquinolones. (Niranjan & Malini, 2013). Another study carried out among the 80 *E.coli* isolates, 77.5% are resistance to streptomycin, 18.8% to Cephoxitin. They reported resistance trades are distributed across hosts in different environments rather than being host or environment specific .

MATERIALS AND METHODS

Collection of sample

A total of ten *E.coli* samples were collected from diagnostics labs were inoculated in sterilized nutrient agar medium. Kirby-Bauer disc diffusion method was used to determine the in vitro susceptibility of collected *E.coli* isolates. Four different antibiotics - Streptomycin (S10), Trimethoprim (Tr5), Cephoxitin (Cn30)and Lincomycin (L2) were used for the test. A sterilized forceps is used to deposit the antibiotic disc on to the surface of inoculated medium in different Petri dishes. The preparation is kept overnight for the formation of colony and to react the antibiotics to the bacteria. After 12 hour s the culture is taken and zone of inhibition were recorded.

RESULT AND DISCUSSION

A total of 10 *E.coli* isolates were subjected to antibiotic sensitivity test. Most of the *E.coli* strains exhibited "multi drug resistance". 50% of the *E.coli*

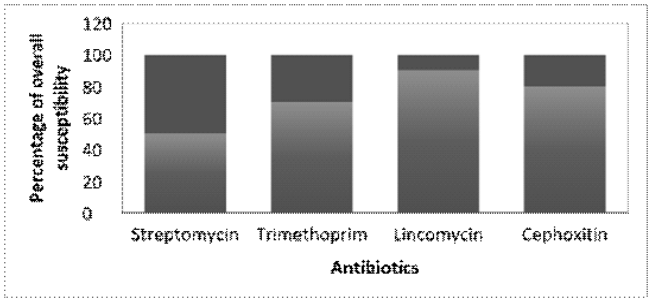
strains were susceptible to streptomycin and 50% of them showed resistance to the same. About 90% of *E.coli* strains showed resistance to lincomycin, interestingly one strain showed sensitive to lincomycin. In the case of Tri methoprim 70% resistance is observed with 30% sensitivity by the *E .coli* strain. It was found that 80% of the *E.coli* strain was resistant to cephoxitin and 20% showed to be sensitive. One strain was susceptible to all the four antibiotics. Surprisingly five *E.coli* strains were resistant to all the four antibiotics. Most co resistant phenotype observed for L2 and Cn. (almost 90%).

***E.coli* sample**	**S10**	**L2**	**Tr5**	**Cn**
S1	0.9 mm	0	0	0
S2	0.8mm	0	0	0.5 mm
S3	0	0	0	0
S4	0	0	0	0
S5	0	0	0	0
S6	0	0	0	0
S7	0	0	0	0
S8	0.7 mm	0	0.8 mm	0
S9	0.6 mm	0.4 mm	0.7 mm	1.1 mm
S10	0.8 mm	0	0.7 mm	0

The major goal of the study was to document antibacterial drug resistance among *E.coli* isolates. This study showed an increasing resistance trend for Trimethoprim (70 %) and streptomycin (50 %). The rate of resistance against trimethoprim is a serious matter of concern because it is most frequently prescribed drug in UTI (Urinary tract infection) treatment throughout the world. It was noted that much smaller number of isolates were sensitive to the antibiotics.

One of the most important resistance profile identified in the study was the increasing resistance trend for trimethoprim (70%).This result was similar to the study of Daniel *et. al*. (2012). A study by Ronald *et al*, (2015) found that among the 176 urine isolates of *E.coli* from female students, 29.6% were Tri methoprim-sulpha methaxazole resistant. According to them resistance to trimethoprim- sulphamethaxazole (TMP-SMX) has emerged more recently. In one study (Daniel .A .Tadesse *et al,2012*), it was found that animal *E.coli* isolates showed an increasing rate of streptomycin resistance. The present study has a correlation with it; the resistant *E.coli* strains from animals may be entered into human body by various means. The reason for resistance is that, streptomycin is approved in animal feeds, so constant use of such feeds cause *E.coli* become resistant to it. Also the indiscriminate use in environment also accounts for this resistance. It may be due to the use of streptomycin to control various plant diseases like fire blight in pear and apple . It is also used as a pesticide and a fungicide. It controls algae in ponds and aquaria.

Figure 1. % Bar diagram showing overall susceptibility pattern of *E.coli*



A large percentage of E .*coli* strains showed resistance to Lincomycin (90%).only 10% showed sensitivity to it. The high resistance rate probably due to transfer of resistant bacteria from animals to humans. Lincomycin is approved for use as sub therapeutic agents and growth promoters in poultry and livestock. It is commonly used for weight gain in chickens and swine. As humans consume animal products containing antibiotic residue lead to resistance in bacteria present in humans or may be the whole bacteria enter into humans and transfer the resistant gene to other bacteria and then undergoes replication producing more resistant bacteria. Other reason for

the high resistance rate may be due to over and continuous use of this antibiotic by humans as medicine.

About 80% Cephoxitin resistant *E.coli* strains are observed, only 20% were sensitive. The reason for this may also be due to overuse of antibiotics by humans. Normally cephoxitin is recommended for use in animals, so that means of resistance is negligible. Most co-resistant phenotype observed for Cephoxitin and Lincomycin(almost 90%).

CONCLUSION

The study highlighted the emergence of new antibiotic resistance strains of *E.coli* .It was striking to note the contribution of animal feeds and over use of antibiotics to drug resistance to *E.coli*. Present study revealed the sensitivity pattern of *E .coli* .It may help the medical practitioners to prescribe the efficient drugs for the diseases caused by *E.coli* . This study suggested that regular monitoring of antibiotic sensitivity is important to control the bacterial diseases and their treatment.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

PREVALANCE OF OBESITY AT THE AGE OF 2-40 IN IT INDUSTRY

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ABSTRACT

Obesity is a medical condition in which excess body fat has accumulated to the extent that it may have an adverse effect on health, leading to reduced life expectancy and increased health problem.The present study was conducted on obesity among 120 people which were randomly selected. Questionnaire method is used to obtain relevant information. According to BMI classification they were classified as underweight, normal, overweight and obese. Of the 120 individuals studied, 50% were males and 50% were females. According, to the BMI index, 25% were found to be underweight, 53% were normal, 20% were overweight and 2% were obese. It was found that males were more obese than females. Further, disease like cholesterol was found to be higher in males. It was also noted that rate of obese people are low in the IT industry.

KEYWORDS: Obesity,Underweight, Overweight

INTRODUCTION

Traditionally known for malnutrition, Indians now report more and more frequently with overweight, obesity and their consequences. Obesity is a major driver for the widely prevalent metabolic syndrome and type 2 diabetes mellitus. Although this phenomenon is a global one, India is unique in that it has to grapple with both over- and undernutrition at the same time.

People were considered obese when their BMI, a measurement obtained by dividing a person's weight in kg by the square of the person's height in meters, exceeds kg/m^2. Excessive body weight is associated with various diseases, particularly cardiovascular diseases, hypertension, diabetes mellitus type II, dyslipidemia, obstructive sleep apnoea, certain types of cancer, left ventricular hypertrophy, non alcoholic steatohepatitis, osteoarthritis, asthma and sometimes psychosocial problems.WHO in 1995 recommended an anthropometry that could be used to assess the nutritional and health status of adults. One such measure in widespread use now is Quetelet's index, better known as Body Mass Index (BMI). It is a measure for human body's shape based on weight and height.

BMI= Mass (kg) / Height(m^2)

MATERIALS AND METHODS

Anthropometric data from 60 males and females coming under the age group of 25-40 from an IT firm was collected. The questionnaire covered the details regarding their lifestyle, food habits and other relevant information. The data was compiled, computed and from this, BMI of each subject were calculated using the formulae:

BMI= Weight in kg / Height in m^2

Weights were taken using a weighing machine and height was detected using a tape.Sex wise differentiation was done and based on BMI classification by WHO and revised guidelines as per the Health Minisitry of India, subjects were differentiated into various categories as normal, underweight, overweight and obese.

RESULTS AND DISCUSSION

In the present study , obesity is found to be more in males (2%) than female (0%). The NCHS adult health survey results of 2010 data on the prevalence of overweight and obesity and its determinants in adults aged 16 and above were contradictory to the present survey. The survey by NCHS shows that females are more obese than males. It is noted in the present survey that overweight is higher in females but obesity is higher among males.

Table 1 Variation of Weight with age (Age: 25-40)

	Under weight	Normal	Over weight	Obese
Males	12%	72%	14%	2%
Females	32%	50%	18%	-

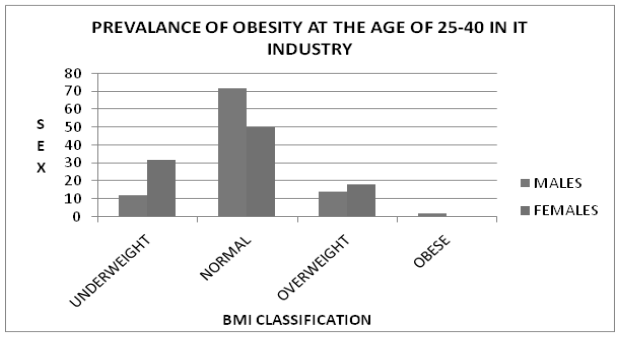

Table 2. Factors affecting weight (Male)

Category	Veg	Non Veg	Fast Food	Homely Food	Excercise	Cholestrol	Diaabetes	Any Other
Normal	16%	84%	50%	50%	85.6%	6.67%	0	13.33%
Underweight	20%	80%	100%	0	0	0	0	0
Overweight	0	100%	100%	0	1.3	50%	0	0
Obese	0	100%	100%	0	0	100%	0	0

Table 3. Factors affecting weight (Female)

Category	Veg	Non Veg	Fast Food	Homely Food	Excercise	Cholestrol	Diaabetes	Any Other
Normal	10.75%	89.25%	13%	100%	50%	0	0	0
Underweight	0	100%	23%	87%	5.62%	0	0	0
Overweight	0	100%	100%	0	25%	40.66%	0	0
Obese	0	0	0	0	0	0	0	0

It is also found that females prefer homely food than fast food while it was opposite in the case of males. Cholesterol was found to be higher in males than females. Low level of cholesterol in females can be attributed to high level of estrogen during the reproductive period of females. Obesity is the most common metabolic disease and the number of individual who are overweight and obese is fast increasing worldwide. It has been suggested that there will be more than 220 million individuals with diabetes by the year 2015. The WHO has called the global increase in obesity and diabetes as the 21st century epidemic. The relative risk of developing type II diabetes increases ten fold in obese women and eleven fold in obese men. Obesity is hence a major risk factor for type II diabetes. But, in the present survey, none of the individuals are affected by diabetes.

According to the present study, when excercise and physical activity was considered, it was found that females also do physical activity as males. But, the result of physical activity and obesity in Canadian women by Shirley Bryan and Peter Walsh states that only a small proportion of female population is actively involved in physical activity. The most commonly reported hindrance to women's participation in physical activity is lack of time due to family responsibility, including child care and other household chores.

According to NFHS data, in obesity Punjab attains top rank followe by Kerala and Tripura lining up the bottom position.

CONCLUSION

In the present study, of the 120 individuals studied, 25% were found to be underweight, 53% were normal, 20% were overweight and 2% were obese. It was found that obesity rate in adults are lower than previous studies. The lifestyle disease was found higher in males than in females. The cholesterol level in males is 31.2% and it was 21.6% in females. It was also noticed that percentage of diabetes has surprisingly come down to zero in both females and males.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

SCREENING OF CASES OF ANEMIA FOR INHERITED MOLECULAR DEFECTS IN ERYTHROCYTES

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ABSTRACT

Screening of blood samples with anemia for the presence of HbF, HbS and G6PD deficiency, indicate the causes inside the RBCs that include hemoglobinopathies and enzymopathies. In the present study blood samples were screened for the presence of anemia resulting from molecular defects like hemoglobinopathies and thalassemias and red cell enzyme defects like G6PD deficiency. A slightly higher value of fetal hemoglobin percentage was obtained from the blood samples screened. It may be due to the iron deficiency anemia. Blood samples do not show any of the inherited causes like thalassemia, sickle cell anemia and G6PD deficiency. The results indicates that G6PD deficiency disease has a low incidence rate and Sickle cell anemia is usually seen in tribal peoples. Its incidence rate is lower in urban societies.

KEYWORDS: Anemia, hemoglobinopathies, thalassemia

INTRODUCTION

If the amount of functioning hemoglobin is reduced, a condition known as anemia arises. Causes of Anemia range from deficiencies in red cell production to improperly functioning hemoglobin. Furthermore, these problems can be caused by a multitude of factors, including genetic inheritance, infection or even malnutrition. A thorough evaluation must be made, therefore, in order to identify the actual course of the anemia and prescribe an appropriate treatment.

The presence of HbF, HbS, G6PD levels in the blood, will indicate the causes inside the RBCs which include hemoglobinopathies and enzymopathies. With newborn screening, we are able to identify babies with sickle cell anemia early and start prophylactic treatment to help prevent most serious complications (Thomas P, 2005). Adults with severe anemia are at risk for cardiopulmonary complications (Helf *et al* 1996. Presence of abnormal hemoglobin in blood is called hemoglobinopathy. It is a genetic disorder and can be inherited by the offspring. In normal adults amount of HbF is about 1%. If it is more than 1% in adults and children above the age of one year, then it is abnormal and the condition is known as hemoglobinopathy. An elevated level of fetal hemoglobin (HbF) in an adult may result from a genetic disorder of hemoglobin production or from various acquired hematological conditions.

The sickle cell hemoglobinopathies are hereditary disorders in which the red cells contain HbS. HbS, causes a condition called sickle cell anemia. HbS differs from HbA in the substituition by valine for glutamic acid in the 6th position from the N- terminal end of the beta chain. The level of HbF in individuals with sickle cell anemia varies. Enzymopathy is a disorder that results in missing or defective enzymes. They are genetic disorders affecting genes encoding red blood cell enzymes. The common enzyme disorders are pyruvate kinase(PK) and Glucose 6 Phosphate Dehydrogenase(G6PD) .

G6PD deficiency is the most prevalent human enzyme deficiency, affecting hundreds of millions of people around the world. G6PD deficiency is an inherited condition in which the body does not have enough of enzyme glucose 6-phosphate dehydrogenase, which helps red blood cells to function normally. This deficiency can cause hemolytic anemia.

MATERIALS AND METHODS

The study group consists of 50 cases. Samples with anemia (Hemoglobin < 8 g/dl) were screened for possible molecular defects leading to anemia. four ml. of venous blood was collected by vein puncture in EDTA using vacutainers were used for the study. The samples were immediately placed vertically in the ice

packs and transported to the lab within 20 minutes of collection. Plasma was separated by centrifuging at 2000 rpm for 5 minutes on an R – 303 series (REMI) centrifuge. Tests were done to detect the presence of HbF(alkali denaturation test), HbS (sickling test and solubility test).G6PD activity (lyozyme G6PD test) in the RBCs was also measured. Red Blood Cell Indices were measured on automated Sysmex 800. Osmotic fragility was calculated according to the test described by Dacie and Lewis (1991). Fetal hemoglobin (HbF) was estimated by alkali denaturation technique. (Betke *et al* 1959). Sickling test was performed by the method of Dacie and Lewis (1991).

RESULT AND DISCUSSION

Mean Values

Among 50 samples 27 were females and 23 were males. 22 samples show elevated HbF % than the normal value. Mean values were calculated. The females have increased HbF% than males. The females are more anaemc and they have higher values.

Table 1. Relation between gender and HbF g %

Gender	No. of Cases	HbFg%
Male	23	2.29
Female	27	3.49
Total	50	2.94

From the study we can conclude that iron deficiency anemia is more common in our society and in those patients there is chance of elevated HbF %. So we have to recommend routine screening of adults for anemia. Iron deficiency anaemia is common particularly in females. They are more anaemic and have alkali resistant hemoglobin higher percentages. Our results were in concurrence to the previous studies.

As the samples were analysed from urban area, no sickle cell patients and G6PD deficiency patients was obtained. G6PD deficiency is very rare in our population as reported by earlier studies. Due to consanguinity of marriages sickle cell anaemia is more in tribal peoples. In the urban society it is not common and hence from the samples we obtained no cases of sickle cell anaemia or traits were detected. The presence of HbF, HbS, and G6PD levels in the blood will indicate the hemoglobinopathies and enzymopathies.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

A COMPARATIVE STUDY ON DOMESTIC ANIMAL DISEASES FORTHE LAST SIX YEARS IN CALICUT, KERALA

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ABSTRACT

Animal diseases are the impairment of normal state of an animal that interrupts or modifies its vital function. The present study was conducted on domestic animal diseases for the last six years (2009-2015). Major diseases include circulatory diseases, congenital diseases, digestive disorders, diseases of sense organs, gynecological disorders, infectious diseases, musculoskeletal disorders, nervous system disorder, parasitic diseases, respiratory problems, skin diseases, surgical conditions, toxicoses and urinary disorders. Parasitic diseases and digestive disorders are the most frequently occurring diseases for the last six years. Occurance of diseases were maximum in rainy season.

KEY WORDS: Mastitis, enteritis, anorexia, ascariasis, ADCP, ASCAD

INTRODUCTION

In India as 65-70% human population is dependent on agriculture and allied sector especially animal husbandry. Domestic animal plays an important role in national economic contribution . Major threat to our economic wealth is the domestic animal diseases. Only by statistical analysis of data we can understand about the present status of diseases and there by implementing control measures to eradicate or control diseases.

Dr.R.Vijayakumar done an animal disease control project designated as "Goraksha mission" during the 2004-2008 with the assistance of National Diary Development Board (NDDB). A three year study was carried out on the domestic animals of Kerala for the presence of tick infestation by K. Prakashan and N.Ramani (2007). Eighteen tick species were collected from various domestic animals. Dogs showed the maximum rate of infestation (84%) and cats had the lowest (8.33%). A total of 1020 serum samples were collected from there different slaughter houses of Kerala from the period june,2013 to march 2014. The study included the animals aged greater than three years of both the sex. Serum samples were processed for detection of antibodies against *Brucellaabortus* and *Brucellamelitensis* using RBPT and C-ELISA. The study results are the overall prevalence of brucellosis in slaughter cattle found to be 6.17%. Among the Brucella positive animals 6.81% was prevalent in females and 5.26% in males (RaghunathaReddy R,Prejit, Sunil.B, Vinode V K and Asha K, 2014).This study will help to give awareness to people about common diseases and control measures present in the district.

METRIALS AND METHODS

A preliminary visit was done in houses/nearby localities, pet shops to know about the various diseases of domestic animals. A thorough search of journals, periodicals and discussion with experts in the field of animal husbandry were sought out.

Detailed data about the diseases affected by different domestic animals like cow, buffalo, goat, pig, dog, cat, fowl, duck and sheep, for a period of six years(2010-2015) were collected from the District Animal Husbandry Office (DAHO);Calicut with the help of an appropriate data sheet. The occurrence of diseases with respect to individual animals and year was analyzed by applying statistical methods one way ANOVA.

Interviews were carried out in the nearby localities, houses, grazing field or pet shops by using an appropriate questionnaire. Information about major diseases control programs were collected from the ADCP office, Calicut.The information about the

diseases, symptoms, programs for the control of infectious diseases was discussed with doctors of DAHO, Calicut.

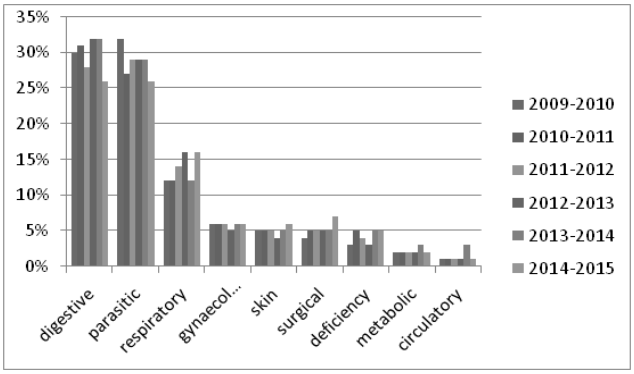
RESULT AND DISCUSSION

Table 1 shows the output of the ANOVA analysis and whether we have a statistically significant difference between year means. We can see that the significance level is 0.996 (p = .996), which is below 0.05. and, therefore, there is a statistically significant difference in the mean of disease to different animals between the different years. This is great to know the specific groups differed. (Here p – value is greater than á (0.05), we accept the hypothesis otherwise reject it.)

Table 1:Variation in the occurrence of different domestic animal diseases for last six years

Variables	Sum of Squares	Df	Mean Square	F	Sig.
Between	1451803	5	290360	.071	.996
Years	290.000		658.000		
Within Years	2697852	66	408765		
	98496.000		6037.819		
Total	2712371	71			
	01786.000				

Fig. 1. Percentage proportion of different diseases that affect particular animals for last six year.



Major domestic animal disease reported was digestive disorder. Out of total cases 30-32% are digestive disorders(Fig. 1). Digestive disorders include anorexia, impaction, enteritis, gastritis, indigestion, colic, choke, bloat etc. Maximum number of diseases was reported in 2013 and 2014, and minimum in 2015. Next frequently occurring diseases wasparasitic conditions (28-31%). Parasitic conditions are amphistomiasis, anaplasmosis, ascariasis, coccidiosis, fasciolasis, mange, strongylosis, schistosomiasis etc. Domestic animals are infected with some species of ticks and mites like hard tick, boat tick, ixodid tick etc. Malathion, Lime-sulfur, Coumaphos, Phosmetand Methoxychlor are common used to treat the external parasites.

Table 2:Percentage proportion of different animals that affect particular diseases for last six year.

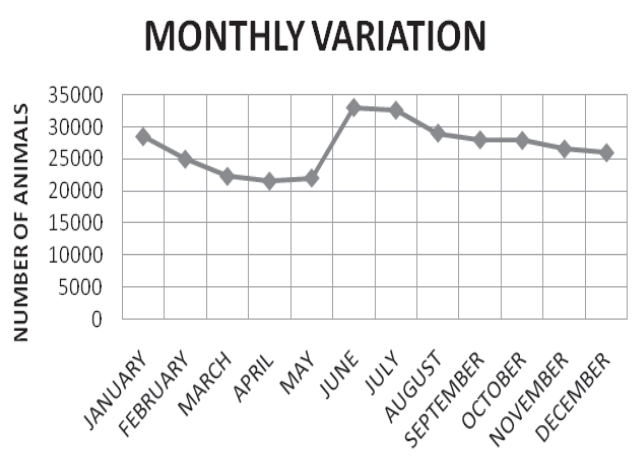
% Proportions	Cattle	Buffaloes	Goat	Sheep	Dogs	Cats	Pigs	Fowls	Duck	Other Birds	Other Animals
Cases treated 2009-2010	62.033	1.159	18.19	0.02	2.4	0.2	0.349	15.2	0.139	0.06743	0.24369
Cases treated 2010-2011	61.818	1.71534	16.3	0.05	2.25	0.2	0.28	16.88	0.3	0.025	0.28368
Cases treated 2011-2012	61.637	1.97349	13.66	0	2.13	0.2	0.2	17.46	0.15	0.072	0.55653
Cases treated 2012-2013	58.114	2.75197	14.9	0.003	3.04	0.2	0.2	19.68	0.14	0.025	0.95457
Cases treated 2013-2014	53.528	3.10214	17.87	0.002	3.852	0.42	0.1	19.77	0.25	0.193	0.8848
Cases treated 2014-2015	55.274	2.89368	18.45	0.01	3.777	0.4	0.2	17.76	0.45	0.182	0.57752

Out of total reported diseases 12-16% is respiratory disorders such as bronchitis, epistaxis, pneumonia and other respiratory diseases. Gynecological disorders occurred in 5-6%, out of this, anoestrum is most common. Abortion, cystic disorder, delayed ovulation, dystocia, retention of placenta, uterine tortion, prolapse and vaginitis were occurred in low percentage. Circulatory diseases, deficiency disorder, sense organ disorders, metabolic diseases, musculoskeletal disorders, nervous disorders, skin diseases, urinary disorders are also affecting domestic animals at low levels.80-90% of the circulatory disorder is the aneamia,60-70% of the sense organ disorders is the conjunctivitis,35-40% of the metabolic diseases is the ketosis, major musculoskeletal disorder is paralysis.

The most effected animal is cattle (53-62%) that will severely effect the total milk yield. Parasitic diseases and digestive diseases are the most common diseases among cattle. Secondly, most affected animal is the goat, then the fowls. In goats parasitic diseases are more frequent than digestive disorders. Other domestic animals like buffaloes, dog, cat, and duck are also affected by many diseases. Occurrence of diseases for these animals are less when compared to the other animals.

Fig. 2:Monthly variations in the occurrence of diseases

There is a correlation between the season and occurrence of diseases.(Fig. 2). Domestic animal diseases were maximum during June and July. As it is rainy season the environment will be more polluted. It is assumed that in the polluted condition, parasites grow rapidly and become more powerful to attack the animals, so parasitic diseases will be high. Digestive diseases also show marked increase during June and July, because most of the food may be contaminated by various micro parasites. Domestic animal diseases show minimum number during March, April, and May. Major diseases control programs under ADCP are FMDCP(Foot and Mouth Disease Control Program), ASCAD (Assistance to State for Control of Animal Diseases), SADEC(State Animal Disease Emergency Control Room),RFK (Rabies Free Kerala Vaccination) and animal movement management.



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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

STUDY ON THE FISH DIVERSITY OF MANJALY THODU OF PEECHANIKADU, ANGAMALY

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ABSTRACT

Diversity studies are the basic tool of conservation strategies. Fish diversity of Manjaly thodu of Peechanikadu area of Angamaly Municipality was studied. Fishes were collected monthly. During the study period a total of 16 species of fishes belonging to five orders and 11 families were collected. Fishes were categorized based on its economic value. They come under ornamental fish, food fish and biological control fish. The study indicated that, the fish fauna of the Manjaly Thodu composed majority of Cyprinids.

KEYWORDS: Manjaly Thodu, food fish, ornamental fish, biological control

INTRODUCTION

Indian subcontinent has tremendous diversity of plant and animal species due to its position at the confluence of three biogeographical realms viz. Paleartic, Afro-tropical and Indo-Malayan and wide variety of ecological conditions available here (Gadgil and Meher-Homji, 1990). The streams of Kerala have been identified as one of the few sites in the world that show exceptional fish diversity and great degree of endemism with respect to freshwater fishes (Kottelat and Whitten, 1996). The distribution of more than 90% of the fishes so far reported from Kerala is mostly confined to 5 major rivers, viz. Kabbani, Kallada, Bharathapuzha, Periyar and Chalakudy. The barbs of the group Cyprinids dominate over all other fish families with 83 members and are followed by loaches with 26 members and bagrid catfishes with 11 members. One of the major causes of the significant reduction in the population of 99% of critically endangered species is reported to be due to anthropogenic interventions (Kurup and Radhakrishnan, 2006). The present study was an attempt to assess the fish diversity of Manjaly Thodu of Peechanikadu area of Angamaly municipality.

MATERIALS AND METHODS

The fishes were collected using cast net from Manjaly Thodu of Peechanikadu area of Angamaly Municipality, Ernakulam district. Collections were made monthly once. The fishes were brought to the laboratory and identified (Thalwar and Jhingran, 1991).

RESULTS AND DISCUSSION

The samples were made from Manjaly Thodu of Peechanikadu area of Angamaly Municipality. During the study period a total of 16 species of fishes belonging to five orders and 11 families were collected (Table I). Fishes were categorized based on its economic value. They come under ornamental fish, food fish and biological control fish (Table II). The study indicated that, the fish fauna of the Manjaly Thodu composed majority of Cyprinids. Family Cyprinidae recorded three species. Among Cyprinidae, *Puntius Sarana subnasutus*(*Systomous sarana subnasutus*) found to be vulnerable and endemic to Western Ghats. Order Perciformes formed the largest order with six families represented eight species of fishes.

The present study indicated that the fish diversity of Manjaly Thodu is diverse, enriched and endemic. This is attributed with the fresh water zones like reservoirs, canals, irrigation canals slightly saline waters in river mouths and estuarine waters of Purapilly kavu Bundu. One part of Manjaly Thodu flows into Chalakudy river and other part into Periyar.

Table I Diversity of fish with their classifiaction

Sl. No	Order	Family	Species
1	Perciformes	Cichlidae	2
		Anabantidae	1
		Channidae	2
		Gerriedae	1
		Belontiidae	1
		Ambassidae	1
2	Siluriformes	Heteropneustidae	1
		Bagridae	1
3	Cypriniformes	Cyprinidae	3
4	Cyprinidontiformes	Aplocheilidae	1
5	Beloniformes	Belonidae	2

Table II. Classification of fishes on their economic importance

Sl. No	Family	Species	Economic Importance
1	Cichlidae	*Etroplus suratensis*	Food Fish
	E. maculatus	Food fish & Ornamental fish	
2	Anabantidae	*Anabas testudineus*	Food fish
3	Channidae	*Channa striatus*	”
		C. marulius	Food fish & Ornamental
4	Gerriedae	*Gerres oyena*	Food fish
5	Ambassidae	*Ambassis gymnocephalus*	Minor food fish
6	Belontiidae	*Macropodus cupanus*	Biological control agent
7	Heteropneustidae	*Heteropneusteus fossilis*	Food fish
8	Bagridae	*Horabagrus brachysoma*	Food fish& Ornamental fish
9	Cyprinidae	*Puntius mahecola*	Minor food fish
		Puntius filamentosus (Dawkinsia filamentosa)	Food fish & Ornamental fish
		P. sarana subnasutus (*Systomus sarana subnasutus*)	Food fish
10	Belonidae	*Hyporamphus xanthopterus*	Food fish
		Xenotodon cancilla	”
11	Aplocheilidae	*Aplochelius lineatus*	Biological control agent

Perciformes was identified to be the largest order followed by Cypriniformes. On categorization fishes with food value, ornamental value and biological control agents could be identified. *E. maculatus, C. marulius, P. filamentosus and H. brachysoma* have been accepted as an ornamental fish as well as food fish. Cyprinidae is the largest family and cyprinids include the most popular ornamental fishes and it ranks as one of the most commercially important groups of fresh water fishes. Cyprinids are dominant in the aquatic systems of North India (Kar, 2006), South Kerala and Western Ghats (Johnson and Arunachalam, 2009). The present study reported the occurrence of the endemic barb *P. sarana subnasutus* at Manjaly Thodu. Catfishes have been reported as vanishing from the waters of Kerala (Binoy, 2010). A decline in cat fishes from central zone was indicated to be due to habitat destruction and fishing pressure (Sebastian, 2014). In this study also only two species of catfishes could be identified. It might be attributed with the ecological transformation of the habitat.

Fish diversity study of Majaly Thodu is a pioneer work and recent studies on the fish fauna of Periyar River and Chalakudy River showed that there was decline in the population dynamics of fish. As Manjaly Thodu flows into Periyar river and Chalakudy river, Manjaly thodu has a potential role in contributing diversity in these riverine systems. Alarming decline in fish diversity might be due to habitat destruction, saline intrusion and entry of agricultural runoff, modification of channels and net work of roads across the river and sand mining.

CONCLUSION

As it was a pioneer work at Manjaly Thodu to identify the diversity of fish fauna of Peechanikadu area, the present study is very important as it may provide a benchmark data of highly productive rivers like Chalakudy and Periyar. Diversity studies are the basic tool of conservation strategies.

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Millennium Zoology
VOL.17 (1), 2016:
ISSN 0973 - 1946
Research Article

SEASONAL VARIATION OF MACROBENTHOS IN COCHIN BACKWATERS PRIOR TO THE CONSTUCTION OF VALLARPADAM INTERNATIONAL CONTAINER TRANSSHIPMENT TERMINAL COCHIN, KERALA

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ABSTRACT

The Vallarpadam ICTT project will be a benchmark in Cochin port development. Rail link from Kochi to the Vallarpadam ICTT creates barriers in the Cochin estuary. Seasonal variation of macrobenthos in Cochin backwaters prior to the construction of Vallarpadam ICTT was studied. The study showed pronounced variations in species composition during different seasons. Monsoon season showed poor species richness. Macrobenthos can be used as the indicators of health of aquatic ecosystem. The current data of macrobenthos will provide a quantitative standard for tacking any future changes due to disturbances within the estuary.

KEYWORDS: Macrobenthos, Seasonal variation, Cochin backwaters, Vallarpadam ICTT

INTRODUCTION

The benthos refers collectively to all aquatic organisms, which dwell, in, on or near the bottom of water bodies. They encompass a huge array of life with many phyla. Benthos retained on a 500 μ mesh sieve is referred to as macrobenthos. They are the critical component of shallow water estuarine and coastal marine ecosystems. No aquatic system will function long without a healthy benthic community. They regulate the physical, chemical, and biological environment (Hampel *et al*., 2009).

The construction of Vallarpadam ICTT (International Container Transshipment Terminal) project commenced in Cochin backwaters on February 2005. The land reclamation for this purpose can have disastrous consequences for the marine and coastal ecosystems. The aim of the study is to determine the present health status of the benthic fauna in the Cochin backwater. The documentation of the existing conditions within the estuary will provide a quantitative benchmark for tacking any future changes due to the disturbances.

MATERIALS AND METHODS

Cochin Estuary (Lat. 09^0 30'-$10^0$10' N and Lon. $76^0$15'-$76^0$25' E) is a bar-built estuary constituting a network of shallow canals situated on the southwest coast of India.

A calendar year was divided into 3 distinct seasons viz .Monsoon (June- September),Post-monsoon (October -January) and Pre-monsoon (February -May). Four van Veen grab hauls were taken from each station. Macrobenthos was extracted by washing the samples through a 0.5 mm mesh sieve; and the material retained in the sieve was stored in a labeled plastic container and fixed with 5 % neutral formalin.

In the laboratory the sediment was stained with Rose Bengal biological stain (0.1g in 100 ml of distilled water) and re-sieved using 0.5mm sieve to remove the residual sediment and formalin. The residue in the sieve was then transferred into petri dishes. The organisms were extracted and preserved in 5% neutral formalin for further analysis. Specimens were identified to the lowest possible taxonomic level.

RESULTS AND DISCUSSION

On the whole 32 species of polychaetes belonging to 27 genera were identified. Errantia and Sedentaria were represented by 16 species each. The total number of polychaetes species recorded from Stations 1 to 6 were 23, 22,24,22,20 and 6 respectively.

Table 1. Details of study area in the Cochin backwaters

Sl. No.	Name	Latitude	Longitude
1	Thevara	Lat 9^0 55' 35 N	76^0 17' 53 E
2	Mattancherry	Lat 9^0 56' 47 N	76^0 15' 52 E
3	Barmouth	Lat 9^0 58' 26 N	76^0 14' 39 E
4	Marine Science Jetty	Lat 9^0 57' 39 N	76^0 16' 40 E
5	Bolghatty	Lat 9^0 58' 52 N	76^0 15' 50 E
6	Varapuza	Lat 10^0 4' 30 N	76^0 16' 48 E

Crustaceans were mainly represented by four species of amphipoda, two species of isopoda, two species of tanaidacea, one species of cumacea, one species of caridean shrimp and two species of brachyuran crabs. The molluscan fauna includes three species of bivalves and one species of gastropod.

During pre-monsoon, station 1 registered 22 species of polychaetes, 11species of crustaceans and 3 species of molluscs. During pre-monsoon at station II there were 19 species of polychaetes, 8 species of crustaceans and 1 species of molluscs. At station III, 23 species of polychaetes, 8 species of crustaceans and 4 species of molluscs were present during pre-monsoon. In station IV, there were 20 species of polychaetes, 7 species of crustaceans, 2 species of molluscs were seen. At station V, 18 species of polychaetes, 6 species of crustaceans and 4 species of molluscs were encountered. In station VI, 6 species of polychaetes and 4 species of were present during pre-monsoon period.

During monsoon period at station 1, 18 species of polychaetes, 9 species of crustaceans and 3 species of molluscs were recorded. Station II consisted with polychaetes of 8 species, crustaceans 5 species and 2 species of molluscs during this period. At station III, there were 17 species of polychaetes, 9 species of crustaceans and 3 species of molluscs .In station IV, there were 15 species of polychaetes and 4 species of crustaceans during monsoon season. At station V, 14 species of polychaetes and 7 species of crustaceans were reported. In station VI, there were 3 species of polychaetes and 3 species of crustaceans were present during monsoon period.

Station 1 registered 19 species of polychaetes, 6 species of crustaceans and 2 species of molluscs during post-monsoon period. At station II, 16 species of polychaetes, 7 species of crustaceans and 2 species of molluscs were encountered at this period. At station III, there were 19 species of polychaetes and 7 species of crustaceans were seen. In station IV, there were 19 species of polychaetes, 8 species of crustaceans and 1 species of molluscs were reported. At station V, 16 species of polychaetes, 8 species of crustaceans and 1 species of molluscs were encountered during post-monsoon. In station VI, there were 5 species of polychaetes and 5 species of crustaceans were present during post-monsoon period.

Polychaetes formed the bulk of the fauna throughout the survey. The crustacea formed the second dominant group in the study area. Macrobenthos showed pronounced variations in density and diversity during different seasons in all the stations. Estuarine organisms have different tolerance and responses to salinity changes (Ranasinghe *et al.*, 2009). A gradient of increasing species diversity from head of the estuary (station VI-low saline region) to the mouth (station III-high saline region) is clearly demonstrated in the present study. The greatest number of taxa were recorded from stations where surface and bottom salinity differences were minimum, with increasing in the difference between

surface and bottom salinities (station V) there was a trend for the number of taxa to be decreased.

In tropics the variation in temperature over months is minimal. According to (Jacob *et al*., 2013) seasonal difference in the temperature in the backwater is not a deciding factor for the distribution of bottom macrofauna. Variation in salinity produces changes in species composition, distribution and abundance in estuary. Salinity is the major factor controlling the species composition of estuaries (Martin *et al*., 2013). During the monsoon season the drastic changes in salinity may results in destruction of stenohaline species or their migration to adjacent sea. The mortality and recruitment of fauna during different seasons result in continuous seasonal variation in abundance and composition of fauna. Post-monsoon was presenting a gradual increase in faunal density. But the diversity was highest during pre-monsoon season. Similar variation in the macro faunal density during different seasons was observed earlier by Chandran (1987) in Vellar estuary and Raveenthiranath Nehru (1990) in Coleroon estuary . Present study will provide a quantitative standard for tacking any future changes in the estuary.

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AMYGDALA - IN PURSUIT OF FEAR OR CHEER?????

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When life throws you a gift or a gain, it's not just your mood that perks up. At the same time, the sight of a snake or the sound of a gunshot also evokes fear in you, a shock or fright. Your response to these kind of emotions are mediated by structures known as Amygdala situated in the forebrain. They are two small almond-shaped masses of nerve cells buried deep in the forebrain, located within the median temporal lobes, as identified by Budarch in early 19th century.The amygdaloidal complex is structurally diverse and comprises of approximately 13 nuclei.

For years the amygdala has been regarded primarily as the brain's center for fear, both for perceiving and expressing it. The function of Amygdala was considered to take part in response to fear and terror (Sweeney, 2009.). Amygdala is a part of limbic system along with hypothalamus, thalamus, cingulate gyrus and hippocampus. All these structures constitute the Papez circuit involved in the control of emotional expression (Papez, 1937). Amygdala, in conjunction with prefrontal cortex and medial temporal lobe, is involved in consolidation and retrieval of emotional memories. (Rajmohan and Mohandas, 2007)

But in recent years, scientific view of the amygdala's importance has been changed as it turns out that the amygdala helps shape behavior in response to all sorts of stimuli, bad and good. It plays a role not only in aversion to fright, but also in pursuit of pleasure. Signals about everything you encounter are passed from the brain's sensory processing areas directly to the amygdala. The amygdala shares elaborate communications channels with the prefrontal cortex (the brain's control center for planning and decision making).

Its strategic location allows the amygdala to act as a spotlight, calling attention to sensory input that is new, exciting and important. In this way, it helps to predict the timing and location of potential dangers, helping you dodge many of the things you dread. But surprisingly, those same connections also help you acquire the good things in life, by identifying and assessing rewards such as food, sex and other delights.This is important as identifying pleasant situations and avoiding aversive ones can boost well-being and chances for survival. Now it is known that at least part of that reward-based behavior is driven by some sort of interaction between the amygdala and the frontal lobe, known to be involved in thought, memory and consciousness. (Phelps *et al.*, 2004)

In 2006, researchers at Columbia University provided a clue, showing how the amygdala judges the emotional value of stimuli. A team led by C. Daniel Salzman taught monkeys to associate two patterns on a TV monitor with either a rewarding sip of water or an irksome puff of air to the face. By recording the electrical activity in the amygdala as animals watched the screen, the scientists showed that different amygdala nerve cells are tuned to handle positive and negative events. In a follow-up experiment with a slightly different setup, Salzman's group found that a set of nerve cells is specifically tuned for processing surprise. Some among those nerve cells were dedicated solely to the rewarding surprise specialized for the purpose, the water sip. Another set amygdala neurons did the opposite, registering surprise when it was aversive but not rewarding. By carrying two different sets of neurons for surprise, the amygdala may be better able to predict what's coming in order to prepare appropriate actions, Salzman says. But the interesting part is that the same stimulus, depending on the circumstances, can be rewarding or not, Salzman explains. He uses an example from the card game blackjack.

The object of the game is to hold cards with a total value as close as possible to 21, without going over. Players are initially dealt two cards and then can request additional cards.Say a player is dealt two cards with a total value of 11 and then gets a 10 of hearts, worth 10 points, to reach a perfect 21. Now suppose that in the next hand, after the cards are shuffled, the same player is dealt two cards that total 15. The third card reveals the exact same 10 of hearts. While golden in the first hand, the 10 becomes an unfortunate deal the second time around. Most people would have no difficulty recognizing this point, Salzman says, evidence that the amygdala's emotional response to the same sensory stimulus can be flexible.

Dr. Murray noticed such flexibility also among monkeys in making food choices in the lab. Given a choice between two foods, monkeys (like most people) will invariably reach for their favorite. But after gorging on a favored food for a while and savouring it, the reward value of that treat diminishes, the way the value of the 10 drops when a blackjack player already has 15 points in hand. At that point the monkeys shift their choices and select a new food. Monkeys without a working amygdala, however, show little change in behaviour and continue to stuff themselves with the first food choice. These findings suggest that the amygdala is needed to revise the assessment of a reward's value.

Another recent study shows that people, like monkeys, do indeed use the amygdala to judge the value of a particular item. Rick Jenison, who studies Neuroeconomics at the University of Wisconsin, Madison, and his colleagues recruited three volunteers who were already undergoing a procedure that required electrodes to be implanted in the brain. Using the electrodes, the researchers eavesdropped on 51 amygdala nerve cells as the volunteers put price tags on a series of junk food items. Listening in on nerve cell chatter, Jenison's group found 16 individual cells that responded in a way consistent with the values that participants assigned to individual foods. Thus it shows how single neurons in the human amygdala work to assess the value of an object. In addition, the study shows how amygdala neurons compute value in real time, while decisions are being made (Jenison *et al.*, 2011).

While the amygdala may be important for assigning an emotional value, it may not be the "be-all and end-all" in valuing objects. As the saying goes, the brain isn't as simple as we sometimes make it out to be. A deeper knowledge of the neural circuitry that regulates emotional responses may help scientists understand what goes awry in addiction and may also allow finding new ways to intervene in times of distress. This could lead to medications and therapies designed to treat mood disorders, anxiety disorders, phobias and panic disorders such as depression, where stimuli that were previously pleasing aren't any more so.

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WHO WILL SELECT THE FUTURE HUMAN: HUMAN OR NATURE?

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INTRODUCTION

The origin and existence of life is still a miracle. Till today no one had the opportunity to experience the entire history of that journey. There is only one "witness" for the entire events "the nature". She provides information about her past through various genetic to fossil level evidences. We termed the process of selection of the members into the "script" by nature as natural selection.

Modern human advanced in many aspects with the help of the progresses in the field of Science and technology. In medicine and agriculture, managing evolution is a familiar procedure. The functioning and the innate efficiency of the ecosystem are dominated by human effects (Palumbi, 2001). Technological impact has increased dramatically over the last few decades and placed human as the world's dominant evolutionary force. Insecticide, pesticide and antibiotic resistance among a series of organisms had already been reported by the effect of human induced evolution or indirect and direct artificial selection. Up to which level man can regulate the evolution or biological processes in a living system is still an area of debate.

Life expectancy and evolution

Human enjoys the benefit of the greatest life expectancy (LE) among the primates. It is an interesting area of research to know and verify the facts behind the progression in human LE than other primates. Human lifespan has substantially increased over its last few million years, during ape-human lineage of evolution (Rose and Mueller, 1998). Still the reports of Finch (2010) and Finch and Austad (2012) clearly distinct the LE of human in pre-industrial and industrial era. The LE at birth of pre-industrial humans was 30–40 years, is twice that of the four extant great ape species. During industrialization and as part of economic development, the LE doubled again, reaching 70–85 years in favoured populations (developed countries). The recent rapid increases in lifespan within ten generations as compared to the millions of years before industrialization are consistent with environmental factors, rather than genetic selection. Our larger brains and longer postnatal maturation have received most attention in evolutionary studies, the mortality patterns after puberty in humans also differ strikingly from those of the great apes in the much lower values and in the delayed acceleration during adult aging. Finch (2012) pointed out the future challenges to the accomplishments in LE that were enabled by improved nutrition, hygiene, and medicine.

Human longevity: Genetics or Lifestyle

The future of human LE remains an open question and this area invites lot of debates among population scientists. From the earlier discussions based on the arguments by Finch it is clear that the industrialized era generated modern man with higher LE. The main cause of mortality throughout human evolution until 20th century must have been the infections, arterial diseases, cancer, neurodegenerations and other age related changes (Finch, 2010). Both economic progression and industrialization boost up the medical science and the life style of the individual and results the increase in the LE. Some scientists propose that LE is not likely to exceed 85 years (Hayflick, 2007), some suggest that life expectancy may reach 100 years in the 21st century. The difference between these two positions stems from beliefs about the relative importance of environmental and genetic variance in determining life expectancy.

Healthy aging and longevity in humans are controlled by a combination of genetic and non-genetic factors. The search for genetic and molecular basis of aging has led to the identification of the main genetic factors affecting the individual variation of the aging phenotype (Passarino *et al*., 2016).

Studies on genes to extend LE

Lumpkin *et al* in 1986 proposed that telomere shortening is the molecular clock that triggers senescence. The Human Genome Project has also provided new targets for pharmaceutical therapies that could slow ageing or prevent various age-related diseases. Passarino *et al*., 2016 pointed out the deviation among the researchers towards the studies on Epigenomics of aging. Various studies reported the relatedness between the individual lifestyle characteristics and genetic backgrounds. As a result, ethicists, demographers and scientists have begun to consider the probable outcomes of life extension research. Some, such as the 'transhumanists', believe that humans may attain immortality in the near future (Elliot, 2003). In parallel to these studies, many researches have been carried out to search the genetic variants responsible of modulating human longevity either using the genes involved in age related diseases or genes implicated in pathways related to longevity in studies with model organisms (Morris *et al*., 2015). The adoption of innovative study design and the development of new statistical and computational tools for effective processing of genetic data arising from high-throughput DNA technologies will help to better understand the complex genetic architecture underlying human longevity.

Missions to immortality

In 2013 Google and Apple took a step to tackle 'aging and associated diseases. For that they opened a new research and development company named 'Calico' (https://www.calicolabs.com/). At the "Global Futures 2045 International Congress" in New York, Kurzweil (one of the member of Calico) claimed that the biological parts of human body will be replaced with mechanical parts and could happen as early as 2100. He also claimed that by 2045 humans will be able to upload all their entire minds to computers and become digitally immortal. Calico believe that they can extend the life of human up to 500 years by the application of Science and technology.

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A POSSIBLE CURE FOR AIDS ?

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INTRODUCTION

AIDS is a syndrome caused by a virus called HIV . The illness alters the immune system, making people much more vulnerable to infections and diseases. This susceptibility worsens as the syndrome progresses. HIV is found in the body fluids of an infected person (semen and vaginal fluids, blood and breast milk). The virus is passed from one person to another through blood-to-blood and sexual contact. In addition, infected pregnant women can pass HIV to their babies during pregnancy, delivering the baby during child birth, and through breast feeding. It can be transmitted in other ways- such as vaginal, oral sex, anal sex, blood transfusion, and contaminated hypodermic needles. There is currently no cure for HIV or AIDS. Treatments can slow the course of the condition - some infected people can live a long and relatively healthy life. There are approximately 37 million people living with HIV worldwide and about 35 million people have died from the virus.

Symptoms

For the most part, the symptoms of HIV are the result of infections caused by bacteria, viruses, fungi and parasites. Many people with HIV have no symptoms for several years. Others may develop symptoms similar to flu, usually two to six weeks after catching the virus. The symptoms can last up to four weeks. Symptoms of early HIV infection may include: fever , chills, joint pain, muscle ache, sore throat, sweats (particularly at night), enlarged glands, a red rash, tiredness, weakness, weight loss etc.In many cases, after the initial symptoms disappear, there will not be any further symptoms for many years. During this time, the virus carries on developing and damages the immune system. This process can take up to 10 years. The infected person will experience no symptoms, feel well and appear healthy. If left untreated, HIV weakens the ability to fight infection. The person becomes vulnerable to serious illnesses. This stage of infection is known as AIDS.

During late-stage HIV infection, the risk of developing a life-threatening illness is much greater. Examples include: oesophagitis (an inflammation of the lining of the lower end of the esophagus) ,infections to the nervous system (acute aseptic meningitis, subacute encephalitis, peripheral neuropathy), pneumonia, some cancers, such as Kaposi's sarcoma, invasive cervical cancer, lung cancer, rectal carcinomas, hepatocellular carcinomas, head and neck cancers, cancers of the immune system known as lymphomas, oxoplasmosis (a disease caused by a parasite that infects the brain). It can also cause disease in the eyes and lungs) ,tuberculosis etc. Life-threatening illnesses may be controlled and treated with proper HIV treatment.

Diagnosis

Diagnosis is made through a blood test that screens specifically for the virus. If a person has been exposed to the virus, it is crucial that they get tested as soon as possible. The earlier HIV is detected, the more likely the treatment will be successful. Also, precautions can be taken to prevent the virus from spreading to other people. Tests used for the diagnosis of HIV infection in a particular person require a high degree of both sensitivity and specificity. This is achieved using an algorithm combining two tests for HIV antibodies. If antibodies are detected by an initial test based on the ELISA method, then a second test using the Western blot procedure determines the size of the antigens in the test kit binding to the antibodies. The combination of these two methods is highly accurate.

Treatment

HIV is treated using a combination of medicines to fight HIV infection. This is called antiretroviral therapy

(ART). ART isn't a cure, but it can control the virus. ART involves taking a combination of HIV medicines (called an HIV regimen) every day, exactly as prescribed. These HIV medicines prevent HIV from multiplying, which reduces the amount of HIV in the body. Even though there is still some HIV in the body, the immune system is strong enough to fight off infections and cancers. By reducing the amount of HIV in body, HIV medicines also reduce the risk of transmitting the virus to others.

HIV medicines are grouped into six drug classes according to how they fight HIV. The six drug classes are: Non-nucleoside reverse transcriptase inhibitors (NNRTIs), Nucleoside reverse transcriptase inhibitors (NRTIs), Protease inhibitors (PIs), Fusion inhibitors, CCR5 antagonists (CCR5s) (also called entry inhibitors) and Integrase strand transfer inhibitors (INSTIs). The six drug classes include more than 25 HIV medicines that are approved to treat HIV infection. Some HIV medicines are available in combination. Potential risks of ART include side effects from HIV medicines and drug interactions between HIV medicines or between HIV medicines and other medicines a person is taking regularly. The poor adherence-not taking HIV medicines every day and exactly as prescribed, increases the risk of drug resistance and treatment failure.

Drug Resistance

When HIV multiplies in the body, the virus sometimes mutates (changes form) and makes variations of itself. Variations of HIV that develop while a person is taking HIV medicines can lead to drug-resistant strains of HIV. HIV medicines that previously controlled a person's HIV are not effective against the new, drug-resistant HIV. In other words, the person's HIV continues to multiply. Poor adherence to an HIV regimen increases the risk of drug resistance and treatment failure.

Possible Cure

HIV is able to hide from the immune system in dormant cells where highly sophisticated modern testing cannot find it, and therefore resist therapy. The treatment endeavors to trick the virus into emerging from its hiding places and then trigger the body's immune system to recognise it and attack it, an approach that has been called "kick and kill." The only person believed to have been cured was Timothy Ray Brown, an American treated in Germany. He needed a bone marrow transplant to replace his own cancerous cells with stem cells that would remake his immune system; his doctor found him a donor who was naturally resistant to HIV infection due to a genetic mutation that blocks HIV from entering the cells in the human body. However, stem cell transplants are difficult and potentially dangerous for the recipient and only undertaken where they can save a life.

CONCLUSION

On the prevention scoreboard, experimental vaccines show promise, but are probably years away. As for eradication, scientists understands far better now how HIV remains barricaded in tissues such as the lymph nodes and the gut after being beaten back by ART therapy, the standard drug cocktail given to HIV patients.

Foot-soldiers known as "broadly neutralising antibodies" may be able to recognise these latently-infected cells, and then call on specialised "killer" cells to destroy them. Better lab tools are needed, for measuring HIV persistence. There is still a long way to go before the treatment can be deemed a success as the virus has previously re-emerged in people thought to have been "cured" and the use of antiretroviral drugs means the researchers cannot be sure the HIV has gone.

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AGENING OF BRAIN

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INTRODUCTION

Human brain which looks like a big walnut contains about 86 billion nerve cells (neurons) which forms "gray matter", billions of nerve fibers (axons and dendrites) as"white matter" which are connected by trillions of connections, or synapses. Anatomically brain is divided down the middle lengthwise into two halves called cerebral hemispheres. Each cerebral hemisphere is divided into four lobes by sulci and gyri. They are

Frontal Lobe: Located in front of the central sulcus concerned with reasoning, planning, parts of speech and movement (motor cortex), emotions, and problem-solving

Parietal lobe: Located behind the central sulcus concerned with perception of stimuli such as touch, pressure, temperature and pain.

Temporal lobe: Located below the lateral fissure concerned with perception and recognition of auditory stimuli (hearing) and memory (hippocampus).

Occipital lobe: Located at the back of the brain, behind the parietal lobe and temporal lobe concerned with vision. All these parts functions coordinately to perform all the cognitive life activities.

Physical changes

Ageing on brain and cognition are widespread with multiple aetiologies. It effects cells, molecules, vasculature, gross morphology and cognition. As per the studies of Barnes(2003) volume of brain declines with age at a rate of around 5% per decade after age of 40 where there will be fading sharpness in memory, verbal in fluency occurs where as other measures of cognition such as moral decision making, regulating emotions and reading social situations began to improve with middle age. The manner in which this occurs is less clear. The research in neuroanatomy by Artero *et.al* (2004) suggest that ageing may be due to factors like shrinking of gray matter by the neuronal cell death and by the deterioration of myelin sheath which results in decline of white matter. Different neurological research ranked prefrontal cortex as most effected, straitum as second, followed by temporal lobe, cerebellar vermis, cerebellar hemispheres and hippocampus. Among these structures occipital cortex was least effected. The ageing of the brain is also related to sex difference in humans. There is a significant effect in cognitive ability and neurological disorders. In the magnetic resonance imaging study (Murphy, 1996) reported that age-related volume loss was significantly greater in men than women, in which frontal and temporal lobes are most effected in men but parietal lobes and hippocampus are more effected in women.

Cognitive Change

The most widely seen cognitive change with ageing is that memory. Normally memory functions are broadly divided into four types: episodic memory, semantic memory, procedural memory and working memory. The first two are most important with regard to ageing. Episodic memory is defined as a form of memory in which information is stored with mental tags. For example memory of important meeting we have attended last week. This type of memory declines from middle age onwards. Semantic memory is the memory of meanings. For example knowing ten millimeters make up a centimeter. Semantic memory increases gradually from middle age to young elderly and decline very elderly which means episodic memory is encoding and semantic memory is retrieval. The investigation focusing in this area of cognitive change highlighted the changes in regional brain activation in which older brain

tend to show more symmetrical activation, either because they have increased activation in a hemisphere that is less activated than in younger adults or because they show reduced activation in the areas most activated in younger adult (Nyberg *et al*., 2004).

Mechanism of Change

Finch (2004) reported that neurotransmitters plays a vital role in ageing of brain, most often discussed with this regard are dopamine and serotonin. Dopamine levels decline by around 10% per decade from early adulthood and have been associated with reduced cognitive and motor performance because the dopaminergic pathways between the frontal cortex and striatum decline with increasing age or the level of dopamine itself decline due to the reduction in receptors or due reduced binding of receptor with neurotransmitter. In the case of serotonin, receptors and transporters for serotonin decreases with age result in behavioral changes like depression commonly observed in the elderly population (Riddle, *et al*., 2003). Other factors that have been implicated in ageing of brain includes calcium deregulation, increased level of monoaamino oxidase which liberate free radicals, mitochondrial dysfunction etc. Another important factor is the hormonal influence. It is known that the sex hormones involved in cognitive process in adulthood. Absence of estrogen after menopause reduces cognitive processing in women as it is involved in dopaminergic responsivity. The ageing may also suffer from impaired glucose metabolism due to fall of cardiovascular efficiency.

CONCLUSION

As brain changes with increasing chronological age, rate of change, biological age of brain and the process involved are yet to found out. Many areas of research are trying to elucidate the mechanism of ageing and to alleviate age associated disorders like dementia that have biggest impact on population. A healthy life both physically and mentally may be the *best* defence against the changes of an *ageing brain*.

Eat wisely: Diet may have a part to play in biological ageing. Food rich in antioxidant like fruits, vegetables, seafood can prevent the damage of brain due free radicals.

Drink in moderation: Heavy consumption of alcoholic beverage is linked with premature loss of brain cells which increases risk of dementia.

Break a sweat: Exercise a pump more blood to the brain, seems to slow the loss nerve cell in the area involved in memory and keeps the remaining nerve cells functioning.

Stay smoke free: Smoking may affect body's ability to deliver oxygen and nutrients for the functioning of brain.

Challenge yourself: mentally stimulating activities may help to reverse cognitive decline by strengthening the synapse.

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