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# MENDELIAN SOCIETY OF INDIA

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# CONTENTS

# Interdisciplinary Fusion : Navigating the Future Research in Aerobiology

**Mahesh Roy***

**Keywords** : Future Aerobiology, Interface, Atmospheric Chemistry, Aerosol Physics, Molecular Microbiology

Traditional aerobiology has remained grossly concerned with the plant, animal and human diseases caused by airborne pathogens, including fungal spores, pollen, bacteria, viruses and a host of allied biogenic particles. Gradually new domains of aerobiological studies emerged which consolidated into specialized microbiological subdisciplines. Prospects of future aerobiology have under its ambit an interactive combination of biological, physical and chemical characterization of aerosol particles. Under this exhaustive proposition, potential tools for the future aerobiology have been examined at the interface between atmospheric chemistry, aerosol physics and molecular microbiology where the heterogeneity and variability of aerosols can be explored at the single – droplet and single microorganism levels within a bioaerosol. Application of novel techniques could foster the understanding of aerobiological phenomena in diverse research fields, particularly during the progression of atmospheric transport, where complex independent physico-chemical and biological processes occur within bioaerosol particles.

**Prologue**

Bioaerosols are a significant portion of organic aerosols which are generally defined as living (e.g., bacteria, fungi, pollen, viruses) or dead debris or by-products of biological activities such as semi-volatile organic compounds and micromolecules with a large degree of variability in physical and chemical characteristics. They can be spores, pollen, bacteria, viruses or biological aggregates and their products and byproducts attached to non-biological particles. They are speculated to influence climate through their behaviour as cloud condensation nuclei and are also significant for human health on account of their involvement in the transmission of many respiratory pathogens.

This assessment explores the current understanding of atmospheric transport in relation to advances and limitations of aerosol generation, maintenance in the aerosol phase and sampling techniques. Potential tools for the future are examined at the interface between atmospheric chemistry, aerosol physics and molecular microbiology where the heterogeneity and variability of aerosols can be explored at the single – droplet and single – microorganism levels within a bioaerosol.

*P.G. Department of Botany, R.N. College, Hajipur, Vaishali - 844101
E- mail: maheshroy54@gmail.com

Application of novel techniques could bring to increasing the understanding of aerobiological phenomena in diverse fields of research, particularly during the progression of atmospheric transport, where complex independent physico-chemical and biological processes occur within bioaerosol particles.

Research on bioaerosols has mostly focused on their detection and enumeration related to public health hazards, and several methods for sampling and measurement of aerosol number, density, shape, optical and surface properties, chemical characterization of condensed and semi- volatile matter and identification of biological particles have been developed. No single technique is, however, capable to fully capture the physical and chemical complexity of biological matter.
Methods of characterization target either the entire cell or specific cell components in a sample of air or precipitation. Methods which target the entire cell involve microscopic examination, immunological identification or, in the case of microorganisms, culture on various nutrient media.

Attempts have been made in this communication to illustrate methods which are used to characterize the biological components of aerosols, ranging from methods to quantify and identify entire cells, followed by methods to measure total biomass or specific cell components, and those which permit quantification and identification of cells down to species level. The techniques for studying specific properties of individual biological particles have been reviewed. It has also been shown that it is possible to identify and quantify a class of biological ice nuclei in bioaerosols, and the ice nucleation active bacteria, which seem to be the most suitably described biological ice nuclei.

**METHODS OF AEROSOL STUDIES:**

**(A) Methods Based on Detection of Entire Cells (Spores/ Pollen/ Bacteria/ Viruses)**

**(a) Cell Culture**

(i) Classic isolation techniques on nutrient media have been widely used to enumerate and characterize airborne bacteria and fungi (Andreeva *et al.*, 2001 & Bauer *et al.*, 2002). These are collected by impaction on a filter or an agar surface and, after incubation, visible colonies that develop are enumerated and subsequently identified.

(ii) Bacteria are identified biochemically (Gram stain, metabolic profile of carbon sources, enzymes produced, pathogenicity, etc.)

(iii) Fungi are identified mainly by morphological characteristics of spores and fruiting bodies. An advantage of this method is the compatibility with several types of air samplers, designed to be fitted with Petri dishes or filter holders.

However, its limitation is that it underestimates the actual number and diversity of microbes in a bioaerosol, because only microbes that are metabolically active and reproduce under the imposed culture conditions will be enumerated, but not those in the viable but non- culturable state.

3As there is no nutrient medium suitable for the growth of all microorganisms, a variety of media and incubation conditions are necessary for a provisional assessment of bioaerosol diversity or enumeration of a selected group of microorganisms.

Fungi are selectively isolated in acidified media and media containing antibiotics to prevent bacterial growth. To prevent variability in results, especially for microbes found in low numbers in bioaerosols, large sample sizes and replications are required.

The error associated with the air samplers is also a source of variability, because in these samplers air passes through holes, and microbes which pass through the same hole and land on the agar surface as aggregates may produce only one colony, thus underestimating their actual number. However, manufacturers provide statistical corrections for the number of microbes.

Unless one is interested in a particular group of microbes whose growth requirements are well documented, culturing is not a practical approach for community characterization.

**(b) Microscopy**

Microscopic examination of airborne bioparticles is performed with air samples drawn onto suitable glass slides, glass rods, or filters fitted in the various types of samplers.

Number of bioparticles in a given volume of air is estimated by appropriate division of slides into grids/fields of view as per specifications of used samplers.

Immunospecific staining with fluorescent dyes is done for the identification of taxa or species. Fungal spores and pollen are also indentified on the basis of their morphological characters with significant expertise.

Special care is necessary to avoid overestimation of bacterial counts in cloud water, as the number is much lower ($10^3 l^{-1}$) in the latter (Alfreider *et al*., 1996 & Ahem, 2007)

An advantage of microscopy over culture techniques, especially when acridine dyes are used to detect viable cells, is the possibility to enumerate significant non- culturable fraction of microorganisms.

Use of FISH (Fluorescent *in situ* hybridization) with specific probes targeted at the small subunit of rRNA (16S rRNA) is now a widely used tool to distinguish certain groups of bacteria or clones (Amann and Ludwing, 2000).

To determine the total number of viruses in environmental samples is more difficult. Presence of viruses in bioaerosols is usually monitored for human, animal or plant health purposes, but in most cases, only one or a few species are counted, using methods to specifically detect viruses under investigation.

Studies of total virus particles in environmental samples are often more difficult. Presence of viruses in bioaerosols is commonly monitored for plant, animal and human health purposes, but with the use of methods to detect virus particles under investigation, only one or few species of viruses are often counted.

Determination of total virus particles in environmental samples is rare, and with the use of fluorescent dyes, virus-like particles are often counted in several fields of microscopic observation.

**(c) Immunological Detection**

This methods is widely used to detect microorganisms of medical or phytopathological significance. Antibodies isolated from the serum of inoculated animals can detect several different microbes, which are produced by the immune system of the animal as a reaction to specific antigen on the surface of the microorganism, *viz.*, proteins, polysaccharides, etc.

It is, therefore, necessary to produce antibodies with specificity towards a single species, to avoid false positive detection and counting errors. Monoclonal antibodies provide increased specificity and may be relevant for the characterization of bioaerosols.

Antibodies can be used as vector carrying a label to observe a cell or virus. Fluorescent dyes, enzymes or a radioactive compound may be used as labels. In fluorescence microscopy, only the cells to which the antibody/ fluorescent dye conjugate bands will be visible under the microscope.

Theoretically it may be possible to selectively stain and detect ice nucleation active bacteria, using an antibody with specificity for the ice nucleation protein. Although antisera against this protein have been produced, they have not been used to detect bacterial ice nuclei in environmental samples. These methods have been used to measure allergens in bioaerosols, and are compatible with bioaerosol sampling techniques (Amato *et al.,* 2005).

**(d) Flow Cytometry**

In this process, a suspension of cells from culture or environmental samples is passed rapidly in front of a measuring window. Light emitted

source is scattered by the particles in the liquid and several parameters such as size, shape, biological and chemical properties can be measured simultaneously.

Autofluorescence or indirect fluorescence of cells after labelling is also used to detect cells.

Cell labelling is done with DNA - or RNA-binding fluorescent dyes, fluorochromes conjugated to taxa-, species- or protein- specific antibodies, or probes for nucleic acids. It is possible to differentiate live from dead cells, metabolically active from non-active cells, particles of biological and non-biological origin, and to identify taxa, or even species, and viruses

For bioaerosol samples drawn into a liquid, a minimum concentration of 1000 cells $ml^{-1}$ is necessary for detection. This limitation can be overcome by allowing for longer sampling durations.

Viruses in environmental samples can also be identified using SYBR Green 1 (which binds to their nucleic acid) and counting for particles with scatter characteristics of known viruses.

Flow cytometry offers great speed in sample processing and identification. Automation allows for more accurate enumeration of biological particles in bioaerosols and flow cytometry has been used to monitor biocontaminants in indoor aerosols.

To identify bacterial ice nuclei in bioaerosols using flow cytometry, a specific antibody recognising the ice nucleation protein on cell membranes, or a nucleic acid probe specific for the IN gene conjugated to a fluorochrome, could be used.

**(e) Physical and chemical characterization of atmospheric biological particles: Single particle methods**

This traditionally involves the study of bulk samples. However, since biological particles form a small fraction of the total aerosol, the analysis of bulk samples rarely offers detailed information on the properties of such particles.

In contrast, studies of individual particles can provide data on the sizes, shapes, compositions, structures, and surface properties of any types of particles. Various microscopic and spectroscopic methods are now routinely used in atmospheric science, but **Single-particle studies** specifically aimed at understanding the atmospheric effects of biological particles if they are scarce.

Some established and emerging techniques are reviewed here which have been used or are potentially useful for studying specific properties of individual biological particles.

The distinct types of biogenic particles have well defined size ranges and characteristic shapes that enable their identification using microscopic techniques. The larger particles, including spores and pollen, can be studied using optical microscopy (OM) and epifluorescent microscopy.

SEM in combination with **energy-dispersive X-ray spectrometry (EDS)** has been used for studying single atmospheric particles since 1980s (Anderson *et al*., 1988). In the past two decades SEMs equipped with field-emission guns became available and their improved spatial resolution made observation of the morphology of bacteria and viruses possible. A great advantage of SEM is that particle analysis can be automated and thousands of single particles can be analyzed in each sample.

Among the microscopic methods, TEM provides the highest specificity for the analysis of several particle properties. The sizes and two-dimensional projected shapes of all kinds of bioparticles, including bacteria and viruses, can be conventionally studied using TEM. Thus particle aggregations and the degree of internal mixing of the individual components of aerosol can be estimated. The structures of particles can be studied with the unique ability of electron diffraction of TEM. Elemental composition can be obtained by TEM using EDS or electron energy-loss spectroscopy (EELS). TEM provides more spatial detail within individual and potentially complex particles. However, TEM is operated manually, and much fewer particles can be analyzed than in an automated SEM. EELS is particularly suited for the study of lighter elements (such as C, N and O) which are important in biogenic particles. By selecting energy windows at specific core-loss regions of the EEL spectrum, it is possible to obtain compositional maps that show the distribution of the selected elements within the particles. This technique is usually referred to as energy- filtered TEM (EFTEM), and is gaining popularity in the study of atmospheric particles.

A major limitation of EFTEM is that the particles have to be thin (<100 mm in case of organic particles) for a fruitful analysis. As TEM micrographs provide only two-dimensional projections of the studied objects, it has been a problem to obtain reliable data about the third dimensions of particles.

As demonstrated recently, accurate 3-D morphological data can be obtained from atmospheric particles using electron tomography (ET). ET involves the procurement of a series of images taken at different specimen tilt angles. Since shapes significantly affect the optical properties of particles, ET will likely emerge as a useful tool in the study of individual atmospheric particles, including those of biological origins.

As in most studies concerned with the atmospheric effects of particles the objective is a general characterization of the aerosol, the specimens are, in general, not prepared in any special way to preserve biological structures. Due to possible dehydration and resulting altered morphology of samples treated under vacuum in conventional SEM and TEM, it may become impossible to recognize the particles. These problems have been partly overcome by recent developments of electron microscopes in which the sample can be studied in low-vacuum conditions. The Environmental SEM (ESEM) is now an established tool in the study of atmospheric particles, and has been used for characterizing the hygroscopic behaviour of a variety of particle types and for studying heterogeneous surface reactions. ETEM is an emerging technique that has only been used in a handful of atmospheric studies but, on account of superior resolution of TEM, appears to hold great promise for the analysis of biological particles. Yet the use of ESEM and ETEM offers exciting new possibilities for the study of atmospheric biogenic particles.

Atomic Force Microscopy (AFM) appeared as a promising complementary technique to the electron microscope methods for studying atmospheric particles (Barkay *et al.,* 2005). AFM operates under ambient conditions and so the shapes of the particles are not affected by the vacuum as in conventional SEM and TEM studies.

In a controlled specimen environment, both the hygroscopic and chemical behaviour of aerosol particles can be observed (Birenzvige *et al.,* 2003 & Bent *et al.,* 2007).

**(B) Methods based on detection of cell components**

**(a) General Biomass Measurements**

(i) This is useful to determine organic carbon content of aerosols. However, small biomass of cloud or rain samples limits the available methods.

(ii) C:N:P ratios of organisms are often compared to marine plankton samples from where the classical Redfied stoichiometry of 106:16:1 has been derived. This ratio fluctuates over a wide range and thus may not be an unambiguous indicator of living cells.

**(b) Measurement of ATP levels**

(i) ATP is the ultimate energy carrier for biosynthesis in all living cells.

(ii) Energy cannot be stored in ATP as it is transient and only produced in active cells.

(iii) It has been used by soil scientists and food microbiologists for a long period as a measure of microbial viability.

(iv) Amato *et al.,* (2007) were the first to measure ATP levels in cloud water. Based on the available figures for the amount of ATP per viable cell, they concluded that the vast majority of bacteria are in a viable but non-culturable state.

**(c) Methods based on Detection and analysis of Nucleic Acids**

(i) DNA/RNA Isolation

(ii) Using the PCR with bioaerosols

(iii) Amplified Ribosomal DNA Restriction Analysis (ARDR) Fragment

(iv) Terminal Restriction Fragment Length Polymorphisms (T-RFLP) & Ribosomal Intergenic Spacer Analysis (RISA)

(v) Denaturing/ Thermal Gradient Gel Electrophoresis (D/TGGE)

(vi) Quantitative PCR (qPCR)

(vii) Dominant bacteria in bioaerosols using DNA-based methods

**Conclusion**

Detection, quantification and characterization of particles of biological origin in aerosols, including microbes, pollen, plankton, plant and animal debris, is necessary to understand the role and the effects of bioaerosols in a number of processes, such as ice nucleation, to atmospheric chemistry, ecology and health effects. It is generally believed that the biosphere influences and perhaps drives climate changes. Bioaerosols have been recently suggested as a potentially important factor, but their role in climate remains undermined. The contribution of different bioaerosols to significant atmospheric processes such as ice nucleation or cloud condensation is yet to be understood. To address these aspects, we need a clearer picture of the composition, seasonal fluctuation, regional diversity and evolution of bioaerosols. The current and emerging methods for the characterization of bioaerosols have been reviewed. From a meteorological perspective, it is important to know the actual composition of a bioaerosol in order to evaluate the role of individual components as ice nuclei or cloud condensation nuclei which potentially trigger precipitation. To this end, only pollen and certain bacteria have been characterized as ice nuclei; regarding the ice nucleation property of most of the pollen and other biological ice nuclei, nothing is known about the factors which determine their ice nucleation properties. It is, therefore, important that future research is coordinated, in characterizing the composition, seasonal fluctuation and evolution of ice nucleation and cloud condensation components. A significant

progress in characterizing the role of bioaerosols in atmospheric processes could be achieved with a reverse strategy. New methods of bioaerosol characterization that can be integrated into methods and equipment used in cloud physics should be developed to serve the integration of research from the various disciplines of microbiology, meteorology, molecular biology, cloud physics and cloud chemistry.

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# Ethnomedicinal use of some plants for skin related problems

***Praveen Sinha[1], Amit Kumar Singh[2] & Murli Dhar Mishra[3]***

**Key Words :** Skin diseases, Medicinal plants, Secondary metabolites.

**Abstract:**

Skin diseases have considerably increased during the last three decades. Common plants can be used to treat a variety of skin disorders free or at a very reasonable cost. Plant materials for the present investigation were taken from Gaya town's Brahmayoni hill. Local vaidyas were consulted for ethnomedicinal information on the utilisation of medicinal plants to cure skin diseases. The current study demonstrates the utilisation of ten plant species from seven families for the treatment of various skin disorders.

**Introduction :**

Skin diseases have become increasingly prevalent in recent decades, posing a considerable strain on global health-care systems. Over the last three decades, the burden of infectious skin diseases such as scabies, fungal diseases, bacterial diseases and non-infectious diseases including urticaria and psoriasis have considerably grown. It is critical to recognise that recent therapeutic procedures are not without possible drawbacks. According to research findings, the efficacy of presently used medications in the treatment of dermatological conditions is accompanied by an increased vulnerability to infections and particular types of malignancy. As a result, natural therapies for a variety of skin diseases have gained popularity.

For millennia, herbal remedies have been utilised to treat various skin diseases. Ointment, decoction, compress, and poultice are among the most common preparation forms, and they frequently serve as the foundation for the development of commercial products used to treat skin diseases. Natural plant-based medications are gaining popularity for a variety of reasons, including fewer side effects, improved patient tolerance and acceptance owing to a long history of use. Herbal treatments offer rational therapy options for many diseases that are stubborn and incurable in conventional systems of medicine (Nahida and Mariya, 2014).

Common plants can be used to treat a variety of skin disorders free or at a cheap cost. The current study was carried out to document traditional knowledge about native medicinal plants that are used to treat various skin problems. After visiting with some Vaidyas living in the vicinity of Gaya town's Brahmayoni hill, data on some plants useful in skin therapy, were compiled.

**Materials and Methods :**

**Plant collection and Preservation :** During the year 2020, regular visits were made to Gaya's Brahmayoni hill to know about the medicinal plants distribution pattern

1. P.G. Department of Botany, Veer Kunwar Singh University, Ara
2. P.G. Department of Botany, Magadh University, Bodh-Gaya
3 P.G. Centre of Biotechnology, Gaya College, Gaya

and their natural habitat. The plant species collected were identified using the flora book of Haines (1925). Herbaria of the collected plants were preserved in the Post Graduate department of Botany, Magadh University, Bodh Gaya.

**Data Collection :**

The ethnomedicinal data on the use of medicinal plants to treat skin problems were compiled with the help of local vaidyas. On the basis of gathered information, ten angiospermic plant species from eight families have been selected and their role in the control of skin diseases has been discussed.

***1.*** ***Achyranthes aspera*** L. (Amaranthaceae) Local Name : Apamarg

Uses : To treat ringworms, scabies, eczema and other skin problems, leaf juice mixed with regular salt is applied to the affected area. Similarly to clear acne, leaf extract containing camphor is applied on the face.

***2.*** ***Ageratum conyzoides*** L. (Asteraceae) Local Name : Visadoori

Uses : Leaf juice derived from mature fresh leaves is used to treat boils, itching, and minor cuts**.**

***3.*** ***Euphorbia hirta*** L. (Euphorbiaceae) Local Name : Dudhi

Uses : Leaf juice derived from mature fresh leaves is used to treat blisters, irritation, and minor cuts.

***4.*** ***Cardiospermum halicacabum*** L. (Sapindaceae) Local Name : Kanphuti

Uses : To treat dandruff, the whole plant juice extract is blended with mustard oil and massaged into the scalp.

***5.*** ***Ricinus communis*** L. (Euphorbiaceae) Local Name : Aerand

Uses : To treat various forms of skin problems, seed oil is mixed with fresh turmeric and dry neem bark powder and applied externally.

***6.*** ***Ocimum sanctun*** L. (Lamiaceae) Local Name : Tulsi

Uses : A paste is made from the leaves of this plant and blended with a half amount of sandalwood paste before being applied on pimples. It removes pimples quickly.

***7.*** ***Psoralea corylifolia*** L. (Fabaceae) Local Name : Bemchi or Bakuchi

Uses: The seed powder blended with haratalabhasma (yellow arsenic), is converted into a paste using cow urine. This paste is used to treat leukoderma lesions. Another concoction involving powdered seeds with buttermilk is applied externally to cure ringworm and scabies.

***8.*** ***Argemone mexicana*** L. (Papaveraceae) Local Name : Satyanashi

Uses : Dried powder of the plant mixed with *Madhuca indica* seed oil, is administered topically to treat toe cracks.

***9.*** ***Clitoria ternatea*** L. (Fabaceae) Local Name : Aparajita

Uses : Root paste is applied on wounded area for curing leprosy

***10.*** ***Saraca indica*** (Fabaceae) Local Name : Ashoka Tree

Uses : Bark extract treats a variety of skin issues, including psoriasis, pruritus, and skin inflammation, and it even improves the skin's tone.

**Discussion :**

India is a rich place for medicinal plants. Many Indian medicinal plants are used primarily as cosmetics to treat skin diseases. Medicinal plants play a vital role and have the ability to treat many types of skin infections due to their active ingredients, which include flavones, alkaloids, and polyphenols with antiseptic qualities.

Lavender, rosemary, sandalwood, and clove phytochemicals not only treat various types of dermatitis, but they also moisturise and smooth the skin due to their high antioxidant activity and robust suppression of lipid peroxidation (Das, 2020).

*Achyranthes aspera* is frequently referred to as the Devil's Horsewhip. The primary chemical components are triterpenoid saponins, which contain oleanolic acid. Apart from that, the plant contains alkaloids, flavonoids and steroids also. The primary steroids are beta-sitosterol, ecdysone, and ecdysterone. Because of the presence of these chemicals, the plant has anti-allergen properties (Edwin *et al.,* 2008). Arulprakash *et al,.* (2012) found that the *Ageratum conyzoides* extract stimulated cellular proliferation and collagen synthesis. Wounds treated with the extact were found to heal faster due to increased epithelialisation and wound contraction mechanisms. They also showed a 40% increase in tensile strength for treated tissue. Thus, topical 16administration of *Ageratum conyzoides* enhances wound healing. *Euphorbia hirta,* a pantopical weed, includes flavonoids, triterpenoids, quercetin, kaempferol, gallic acid, camphol, and beta-amyrin. The dry herb decoction has antiseptic qualities and is used to treat fungal infections, rashes, and skin problems (Singh *et al.,* 2006). *Cardiospermum halicacabum* plant extract has a cortisone-like activity that treats seborrhoeic dermatitis, sun rashes, and keratosis. Phyto-constituents found in plant extract, such as beta-sitosterol, stigmasterol, apigenin, luteolin and pentacyclic triterpenes, exhibit specific action (Carloni, 2012).

*Ocimum sanctum* has antibacterial, antiviral, and antifungal properties. It removes harmful toxins and regenerates the skin, and it is used to treat acne, eczema, psoriasis, and other skin conditions (Singh *et al*., 2005). The bark of *Saraca indica* has a high commercial value. The bark includes procyanidin, epicatechin, 11-deoxyprocyanidin B, catechin, leucopelargonidin, and leucocyanidin. The bark extract treats a variety of skin issues, including eczema, psoriasis, acne, scabies, and skin inflammation and it even improves skin tone (Mishra *et al.,* 2013).

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# Scientific Relevance of using Rice, Barley, Sesame seeds and Kusha grass during Pind-Daan at Gaya

***Arvind Kumar Sinha****

**Keywords** : Pind-daan, Rice, Barley, Sesame seeds & Kusha grass

Abstract : Rice, Barley, Sesame seeds and Kusha grass are used during Pind-daan at Gaya. Scientific analysis of the mentioned plants have been given and the possible reasons for using the four plants during Pind-daan have been discussed. It has been concluded that positive energy of the four plants detoxifies the soul during Pind-daan.

**Introduction** :-

According to Hindu religion, Pind-daan is the only religious and spiritual process that helps in bringing peace and contentment to the restless deceased souls. Pind daan is the offering of 'Pindas' to the ancestors which are made up of cooked rice and barley flour balls mixed with black sesame seeds. The Pindas offering is accompanied with the release of water from the hand. It is followed by the worship of Lord Vishnu in the form of kusha grass. The custom of pind daan dates back to the time when the 'Vedas' were written. The word 'pind' means the body and the word 'daan' denotes charity. Therefore, pind daan means charity for the body of deceased. It is aimed to give peace to the departed soul as it journeys towards next destination within the complete revolutionary process. The ritual helps the soul cut its ties and attachment with the material human body. Pind daan is performed to let the soul move forward to peace.

When we analyze this ritual scientifically, we say that we all are connected by our ancestors through genes (part of DNA). We are the product of genes and genes pass on from one generation to another i.e., it is an endless story. So every individual is indebted to his ancestors for what he is today and to show his gratitude, he offers rituals. According to Hindu shastra, Gaya city has been considered as the most pious place for offering pind daan. There is an interesting story as to why pind daan is offered in Gaya. Demon called Gayasur offered a great penance to Lord Vishnu, pleased with Gayasur, Lord Vishnu asked him to seek one blessing. Gayasur asked that whoever comes in touch with him-be it an angel or demon, a sinner, a saint, a sage or and evil spirit, should get salvation after being purified of all sins.

Rice, barley, black seeds of sesame and kusha grass are used in pind-daan and their offerings are supposed to detoxify the soul. So, in the present paper it has been tried to analyse the scientific values of the four mentioned plants and their relevance in pind-daan in addition to the mythological significance. All the mentioned plants have got scientific relevance besides mythological in pind-daan, which have been discussed in the present paper.

*Retired Professor, Department of Botany, Gaya College, Gaya

**Materials & Discussion**

Rice, Barley, Sesame seeds and Kusha grass are the materials whose scientific relevance have been discussed besides mythological in the following stanza.

**Rice** – It is one of the oldest crop plants and has been cultivated in India and other Asian countries for several thousand years. According to the most plant breeders, India and Myanmar (part of India till 1937) should be regarded as the centre of origin of the cultivated rice (Crawford, 1998). Rice plant belongs to the family Poaceae and its botanical name is *Oryza sativa* (fig. 1). Chemically rice contains starch rich in amylase and amylo-pectin which are responsible for providing instant energy to the body. Detailed chemical analysis indicates that the rice contains 12% water, 75% to 85% starch and 7% proteins along with iron, manganese and vitamin B. Due to its chemical constituents, rice provides instant energy to human body. In Hinduism, rice holds great spiritual and ritual significance as it is called 'Akshat' i.e., which cannot be broken. It is also a potent symbol of auspiciousness, prosperity and fertility. Due to instant energy providing properties, rice is used as a tool to absorb curses, protect against the evil eyes and to cleanse the surrounding from spiritual debris and negative energy. In Rig Veda, there is the reference of the word 'dhana' while in subsequent Veda, the Yajur Veda, the word 'rice' has been mentioned at several places. Therefore, it can be said that rice being one of the oldest and positive energy providing cereal with south-eastern India being the origin point and hub of its cultivation and above all possessing the property of removing negative energy, make it as one of the most important materials for offering during pind-daan.

Fig. 1 : RICE PLANT GRAINS

Barley – It is said to be the most lovable cereal of Lord Vishnu and according to 'Vedas & Purans, it is the most pious cereal and can be used in important religious rituals. Scientifically, it is called *Hordeum vulgare* and it belongs to the family of cereals called Poacceae. It is an annual plant ranging in height from 2.5 feet to 3 feet. Barley is a wonderfully versatile cereal grain with a rich nut like flavor (fig. 2). It contains starch in abundance and important vitamins, minerals, fibres and other beneficial compounds. Vitamin $B_1$, copper, magnesium, chromium and phosphorus are present in good amounts in barley. It is interesting to mention that barley plant contains soluble fibres which reduce hunger and enhance filling of fullness. This

cereal is said to be of great antiquity and was used for bread even before wheat. Many earlier workers claimed that 'Barley' is man's ancient foodstuff and most of the modern scholars also consider it as the oldest of all cultivated plants. (Crawford & Gyoung, 2003).

Interestingly Barley originated in South-Western Asia or South-Eastern Asia (Albert Hill, 1986). Therefore Egypt, greater India must have been the centres of origin of the pious cereal 'Barley'. So Barley is the most ancient cereal and must have been cultivated before the arrival of wheat and rice. Barley is popular in temperate areas where it is grown as a summer crop and tropical areas where it is sown as a winter crop. Its germination time is one to three days. Barley is more tolerant of soil salinity than wheat. Barley was one of the first domesticated grains in the fertile crescent, an area of relatively abundant water in western Asia and near the Nile river of North East Africa.

Barley has got tremendous applications. In Magadh zone of Bihar state, the ashes of the leaves of Barley are employed in the formation of cooking sherbats. Barley is aphrodisiac, appetizer and acrid also. It is said to improve the voice and it is used as diet for anaemic patient and for invalids. It is said that Prophet Mohammad prescribed barley for curing various diseases. It is also said to soothe and calm the bowel. Barley has a prominent role in the Israelite sacrifices too. In ancient Greece, the ritual significance of barley dates back to the earliest stages of the Eleusinian Mysteries. The preparatory 'kykeon' or mix drink of the initiates, prepared from barley was referred to as Homeric Hymn to Demeter, who was also called barley-mother" (Bailey, 1943).

As Barley is the most ancient cereal with tremendous scientific applications related with mythological significance, it is aptly used in Pind-daan to free the deceased soul from the evils.

Fig. 2 : BARLEY PLANT GRAINS

Sesame – Sesame seed is considered as the oldest oil seed crop, domesticated well over 5000 years ago. It is considered most pious and since ancient days, it is used for religious rituals.

Sesame is a broad leaf plant that grows above five to six feet in length. Flowers are large white and bell shaped. Scientifically sesame is known as *Sesamum*

*indicum* (fig. 3) and it belongs to the family Pedaliaceae. The first written record related to the origin of sesame dates back to 3000 BC and the origin centre has been considered India. Records also show that sesame has been cultivated in some parts of India since 1600 BC (Poehlman & Brothakur, 1972).

Seasame seeds are valued for their oil which is exceptionally resistant to rancidity as seeds possess beneficial monounsaturated and polyunsaturated fats. According to Hindu tradition, sesame seeds represent immortality. There is an interesting legend about the Assyrian Gods who drank sesame wine one night and then created the earth next day. Such is the importance of sesame seeds (Hylander & Stanley, 1940).

The famous Arabian phrase 'open sesame' reflects the distinguishing feature of the sesame seed pod which bursts open when it reaches maturity. Sesame seeds have got tremendous medicinal values. Its history as a medicinal plant goes back 3600 years to Egyptiyan times where it was listed in the scrolls of Ebers as a favoured medicine. Women in ancient Babylon were believed to use a mixture of honey and sesame seeds to prolong youth and beauty and Roman soldiers use to eat the mixture for strength and energy. Scientifically it has been seen that sesame seeds contain health benefitting nutrients, minerals, antioxidants and vitamins that are essential for wellness. (Ray, 2011). Sesame seeds have the property to absorb spiritual purity and remove spiritual impurities. It is said that Asur and Danavs flee from the place where sesame seeds are kept. Therefore sesame seeds have vast store of positive energy and are rightly used in pind-daan.

Fig. 3 : SESAME PLANT POD & SEEDS

**Kusha grass** – It is the belief that Kusha grass has originated from God's hair and 'Brahma' is stationed at the root of Kusha while 'Keshav' is in the middle and 'Shankar' is at the tip of the grass. That's why Kusha is quite significant from the point of mythology. This is a tropical grass which belongs to the cereal and grass family Poaceae. Its scientific name is *Desmostachya bipinnata*. (fig. 4) It grows in plains as well as in hilly regions. This grass is eco-friendly food preservative. The root of the plant contains cylindrin, arundroine and feninole isoarboninole which have cooling properties and therefore, it is used as a medicine to treat the condition of diarrhoea and excessive burning sensation of the body. From Kusha grass mat is prepared which is used for sitting and sleeping. (Krishna, 2014).

Scientifically it has been confirmed that Kusha grass consists of stunning nano pattern of microstructures which can attract enormous number of bacteria into its hierarchial surface thus making the kusha mat most appropriate and ideal seat for rituals. It acts as a natural coolant and hence keeps the body cool. It blocks x-ray radiation and therefore, during fire rituals, kusha is placed on all four sides of the fire to help block all negative radiations. During eclipses, this grass is placed on vessels containing water and food so that the negative effect of x-ray from eclipses does not spoil them. Lord Krishna in 'Bhawad Gita' has recommended the Kusha as an ideal seat for meditation as it blocks energy generated during the meditation from being discharged through the body in the ground. Lord Buddha also used Kusha as His meditation seat.

This plant has been specifically mentioned in Rig Veda for its use in sacred ceremonies and as a seat for the priests. So, mythologically Kusha grass is of great significance and science justifies it by its typical nano pattern of microstructure.

Fig. 4 : KUSHA GRASS

**Conclusion :** By looking to the above mentioned facts it can be aptly said that rice, barley, sesame seed and kusha grass contain positive and instant energy in the form of chemical constituents and so they are rightly used in pind-daan to detoxify the deceased souls.

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# Preliminary Phytochemical Estimation of Catharanthus roseus (L.) Plant

***Praveen Sinha[1] and Murli Dhar Mishra[2]***

**Key words:** phytochemicals, methanol, ethyl acetate, acetone, flavonoids, saponins, alkaloids, tannins, and phenolics.

**Abstract: -**

It is estimated that almost 25% of contemporary medicines are either directly or indirectly derived from plants. A wide range of highly prospective secondary metabolites have been identified in *Catharanthus roseus* (L.). Indian medicinal plants are regarded as a rich source of several pharmaceutically active principles and chemicals that are frequently utilized in home treatments for a variety of illnesses. Performing the initial phytochemical screening of *Catharanthus roseus* (L.) is the aim of this study. The leaves and stem of *Catharanthus roseus* (L.) were collected and plant component extracts were made with organic solvents like methanol, ethanol, ethyl acetate and acetone and solvents such as cold and hot water. These solvents helped in identifying and screening of the compounds in plants that have therapeutic value. Some of the bioactive substances that can be derived from plants are carbohydrates, proteins, flavonoids, alkaloids, tannins and saponins compounds.

## INTRODUCTION

*Catharanthus roseus* (L.), commonly known as the Madagascar periwinkle, is an erect or prostrate herb that can grow between 1 to 2 meters in height. Its leaves are opposite with undulating margins, and it produces numerous flowers that are stiffly deflected along a pubescent rachis in elongated terminal spikes measuring 20 to 30 cm. The seeds of the plant are oblong-ovoid in shape **(Edeoga *et al*., 2005).**

Native to Madagascar, *C. roseus* (L.) is widely cultivated globally both as an ornamental and medicinal plant. It is particularly renowned as a source of the alkaloid's vincristine and vinblastine, which are critical in cancer treatment. Despite its toxicity, traditional practices such as Ayurveda utilize its extracts from the different parts to address various health issues **(Edeoga *et al*., 2005).**

Catharoseumine, a novel monoterpenoid indole alkaloid extracted from *C. roseus* was shown to have an inhibiting effect on the human promyelocytic leukameia HL-60 cell line. Cathachunine, a newly discovered bisindole alkaloid isolated from this plant has been found to suppress the growth of leukamia cells and showed significantly lower cytotoxicity against normal human endothelial cells **(Wang *et al*, 2012).**

One notable bioactive compound derived from *C. roseus* (L.) is vincoline, which has demonstrated insulin- stimulating properties. This highlights the plant's

1. Department of Botany , V.K.S. University, Ara.
2. P.G. Department of Biotechnology, Gaya college Gaya

potential not only in cancer therapy but also in other therapeutic applications. Understanding the phytochemical profile of *C. roseus* (L.) is essential for exploring its medicinal value and further integrating it into contemporary herbal medicine **(Daisy P. 2007)**.

## MATERIALS AND METHODS

### A. Sample Collection

The entire plant samples were collected in January 2018.

### B. Preparation of plant extracts using aqueous and organic solvents

Extracts of various plant parts (leaves and stem) of *Catharanthus roseus* (L.) were prepared using solvents like water (cold and hot) and organic solvents (methanol, ethanol, ethyl acetate, acetone). Fresh plant parts collected were surface sterilized with 0.1% HgCl2 and washed repeatedly with sterile phosphate buffered saline (pH 7.2), followed by distilled water. Plant parts were then dried at 50 °C.

Using an electric dryer and crushed with the aid of a mechanical grinder to powdered form, these powdered plant parts were used to prepare different extracts as described below.

#### 1) Aqueous extract

Fifty grams of dried coarse powdered plant parts were soaked in autoclaved triple distilled water under constant stirring. The filtrate was collected three times at 24 hours intervals during a total extraction period of 72 hours. The aqueous dry extracts were obtained by concentrating the extract liquid under reduced pressure at 40°C using a vacuum rotary evaporator. The dry extracts were stored at –20 °C until use.

#### 2) Organic solvent extracts

The dried samples were grounded to coarse powder form and phytoconstituents were extracted by a Soxhlet extractor at 60 ˚C using various solvents like methanol, ethanol, ethyl acetate, and acetone. The extracts were evaporated to dryness on the rotary evaporator and stored in a refrigerator at 4˚C until required for use. The dry weight of powder before and after extraction was taken to calculate the expected total amount of phytoconstituents extracted with the given solvent.

### C. Qualitative estimation of phytoconstituents

These extracts were subjected to chemical test for different phytoconstituents viz. alkaloids, carbohydrates, phenolics, flavonoids, proteins, amino acids, saponins using the standard procedures **(Gupta and Sharma, 2011).**

**Test for *Proteins &* Amino acids**

**a) Ninhydrin test:** 2 ml ninhydrin reagent was added to 2 ml test extract and boil for few minutes. Formation of bluish purple colour indicated the presence of amino acid.

**b) Biuret's Test*:*** 4% of sodium hydroxide solution and few drops of 1% copper sulphate solution were added to the 1 ml test extract. Formation of a violet red colour indicated the presence of proteins.

**Test for Carbohydrates**

**a) Molisch's Test:** Filtrates were treated with 2 drops of alcoholic alpha-naphthol solution in a test tube. Formation of the violet ring at the junction indicated the presence of carbohydrates.

**b) Fehling's Test:** Filtrates were hydrolyzed with dilute HCl, neutralized with alkali and heated with Fehling's A&B solutions. Formation of red precipitate indicated the presence of reducing sugars.

**Test for Coumarin**

3 ml of 10% NaOH was added to 2 ml of aqueous extract. Formation of yellow colour indicated the presence of coumarins.

**Test for Diterpenes**

Copper acetate Test: Extracts were dissolved in water and treated with 3 to 4 drops of copper acetate solution. Formation of emerald green colour indicated the presence of diterpenes. **(Roepke *et al.*, 2010).**

**Test for saponins**

One ml of the tepal extract was diluted with distilled water to 20 ml and shaken in a graduated cylinder for 15 minutes. The formation of one centimeter layer of foam indicated the presence of saponins.

**Test for Alkaloids**

**a) Mayer's Test**: Filtrates were treated with Mayer's reagent (Potassium Mercuric Iodide). Formation of a yellow colored precipitate indicates the presence of alkaloids.

**b) Wagner's Test**: Filtrates were treated with Wagner's reagent (Iodine in Potassium Iodide). Formation of brown/reddish precipitate indicated the presence of alkaloids **(Wang *et al.*, 2011).**

**Test for Flavonoids**

**a) Alkaline Reagent Test**: Extracts were treated with few drops of sodium hydroxide solution. Formation of intense yellow colour, which became colourless on addition of dilute acid, indicated the presence of flavonoids **(Harborne & Williams 2000).**

**Test for *Tannins***

a) Lead acetate Test : Few drops of 1% lead acetate were added to 2 ml of extract. The formation of yellowish precipitate indicated the presence of tannins.

b) Ferric Chloride Test : Extract solutions were treated with 5% ferric chloride solution. Formation of blue colour indicated the presence of hydrolysable tannins and formation of green colour indicated the presence of condensed tannins.

## RESULT :

Table 1 Preliminary phytoconstituents analysis of *Catharanthus roseus* (L.) leaves

| | | ***Catharanthus roseus* (L.) leaves Extracts** | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No.** | | **Methanol** | **Ethanol** | **Ethyl acetate** | **Acetone** | **Aqueous (Cold)** | **Aqueous (Hot)** |
| **1.** | **Carbohydrate test** | | | | | | |
| a. | Molish's test | + | + | + | + | + | + |
| b. | Fehling's test | + | + | - | - | - | - |
| **2.** | **Protein test** | | | | | | |
| a. | Ninhydrin test | + | + | + | + | - | + |
| b. | Biuret test | + | + | + | + | - | + |
| **3.** | **Tannins** | | | | | | |
| **a** | Lead acetate Test | - | - | - | + | - | - |
| **b** | Ferric Chloride Test | + | + | - | + | - | - |
| **4.** | **Saponin** | - | + | - | + | + | - |
| **5.** | **Flavonoid** | + | + | - | - | + | + |
| **6.** | **Alkaloid test** | | | | | | |
| a. | Mayer's test | - | + | - | + | + | - |
| b. | Wegner's test | + | + | + | + | - | + |
| **7.** | **Coumarin** | + | + | + | + | + | - |
| **8.** | **Diterpenes** | - | + | - | - | + | + |

(+) = Present, (-) = Absent

Table 2 : Preliminary phytoconstituents analysis of *Catharanthus roseus* (L.) stem

| | | ***Catharanthus roseus* (L.) Stem Extracts** | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No.** | | **Methanol** | **Ethanol** | **Ethyl acetate** | **Acetone** | **Aqueous (Cold)** | **Aqueous (Hot)** |
| **1.** | **Carbohydrate test** | | | | | | |
| a. | Molish's test | + | + | + | + | + | + |
| b. | Fehling's test | + | + | - | - | - | - |
| **2.** | **Protein test** | | | | | | |
| a. | Ninhydrin test | + | + | + | + | - | - |
| b. | Biuret test | + | + | - | + | - | - |
| **3.** | **Tannins** | | | | | | |
| **a** | Lead acetate Test | - | - | - | - | - | - |
| **b** | Ferric Chloride Test | + | + | - | + | + | + |
| **4.** | **Saponin** | - | + | - | - | - | - |
| **5.** | **Flavonoid** | + | + | - | - | + | + |
| **6.** | **Alkaloid test** | | | | | | |
| a. | Mayer's test | + | + | - | - | - | - |
| b. | Wegner's test | + | + | + | + | + | + |
| **7.** | **Coumarin** | - | + | - | + | + | - |
| **8.** | **Diterpenes** | + | + | - | - | + | + |

(+) = Present, (-) = Absent

All the extracts were subjected to different chemical tests, and the organic extracts showed the presence of most chemical constituents. Alkaloids, diterpenes, flavonoids, tannins, saponins, coumarin, carbohydrates, and proteins were present in the organic extract in high amounts of ethanol, acetone and methanol respectively (Tables 1 & 2).

## DISCUSSION:

In the present work primary phytochemical assessment of *C. roseus* was performed and the finding demonstrated that the investigated plant contains several bioactive compounds like carbohydrate, protein, tannin, saponin, flavonoid, alkaloid, coumarin and diterpenes. In the present investigation ethanol based phytochemical screening revealed a significantly higher concentration of phytochemicals than other solvents. These finding supported earlier research showing that alcoholic solvents, such as ethanol and methanol are better suited than other solvent for extracting constituents of medicinal plants **(Cowan 1999, Emad *et al.*, 2009; Aziz, 2014 and Kabesh *et al.,* 2015).**

Scientific study has demonstrated that secondary metabolites of plants contain medicinal potential. According to the present investigation *C. roseus* extract contains phenolic components such as flavonoids and tannins. Because of its astringent qualities, tannins speed up the healing of wounds and irritated mucous membranes. Tannin containing plants are used to treat oral inflammation and non-specific diarrhoea (*Ojewole*, *2005*). Flavonoids are recognised for their ability to prevent allergies and protect the blood vessels. The most significant biological effect of coumarins that have been documented are anti- Alzheimer's effects. Among the many pharmacological activities that alkaloids exhibit include analgesic, local anaesthetic, muscle relaxant and hypotensive qualities (*Rehab et al., 2018*). In the light of above-mentioned facts, *C. roseus* can be considered as a rich source of phytochemicals with diverse therapeutic potentials.

## CONCULSION

The leaf and stem material from *C. roseus* (L.) was analyzed and found to include a variety of phytochemicals including alkaloids, diterpenes, flavonoids, tannins, saponins, coumarin, carbohydrate and protein. Alkaloids, diterpenes, flavonoids, tannins, saponins and coumarin were found in high amounts in ethanol, acetone and methanol respectively.

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# Survey of Ethnomedicinal Plants in Jhunjhunu district, Rajasthan, India

***Saroj Kumari*[1] *& Aparna Pareek*[2]**

**Key words** : Ethno-medicinal, Jhunjhunu, Traditional knowledge, Medicinal plants, local people.

**Abstract**

Plants have long been essential to human survival. Ethnobotany is the branch that illustrates the direct interaction between man and the plants. Ethnomedicinal plants provide valuable organic and inorganic compounds that can treat a variety of diseases. The study aimed to document indigenous therapeutic plant practices in the Jhunjhunu District. Residents of the area provided data through interviews and questionnaires. This report lists 29 plant species from 18 families commonly employed by local traditional practitioners. These plant species are utilized to treat ailments in the local area. The current study aims to investigate the therapeutic properties of these plant species and raise awareness about their ethnic value. The current study focuses on the ethnomedicinal usage of plants in Rajasthan's Jhunjhunu area. Data was acquired through conversations with the local people and plant healers. This project aims to educate locals on the usage of nearby plants and preserve traditional knowledge.

## Introduction

India is a densely populated developing country that is one of the world's biggest biodiversity hotspots, with a diverse plant population [Anand *et al*., 2016]. Africa has the greatest tribal population in the world, followed by India [Jagtap, *et al.,* 2006]. India is one of the world's 12 mega diversity countries and its diverse flora and fauna can be attributed to its various climate zones. India is home to around 45,000 plant and 81,000 animal species, accounting for 8% of global biodiversity. It is a place with a distinct system of ancient medicinal practices, including Siddha, Ayurveda, and Unani.

Surprisingly, the rural sector contributes more to biodiversity than urban areas in the country, where modern health facilities are insufficient, forcing people to rely on traditional medical techniques and indigenous plants as herbal treatments [Shakya, 2016]. Traditional knowledge refers to indigenous people's knowledge gained through experience and adaption to local culture and environment.

The study of the interaction between humans and plants is known as ethnobotany, which is derived from the words "ethno" (people study) and "botany" (plant study). Ethnobotany investigates the intricate connections (and applications) between plants and societies. In other words, it can be said that it is the study of how plants have been and are used, managed, and perceived in human civilizations.

1. Research Scholar, Department of Botany, University of Rajasthan, Jaipur, Rajasthan, India.
2. Assistant Professor, Department of Botany, University of Rajasthan, Jaipur, Rajasthan, India.

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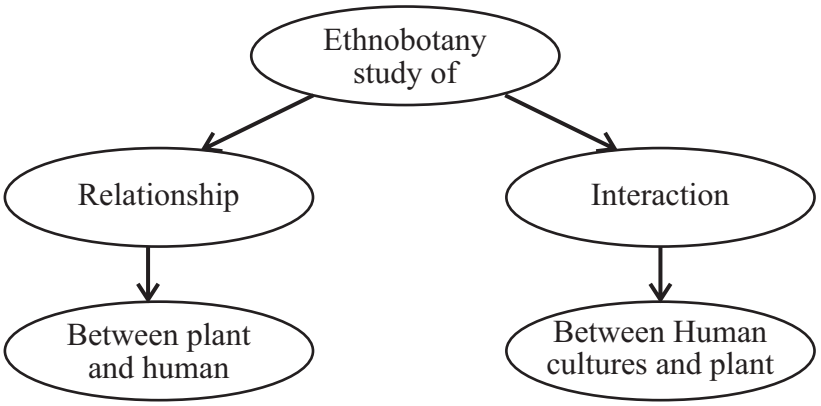


Figure: 1 Flow chart of Ethnobotany

**Materials and Methods :**

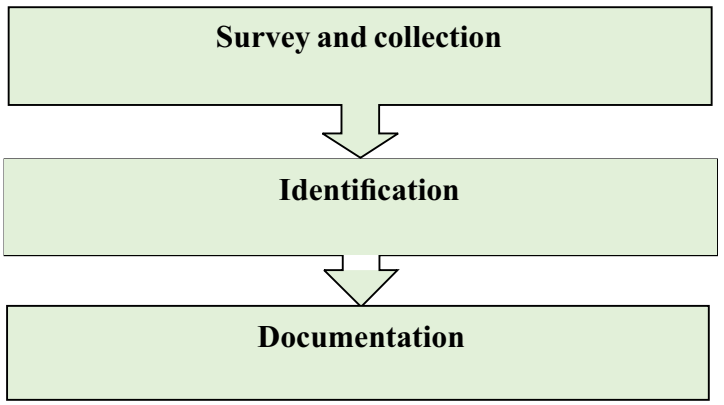


Figure : 2

Jhunjhunu is a district in Rajasthan's Shekhawati area that borders the state of Haryana. The district is mostly made up of sand dunes, but there are some hills as well. Jhunjhunu is located between 27 21' to 28 12' North latitude and 74 44' to 75 25' East longitude. The area was studied throughout the year, at various seasons. Interviews were conducted with herbal healers, dealers, physicians, and local people. Field expeditions were conducted in several areas to select plants and identify species using herbarium. The study used a systematic questionnaire and interviews to gather information on plant applications, cures for various conditions, medicine preparation, and potential risks. The information provided by each participant was documented in the field notebook. Plant specimens were collected on various field visits, and herbarium sheets were made. The specimens were identified using literature and the Herbaria of the Department of Botany (RUBL) at the University of Rajasthan in Jaipur.

**Result and discussion**

The current study demonstrates that Jhunjhunu is rich in ethnomedicinal plant diversity. Plants from 18 different families were collected from the research region. Plants have medicinal properties and can treat a variety of ailments, including kidney and urinary disorders, diabetes, jaundice, arthritis, skin disorders, fever, respiratory diseases, anaemia, constipation, liver diseases, leprosy, rheumatism, dysentery, eye diseases and toothaches. The investigation involved collecting and identifying 29 ethno-medicinal plant species.

Table 1. Ethnomedicinal plants of Jhunjhunu district

| S.No. | Common Name | Botanical name | Family | Plants Parts used | Medicinal uses |
|---|---|---|---|---|---|
| 1. | Chirmi | *Abrus precatorius* L. | Fabaceae | Root, leaves, seed | Used in joint pain, paralysis, tetanus, rabies, cold, cough, fever, jaundice and leprosy (Attal *et al*., 2010). |
| 2. | Kanghi | *Abutilon indicum* (L.) Sweet | Malvaceae | Root, bark, leaves, seed | Used in gonorrhea, bronchitis, piles, ulcers and bleeding (Chatterjee and Pakrashi, 1991) |
| 3. | Katha | *Acacia catechu* (L. f.) Willd. | Fabaceae | Root, stem, bark, leaves | Used in asthma, bronchitis, chest pain, diarrhea and gonorrhea (Alambayan, *et al*., 2015) |
| 4. | Babul | *Acacia nilotica* (L.) Delile | Fabaceae | Bark, latex, gum, leaves, pod, seed | Used in cholera, colic pain, ulcers scorpion sting, wounds, ulcers and diarrhea (Pullaiah, 2006) |

| | | | | | |
|---|---|---|---|---|---|
| 5. | Latjira | *Achyranthus aspera* L. | Amaranthaceae | Whole plant | Used in skin diseases, piles, urinary problem, gonorrhea, asthma, cough, oedema, piles, pneumonia and piles (Nadkarni & Nadkarni, 1976) |
| 6. | Bui | *Aerva javanica* (Burm. f.) Shult | Amaranthaceae | Whole plant | Used in digestive disorder, arthritis, rheumatism, jaundice and skin disorder (Nandal & Bhatti, 1983) |
| 7. | Satyanasi | *Argemome mexicana* L. | Papavaraceae | Whole plant | Used in abdominal colic pain, respiratory disease, joint pain,blood purifier, scorpion bite, asthma and stomach pain (DeFilipps, *et al*., 2004) |
| 8. | Satavari | *Asparagus racemosus* Willd. | Asparagaceae | Whole plant | Used in anemia, dysentery, gastric ulcers, inflammation, liver disease, dyspepsia and joint pain (Choudhary & Kar, 1992) |
| 9. | Neem | *Azadirachta indica* A. Juss. (Fig. 4) | Meliaceae | Bark, leaves, flower, fruit, seed | Used in skin diseases, blood disorder, malarial fever diabetes, wound, ulcers, and rheumatism (Heinrich, 2001) |
| 10. | Hingot | *Balanites aegyptiaca (L.) Delil* (Fig. 5) | Zygophyllaceae | Whole plant | Used in malaria, leukoderma, wounds and syphilis (Hamid, *et al*., 2001) |
| 11. | Sata / Punarva | *Boerhavia diffusa* L. | Nyctaginaceae | Whole plant | Used in jaundice (Rawat, *et al*., 1997) |
| 12. | Aak | *Calotropis procera* (Ait) Ait. F. *(Fig. 6)* | Asclepiadaceae | Root, bark,latex , leaves, flower | Used in fast healing of wounds, skin disorder, liver and skin problems (Larhsini, *et al*., 1997) |

| | | | | | |
|---|---|---|---|---|---|
| 13. | Kair | *Capparis decidua* (Farssk.) Edgew (Fig. 7) | *Capparidaceae* | Root, bark, flower, fruit | Used in lumbago, rheumatism, stomach problems, cough and asthma (Satyanarayana, *et al*., 2008) |
| 14. | Bathua | *Chenopodium album L.* | Chenopodiaceae | Seed | Used in hepatic disorders, spleen enlargement and intestinal ulcers (Sarma, *et al*., 2008) |
| 15. | Tumba | *Citrullus colocynthis* (L.) Schard. (Fig. 8) | Cucurbitaceae | Roots, fruits | Used in skin diseases and joint pain (Dan, *et al*., 1998) |
| 16. | Saniya | *Crotolaria burhia* Buch. - Ham. Ex Benth. (Fig. 10) | Fabaceae | Whole plant | Uses in swelling, hydrophobia and gout (Tripathi, *et al*., 1996) |
| 17. | Kala bhangra | *Croton bonplandianus* Baill. (Fig. 9) | Euphorbiaceae | Leaves, seeds | Used in jaundice, acute constipation, skin diseases and abdominal dropsy (Divya, *et al*., 2011) |
| 18. | Jimsonweed | *Datura stramonium* L. | Solanaceae | Root bark, leaves, flower &seeds | Used in skin diseases, diarrhea, skin ulcers, wound, and burns (APC, 2001) |
| 19. | Lal dudhi | *Euphorbia hirta* L. | Euphorbiaceae | Aerial part | Used in diarrhea, dysentery and leucorrhoea (Tripathi, *et al*., 1996) |
| 20. | Khimp | *Leptadenia pyrotechnica* (Farssk.) Decne (Fig. 11) | Asclepiadaceae | Whole plant | Used in fever, urinary disease, cough, stones and kidney disorders, (Katewa & Galav, 2006) |

| | | | | | |
|---|---|---|---|---|---|
| 21. | Bada Gokhru | *Pedalium murex* L. (Fig. 12) | Pedaliaceae | Root, leaves, fruit | Used in wounds, ulcers, fever and puerperal disorder (Rajashekhar, *et al*., 2012) |
| 22. | Khejri/janti | *Prosopis cineraria* (L.) Druce (Fig. 13) | Fabaceae | Bark, flower, inflorescence, fruit | Used as astringent and in rheumatism (Tripathi, *et al*., 1996) |
| 23. | Erandi | *Ricinus communis* L. | Euphorbiaceae | Root, leaves, seed | Used in asthma, fever, bronchitis, leprosy and rectal disease (Tripathi, *et al*., 1996) |
| 24. | Jhal | *Salvadora persica* L. | Salvadoraceae | Root, bark, leaves, fruit, seed | Used as astringent, diuretic and liver tonic (Tripathi, *et al*., 1996) |
| 25. | Makoy | *Solanum nigrum* L. | Solanaceae | Whole plant | Used in eye, ear, nose and ulcer on the neck (Tripathi, *et al*., 1996) |
| 26. | Rohida | *Tecomella undulata* (Sm.) Seem | Bignoniaceae | Bark, flower | Used in cough, throat sore, blood and eye diseases (Tripathi, *et al*., 1996) |
| 27. | Bhankari | *Tribulus terrestris* L. (Fig. 14) | Zygophyllaceae | Root, leaves, fruit | Used in heart disease, piles and leprosy (Tripathi, *et al*., 1996) |
| 28. | Ashwagandha | *Withania somnifera* Dunal | Solanaceae | Root, leaves | Used in ulcer, rheumatism and bronchitis (Tripathi, *et al*., 1996) |
| 29. | Jhadi-ber | *Ziziphus nummularia* (Burm.f.) Wt. Arn | Rhamnaceae | Leaves, fruit | Used in Cough and cold, skin diseases, sores, ulcerated gums and biliousness (Tripathi, *et al*., 1996) |

*Aerva javanica*

**Figure: 3**

*Azadirachta indica*

**Figure: 4**

*Balanites aegyptiaca*


**Figure: 5**

*Calotropis procera*

**Figure: 6**

*Capparis decidua*

**Figure: 7**

*Citrullus colocynthis*

**Figure: 8**

*Croton bonplandianus*

**Figure: 9**

*Crotalaria burhia*

**Figure: 10**

*Leptadenia pyrotechnica*

**Figure: 11**

*Pedalium murex*

**Figure: 12**

*Prosopis cineraria*

**Figure: 13**

*Tribulus terrestris*

**Figure: 14**

## Conclusion

The use of plants as medicine is gradually expanding among both rural and urban dwellers. According to the World Health Organization (WHO), herbal medicines are used by 80% of the global population for primary healthcare purposes. This study shows that ethnic communities in Jhunjhunu area rely on traditional knowledge of ethno-medicinal plants for basic health care. Despite ongoing socio-cultural changes, residents nevertheless have a thorough understanding of plants and their applications. Research indicates that 29 ethno-medicinal plant species have been employed in traditional medicine to treat a variety of human diseases.

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# Parthenium weed (Parthenium hysterophorus L.,) : A threat to the environment

***Md. Minhaj Alam[1] and Rizwana Perween[2]***

Key words: *Parthenium hysterophorus*, Allelopathy, Parthenin, Allergy, Biodiversity.

Abstract

*Parthenium hysterophorus* L., commonly known as carrot grass is an invasive annual obnoxious weed. It is one of the most devastating and hazardous weed. It causes serious agronomic, medical and environmental problems. This weed has vigorous growth and seeds of this weed have ability to germinate in any season of the year which makes it a constantly flourishing throughout the year. This weed has socio-economic impact because it has adverse effect on human beings, animals, plants and environment. It causes allergic responses in human beings and has phytotoxic and alleleopathic effect on plants particularly crop-plants. It has adverse effect on ecosystem and environment. It interferes with the biodiversity and has capacity to replace indigenous plant species. It poses serious threat to the environment. The present paper describes effect of this weed on human beings, plants and environment.

Introduction

*Parthenium hysterophorus L.*, commonly known as carrot grass, is an obnoxious weed belonging to the family Asteraceae. It is one of the most obnoxious members of the family Asteraceae (Kohli *et al.*, 2006). This weed is also known by some other names like congress grass, star weed, famine weed and white top plant. This weed is widely prevalent in India (Singh *et al.*, 2008). It is very commonly found to grow along road side, railway track, around the crop land and in waste land. It is also found to grow and survive in harsh climatic condition (Mahmood *et al.*, 2018). This weed causes serious agronomic, medical and environmental problems (Pandey, 1992). It can grow in both cultivated and waste land (Hassan & Khan, 2014). Approximately two million hectares of land in India are infested with this weed (Dwivedi *et al.*, 2009). This weed has spread like wild fire in every part of India. It exhibits prolific seed production and has ability to grow and spread very fast. It can also colonise degraded natural ecosystem and has inhibitory effect on the growth of adjoining herbaceous vegetation. This weed interferes with field crops (Patel *et al.*, 2011). It exhibitis high alleleopathic effect on neighbouring plants and competes with economically important crop plants (Lalita & Ashok Kumar, 2018). This weed has phytotoxic effect on seed germination

1.Department of Botany, M.G College, Gaya- 823001
2.Research Scholar, P.G. Dept. of Botany, Magadh University, Bodh-Gaya

and seedling growth of crop plants (khalique *et al.*, 2016). Tefera (2002) has reported allelopathic inhibitory effect of leaf extract of this weed. This weed adversely affects human health and causes allergic diseases like eczema, contact dermatitis, asthma and allergic rhinitis. Exposure to pollen grains of this weed causes allergic bronchitis in human beings. (Towers & Subbha Rao, 1992). This weed is posing a serious threat not only to human beings and crop plants but also affecting our environment. It interferes with the biodiversity. It can bring about change in habitat like grassland, river banks and flood plain (Lakshmi & Srinivas, 2007). This weed poses a serious threat to the ecosystem and environment. This weed is a native of north east Mexico and it is believed to have been introduced in India as a contaminant in PL 480 wheat from USA in 1950s. Now it is found everywhere in India.

**Botanical Features of *Parthenium hysterophorus***

*Parthenium hysterophorus*, is an annual or short lived perennial herb. It is an erect herb having alternate and deeply dissected leaves (fig. 1). It forms a basal rosette of leaves during early stage of growth. The inflorescence of this weed is branched producing white floral heads and a number of obovoid, smooth and black achenes. This weed has a deep root and erect stem bearing many branches and leaves. The leaves of this plant appear like leaves of a carrot plant. Therefore it is known as carrot grass. A single plant can produce ten thousand to fifteen thousand Viable seeds which can get dispersed widely and germinate to cover a large area. The seeds of this weed germinate normally in spring and early summer. This optimum temperature required for seed germination varies from 22-25$^0$c.

The achenes are black, obovate measuring 2.0-2.5 mm long and light in weight. Each flower bears 4-5 black seeds which are wedge shaped. These seeds are about 2 nm in length with white scales. Flowers are white or cream coloured which signifies the name of this weed as a white top plant. Flowers are present on the top of stem and branches. Trichomes are present on the epidermal surface.

The number of trichomes varies from two to eight. Trichomes are generally of tapering types. The pollen grains of this weed are 43small and light in weight. The pollen grains are allergenic in nature and can incite harmful immune response in human beings on inhalation. (Alam & Sinha, 2006 & 2017). The seeds of this weed have ability to germinate in any season of the year and this feature makes it a constantly flourishing component of the vegetation. (Nikam, S.R. and Namdas, D.D. 2021)

**Phytochemical Features of *Parthenium hysterophorus***

Chemical analysis of different parts of *Parthenium hysterophorus* has indicated the presence of various types of phytochemicals of which sesquiterpene lactone is an important chemical. Parthenin, a bitter glycoside (Maishi *et al.*, 1998) is a major sesquiterpene lactone. Besides Parthenin other phytochemicals reported in this weed include hysterin, ambrosin, P- Phydroxy benzoin, hyminin etc. Parthenin is present in almost all parts of this plant. Flowers of this weed contain four

acetylated pseudoguaianolides (Das *et al.*, 2007). Parthenin has allergenic property and can incite allergic responses in human beings. Concentration of parthenin is variable in different parts of this weed. Ambrosanolides are present in this plant (Chhabra *et al*., 1999). Gupta *et al.*, (1996) reported hydroxy proline-rich glycoprotein present as a major allergen in pollen grains of this weed. Different classes of secondary metabolites such as alkaloids, flavonoids, phenol, tarpenoids, quinones, coumarins etc have also been reported in this weed.

**Effect of *Parthenium hysterophorus* on human health**

This weed causes many health problems in human beings. Physical contact with this weed is reported to cause skin diseases like contact dermatitis, itching, eruptions, rashes and eczema in human beings. (Guanaseelan, 1987 and Morin *et al.*, 2009). Such persons who are exposed to this weed for long period may develop skin inflammation also. Inhalation of pollen grains of this weed may cause breathing problems like Asthma (Alam & Sinha, 2006). This weed may cause allergic rhinitis and hay fever (Towers & Subbha Rao, 1992). The involvement of TH type cytokines in *Parthenium* induced dermatitis has been studied by Akhtar *et al.*, (2010). The adverse effect of this weed has also been reported in animals feeding on this weed. Loss of pigmentation from the skin and dermatitis has been reported in animals. Liver and kidney of animals may also be affected if they feed on this weed (Raj kumar *et al.*, 1988). This weed causes systemic toxicity in livestock (Guanaseelan, 1987)

**Effect of *Parthenium hysterophorus* on Crop plants**

This weed invades crop land and causes serious agronomic problems (Pandey, 1992). This weed has effects on adjoining plants. It causes phytotoxic and allelopathic interference with the crop plants (Singh *et al.*, 2003). Parthenin found in this weed has allelopathic effects on surrounding plants (Belz *et al.*, 2007). The inhibitory effect of this weed on seed germination and seedling growth of crops plants are reported.

The phytotoxic chemicals found in this weed enter the soil through decomposition of leaf litter (Guanaseelan, 1998). *Parthenium* weed leaf litter can reduce seedling emergence and affects early growth of a wide range of crop plants. This weed is known to bring about reduction in the productivity of crop plants the like cereals, legumes, oil yielding and vegetable plants. Allelopathic effects of this weed on various crop plants have been reported. Being hardy and vigorous in growth, this weed outgrows the crop plant and causes reduction in crop yield.

**Effect of *Parthenium hysterophorus* on Ecosystem and Environment**

This weed is capable of disrupting natural ecosystem due to its invasive nature. It can rapidly invade new surrounding and can replace plant species present there. This weed can grow successfully and has capacity to replace native flora because of its allelopathic potential which poses a threat to the biodiversity (zuberi *et al.*, 2014). This weed can grow and surrive even in harsh climatic condition. It interferes with the biodiversity and can replace indigenous species. This weed can

colonise degraded natural ecosystem and produce inhibitory effect on surrounding herbaceous vegetation. This weed has potential to bring about change in the habitat (Lakshmi & Srinivas, 2007) and it can bring about changes in properties of soil, such as soil pH, soil organic matter, soil nitrogen, phosphorus, and potassium content of soil. This weed can cause habitat loss and fragmentation and it may have adverse effects on the environment. Invasion of this weed causes changes in above-ground vegetation and below-ground soil nutrient content disturbing entire grassland ecosystem. (Timsina *et al.,* 2010)

## Control of *Parthenium hysterophorus*

*Parthenium hysterophorus* being an obnoxious weed has multiple harmful effects. Its control is a major issue. There are various methods to control this weed. These methods include physical, chemical and biological methods. These methods are used to eliminate this weed. Uprooting and burning methods are simple methods for controlling this weed but this method is not safe. Mechanical methods may also be applied for eradication of this weed. The use of chemicals like herbicides and weedicides may be effective in controlling this weed but it may be hazardous. Biological methods are being used now to control or eradicate this problematic weed (Pandey, 1992). Eucalyptus oil may be used as a natural herbicide for biological control of this weed (Kohli *et at.,* 1998). *Cassia sericea* has the ability to outgrow *P.hysterophorus*. *Tagetes erectus* is also reported to suppress the growth of this weed in field trial. (Lakshmi and Srinivas, 2007). Leaf feeding beetles and stem boring weevil have also been tried to control this weed (Dhileepan, 2003). Awareness about harmful effects of this weed may be generated among people for control and management of this problematic weed.

## Conclusion

*Parthenium hysterophorus L*., a member of family Asteraceae being one of the most devasting and hazardous weed has socio-economic impact because it not only causes serious agronomic and human problems but it also has adverse impact on our environment. It interferes with the biodiversity and has capacity to replace native plant species. It has phytotoxic impact on surrounding plants. Invasion of this weed causes changes in above-ground vegetation and below-ground soil nutrient content disturbing entire grass land ecosystem. It has capacity to colonise degraded natural ecosystem and cause inhibitory effects on surrounding herbaceous vegetation. It causes serious health problems in human beings by causing allergic responses like skin diseases and breathing problems. It affects productivity of crop plants adversely. This weed acts a threat to the environment and therefore it should be controlled and managed.

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# Biochemical profiling of secondary plant metabolites in the leaves of Lantana camara Linn

***Raviranjan Kumar[1], Manoj Kumar[2], Amit Kumar Singh[3] & Murlidhar Mishra[4]***

**Keywords :** Phytochemicals, Qualitative evaluation, Secondarymetabolites, *Lantanacamara*

***Abstract :***

*Lantana camara Linn*. is a well-known weed. It is widely employed in several traditional medical practices to address a broad range of health issues. *L. Camara* is available throughout India. This plant is traditionally utilized as a diaphoretic, carminative, antispasmodic and to treat respiratory infections. The phytochemical webbing of the greasepaint of splint of *Lantana camara* methanolic excerpt was executed in the current disquisition. The existence of colourful bioactive secondary metabolites such as alkaloids, flavonoids, phenols, tannins, saponins, coumarins, amino acids, reducing sugar, steroids and terpenoids were discovered through qualitative phytochemical study. The quantitative phytochemical analysis of a methanolic extract of *Lantana camara* leaves revealed that flavonoids received the immediate attention, followed by alkaloids. The current study concluded that *Lantana camara* leaves may be beneficial source of phytochemicals.

**Introduction:**

*Lantana camara Linn*. is a medicinal aromatic plant of the family Verbenaceae that grows as an evergreen weed in almost all parts of the world. It is frequently utilised in several traditional medicinal practices to cure a variety of health issues. Most traditionally recognized herbs have been widely examined and reported for various medicinal characteristics throughout the last few decades.

However, in comparison to modern medicinal system, this subject remains underdeveloped, owing to the lack of scientific documentation. In contrast to primary molecules, the majority of the pharmacological activity of medicinal plants is found in their secondary metabolites. Plant elements containing bioactive compounds such as alkaloids, tannins, glycosides, volatile oils, phenols, and flavonoids are some examples. Due to their medicinal importance, phytochemical screening of plants is an urgent requirement in order to find and develop new medicinal compounds with increased efficacy. Throughout the world, numerous studies have discovered similar findings. There is an increasing understanding of the relationship between a medicinal plant's phytochemical ingredients and their pharmacological activities. The analysis of active chemicals from plants has resulted in the development of novel medicinal applications that provide effective protection and are used to treat a diverse array of ailments. Natural chemicals derived from

1. Ph.D. Scholar, P.G. Department of Botany, Magadh University, Bodh-Gaya. (Bihar).
2. Asst. Professor. S.N. Sinha College, Tekari, Gaya, (Bihar).
3. Asst. Professor, P.G. Department of Botany, Magadh University, Bodh Gaya, (Bihar).
4. Asst. Professor. P.G. Centre Biotechnology, Gaya College, Gaya, (Bihar).

plants are now being studied for the presence of novel medicines with unique mechanisms of pharmacological action (Roghini R, Vijayalakshmi K, 2018).

*Lantana camara Linn*. is used as an ornamental plant also, which is known by different names like, Wild sage, Surinam teaplant. Spanish flag and West Indian Lantana. This is found throughout India in areas with moderate to high summer rainfall and well-drained sloping terrain. The majority of variations favour fertile organic soils, but some or all can live in siliceous sands and sandstone-derived soils (Ganesh *et al.,* 2010). Traditionally, the plant is used to treat respiratory infections, tetanus, and gastropathy as a diaphoretic, carminative and antispasmodic. Powdered leaves are applied to wounds, ulcers and swellings. Eczema outbreaks are treated with a leaf infusion (Verma *et al.,* 2013). *Lantana camara* leaf extract has antibacterial properties and contains verbascoside which has antimicrobial properties. *L. camara* leaf extract was examined for wound healing in rats. Treatment of wounds with extract dramatically increases wound severity (98%), collagen synthesis, and decreases the mean wound healing time (Nayak *et al.,* 2009). In view of the foregoing information, the current study was done to assess the qualitative and quantitative phytochemical analysis of methanolic extract of *Lantana camara* leaves.

**Materialsand Methods :**

**(1) Plant material Collection:**

*Lantana camara* leaves were collected from various areas of Gaya town.

**(2). Plant material processing:**

The plant leaves were cleaned with running tap water and rinsing with distilled water to remove foreign matter such as soil particles, sand, and so on. They were then kept in the shadow for two weeks before being dried in a thermostatic oven at a temperature not more than 20o C for 20 hours. The harvested plant's leaves were pulverized in a sterile electric pot to produce a fine powder. The powdered plant leaves were kept in an airtight vessel, away from sunlight, until they were ready for examination.

**(3) Preparation of the extract:**

The plant components of interest were dissolved and incorporated into the solvent. In 100ml of methanol, 10gm of powdered leaves were extracted. Under the hood, the methanolic extract was vaporised on a water bath. Following evaporation, 100ml of DMSO (Dimethyl Sulfoxide) was gently added.

**(4) Phytochemical Qualitative Analysis:**

Qualitative phytochemical testing was carried out in accordance with standard procedures.

**Analysis of alkaloids**:

(i) A small amount of root extract (about 2ml) was treated with 10% NaOH solution. The white precipitate was utilised as a positive alkaloid test.

(ii) Wagner's reagent was added in to the test solution. The existence of alkaloids

**Coumarin screening:**

10% NaOH solution was added to the test solution. The presence of coumarins is indicated by the development of yellow colour.

**Terpenoids testing:**

H2SO4 and chloroform were mixed into the test solution. The presence of terpenoids is denoted by the development of yellow hue in the lower layer.

**Checking glycosides**:

For this, 10 ml of 50% H2SO4 was added to 1 ml of the test solution and the filtrate was placed in separate test tubes and the mixtures were heated for 15 minutes before adding 10 ml Fehling's solution and boiling. The presence of glycosides was revealed by a brick red precipitate.

**Checking phenols**:

(i) Sodium nitrate was added to the test solution and it was heated and then was treated with diluted H2SO4 and excess diluted NaOH. The presence of phenols is indicated by the development of red/green/blue colours.

(ii) 1% FeCl3 was added to the test solution. The presence of phenols is indicated by the development of a deep blue/black coloration.

**5. Phytochemicalquantification :**

**(A) Total Alkaloids Determination :** Harborne method was used to identify alkaloid. 5 gm plant extract was combined with 10ml of 10% acetic acid in ethanol and allowed to stand for 4 hours before filtering. Concentrated ammonium hydroxide was gradually added to the extract until precipitation occurred. The alkaloid residue was dried and weighed with the results expressed as mg of catechin equivalent /gm dry weight of plant material. (Harborne and Kokate, 1998).

**(B) Total FlavonoidsDetermination :** 2 ml of plant extract (1 mg/ml) was treated with 2 ml of ethanol prepared AlCl3 and 3 ml of 50g/L sodium acetate solution. After 2.5 hours of incubation at 20oC, the absorbance was measured at 440 nm and result was expressed as mg quercetin equivalent using the curve of calibration. (Van-Burgden and Robinson, 1981).

**(C) Total phenols and Tannins determination :** A beaker was filled up with 1 ml of extracts and standard solution, followed by 9 ml of distilled water. A reagent blank was made by adding distilled water. The mixture was shaken after 1 ml of Folin-Ciocalteu phenol reagent was added. After 5 minutes 10 ml solution of 7% sodium carbonate was added. After 90 minutes of incubation at room temperature, the absorbance was measured at 550 mm using a UV/V spectrophotometer. The results are given in terms of mg of tannic acid equivalent/gm dry weight of plant material (Peri and Pompei, 1977).

is shown by the formation of reddish brown precipitate. (iii). The test solution was subjected to Hager's test. The test fluid was fortified with picric acid. The existence of alkaloids is shown by yellowprecipitate formation.

**Tannins Testing:**

(i) 5% of the FeCl3 was added to the test solution. The presence of tannins is confirmed by the formation of bluish black/green precipitate.

(ii) 1% of the lead acetate was added to the test solution. The presence of tannins is shown by the formation of yellow precipitate.

**Steroid testing:**

(i) H2SO4 and ethanol were added to the test solution. The presence of steroids is denoted by the development of violet/blue/green colour.

(ii) H2SO4 and chloroform were added to the test solution. The trace of steroid is indicated by the emergence of a red hue in the lower layer.

**Saponin testing:**

Half gram of the powdered material was taken in a test tube. After this5.0 ml of distilled water was added and violently shaken. Saponins were detected by a continuous foam that lasted for about 15 minutes.

**Carbohydrate testing:**

Molisch reagent was added to the test solution, and conc. H2SO4 added from the sides. The presence of carbohydrates is shown by the formation of a purple ring at the junction.

**Analysis for amino acids:**

5% FeCl3 was added to the test solution. The presenceofamino acid is denoted by the formation ofpurple/bluish colour.

**Test for reducing Sugars :**

Fehling's Reagent was added to the test solution and the extract was heated. The presence of reducing sugars is indicated by the formation of brick red precipitate.

**Test for flavonoids**:

Increasing amount of 2N NaOH was added to the test solution. The presence of flavonoids is shown by the development of yellow colour that disappears when an acid is added. For this lead acetate was added in 1% solution, as a result, white precipitate is formed which confirmed the presence of flavonoids.

**Result :**

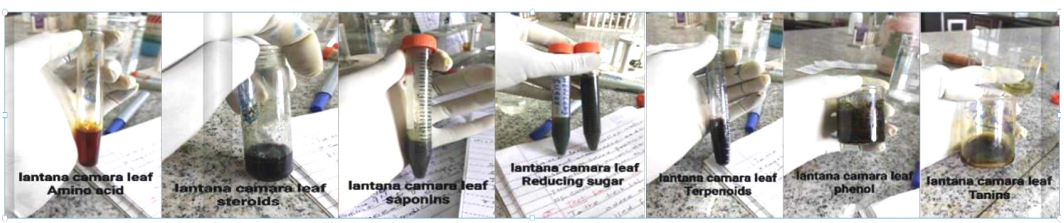

Table 2 : Quantitative Phytochemical analysis of *Lantana camara* leaves.

| S. No. | PHYTOCHEMICALS | SECONDARY METABOLITES CONCENTRATION |
|---|---|---|
| 1 | Alkaloids | 30.17 ± 0.033 |
| 2 | Flavonoids | 43.31 ± 0.081 |
| 3 | Phenols | 16.04 ± 0.025 |
| 4 | Tannins | 14.02 ± 0.014 |

Values are expressed as mean ± SD for triplicates

| | | |
|---|---|---|
| 7 | Reducing sugar | + |
| 8 | Flavonoids | ++ |
| 9 | Coumarins | ++ |
| 10 | Terpenoids | + |
| 11 | Glycosides | + |
| 12 | Phenols | + |

(-): Absent (+): Present (++): Present with high intensity of colour

**Discussion :**

Quantitative examination revealed that the plant includs alkaloids, flavonoids, phenols and tannins. In this work, quantitative phytochemical analysis of the methanol extract of *Lantana camara* leaves revealed the highest content of flavonoids. Flavonoids have been found to be superior antioxidants with a variety of biological effects, including vasodilator, anticancer, anti- inflammatory, antibacterial, immune- stimulating, anti-allergic, antiviral, and radioactive properties (Yanishlieva, 2001). Alkaloids or secondary metabolites are cyclic molecules containing nitrogen in a negative oxidation state. They have pharmacological actions such as analgesia, antispasmodic, antihypertensive and antimicrobial properties (Benzouzi, 2004).

Alkaloids have been extracted from a variety of plants and studied for therapeutic qualities. The most well-known use of alkaloids is for malaria therapy. According to Ameyab and Duker (2009), many antimalarial medications have been found to contain plant alkaloids. According to Ayitey and Addae (1977), bitter leaves containing alkaloids help alleviate headaches caused by hypertension. Tannins are secondary metabolites in plants. These are garlic glycosides or protocatechin acids. Because of their propensity to precipitate proteins, mucus and restrict blood vessels, astringents are effective in preventing diarrhea and controlling bleeding (Kokwaro, 2009) As a result, traditional healers utilise tannin plant to treat wounds and burns, which can cause blood to clot. Many tannin compounds have been found to lower the mutagenicity of certain mutagens. Tannins carcinogenic and mutagenic potential can be attributed to their antioxidant activities, which are vital in protecting cells from oxidative damage, particularly lipid peroxidation (Bajal, 1998).

The Phytochemical analysis of *L. camara* extract revealed the presence of alkaloids, steroids, flavonoids, amino acids, tannins and phenols. The

phytochemical elements that have specific pharmacological effects on the human body are what we call therapeutic plants (Shah, 2011). Plants are rich sources of numerous antimicrobial chemicals. Phytocomponents such as flavonoids, phenols, polyphenols, tannins, and terpenoids are efficient antimicrobial and cover a wide range of microorganisms (Shah, 2011).

The numerous phytochemical components found in *L. camara*'s crude extract contribute to its antibacterial activity. Secondary metabolites are non-nutritive substances that arise from main metabolites. Secondary metabolites are not often required for plant growth or reproduction, but they are significant in medicine. Phytochemicals are the primary source of establishment for many pharmaceutical enterprises. The main advantage of these herbal bioactive compounds is that they are more effective and have fewer or no negative effects than routinely used synthetic chemotherapeutic drugs (Mallikaharjuna *et al.,* 2007). Different plant extracts have been used to cure various diseases and they constitute the foundation of the entire Indian medicinal system.

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# Nanotechnology in Agriculture-Pros and Cons: A Review

***Aamna Hassan****

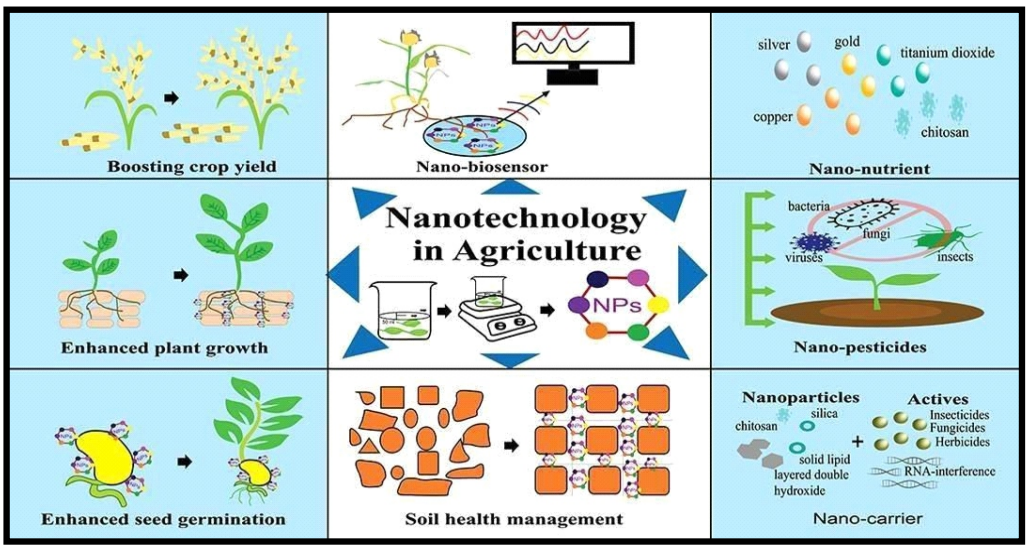
**Keywords :** Nanotechnology, Nanoparticles, Nanomaterial, Antimicrobial

**ABSTRACT**

Many studies reflect that nanotechnology will have major, long-term effects on agriculture and food production. These days sustainable agriculture is needed. The development of nanochemicals has appeared as promising agents for the plant growth, fertilizers and pesticides. These days, nanomaterials are proved as key solution to control plant pests and also plays vital role in protecting plants or crops from insects, fungi, weeds or any other unwanted ill factors which hamper or slow down plant growth and crop production. Several nanomaterials are used as antimicrobial agents in food packing in which several nanoparticles such as silver nanomaterials are of great interest. Many nanoparticles (Ag, Fe, Cu, Si, Al, Zn, ZnO, TiO2, CeO2, Al2O3 and carbon nanotubes) have been reported to have some adverse effects on plant growth apart from the antimicrobial properties. In food industries, nanoparticles are leading in forming the food with high quality and good nutritive value.

## Introduction

Nanotechnology has received great attention as it had wide scope in several areas like medicine, agriculture, etc. Recent scientific data indicate that nanotechnology has the potential to positively impact the agrifood sector, minimising adverse problems of agricultural practices on environment and human health, improving food security (as required by the predicted rise in global population) and promoting social and economic equity (Fraceto *et al.,* 2016).




*Department of Botany, Jamia Hamdard New Delhi – 110062

**Advantages of Nanotechnology in Agriculture :**

Nanotechnology can increase agricultural production and helps in promoting crop improvement by protecting the crops from the diseases and from many other unwanted factors which can lead to the degradation of the crop plants.

There are many benefits of Nanotechnology in Agriculture, some of which are as follows:-

## A. INCREASE IN PRODUCTIVITY

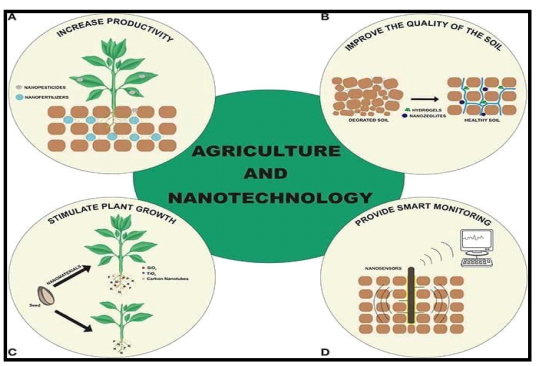
Sustainable agriculture aims to increase the yield without adverse environmental impact while cultivating the same agriculture area. Nanomaterials based on the use of inorganic, polymeric and lipid nanoparticles, synthesised by exploiting different techniques (Emulsification, ionic gelation, polymerization, oxyreduction, etc.) have been developed to increase productivity. They have numerous applications, as for example, nanosystems have been developed for immobilisation of nutrients and their release in soil. They have minimised leaching, while improving the uptake of nutrients and their release in soil (Chhikara, 2020).

## B. IMPROVING THE QUALITY OF THE SOIL

Hydrogen clays and Nano-zeolites have been reported to enhance the water holding capacity of soil, hence acting as a slow release source of water, reducing the hydric shortage period during the crop season. Application of such systems is favourable for both agricultural purposes and reforestation of degraded areas. Organic e.g., polymer and carbon nanotubes and inorganic e.g., nano-metal and metal oxides have also been used to absorb environmental contamination, increasing soil remediation capacity and reducing times and costs of treatment (Chhikara, 2020).

## C. STIMULATING PLANT GROWTH

The major impact of nanomaterials on agriculture or plants is dependent on their composition, concentration, size, surface charge and physico chemical properties, besides the susceptibility of plant species. Several Nano composition such as carbon nanotubes and nanoparticles of Au, SiO2, ZnO and TiO2 helps in plant development by promoting the uptake of the elements and use of nutrients for proper growth of plants



**Disadvantages of Nanotechnology in Agriculture**

There are several disadvantages associated with the use of nanotechnology in agriculture. Few of which are high processing costs, industrial production and concerns about public perception of environment, health and safety issues. The use of certain engineered nanoscale materials in agriculture, water and food may have risks for human use and consumption, for the environment, or for both (Gruere *et al*., 2011a).

**Conclusion And Future Perspective**

New tools are underway which will be equipped with nanodevices capable of replacing many cellular types of machinery efficiently . Use of nanotechnology could permit rapid advances in agricultural research, such as reproductive science and technology which will produce large amount of seeds and fruits unaffected by season and period, early detection of stresses and alleviating stress effects and disease prevention and treatment in plants. Still, the full potential of nanotechnology in agricultural and food industry is yet to be realized and is gradually moving from theoretical knowledge towards the application regime. Smart sensors and smart delivery systems will help the agricultural industry combat viruses, spores and other crop pathogens. Nanostructured catalysts will be available which will increase the efficiency of pesticides and herbicides, allowing 'on demand' measured does to be used. In the future, nanoscale devices could be used to make agricultural systems "smart". Apart from the potential benefits of nanotechnology in agricultural sector it also involves some risks. It cannot be claimed with certainty either those nanotechnologies are fully safe for health or that they are harmful. Risks associated with chronic exposure of farmers to nanomaterial, unknown life cycles, interaction with the biotic and the abiotic environment and their possible amplified bioaccumulation effects have not been accounted for and these should be seriously considered before these applications move from laboratories to the field. The common challenges related to commercializing nanotechnology, are:

High processing costs, Problems in the scalability of R & D for prototype and industrial production and concerns about public perception of environment, health and safety issues. The Governments across the world should form common and strict norms and monitoring, before commercialization and bulk use of these nanomaterials (Agarwal and Rathore, 2014).

In conclusion, nanotechnology in agriculture have both good and bad influence. Attempts to apply nanotechnology in agriculture began with the growing realizations that conventional farming technologies would neither be able to increase productivity any further nor restore ecosystems damaged by existing technologies (Mukopadhyay 2014 & Ghidan and Tawfiq, 2019). Despite demerits, nanotechnology is reaching the farmer's fields in order to rise the economy from the crop production at high scale and in less time.

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# Study of Quantitative Morphological Variations In Different Populations Of Two Weeds

***Priyanka Sinha****

**Keywords :**

Quantitative morphological characters, Solanum surattense Burm F., Solanum sisymbrifolium Lam., Phenotypicplasticity.

**Abstract :**

Six populations of two weeds namely Solanum surattense Burm F.& Solanum sisymbrifolium Lam belonging to the family Solanaceae have been studied morphologically from quantitative point of view. Variations have been noted indifferent populations of the mentioned two species. On the basis of variations it has been concluded that the phenotype of a plant is exposed to natural selection due to varying environmental conditions and hence this study reflects the factors which affect the plasticity of the phenotype.

**Introduction :**

In the presentpaper, quntitiative morphological variations have been noted and compared in two common weeds of the family Solanaceae. The weeds are Solanum surattense Burm f. and Solanum sisymbrifolium Lam. Six populations of each weed have been studied morphologically from Gaya and quantitative variations have been noted.

It is a well known fact the taxonomy of living organism is concerned with their characters and most of the morphological features. Every species bears characters of significance and without its due recognition, no natural groupcanbedelimited. Characters provide taxonomic evidence for natural classification and evolutionary classification also (Davis and Heywood, 1991). For the study of quantitative characters, taxonomists take the help of numerical taxonomy. Numerical toxonomy actually involves the numerical evaluation of the affinity or simlilarity between taxonomic units and division of these units into taxa on the basis of their affinities. In this method, several characters are taken for correlation and comparison between various populations and different species as well (Sokal and Sneath, 1963; Bonner, 1964 and Grant, 1984). In thepresent investigation, quantitative characters have been studied to analyse the morphological variations within the populations and between the populations (Sinha, 2014).

**Materials and Methods :**

The materials for the present study include two species of family Solanaceae namely Solanum surattense Burm f. and Solanum sisymbrifolium Lam. Six populations of each weed have been studied morpholigically from quantitative point of view.All populationshavebeen collected from different regions of Gaya.

*D. A. V. CANTT PUBLIC SCHOOL, GAYA

## STATISTICALANALYSIS

For knowing thedegree ofqunatitative morpholgical variatioins, statistics wasapplied. Random sampling of the characters was made and means, variance, standard deviation and standard error were analysed with thehelp of the following formula

1. Mean $(\bar{X}) = \frac{\sum x}{N}$
2. Variance $(S^2) = \frac{N\sum f(x^2) - \sum(fx)^2}{N(N-1)}$

   Where N = Number of observations

   $f$ = frequency

   $x$ = class
3. Standard deviation (S) = $\sqrt{S}$
4. Standard error (S. E.) = $\sqrt{\frac{S^2}{N}}$

**Table - 1**
**List of materials with locality and period of collection**

| Name of Species | Populations | Locality | Period of Collection |
|---|---|---|---|
| Solanum surattense Burm F. | Ssu 0512 | Mangla Gauri, Gaya | 16 May 2012 |
| | Ssu' 0512 | Near Railway track, Gaya | 24 May 2012 |
| | Ssu" 0512 | Maranpur, Gaya | 26 May, 2012 |
| | Ssu 0612 | Gaya College Campus, Gaya | 2 June, 2012 |
| | Ssu' 0612 | Katari Road, Gaya | 3 June, 2012 |
| | Ssu" 0612 | Kujapi, Gaya | 4 June, 2012 |
| Solanum sisymbrifolium Lam | Ss 0812 | Near Railway track, Gaya | 10 Aug. 2012 |
| | Ss' 0812 | Gaya College Campus, Gaya | 12 Aug. 2012 |
| | Ss" 0812 | By Pass Road, Gaya | 21 Aug. 2012 |
| | Ss 0912 | Katari Road, Gaya | 6 Sept. 2012 |
| | Ss' 0912 | Kujapi, Gaya | 7 Sept. 2012 |
| | Ss" 0912 | Delha, Gaya | 8 Sept. 2012 |

**Table - 2**
**List of Quantitive Character**

| | |
|---|---|
| 1. Vegetative Characters | (a) Height of Plant<br>(b) Number of Nodes<br>(c) Length of leaf<br>(d) Breadth of leaf |
| 2. Reproductive Chracters | (a) Number of Sepal / flower<br>(b) Number of Petal / flower<br>(c) Number of stamen / flower<br>(d) Number of Carpel / flower |

**Observations :**

The quantitative morphological investigations have been carried out in six populations of two weeds Solanum surattense Burm f. and Solanum sisymbrifolium Lam. Six populations of each weed have been studied and variations have been noted (Tables 1 & 2). The different quantitative morphological parameters taken under investigation have been summarised in tables 3 to 10 and the variations are shown in histograms 1 to 4.

Table - 3 Height of plant (cm)

| Sl. No. | Populations | Range | Mean | Variance | Standard Deviation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 34-102.50 | 59.46 | 308.30 | 17.56 | 5.36 |
| 2 | Ssu' 0512 | 30-95 | 50.42 | 231.38 | 15.21 | 2.49 |
| 3 | Ssu" 0512 | 32-96 | 52.50 | 234.26 | 15.60 | 2.52 |
| 4 | Ssu 0612 | 45-96 | 54.38 | 263.78 | 16.24 | 3.06 |
| 5 | Ssu' 0612 | 48-98 | 55.28 | 268.70 | 16.39 | 5.18 |
| 6 | Ssu" 0612 | 46-92 | 53.20 | 261.12 | 15.63 | 4.92 |
| 7 | Ss 0812 | 44-84 | 57.4 | 256.24 | 16.00 | 5.06 |
| 8 | Ss' 0812 | 45-96 | 54.38 | 263.78 | 16.24 | 5.13 |
| 9 | Ss" 0812 | 30-95 | 50.42 | 231.38 | 15.21 | 4.81 |
| 10 | Ss 0912 | 37-60 | 49.2 | 186.42 | 13.65 | 4.31 |
| 11 | Ss' 0912 | 34-102 | 59.46 | 308.30 | 17.56 | 5.36 |
| 12 | Ss" 0912 | 49-72 | 56.4 | 211.40 | 14.53 | 4.59 |

**Table - 4 Number of nodes**

| Sl. No. | Populations | Range | Mean | Variance | Standard De viation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 20-125 | 62.25 | 1526.75 | 39.07 | 3.07 |
| 2 | Ssu' 0512 | 20-120 | 75.70 | 2022.75 | 44.97 | 2.99 |
| 3 | Ssu" 0512 | 21-124 | 68.86 | 1755.25 | 41.89 | 2.93 |
| 4 | Ssu 0612 | 20-110 | 60.00 | 1510.00 | 38.85 | 3.88 |
| 5 | Ssu' 0612 | 22-120 | 66.50 | 1680.25 | 40.50 | 2.98 |
| 6 | Ssu" 0612 | 22-112 | 62.20 | 1620.10 | 39.80 | 2.99 |
| 7 | Ss 0812 | 20-45 | 28.50 | 50.20 | 7.08 | 2.24 |
| 8 | Ss' 0812 | 20-40 | 28.00 | 48.25 | 6.94 | 2.19 |
| 9 | Ss" 0812 | 21-38 | 26.00 | 40.50 | 6.36 | 2.01 |
| 10 | Ss 0912 | 16-36 | 24.0 | 32.56 | 5.67 | 1.79 |
| 11 | Ss' 0912 | 14-32 | 20.00 | 24.24 | 4.97 | 1.55 |
| 12 | Ss" 0912 | 16-30 | 22.0 | 22.54 | 4.74 | 1.50 |

**Table - 5 Length of Leaf (cm)**

| Sl. No. | Populations | Range | Mean | Variance | Standard De viation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 7-11 | 8.85 | 2.47 | 1.57 | 0.59 |
| 2 | Ssu' 0512 | 9-13 | 11.00 | 1.49 | 1.22 | 0.36 |
| 3 | Ssu" 0512 | 8-12 | 9.36 | 1.94 | 1.39 | 0.48 |
| 4 | Ssu 0612 | 8-13 | 9.86 | 2.05 | 1.43 | 0.45 |
| 5 | Ssu' 0612 | 7-10 | 8.50 | 2.32 | 1.52 | 0.51 |
| 6 | Ssu" 0612 | 7-12 | 9.50 | 2.60 | 1.59 | 0.61 |
| 7 | Ss 0812 | 7-9 | 8.25 | 2.60 | 1.61 | 0.50 |
| 8 | Ss' 0812 | 6-8 | 7.25 | 2.45 | 1.56 | 0.49 |
| 9 | Ss" 0812 | 6-10 | 8.00 | 2.50 | 1.58 | 0.50 |
| 10 | Ss 0912 | 6-11 | 8.50 | 4.10 | 2.02 | 0.64 |
| 11 | Ss' 0912 | 6-8 | 7.25 | 2.20 | 1.48 | 0.46 |
| 12 | Ss" 0912 | 6-8 | 7.0 | 2.40 | 1.54 | 0.48 |

**Table - 6 : Breadth of Leaf (cm)**

| Sl. No. | Populations | Range | Mean | Variance | Standard De viation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 2-5 | 3.57 | 0.95 | 0.97 | 0.36 |
| 2 | Ssu' 0512 | 3-6 | 4.90 | 0.69 | 0.83 | 0.25 |
| 3 | Ssu" 0512 | 2-6 | 3.97 | 0.87 | 0.93 | 0.32 |
| 4 | Ssu 0612 | 2-5 | 3.50 | 0.92 | 0.95 | 0.30 |
| 5 | Ssu' 0612 | 4-6 | 5.00 | 0.90 | 0.92 | 0.26 |
| 6 | Ssu" 0612 | 3-6 | 4.25 | 0.98 | 0.94 | 0.27 |
| 7 | Ss 0812 | 2-5 | 3.57 | 0.95 | 0.97 | 0.31 |
| 8 | Ss' 0812 | 3-6 | 4.90 | 0.69 | 0.83 | 0.25 |
| 9 | Ss" 0812 | 2-6 | 3.97 | 0.87 | 0.93 | 0.32 |
| 10 | Ss 0912 | 2-6 | 4.20 | 0.85 | 0.92 | 0.29 |
| 11 | Ss' 0912 | 2-4 | 3.10 | 0.62 | 0.78 | 0.24 |
| 12 | Ss" 0912 | 2-3 | 2.8 | 0.54 | 0.73 | 0.23 |

**Table - 7 Number of Sepal/flower**

| Sl. No. | Populations | Range | Mean | Variance | Standard De viation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 5-5 | 5 | - | - | - |
| 2 | Ssu' 0512 | 5-5 | 5 | - | - | - |
| 3 | Ssu" 0512 | 5-5 | 5 | - | - | - |
| 4 | Ssu 0612 | 5-5 | 5 | - | - | - |
| 5 | Ssu' 0612 | 5-5 | 5 | - | - | - |
| 6 | Ssu" 0612 | 5-5 | 5 | - | - | - |
| 7 | Ss 0812 | 5-5 | 5 | - | - | - |
| 8 | Ss' 0812 | 5-5 | 5 | - | - | - |
| 9 | Ss" 0812 | 5-5 | 5 | - | - | - |
| 10 | Ss 0912 | 5-5 | 5 | - | - | - |
| 11 | Ss' 0912 | 5-5 | 5 | - | - | - |
| 12 | Ss" 0912 | 5-5 | 5 | - | - | - |

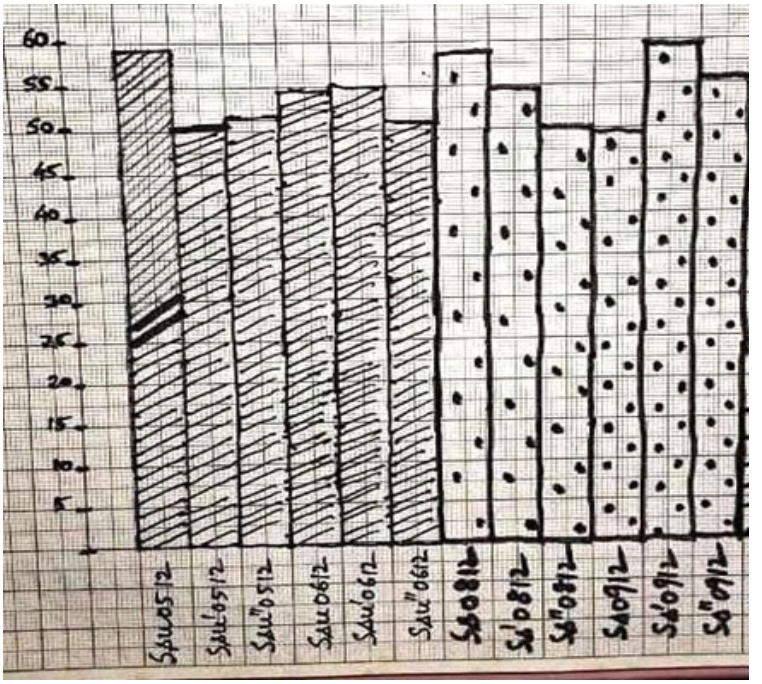
**Table - 9 Number of Stamens**

| Sl. No. | Populations | Range | Mean | Variance | Standard Deviation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 5-5 | 5 | - | - | - |
| 2 | Ssu' 0512 | 5-5 | 5 | - | - | - |
| 3 | Ssu" 0512 | 5-5 | 5 | - | - | - |
| 4 | Ssu 0612 | 5-5 | 5 | - | - | - |
| 5 | Ssu' 0612 | 5-5 | 5 | - | - | - |
| 6 | Ssu" 0612 | 5-5 | 5 | - | - | - |
| 7 | Ss 0812 | 5-5 | 5 | - | - | - |
| 8 | Ss' 0812 | 5-5 | 5 | - | - | - |
| 9 | Ss" 0812 | 5-5 | 5 | - | - | - |
| 10 | Ss 0912 | 5-5 | 5 | - | - | - |
| 11 | Ss' 0912 | 5-5 | 5 | - | - | - |
| 12 | Ss" 0912 | 5-5 | 5 | - | - | - |

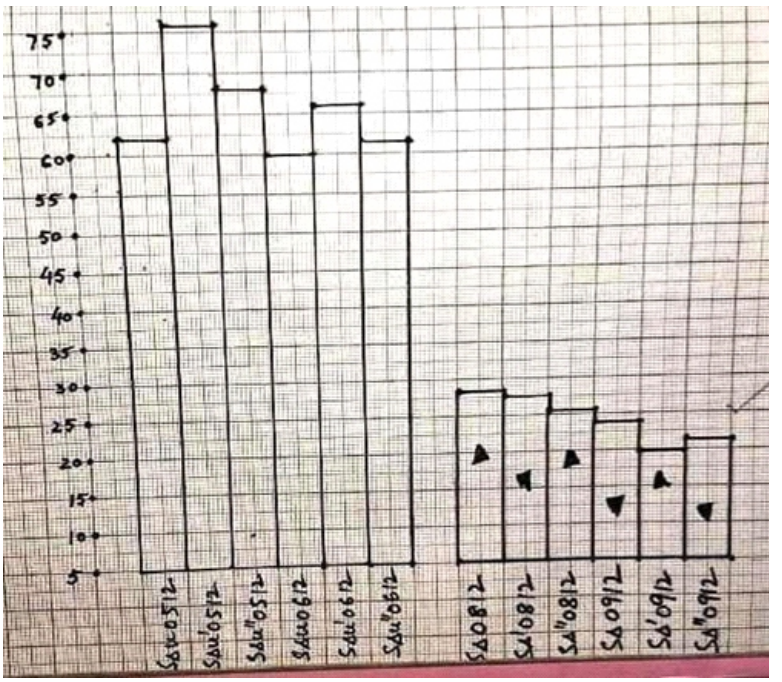
Table - 10 Numer of Carpel

| Sl. No. | Populations | Range | Mean | Variance | Standard Deviation | Standard Error |
|---|---|---|---|---|---|---|
| 1 | Ssu 0512 | 2-2 | 2 | - | - | - |
| 2 | Ssu' 0512 | 2-2 | 2 | - | - | - |
| 3 | Ssu" 0512 | 2-2 | 2 | - | - | - |
| 4 | Ssu 0612 | 2-2 | 2 | - | - | - |
| 5 | Ssu' 0612 | 2-2 | 2 | - | - | - |
| 6 | Ssu" 0612 | 2-2 | 2 | - | - | - |
| 7 | Ss 0812 | 2-2 | 2 | - | - | - |
| 8 | Ss' 0812 | 2-2 | 2 | - | - | - |
| 9 | Ss" 0812 | 2-2 | 2 | - | - | - |
| 10 | Ss 0912 | 2-2 | 2 | - | - | - |
| 11 | Ss' 0912 | 2-2 | 2 | - | - | - |
| 12 | Ss" 0912 | 2-2 | 2 | - | - | - |

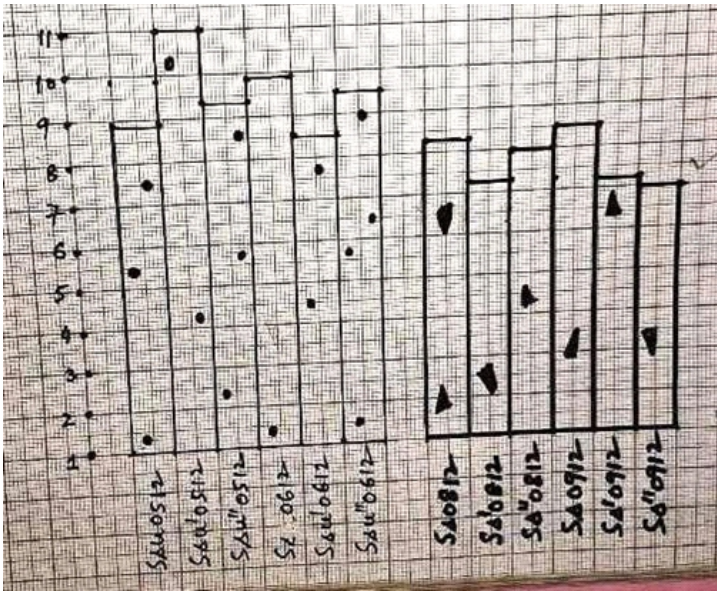
**Histogram 1 Height of plant**



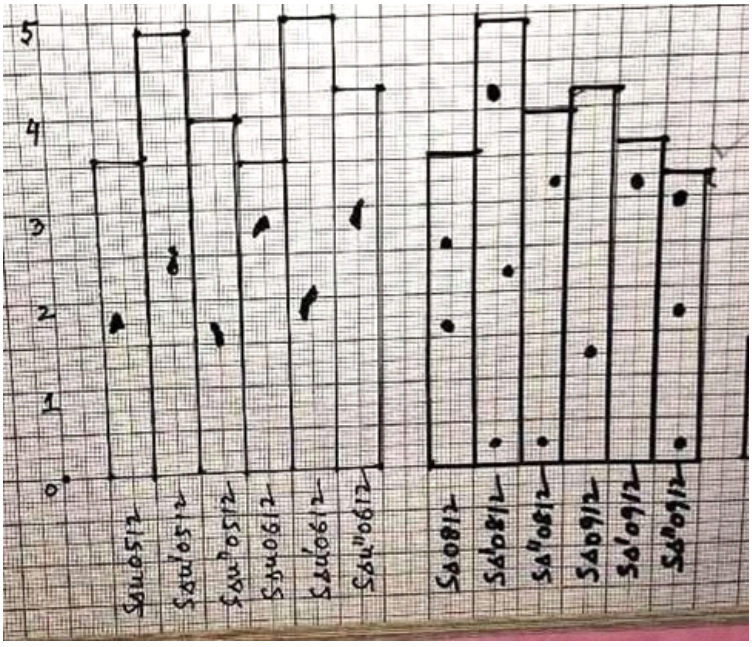

**Histogram 2 Number of nodes**



**Histogram 3 Length of leaf**



**Histogram 3 Breadth of leaf**



**Discussion :**

On the basis of the observations it was noted that the height of the plants in different populations of Solanum surattense showed slight variations. The populations of SSu 0512 showed plants of 34 cm to 102.50 cm., SSu' 0512 from 30 cm to 95 cm, SSu" 0512 from 32 to 96 cm., SSu 0612 from 45 to 96 cm, SSu' 0612 from 48 to 98 cm and in SSu" 0612 from 46 to 96 cm. From this data it becomes clear that the tallest plant has been reported in the population of SSu 0512. Standard error indicates that there was mininum variation in the population SSu' 0512 and SSu" 0512. Different populations also showed considerable disimilarity in the length of leaf of the plants (Table 5). Contrary to theheight of the plant, the leaf length was minimum in the population SSu 0512. In the floral characteristic of the different populations of Solanum surattense no variation was recorded in the number of sepals, petals, stamens and carpels. Similarly in theother weed Solanum sisymbrifolium , variations werenoted in the heightof the plant.The significant variation was recorded in the population Ss' 0912 while the population Ss 0912 showed minimum variation (Table 3). Some significant variations were also noted in the number of nodes of diffferent populations (Table 4).

When we analyse the above mentioned variations, we can saythat they can be regrarded as the product of interaction of all genes with each other and with the environment in which they live (Waddington, 1965 and Sinha, 2014). The living plants like all living systems are regarded as organised system which maintain and adjust themselvesthrough their capacity for homeostasis to the environmental flux.Adistinction is made between the genotype whichremains unaltered andthephenotype which changes inresponse toachangeintheenvironment as has been noted in different populations of the two species. Therefore it appears that there is a fixed factor, the genotype and variable expression of the phenotype in response to varying environmental condition and homeostatic relationship coordinating in the system. Phenotype of a plant is exposed to natural selection and hence the present investigation reflects the factors which affect the plasticity of the phenotype (Stebbins, 1965, Hashmi, 1986 & Alam, 2007).

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# Phytoplanktonic Occurrence With Reference to Aquatic Bodies of Gaya

***Ghausia Ahmad****

**Keywords**: Phytoplankton, Biodiversity, physio-chemical features, Pollution

**ABSTRACT**:

Phytoplanktonic biodiversity of four aquatic bodies of Gaya namely, Bisar pond (A), Bodhgaya pond (B), Jail Pond (C), & Railway pond, Katari(D), witnessed four group of algal classes. The Chlorophycean genera exhibit a clear dominance followed by Cyanophycean, Bacillariophycean and Euglenophycean. They could not achieve any predictable correlations, however, transparency, light fluctuation in water level, physico-chemical features and pollution stresses may be accounted for the present scenario.

## INTRODUCTION:

The biological involvement of water bodies has mainly been focused by phytoplanktons. This concept was highlighted by Forbes (1887) and Lindeman (1942). Reports have been published from various parts of the continent which summarise the importance of algae and other interfering organisms in water supplies and to water quality. Kolkwitz and Marsoon (1908) proposed that some species tend to occur under a certain kind of pollution and their presence is indicative of water quality.

## MATERIALS AND METHODS:

The chief material is pond water from the Pond A, B, C and D as per name introduced earlier. The sample amount was taken as small enough in volume so that it may be convenient to transport. The identification of various phytoplanktonic genera was made with the help of various keys and guidelines for identification (Palmer, 1980 & Prescott, 1938).

Phytoplanktons, which are the microscopic free floating autotrophs were collected by filtering 50 liters of water through phytoplankton net and were preserved in 4% formalin (ALPHA, 1989).

*Makhdoom Colony, Near Creane School, Gaya

## OBSERVATIONS:

Table 1.1: Phytoplanktonic occurrence in Pond A during the year 2006

| | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chlorophyceae | | | | | | | | | | | | | |
| 1 | Chlamydomonas | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Botrigococcus | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Tetraspora | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Lepocinclis | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 5 | Carteria | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 6 | Ankistrodesmus | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 7 | Spirogyra | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 8 | Ulothrix | + | + | + | + | - | + | + | + | + | - | - | + | 10 |
| 9 | Patmella | + | + | + | + | + | + | + | + | + | - | - | + | 10 |
| 10 | Zygnema | + | + | + | - | - | - | - | + | + | - | - | - | 5 |
| 11 | Draparnaldia | + | + | + | + | + | + | - | + | + | | - | + | 9 |
| Total Genera in Month | | 11 | 11 | 11 | 10 | 10 | 7 | 9 | 11 | 11 | 8 | 7 | 10 | |
| | Cyanophyceae | | | | | | | | | | | | | |
| 1 | Lyngbya | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Agmenellum | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Oscillatoria | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Arthrospira | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 5 | Mycrosystis | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 6 | Rivularia | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 7 | Nostoc | + | + | + | + | + | + | - | + | + | + | + | + | 11 |
| 8 | Nodularia | + | + | + | + | + | - | - | + | + | + | + | + | 10 |
| 9 | Anabaena | + | + | + | + | + | - | - | - | + | + | + | + | 9 |
| Total Genera in Month | | 9 | 9 | 9 | 9 | 9 | 7 | 6 | 8 | 9 | 9 | 9 | 9 | |
| | Bacilllariophyceae | | | | | | | | | | | | | |
| 1 | Gomphonema | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Synedra | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Diatoma | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Melosira | + | + | + | + | + | + | - | - | + | + | + | + | 10 |
| 5 | Nitzschia | + | + | + | + | + | - | - | - | + | + | + | + | 9 |
| 6 | Navicula | + | + | + | - | - | - | - | - | - | + | + | + | 6 |
| Total Genera in Month | | 6 | 6 | 6 | 5 | 5 | 4 | 3 | 3 | 5 | 6 | 6 | 6 | |
| | Euglenophyceae | | | | | | | | | | | | | |
| 1 | Euglena | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Phacus | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| Total Genera in Month | | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | |

Table 1.2 : Phytoplanktonic occurrence in Pond B during the year 2006

| | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chlorophyceae | | | | | | | | | | | | | |
| 1 | Chlamydomonas | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Botrigococcus | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Tetraspora | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Lepocinclis | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 5 | Carteria | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 6 | Ankistrodesmus | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 7 | Spirogyra | + | + | + | + | + | - | + | + | + | + | - | + | 11 |
| 8 | Ulothrix | + | + | + | + | + | - | - | + | + | + | + | + | 10 |
| 9 | Patmella | + | + | + | + | + | - | - | + | + | + | + | + | 10 |
| 10 | Zygnema | + | + | + | - | - | - | - | - | + | + | - | - | 5 |
| Total Genera in Month | | 10 | 10 | 10 | 9 | 9 | 4 | 7 | 9 | 10 | 10 | 8 | 9 | |
| | Cyanophyceae | | | | | | | | | | | | | |
| 1 | Lyngbya | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Agmenellum | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Oscillatoria | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Arthrospira | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 5 | Mycrosystis | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 6 | Rivularia | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 7 | Nostoc | + | + | + | + | + | - | - | + | + | + | + | + | 09 |
| 8 | Nodularia | + | + | + | + | - | - | - | - | - | + | + | + | 07 |
| Total Genera in Month | | 8 | 8 | 8 | 8 | 7 | 3 | 6 | 7 | 7 | 8 | 8 | 8 | |
| Bacilllariophyceae | | | | | | | | | | | | | | |
| 1 | Diatoma | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Synedra | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Gomphonema | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 5 | Melosira | + | + | + | + | + | - | - | + | + | + | + | + | 10 |
| 6 | Nitzschia | + | + | + | + | - | - | - | - | - | + | + | + | 7 |
| Total Genera in Month | | 5 | 5 | 5 | 5 | 4 | 3 | 3 | 4 | 4 | 5 | 5 | 5 | |
| | Euglenophyceae | | | | | | | | | | | | | |
| 1 | Euglena | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Phacus | + | + | + | + | - | + | + | + | + | + | + | + | 11 |
| 3 | Trachelomonas | + | + | + | + | - | - | - | - | + | + | + | + | 08 |
| Total Genera in Month | | 3 | 3 | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | |

Table 1.3: Phytoplanktonic occurrence in Pond C during the year 2006

| | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chlorophyceae | | | | | | | | | | | | | |
| 1 | Chlamydomonas | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Botrigococcus | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Tetraspora | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Lepocinclis | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 5 | Carteria | + | + | + | + | - | + | + | + | + | + | + | + | 11 |
| 6 | Ankistrodesmus | + | + | + | + | - | + | + | + | + | + | + | + | 11 |
| 7 | Spirogyra | + | + | + | + | - | + | + | + | + | + | + | + | 11 |
| 8 | Ulothrix | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 9 | Patmella | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 10 | Zygnema | + | + | + | + | - | - | - | + | + | - | - | + | 7 |
| 11 | Spherocystic | + | + | + | - | - | - | - | - | - | - | - | + | 4 |
| 12 | Pediastum | + | + | + | - | - | - | - | - | - | - | - | + | 4 |
| Total Genera in Month | | 12 | 12 | 12 | 10 | 4 | 7 | 9 | 10 | 10 | 9 | 9 | 12 | |
| | Cyanophyceae | | | | | | | | | | | | | |
| 1 | Lyngbya | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Agmenellum | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Oscillatoria | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Arthrospira | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 5 | Mycrosystis | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 6 | Rivularia | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 7 | Nostoc | + | + | + | + | - | - | - | + | + | + | + | + | 10 |
| 8 | Nodularia | + | + | + | + | - | - | - | + | + | + | + | + | 9 |
| 9 | Anabaena | + | + | + | + | - | - | - | - | + | + | + | + | 8 |
| Total Genera in Month | | 9 | 9 | 9 | 9 | 6 | 3 | 7 | 8 | 9 | 9 | 9 | 9 | |
| Bacilllariophyceae | | | | | | | | | | | | | | |
| 1 | Gomphonema | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Synedra | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Diatoma | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Melosira | + | + | + | + | + | - | - | + | + | + | + | + | 10 |
| 5 | Nitzschia | + | + | + | + | - | - | - | - | - | + | + | + | 7 |
| 6 | Navicula | + | + | + | + | - | - | - | - | - | + | + | + | 7 |
| Total Genera in Month | | 6 | 6 | 6 | 6 | 4 | 3 | 3 | 4 | 4 | 6 | 6 | 6 | |
| | Euglenophyceae | | | | | | | | | | | | | |
| 1 | Euglena | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Phacus | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 3 | Trachelomonas | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| Total Genera in Month | | 3 | 3 | 3 | 3 | 1 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | |

Table 1.4 : Phytoplanktonic occurrence in Pond D during the year 2006

| | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Chlorophyceae | | | | | | | | | | | | | |
| 1 | Chlamydomonas | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Botrigococcus | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Tetraspora | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Lepocinclis | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 5 | Carteria | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 6 | Ankistrodesmus | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 7 | Spirogyra | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 8 | Ulothrix | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 9 | Patmella | + | + | + | - | - | - | - | - | - | + | + | + | 6 |
| 10 | Zygnema | + | + | + | - | - | - | - | - | - | + | - | - | 4 |
| Total Genera in Month | | 11 | 11 | 11 | 10 | 10 | 7 | 9 | 11 | 11 | 8 | 7 | 10 | |
| | Cyanophyceae | | | | | | | | | | | | | |
| 1 | Lyngbya | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Agmenellum | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Oscillatoria | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 4 | Arthrospira | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 5 | Mycrosystis | + | + | + | + | + | - | + | + | + | + | + | + | 11 |
| 6 | Rivularia | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 7 | Nostoc | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| 8 | Nodularia | + | + | + | - | - | - | - | + | + | + | + | + | 8 |
| Total Genera in Month | | 8 | 8 | 8 | 7 | 5 | 3 | 7 | 8 | 8 | 8 | 8 | 8 | |
| | Bacilllariophyceae | | | | | | | | | | | | | |
| 1 | Gomphonema | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Synedra | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 3 | Diatoma | + | + | + | + | + | - | + | + | + | + | + | + | 12 |
| 4 | Melosira | + | + | + | + | - | - | - | - | + | + | + | + | 8 |
| 5 | Nitzschia | + | + | + | + | - | - | - | - | + | + | + | + | 8 |
| 6 | Navicula | + | + | + | + | - | - | - | - | - | + | + | + | 7 |
| Total Genera in Month | | 6 | 6 | 6 | 6 | 3 | 2 | 3 | 3 | 5 | 6 | 6 | 6 | |
| | Euglenophyceae | | | | | | | | | | | | | |
| 1 | Euglena | + | + | + | + | + | + | + | + | + | + | + | + | 12 |
| 2 | Phacus | + | + | + | + | - | - | + | + | + | + | + | + | 10 |
| Total Genera in Month | | 2 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | |

## RESULT & DISCUSSION

Phytoplanktonic studies revealed four groups of algal classes such as green algae (Chlorophyceae), blue green algae (Cyanophyceae) and euglenoid (Euglenophyceae), these were the base lines on which the life line of the pond depends(Table 1.1, 1.2,1.3 & 1.4). Phytoplanktonic abundance, distribution bio-diversity and indices were influenced by several factors such as light, temperature, nutrient and dissolved oxygen,

Chlorophycean genera for pond A were having minimum appearance in June as 7 while maximum was witnessed in Jan, Feb, March, Aug & Sept as 11, with percentage share as 39.28%. For pond B, Chlorophycean were having minimum appearance in May as 4 while maximum was witnessed in Jan, Feb, March, Sept & Oct as 10, with percentage share as 38.46. For Pond C, chlorophycean were having minimum appearance in May as 4 while maximum was witnessed in Jan, Feb, Mar, as12 with percentage share as 40. For pond D, Chlorophycean were having minimum appearance in June as 4 while maximum was witnessed in Jan, Feb, Mar & Oct as 10 with percentage share as 38.46 Cyanophycean Genera

For pond A, Cyanophycean were having minimum appearance in July as 06 while maximum was witnessed in Jan to Mar & Sept to Dec as 9 with percentage share as 32.14

For pond B, Cyanophycean were having minimum appearance in June as 3 while maximum was witnessed in Jan to Apr & Dec as 08 with percentage share as 30.76.

For Pond C, Cyanophycean genera were having minimum appearance in June as 03 while maximum was witnessed in Jan to Mar & Aug to Dec as 09 with percentage share as 30.

For pond D, Cyanophycean genera were having minimum appearance in June as 03 while maximum was witnessed in Jan, to Mar, Aug to Dec as 08 with percentage share as 30.76

**Bacillariophycean genera :**

For pond A, Bacillariophycean genera were having minimum appearance in July to Aug as 03 while maximum was witnessed in Jan to Mar and Oct to Dec as 06 with percentage share as 21.42

For pond B, Bacillariophycean genera were having minimum appearance in June and July as 03 while maximum was witnessed in Jan to Apr and Oct to Dec as 05 with percentage share as 19.23

For pond C Bacillariophycean genera were having minimum appearance in June and July as 03 while maximum was witnessed in Jan to Apr, & Oct to Dec as 06 with percentage share as 20

For pond D, Bacillariophycean genera were having minimum appearance in June as 02 while maximum was witnessed in Jan to Apr and Oct to Dec as 06 with percentage share as 32.07

**Euglenophycean Genera**

For pond A, Euglenophycean genera were having minimum appearance in May and June as 01 while maximum was witnessed in Jan to Apr and July to Dec as 02 with percentage share as 7.14

For pond B, Euglenophycean genera were having minimum appearance in July as 01 while maximum was witnessed in Jan to Apr and Sept to Dec as 03 with percentage share as 11.53.

For pond C, Euglenophycean genera were having minimum appearance in May and June as 01 while maximum was witnessed in the rest of the months of this year with percentage share as 10

For Pond D, Euglenophycean genera were having minimum appearance in May and June as 01 while maximum was witnessed in the rest of the months of this year with percentage share as 7.69

It has been indicated that Euglenophycean genera show their lowest share. The similar result has been observed by Nandan and Patel (1985). The ability of chlorophycean algae to withstand against the pollution load has been sounded by Palmer(1969, b) & Jha *et al.,* (1989).

In the aquatic bodies of Gaya the monthly fluctuations in phytoplanktons have been studied and observed that they do not follow any predictable rule.

**CONCLUSION**

Phytoplanktons may be used as indicators of water quality, some are prevalent in eutrophic water, while others in Oligotrophic condition. They respond quickly to the environmental changes, hence, indicate the quality of water mass in which they are found.

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