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President Desks

Dear Readers,

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Dr. Ranjeet K Singh
President
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- Pathology of Plants
- Phytochemistry
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- Plant Ecology
- Plant Evolution
- Plant Genetics
- Plant Nutrition, Plant Stress and Resistance
- Plant Pathology
- Plant Proteomics
- Plant Structure including morphology and physiology
- Primary and Secondary Metabolites study
- Study of Medicinal and Aromatic Plants
- And other related areas

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Index

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Detection of Plant Diseases from Image Processing Techniques

Abdul Shahzad[1]

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Abstract:

More than 80% population of India is depend on the agriculture. It is an important for the survival but some diseases in the plant and crops destroy them due to which a heavy loss are faced by the agricultural industry. The identification of plant diseases is very important to prevent form the heavy loss and more production of yield. The primary symptoms of plant disease are seen the leaf in the form of changing colour, showing the spots on it. In recent time, the identification of plant diseases are done by the eye observation but it is very time consuming and not much accurate. Different researcher has been developed different types of techniques for the detection of diseases. This paper represent the use of image processing technique for the recognition of plant diseases. This method have different types of algorithm with different database of plant species.

Keywords: *Yield, Disease, Image processing, Algorithm*

Authors:

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Introduction

In India, maximum part of the population depend on the agriculture. More production of food with a high quality at reduced expenditure is the aim of research in the field of agriculture. The complex interaction of soil, seed, and agro chemicals given the product in the form of agricultural food production. The most important food product of the agriculture are grain, fruits and vegetables. Their external appearance is the most important because this outer appearance affects the behavior of the consumer for buying any product. So, it is necessary to inspect the quality and grading system of the products in agriculture field for the cultivation of good healthy plants. But due to the disease in the crops and plants, agriculture field can go into an economic loss because these diseases management is a challenging task till today.

The detection of plant diseases is done by the plant pathologist. Plant pathology is the scientific study of diseases in plant generated by the activity of the pathogens and environmental conditions. The leaves or stem of plants show the colored spots or streaks due to the some diseases. In plants, fungi, bacteria and viruses are the main causes of the leaf diseases. In the leaves or stem of plants, different symptoms are seen due to the disease caused by these organism. The major symptoms caused by organisms are stunting, yellowing, wilting, twisting, reddening, leaf spots, browning, blighting etc. According to food and agriculture organization, 25% of the crop is lost due to the diseases and pests.

Plant Disease Triangle

Plant pathology's fundamental concept is represented by the disease triangle. In this triangle, each side or angle show the factor that is required for the disease development. At one side, pathogen causes diseases. Another sides are susceptible host and environmental conditions that are also enhance the development of disease. All three factors should be present in the triangle for the development of diseases.

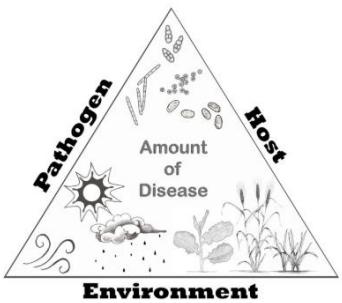

Figure 1 - Disease Triangle

Pathogen: means infectious agents like virus, fungus, bacteria, or parasite that cause the disease in the plants, humans, and animals. These pathogens alter the photosynthesis reaction as well as affects the respiration and transpiration activity of plants.

Abiotic and biotic are the factors which also responsible for the plant diseases.

Biotic Factors: Fungi, Bacteria, Viruses, Protozoa, Nemotodes etc.

Abiotic Factors: Light, temperature, humidity, soil moisture, insufficient nutrient, abnormality in soil conditions like acidic, alkaline, saline, etc.

Image Processing Technique

Manually, the experts detect and identify the plants through eye called eye observation but this method takes time because of the huge farms or land areas. Nowadays, the detection of plant diseases includes laboratory tests, skilled people, well required laboratories etc. But these things are not accessible all over mainly in remote areas. Various diseases can be detected by the help of automatic detection like image processing. Image processing plays vital role in the detection of plant disease because it provides best result with less human efforts. This technique are very helpful in the classification of crops, weed detection, product quality inspection, disease detection, pest identification etc. The characteristics features of disease region is extracted from the image for the recognition of the type of disease because features can vary according to disease. Color, shape, texture and so on are the features that are extracted from the image. Sometimes more features are extracted due to which the cost of hardware and software increases.

Procedure

1. Firstly, captured image is preprocessed and resized.
2. Then, image is segmented for the conversion into HIS color space format.
3. After that the features such as major axis, and minor axis are extracted from the image.
4. In last, classification of diseases are done by the help of these features.

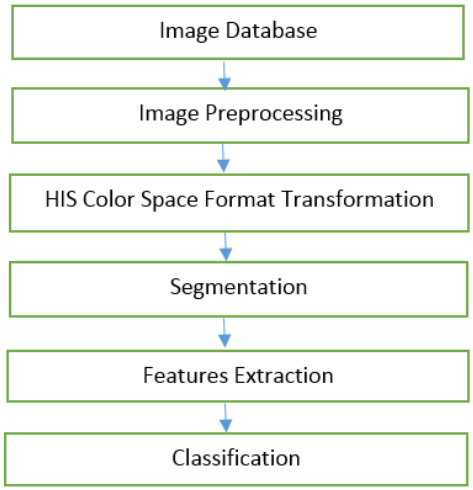

Figure 2 - Image Processing Technique

Application of Image Processing in Plants

1. The detection of disease in plant leaf, stem and fruits.
2. Estimation of the affected area by disease.
3. The edges of the affected areas are detected.
4. The color of affected area can also be determined.
5. The size and shape of the fruits can be determined.
6. Number of spots can also be estimated.

Review of Literature

Rewar *et al.* (2017) stated that image processing method is very useful in the field of agriculture. It detect the leaf diseases such as identifying the types of disease, finding the shape of affected area, detecting the edges of diseased leaf. They used a Weiner filter and adaptive histogram equalizer for the detection of infected and healthy part of the leaf. It gives a better results for the infected parts. This method can be used for the effective measures to solve the problems that can minimize the losses in agricultural production.

Varshney and Dalal (2016) proposed from their review study that different types of image processing techniques are used for the detection of plant diseases. The main feature of the technique should be speed and accuracy. Different techniques gives the different results on different database.

Tate and Kamlu (2017) concluded on the basis of their study that image processing technique can be used for the detection of plant diseases. In image processing, different types of segments are used for the identification of leaf diseases. In their paper, they used the application of image thresholding, K-means clustering and neural networks for the clustering and classification of plant leaf diseases. They concluded that neural network is best technique because of the less computing time with accurate results.

Renugambal and Senthilraja (2015) studied on the sugarcane plant diseases by the help of machine vision system. In which, digital image of sugarcane plants showed the symptoms of particular diseases. These disease segments are identified and segmented by the help of algorithm. GLCM feature used as a classifier because this feature gives the more information compared to others. They concluded that SVM system can be used to identify the plant diseases.

Landge *et al.* (2013) stated that the classification of diseases that affect the plants are formulated by the application of color transformation and neural networks (NNs). In this paper, they focused in developing algorithms like genetic algorithms and NNs by which the recognition rate and severity of detected diseases.

Megha S. *et al.* (2017) concluded from their paper by image processing system from FCM-Clustering technique that it is an efficient technique that give the result of plant disease with high accuracy. They used a SVM classifier which is based on the color, texture, and shape. FCM clustering technique is used to segment the diseased area. In the end, they stated that result can be obtained with less computational efforts and prevention method can also be detected for the diseases.

Raut and Ingole (2017) proposed from their review study that image processing is used for the detection of leaf disease and classification techniques. In this technique, different algorithms has been used for the accurate and less time consuming detection. The major advantage of this technique is that it can detect the disease of leaf at earlier stage. Artificial neural networks and classifier such as ANN, SVM are used in image processing.

Kamlapurkar (2016) concluded that the monitoring and management system are very popular for the detection of diseases. In some case, the detection and identification of disease is unknown to severe stage. So, to increase the accuracy and less time consumption, image processing technique is best.

Conclusion

Plant disease is a major problem due to which huge loss occur in the agriculture field. These diseases are caused by the pathogen as well as environmental effects. There is need to prevent the plant form

diseases. Before the prevention, the detection of disease is necessary. Hence, different types of techniques has been developed for the detection of disease such as DNA technique, immunoassay technique, image processing etc. This paper concluded from the review that image processing is a method that detect the diseases in plant with high accuracy in less time. This method can detect the disease in the early stage of disease.

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Effects of Abiotic and Biotic Stress on the Plant

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Abstract:

Environment affects the plants in the different forms of stresses due to which the growth and development of plants are affected. These stresses may be abiotic such as drought, heat stress, and soil salinity or biotic such as pathogen, bacteria and viruses. Some plants have the ability to fight with these stresses by their morphological, physiological and biochemical activities. But all plants do not control the stresses and affected by these stresses and died because of the changes the activities of plant like reduction in the photosynthesis pigments, reduction in the transportation of water to plant parts etc. This review study shows the response of plants toward the different types of stresses by their activities and new technologies (genetic engineering), use of nutrient in the production of plants that can reduce the stress form the plants.

Keywords: *Abiotic, Biotic, Stress, Nutrient, Genetic Engineering*

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Introduction

An altered physiological condition due to the alteration in an equilibrium is known as stress. Stress produces physical and chemical changes that is called as strain as when an established condition forces a system to leave its thermodynamic optimal state. Plant growth and other activities (Productivity) are affected by many stresses in nature by changes in their morphological, physiological, biochemical and molecular series. So, plant stress is divided into two category. Biotic and Abiotic Stress.

Biotic Stress

Numerous biotic stresses and adverse environmental conditions are faced by the plants in the term of their morphological, biochemical, and molecular mechanisms. Biotic stresses in plant are the damage which are occur due to living organisms such as pests, parasites, bacteria, fungi, nematodes, insects, viruses etc. These living organisms are responsible for the plant diseases. According to Wang et al (2013), biotic stress can cause a 28.2% yield loss of wheat, 37.4% loss of rice, 31.2% loss of maize, 40.3% loss of potatoes, 26.3% loss of soybeans and 28.8% loss of cotton. Fungi factor is a biotic stress factor that cause diseases the plant and crop more rather other factors. Besides fungi factor, other microorganisms can cause plant wilt, leaf spots, root rot and seed damage.

Abiotic Stress

Any environmental condition rather than the action of other organism that reduce the growth, survival and fruitfulness of plants is called as abiotic stress. There are different types of abiotic stress such as draught, high soil salinity, floods, extreme temperatures (too high or too low), reduced light level or excess of UV radiation, acidic or alkaline soils, soils poor in nutrients, etc. Most of the crops and plants are sensitive to abiotic stress. According to Wang et al (2013), Yield losses from abiotic stress were estimated at 65.8% for maize, 82.1% for wheat, and 69.3% for soybeans and 54.1% for potatoes.

Effect of Water Stress on Plant

When the water supply becomes limited to the roots or rate of transpiration become intense, plant is experienced by the water stress. Water deficit (drought and high soil salinity) is a prime cause of water stress as due to high soil salinity, flood, or low soil temperature, plants cannot uptakes the water that exist in the soil solution is known as physiological drought.

Firstly, the effect of water deficit are not understood at biochemical and molecular levels but its understanding is very crucial. Water stress is tolerated by all plants but its degree varies from species to species. In case of drought, due to dehydration, many plant are died. Water potential of plant cell and turgor is reduced in the plants due to water stress that elevate the solute's concentration in cytosol and extracellular matrices. The plant water relations is affected by the reduction of water content, turgor and total water due to drought. Stomatal closure, limits gaseous exchange, reduction in the transpiration and carbon assimilation (Photosynthesis) arrest rate are the seen due to the effect of drought.

Drought and Oxidative Condition in Plants

Oxidative stress also comes under abiotic stress due to high temperature, salinity, draught stress. It is a serious secondary effect on cells. The formation of reactive oxygen species (ROSs) like oxides, water and hydroxides are due to effect of oxidative stress due to which membranes and macromolecules of plant are damaged and affect the metabolism of cells.

An imbalance is created between light capture and its utilization due to effect of drought. This imbalance prevents the photosynthesis in leaves. Reactive Oxygen Species (ROSs) is generated by the degeneracy of excessive light energy in photosynthesis apparatus. ROS gives the result in the form of Denaturation of functional and structural macromolecules, DNA nicking, amino acids, protein and photosynthetic pigments oxidation, and lipid peroxidation. Then, against the ROS, some responses is activated by cells such as an increase in the expression of genes for antioxidant functions and production of stress proteins, up-regulation of anti-oxidants systems, including antioxidant enzymes and accumulation of compatible solutes.

Effect of Salt Stress on Plant

Nowadays, a world has a large population due to which the production of 70% more food crop is a major challenge. In this case, salinity is a major stress that limits the increment in the demand of food crops. Salt stress affects more than 20% cultivated land worldwide and the amount of the salt stress is increasing day by day. On the basis of adaptive evolution, plants are categorized into two parts:

Halophytes: Those plants that can withstand on the salt stress

Glycophytes: These are those plants that cannot be withstand on the salt stress and died.

In the world, the majority of glycophytes are high due to which salinity is the most dangerous environmental stress. Various physiological and metabolic processes are changed because of the salinity. These changes depend upon the severity and duration of the stress due

to which the crop production is inhibited. In the initial stage of salinity stress, water loss from the leaves, the decrement in the water absorption capacity of root systems are occurred due to osmotic stress. This osmotic stress disrupts the cell ions homeostasis through the inhibition of up taking essential elements such as potassium, calcium and nitrogen trioxide and high accumulation of sodium and chlorine. The accumulation of sodium, chlorine and boron in the tissue of transpiring leaves create a high ion toxicity. The high salt is accumulated in soil and plants is considered as hyperosmotic stress.

Salinity also affects the photosynthesis reaction as it decrease the carbon dioxide availability due to which the diffusion in the plants is limited by which the contents of photosynthesis pigments are reduced. Total photosynthetic capacity of the plant is decreased by the salinity by which the decrement in the leaf growth and limiting its ability to grow.

Combination of Different Stress

Different stress combination are arise due to the climate change and the impact of them on plants. Stresses are grouped into three categories that are based on the number of interacting factors: single, multiple individual and combined stresses.

Single Stress: Plant growth and development are affected by only one stress factor.

Multiple Individual Stress: The occurring of two or more stresses at different intervals and they do not overlap to each other.

Combined Stress: The occurrence of two or more stresses at same time and overlap to each other. For example, in summer, the co-occurrence of draught and heat stresses is a combined abiotic stress. It is most evident stress combination. While combined biotic stress is the attack of bacterial and fungal pathogen at a same interval.

Disease triangle is formed due to the impact of environmental factors on the plant diseases which has been made an important attention for the plant pathologist. The effect on plants due to different types of stress interactions depends upon the nature, severity and duration of the stresses. The interaction is not occurred only on the plant interface, also at and outside the plant interface in the abiotic- abiotic and abiotic-biotic stress interactions.

Role of Potassium and Silicon in the Reduction of Stress:

The deficiency of potassium in the plants has a more chances of the infection than the sufficient or adequate supply of potassium. For example; the great borer infestation on the rice due to no supply of potassium but it decrease as the concentration of potassium is increased. In some cases, potassium has an effective impact but sometimes, it gives no effect or even an adverse effect. Plants with the sufficient potassium have high molecular weight compounds such as proteins, starches and cellulose. on the another side, the concentration of low- molecular weight compounds such as soluble sugars organic acids, amino acids and amides are decreased. For the development of infections and insect infestations, low molecular weight compounds play an important role. Therefore, plants leaf are less vulnerable to disease and pest attacks in potassium sufficient plants.

The limits of potassium in the plants are due to the drought stress as both the rates of potassium diffusion in soil from roots and the root growth are restricted. Therefore, a close relationship is seen between the potassium nutritional status and plant drought stress. The potassium plays a role in physiological and molecular mechanisms of plant drought resistance.

Silicon is also a most abundant element in soil. Silicon occurs in the soil solution in the form of monosilicic acid at concentration 0.1 to 0.6 mM. After absorption, it accumulates on various tissues's epidermis as a polymer of hydrated amorphous silica. Silicon suppresses or destroys the insect pests and non-insect pest such as stem borer, brown plant hopper, rice green leafhopper, and white backed plant hoppera and leaf spider and mites. In culture solution, the increment in the concentration of silicon in cucumber that increase the buds, helps in reducing the powdery mildew disease. Physical stresses such as radiation (It injured plants), low and high temperature, wind, drought and waterlogging and so on can also be controlled by silicon.

Review of Literature

Cramer *et al.* (2011) observed the responses of plants against the abiotic stress. There are many factors such as physical. Morphological and molecular limitations that inhibit the plants to respond against the stress. The responses of plant to abiotic stress are dynamic and complex. The genes play a vital role in the improvement of stress tolerance of crops.

Lisar *et al.* (2012) discussed that drought (water deficit) is a severe due to the long effect of it on plants. Some plants are capable to develop their innate mechanism to fight with water stress but no all plants. However in the result, reduce photosynthesis.

The plant adopted the conservative water management scheme to help them to reduce the loss of water and

increase the availability of water uptake by considering the maxim utilization of physiologically available water.

Wang *et al.* (2013) concluded by the effect of biotic and abiotic stresses, the quantity and quality of the crop production is decreasing day by day. In the same way, intensive fertilization is necessary for the production of food as more demand. Therefore, the excess of nitrogen fertilization and deficiency in the potassium are the causes of reduction the crop quality and quantity. There is need of significant increase in the potassium fertilization because potassium is an essential plant nutrient.

Jaleel *et al.* (2014) proposed that ramified root system may be used in the drought tolerance. High biomass production also an important source as it extract more water from soil and transport to the leaves and other parts of plant for the photosynthesis reaction. Photosynthesis pigments class 'carotenoids' help in tolerating the drought by multiple roles such as light harvesting, protection from oxidative damage caused by drought. Hence, carotenoids are important pigment class for the stress tolerance.

Shrivastava and Kumar (2014) Stated that abiotic stress conditions give an adverse effect on the agriculture production. In this case, microorganism of plants play an important role in the decrement of abiotic stress. Genetic engineering and plant breeding is also important for the stress tolerance but it is long process and expensive while microbial phenomenon is more cost effective and environmental friendly for the tolerance of stress.

Gupta and Huang (2014) studied that complete profile of genes, proteins, and metabolites development are responsible for the different types of mechanisms of the salinity tolerance in different plant species. But there is lack of knowledge of genomic, transcriptomic, proteomic, and metabolomics studies. Therefore, in future study should be conducted on intercellular and intracellular molecular interaction with salinity stress response. In the development of salinity tolerant plants, genetic engineering has been proved as an efficient approach.

Pandey *et al.* (2017) Combination of different abiotic and biotic stresses and the interaction between them have an impact on plants either in positive way or in negative ways. Therefore, it is necessary to study the interaction of these stresses to understand the net impact of stresses on plants. The analysis of performance of superior or tolerant genotypes can done in better way by the understanding of plant response against the combined drought and pathogen stress. Hence, the development of combined stress tolerant crop with well performance can be lead by the integrative efforts from crop modeling experts, agronomists, field pathologists, breeders, physiologists, and molecular biologists.

Machado and Serralheiro (2017) proposed that salt stress tolerance can be done by the fertilization and irrigation management strategies. Fertilization increases the nutrient (Silicon, humic acid) use efficiency by which salt tolerance of vegetable crops can be enhanced. Biofertilizers are another sources that can be used to reduce the soil salinization and increase the salt tolerance of vegetable crops.

Conclusion

Stress either biotic or abiotic are the major factors that affect the plant growth and development. This review study shows that drought and salt stresses change the plant activity as oxidative stress produce by the drought condition disturbs the photosynthesis reaction by capturing more light. The salt stress inhibits the transportation of water to the all part of plants due to which the essential nutrient are unable to reach to plant parts. Some researcher worked on the plant physiology and stated that the plants also response against the stresses. Potassium and Silicon are the essential nutrients that can be used in reducing the plant stress. Before dealing with the plant stress, there is a need to understand types of effect of abiotic and biotic stresses because stresses and the capability of controlling these stresses vary from species to species of plants.

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Medicinal and Aromatic Plants Biodiversity in India and Their Future Prospects

R. K. Mishra[1]

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Abstract:

India has different environmental conditions, covering an extensive area rich in medicinal and aromatic plants. It is defined as the region of high plant diversity and endemism by its geographical position, its geomorphology, the presence of flora of past geological eras and the coexistence and interplay of biotic and non biotic factors. Humans have found that diarrhoea can be cured by the plant which is astringent in taste, vomiting can be controlled by the plant which is acidic in taste, and the aromatic plant can arrest nausea. Medicinal and aromatic plants have qualitativr and quantitative advantages therefore plays a vital role in country's development. This review discuss about the current state of Medicinal and Aromatic Plant cultivation in India. There are some medicinal plants and aromatic plants with their commercial uses are also discussed in this review.

Keywords: *Medicinal Plants, Aromatic Plants, Plant Biodiversity*

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Introduction

Awareness of the important role of culture and All over the world, herbaceous plants are used as an essential and significant components for the dsily life and culture. These plants are more significant in the field of pharmaceuticals, cosmetics, cooking and as an antioxidants in food technology. In Greek, these plants can be best cultivated as the flora of Greek is rich in herbaceous plants and the climate and soil condition of Greek enhances the possible cultivation of the medicinal plants or herbaceous plants. In developing countries, the use of medicinal plants sterted for thousands of years. According to the World Health Organization (WHO), the traditional healthcare systems are being used for primary healthcare by the 70-80% of the population of Africa, India and other developing countries. These plants would be soon valuable for the early huamns because of their unique chemical profiles which provides cure and flavors.

Distribution of Medicinal and Aromatic Plants

According to the analytical study of distribution of medicinal and aromatic plants in natural habitat, it has been found that there is about 70% of India's medicinal and aromatic plants are found in tropical forests of Western and Eastern ghats, the Vindhyas, Chotta Nagpur plateau, Aravalis and the Himalayas. It has been also found that most of the known medicinal and aromatic plants are found in dry and moist deciduous area other than the evergreen and temperate area.

Medicinal, Aromatic Plants and their Uses

The biochemical products produced by the green plants synthesis are extractable which can be used as chemical fees stock or as a raw material for the purpose of scientific investigation. Thre are many secondry metabolites of the plants which can be commercially used in variety of pharmaceuticals compounds. Plants which are useful In Ayurveda, provides biologically active molecules for the development of modified derevatives with enhanced activity and reduced toxicity. About 120 therapeutic drugs are yielded by the flowering plants which includes Andrographoloide, Sennosides, Ajmalicin, Resperine, Withonoids, Asiacoside, Bacosides, Vinblastine, Vincristine, Taxol, Podophyllotoxin, Camptothecin, Digitoxigenin, Gitoxigenin, Digoxigenin, Tubocurarine, Morphine, Codeine, Aspirin, Atropine, Pilocarpine, Capscicine, Allicin, Curcumin, Artimesinin and Ephedrine. There are few important medicinal and aromatic plants are listed below in table.

Table 1: Medicinal and Aromatic Plants

BOTANICAL NAME	FAMILY	USES
Abelmoschus moschatus	Malvaceae	Eye disorders, Vomiting, Carminative, Gastric
Adhatoda vesica	Acanthaceae	Cough, cold, bleeding, menstrual problems
Andrographis paniculata	Scanthaceae	Fevers, jaundice, diabetes
Asparagus racemosus	Liliaceae	Strength, acidity and liver complaints, Diabetes
Bacopa monnieri	Plantaginaceae	Mental clarity and longevity, Ulcers, tumors, asthma
Cassia angustifolia	Fabaceae	Laxative, Indigestion, jaundice, Anaemia
Centella asiatica	Apiaceae	Memory enhancer, Neurosis, Physical strength
Costus speciosus	Costaceae	Fever, cough, Diabetes, Digestive, Stimulant
Clitoria ternatea	Fabaceae	Diuretic, Ulcer, Visceralgia

Commiphora mukul	Burseraceae	Arthritis, Gout, Fever, Facial paralysis
Cymbopogon flexuosus	Poaceae	Skin Disorders & Perfumes
Cymbopogon martini	Poaceae	Cardio tonic, leprosy & perfumes
Cymbopogon winterianus	Poaceae	Antiseptic, Bactericidal, Mosquito repellent
Eclipta alba	Asteraceae	Hair, skin, Intestinal worms
Ocimum bacilicum	Lamiaceae	Perfumery, Cosmetic industries
Ocimum sanctum	Lamiaceae	Fever, Cold, cough and skin diseases
Ocimum gratissimum	Lamiaceae	Skin diseases, bakery, Icecream
Plectranthus amboinicus	Lamiaceae	Coughs, sore throats and nasal congestion
Plumbago zeylanica	Plumbaginaceae	Anaemia, Fever, Skin diseases
Tinospora cardifolia	Menispermaceae	Jaundice, Fever, Diabetes, Respiratory disorders
Vetiveria zizanioides	Poaceae	Vetiver root is cooling, Stimulant and tonic
Vitex negundo	Lamiaceae	Ulcer, Eye & ear diseases, Pain
Withania somnifera	Solanaceae	Immunity, Skin diseases, Depression, Strength

Esssential Oils

An odorous, volatile, hydrophobic and highly concentrated compounds owned by the aromatic plants is called essential oils. Essential oils are usually derived from one or more plant parts such as flowers (rose, jasmine, carnation, clove, mimosa, rosemary, lavander), leaves (mint, Oscimum sps., lemongrass, jamrosa), leaves and stems (geranium, patchouli, petitgrain, verbena, cinnamon), bark (cinnamon, cassia, canella), wood (cedar, sandal, pine), root (angelica, sassafras, vetiver, saussaurea, valerian), rhizomes (ginger, calamus, curcuma, orris) and gums or oleoresin exudations (balsam of Peru, balsam of Tolu, storax, myrrh, benzoin). It can be obtained through the distillation process of aromatic plant materials and the volatile isolates can be obtained by the solvent extraction and can be used in various varieties of consumer goods like detergents, soaps, toilet products, cosmetics, pharmaceuticals, perfumes, confectionery food products, soft drinks, distilled alcoholic beverages and insecticides etc.

Importance of Medicinal and Aromatic Plants and Sustainable Agriculture in India

There is approximately one billion population of the India which is a land of various climatic, ethnic, cultural and linguistic zones. India is rich and well aware of the conservation and economical use of natural resources of medicinal plants in this growing national and international markets. Medicinal plants are much beneficial for the socio cultural, health care and spiritual ground of the rural people of India. The collection of the medicinal and aromatic plants can be easily done from the forest or uncultivated wild sources, but a number of species are becoming endangered or threatened due to the increased abiotic and biotic pressures on natural habitat.

Future Prospects

- Medicinal plants plays a vital role in therapeutic uses than the advanced chemical technologies because product obtained by the synthesis may be toxic or may have different therapeutic effect than the found in nature.

- Drugs obtain from the medicinal plants are the cheapest than that of the synthetic drugs. For example, the reserpine drug costs approximately Rs. 1.25/g whereas it costs only RS. 0.75/g as per the extraction from the medicinal plants.
- The demand of the phytopharmaceutical raw medicinal herbs and vegetable drugs of Indian origin from western nations is increasing along with the increase in domestic demands for raw materials which are used for perfumeries, pharmacies and biopesticidal untis. Because of the harmful effects of synthetic chemical drugs and due to the expansion of pharmacies manufacturing natural drug formulations, the demand for the traditional herbal drugs also rapidly increasing day by day.
- India is rich in cheap labor and skilled manpower which adopts technological changes very fast.

Review of Literature

Rao, Palada and Becker, (2004) studied about the medicinal and aromatic plants in agroforestry systems, and said the medicinal and aromatic plants as very significant plants. It is suggested that the most useful species therefore require research attention of topics ranging from propagation methods to harvesting and processing techniques, and germplasm collection.

Sultan, Wani and Nawchoo, (2013) presented an overview of on the current status of pharmacognosy and its place in the future of man and said that the conservation of gemplasm is one of the most important and urgent tasks facing plant scientsts today and said the need is greatest in North West Himalaya.

Phondani *et al.*, (2015) discussed about the development of a participatory approaches to promote the cultivation of medicinal and aromatic plants in Champawat district of Uttarakhand in India. They analyze the people perception and revealed that farmers were dependent solely on wild collection MAPs before the initiation of the National Agriculture Innovation project.

Das, Jain and Malhotra, (2016) discussed on the review study on impact of climate change on medicinal and aromatic plants and said that the current evidence suggested that the phenopmenon are having an impact on medicinal and aromatic plants and there are some potential threats worthy of concern and discussion.

Solomou *et al.*, (2016) elaborated a review study on medicinal and aromatic plants diversity in Greece and their future prospects and aimed to profile the current state of medicinal and aromatic plants cultivation in Greece along with the future prospects. His review showed that the valuable uses are possible and medicinal and aromatic plants diversity represents attainable new environmentally and economically sustainable opportunities for agricultural areas.

Joshi, Satyal and Setzer, (2016) worked on Himalayan aromatic medicinal plants: A review on their ethnopharmacology, volatile phytochemistry and biological activities. This treview represents a summary of aromatic medicinal plants from the Indian Himalaya, Nepal, and Bhutan focusing on plant species for which volatile compositions and summarized 116 aromatic plant species distributed over 26 families.

Conclusion

Most of the population of a developing countries depends on the traditional medicines mostly on plant drugs fro their therapeutic uses. These herbal drugs and Indian medicinal plants have the rich source of beficial compounds which includes antioxidants and components used in functional foods, aromatic crops used in perfumery and cosmetic industry which gives livelihood and employment to many people. There is a need of all manufacturers in India to be set up world standard laboratory in quality control, R&D facility with the help of State and Central Governments which would facilitate and help exporters to maintain quality assurance of drug exported from India. There is also need to study the conservation status of all species in trade.

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Proteomics Technologies and its Application for Crop Improvement

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Abstract:

The study of protiens and their interactions in a cell is called proteomics. Proteomics is a useful tool and important in shifting from genomics to the protein compliment of the human organism within the wide field of functional OMICS. It is expected from proteomics to produce better disease markers for diagnosis and therapy monitoring because of the proteome reflects more precisely on the dynamic state of cell, tissue, or organism. The present review study is on the technologies of proteomics and their technologies and their applications for crop improvement. New opportunities and challenges for those seeking to gain greater understanding of disease is created by the advent of proteomics technologies for global detection and quantitation of proteins. Mass spectroscopy has become an indispensable tool for molecular and cellular biology and plays a vital role in proteomics.

Keywords: *Bioinformatics, Mass Spectroscopy, Proteomics.*

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Introduction

In the area of therapeutics, the rapid momentum gaind at the turn of the century by the proteomics which is the recent member of the omics family. Proteomics have the large scale of study of protiens especially the composition, structures, functions and interactionsof the protiens which directs the activity of the cell. Due to the frequent change in the protein expression profile, micro and macro environmental conditions, Proteomics is more complex than genomics (Holman et al., 2013). It is expected to yield more direct understanding of function and regulation than analysis of genes by the global scale analysis of plant protiens. It is necessary to identify the genes and protiens that controls crop architecture or stress resistance to facilitate the biological improvement of crop productivity. Therefore the main aim of this review is proteomics technologies and its application for crop improvements.

Types of Proteomics

Proteomics are classified into different groups as follows which are based on the responses of proteins under stress conditions

1. Expression Proteomics

The qualitative and quantitative expression of total proteins are studied by the expression proteomics under two different conditions. The expressional changes which are present and absent in tumour tissue as compare to normal tissue is observed by the 1-D gel electrophoresis, mass spectrometry techniques.

2. Structural Proteomics

The three dimensional shape and structural complexities of functional protiens is studied by the structural proteomics which can give the details about the structure and function of protein complexes present in a specific cellular organelle. For the determination of Structure, different technologies such as X-Ray crystallography and NMR spectroscopy can be used.

3. Functional Proteomics

Protien functions and unrevealing molecular mechanisms within the cell that depends on the identification of the interacting protein partners are explained by the functional protiens.

Proteomics Technologies

It is very difficult to completely characterize the proteome and the degree of success achieved which is depends on the available methods and their flexibilithy to automation and high amount formats. The parameters which can be used are complexity of the protein mixture, levels of expression and medication and intracellular localization all impact the choice of proteomics technology. Both analytical and bioinformatics tools are used for the characterization of protein structure and functions.

1. Two-Dimensional Polyacrylamide Gel Electrophoresis (2D-PAGE)

For the separation of protiens from a mixture, 2D-PAGE is used which provides the information such as molecular weight, isoelectric point, presence or absence of protiens in a sample. 2D-PAGE of high resolution can resolve upto 10,000 protiens spots per gel and the stains used for the visualization of protiens are Coomassie blue, silver, SYPRO Ruby and Deep Purple. Isoelectric point separate the common protiens in the horizontal direction and in vertical direction by the size and this map of protein spots is called as the protein fingerprint of that particular sample.

2. Mass Spectrometry for Protein Characterization

Application of the mass spectrometry in the field of proteomics research is the new and rapidly growing development which is now being used for the high amount characterization and identification of protiens in addition with the development of comprehensive protein databases and advances in computational methods. Mass spectrometry is the analytical technique which produces spectra of the atomic mass or molecular mass and this spectra is then used to determine the elemental or isotopic signature of the sample.

3. MALDI-TOF-MS

Ionization of peptides of the protiens is done by the MALDI which has its own energy source the laser pulse. Time of flight (TOF) have been developed for use in mass spectrometers and is common because of the ease to operate. TOFs are commonly used coupled with the MALDI ion source and quadrupole analyzers are used coupled with ESI source. For the determination of precised protein molecular weight, MALDI-TOF nstrument is used.

4. Electro Spray Ionization

In ESI mass spectrometry, a potential is applied to create a fine spray of charged droplets that are dried and introduced into the mass analyzer.

5. Chromatographic Techniques

Closely related components of mixtures are separated by the different group of methods of

chromatography. It is the technique of separating two components distributed between two phase (mobile and stationary). Due to the capability of analyzing large, fragile bio molecules, Chromatography is very applicable in proteomics research.

6. Protein Microarrays

A small amount of crude sample is needed for the protein biochip or protein microarrays. Through this techniques, thousands of proteins can be analyzed and enables screening for specific types of post transitional modification.

Proteomics Techniques Offer New Tools for Plant Biotechnology

The critical role played by the knowledge of key proteins in the proper growth and development of the plant which are critical to drive the biotechnological improvement of crop plants. The cellular homeostasis are maintained by these proteins under the given environment by controlling physiological and biochemical pathways. Genomics and proteomics are the two major wheels that keep the discovery of novel genes rolling, it is revealed by the published research literature which can be placed into the pipelines for the crop improvement programs. Crop proteomics become an essential part of the integrated omics approaches.

1. Two-Dimensional Maps of Different Plant Tissues

Several articles have been published by the Jacoby *et al*. (2013) in which proteomes of different plant tissues from rice and Arabidopsis is discussed and mapped. There are many plant proteomics studies have been published focusing on the specific sub cellular proteomes or protein complexes including plasma membrane, roots, mitochondria and chloroplasts.

Organ Specific Proteome Analysis of a Biotic Stress Response in Crop Plants

1. Proteomics of Leaf Photosynthesis and Senescence to Understand Crop Productivity

2. Xylem and Phloem Proteomics of Root-to-Leaf Signalling Pathways during Stress

3. Root Proteomics of Symbiotic Systems to Improve Legume Productivity

4. Progress in Crop Proteomics for Stress Responses

5. Post-translational modification

6. Analyses of Food Quality, Safety and Nutritional Values

Review of Literature

Lilley and Dupree, (2006) worked on methods of quantitative proteomics and their applications to plant organelle characterization and concluded that 2D-difference gel electrophoresis as well as differential isotope tagging strategies coupled to non gel based LC-MS are proving useful in this area of research.

Chandrasekhar *et al.*, (2014) studied on a review of proteomics and its applications and focused on different types of techniques for analyzing the expressed proteins, also concentrated on applicative perspective of proteomics in the fields of biomedical, agriculture and food finally concluded that applications for proteomics are relevant to all of the biological process.

Katam, Jones and Sakata, (2015) studied on advances in proteomics and bioinformatics in agriculture research and crop improvement. The advances in proteomics in recent years includes protein isolation methods, mass spectrometry, protein- protein interactions and post translational modification and concluded that advances in protein interactions and bioinformatics will have an increasing impact on better understanding the various functional aspects in plants.

Aslam *et al.*, (2016) worked on the technologies of proteomics and their applications, and said that although all fields related to biological science have been benefited with increasing use of proteomics techniques still further work is required in the improvement of the producibility and performance of well known proteomics tools.

Ahmad *et al.*, (2016) discussed the role of proteomics in crop stress tolerance and also different types of abiotic stresses and their effects on plants particularly with stress induced expressions of proteins and concluded that proteomics have gained attention due to the ease in handling the proteomic analysis tools and accuracy of the results.

Komatsu and Hossain, (2017) discussed on plant proteomic research and this includes four reviews and 13 original articles on environmental proteomic studies. Six articles highlight iTRAQ based proteomic approaches among the 13 original articles

Conclusion

The changes of protein which are induced by various conditions are investigated by the proteomics which

is the powerful and useful tool. It is expected to yield more direct understanding of function and regulation than analysis of genes by the global scale analysis of plant protiens. The explanation related to the compound relationship that exists between stress tolerance and crop productivity has contributed to various proteomic studies. The existence of this relationship enables to generate the strategies of development of novel breeding that results in productivity of crop and environmental performance. From this review it is concluded that all the biological process are relevant to the applications of proteomics and provides an effective way to utilize the expressed protein data.

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Role of Phytochemicals in the Prevention of Diseases

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Abstract:

Plant materials have medicinal effects due to the combination of secondary products present in plants, known as phytochemicals. Phytochemicals are chemical compounds that are biologically active in nature found in the fruits, vegetables and grains. These compounds are not essential for body but they play a role in promoting the health and preventing from diseases. Flavonoids, Alkaloids, Sterols, Terpenoids, Phenolic acids, Stilbenes, Lignans, Tannins and Saponins are some phytochemicals. These phytochemical compounds also have the properties of antioxidant and anti-inflammatory activity as the excessive production of oxidant in the organism develops the chronic diseases such as cardiovascular disease (CVD), different types of cancer etc. These antioxidant compounds depress the level of oxidative stress of organisms. This review present different sources of phytochemicals that play a beneficial role in the prevention and treatment of the diseases. By their bioactive properties, it suppress and treat the different types of diseases.

Keywords: *Phytochemical, Antioxidant, Diseases.*

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Introduction

Longevity, youthfulness and health are the desires of every human. In living organism, the level of functional or metabolic efficiency comes under the health. Every individual has the ability to face physical, mental and social challenges. According to World Health Organization (WHO) health is defined as 'a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (Venkatalakshmi, Vadivel, and Brindha, 2016).

For manufacturing the drugs and perfumery products, medicinal and aromatic plants are the vital source. Their raw materials are used for the manufacture. The natural medicine that are derived from these plants are safer than the synthetic alternatives used as therapeutic benefits and more affordable treatment.

Medicinal plants play a vital role in healing and curing of human disease because of the biochemical constitutes, known as phytochemicals or phyto constitutes. Phyto chemical constitutes are found in leaves, vegetables, roots of the medicinal plants that work the nutrients and fibers and form an integrated part of security system against numerous diseases and strain condition.

Phytochemicals have mainly two groups according to their function in plant metabolism.

- **Primary Constitutes:** It contains common sugars, amino acid, protein and chlorophyll etc.
- **Secondary Constitutes:** It contains alkaloids, terpenoid, steroids and flavonoids etc. In which terpenoid have numerous phytochemicals activities such as anti-inflammatory, anti-cancer, anti-malarial, inhibition of cholesterol synthesis, anti-viral and anti-bacterial activities (Thilagavathi *et al.,* 2015).

Screening of Phytochemicals

For synthetic drugs, medicinal plants have many bio resources of drugs, modern medicine, pharmaceutical intermediates and chemical entities. So, there is necessary to extract these sources from the plants by the extraction methods. Extraction is generally a separation of bio resources which are medicinally active form the plants tissues using particular solvents by standard methods. The main purpose of standard method is to attain the therapeutically desired portions with the removal of unwanted materials using a selective solvent called menstrum. After the extraction, the obtained extract is used as tincture, or fluid extract or in the form of tablet or capsules which contain a mixture of various medicinal plant constituents like alkaloids, glycosides, terpenoids, flavonoids and lignans. There are many technique for the extraction of medicinal plant extract: maceration, infusion, percolation, digestion, decoction, hot continuous extraction (Soxhlet) aqueous-alcoholic extraction by fermentation, countercurrent extraction, microwave-assisted extraction etc.

The production of compounds with specific activities to treat various health ailments and chronic disease can be estimated by the correlation between plant's phytochemicals and plant's bioactivity. To know the significant values of any medicinal plant, there is need of the screening of phytochemical in plant. Screening, a valuable step in the detection of bioactive principles in the medicinal plants. A standard method is followed to screen the phytochemicals for the detection of tannins, flavonoids, phenolics, saponins, steroids, cardiac glycosides and alkaloids presence. In screening, different types of tests are performed to know the presence of these compounds such as Gelatin Test for Tannins, Ferric Chloride Test for Phenol etc.

Sources of Phytochemicals

Many global health problems like chronic diseases (cardiovascular diseases, diabetes, and cancers) that cause death and disability to millions of people. Against the development of these chronic diseases, many fruit, vegetables and grains give a protective effect attributed to the phytochemical in them. More than 10,000 phytochemicals have been identified in which tannins, flavones, triterpenoids, steroids, saponins, and alkaloids are some phytochemicals. Phytochemicals work on the basis of their antioxidant activity. There are two kinds of antioxidant phytochemicals: Polyphenols and Carotenoids.

Polyphenols: In phytochemicals extract of different fruits, total phenolic content has a direct relationship with total antioxidant activity as when fruits have stronger antioxidant activity with a high phenolic contents.

Carotenoids: A group of phytochemicals, responsible for the colors of food. The main carotenoids in diet and human body are alpha-carotene, Beta-carotene, Lycopene, lutein and cryptoxanthin. In human diet, fruits and vegetables are the major sources of carotenoids.

Prevention of Antioxidant Phytochemicals form several Chronic Diseases

Human body may be imbalanced and lead to oxidative damage to large biomolecules such as lipid, DNA and proteins due to excessive production of oxidants. From these damage, several human diseases such as

cardiovascular disease, certain types of cancers and aging occur. In this case, antioxidant phytochemicals play a vital role in prevention in both cases: in vivo and in vitro. Antioxidant activities may be due to the additive and synergistic effects of phytochemicals in fruits and vegetables. High content of antioxidant phytochemicals fruits and vegetable consumption increase the antioxidant capacity of serum and plasma.

Many antioxidant phytochemicals have anti-inflammatory action that cure the chronic inflammation. The mechanism: inhibition of prostaglandin production and nuclear factor-ķB activity, enzyme inhibition as well as increase the cytokine production can reduce the inflammation. There are some phytochemicals such as resveratrol, anthocyanins and curcumin, help in reducing the inflammation. Generally, Antioxidant phytochemicals have different activities such as free radical scavenging abilities as well as anti-inflammatory action that helps in the other bioactivities and health benefits.

Beneficial roles of phytochemicals: low toxicity, low Cost, easy availability and biological and antineoplastic properties. These biological properties includes antioxidant activities, antimicrobial effects, modulation of detoxification enzymes, stimulation of the immune system, decrease of platelet aggregation and modulation of hormone metabolism. Phytochemicals are not so important for the life but play an important in fighting some disease by their properties.

Review of Literature

Prakash, Gupta and Sharma (2012) proposed the medicinal plant have a long history because of the use of their phytochemical constituents that prevent human from many diseases. The proper choice of food ingredients can make human healthy. The exciting opportunity is hold by the plant extracts in future.

Wadood *et al.* (2013) Studied on the ten medicinal plants and concluded that these medicinal plant play a vital role in preventing diseases. Different types of activities ntidiuretic, anti-inflammatory, antianalgesic, anticancer, anti-viral, anti-malarial, anti-bacterial and anti-fungal activities are seen in these plant due to the presence of secondary metabolites alkaloids, flavonoids, terpenoids, phlobatannins and reducing sugars. The analysis in previous years and in recent time have a same result due to the presence of phytochemical constituents.

According to Belobrajdic and Bird (2013) a limited benefit of cereal's phytochemical component is seen in preventing oxidative stress and in the development of T2D. Also discussed that a direct role of phytochemicals in improving the health would be in the whole food and diets.

Kumar *et al.* (2013) screened the plant Holoptelea integrifolia and Celestrus emarginata. They used only the leaf extract and stated that secondary metabolites of phytochemicals can be used in pharmaceutical industries in the form of drugs that will react against the pediculosis and help in increasing male sex vigour.

Raina *et al.* (2014) studied about the anticancer activity of phytochemicals on in vitro and concluded that the mechanism of phytochemicals contribute to their anticancer nature as kill the dividing cancer cells. Antitumor ability was also observed that inhibit the abnormally expressed growth factors. The medicinal plants help in the treatment of cancer and tumors.

Zhang *et al.* (2015) proposed that chronic diseases are treated by the antioxidant phytochemicals. These phytochemicals have many biological activities and health benefits i.e., antioxidant and free radical scavenging abilities, anti-inflammatory action, anticancer, anti-aging etc. Fruits, vegetables, grains and medicinal plants are sources of the antioxidant phytochemicals. They also discussed that more antioxidant phytochemicals should be separated and identified in food and medicinal plants. The adverse effects of the phytochemicals should be noticed in human beings.

Thilagavathi *et al.* (2015) analyzed or screened the five medicinal plant and concluded that these medicinal plants have high therapeutic value in pharmaceutical field. These plants have different biologically active constituents and secondary products. They also stated that these secondary product are very valuable and should be analyzed and evaluated in future for more benefits.

Nyamai DW *et al.* (2016) studied that 80% world population relies on medicinal plants for their health. These plants are easily available, cheap and do not have adverse effect. Hence, the development of new drugs entities are possible by these phytochemicals.

Venkatalakshmi, Vadivel and Brindha (2016) concluded that the antioxidants phytochemicals have a relationship with immunomodulation in animal and human beings. Significant antioxidant activities of many indigenous plants help in the immunomodulation by targeting oxidative stress or boosting the endogenous levels of antioxidants for the management of diseases and developed the immunity.

Shoghil *et al.* (2017) concluded that the phytochemicals play an important role in preventing chronic diseases like cancer, diabetes, coronary heart

disease etc. the sources of phytochemical in India are cereals, pulses, oils and spices. Indian food and diet have more scope for these phytochemicals in protecting against chronic diseases.

Meybodi *et al.* (2017) stated that carcinogenesis process is complex and heterogenous. In this case phytochemicals in fruits and vegetables would be effective that help in preventing form cancer. Different group of phytochemicals that are used in chemoprevention are as phenolics, carotenoid, alkaloids, organosulfur, and nitrogen containing compounds. By different mechanism, they make possible in stopping or postpone or reserve the carcinogensis activity in the body.

Conclusion

Phytochemicals present in the plants are natural chemical compound that have different bioactive action in prevention and treatment of diseases. The different sources like fruits, vegetables, grains as well as the dietry product also have these phytochemicals. This review study shows the importance of phytochemicals because they have a different activities as anticancer, antitumor, anti-inflammatory etc. due to the presence of secondary products such as alkaloids, flavonoids, terpenoids. Ant carcinogenic agents are also made from these products for the treatment of cancer. The proper food can prevent from the chronic diseases such as cardiovascular disease, cancer, tumor etc. The secondary products have more scope due to their bioactive actions. With the benefits of phytochemicals, there is need to detect any side effects of them.

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