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DETERMINATION OF ANTIOXIDANT ACTIVITY OF FLOWERS OF CASSIA GLAUCA

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Introduction

The free radicals that are produced during the normal metabolic activities in our body are responsible for some of the major diseases such as heart diseases, gout, diabetes and most recently cancer. Various studies have also shown that free radicals are also responsible for cellular necrosis[1]. Therefore reduction of these free radicals in our body is very important. Nature provides us the solution as it is an excellent store house of remedies. Natural antioxidants present in plants have the potential to scavenge free radicals present in our body[2]. An antioxidant is a molecule capable of slowing or preventing the oxidation of other molecules. Some of the common free radicals include reactive oxygen free radical species, reactive hydroxyl free radicals, the superoxide anion radical, hydrogen peroxide and peroxyl which generates metabolic products that attack lipids in the cell membranes or DNA[3].

Various synthetic antioxidants are also available like BHT (butylated hydroxy toluene), BHA (butylated hydroxy anisole) and tertiary butylated hydroquinones but these are suspected to cause various adverse side effects in body. Hence strong restrictions have been placed on their application and there is a trend to substitute them with naturally occurring antioxidants. Several studies have revealed that phenols mainly type of flavanoids, from some medicinal plants are safe and bioactive, and have antioxidant properties and exert anticarcinogenic, antimutagenic, antibacterial and anti inflammatory effects. Therefore in current years attention have been focused on such plants with antioxidant ability that may be used for human health[4].

India has rich wealth of medicinal plants and most of people still rely on traditional medicines for the treatment of common illness. *Cassia glauca* flowers are traditionally claimed for treatment of diabetes. This plant is also a good pollution tolerant and reduces chemical pollutants from the atmosphere[5].

Thus in the present research paper study was undertaken to determine the in vitro antioxidant activity of methanolic extract of flowers of *Cassia glauca* by DPPH method, reducing power method and nitrogen oxide scavenging method.

Material and Methods

The flowers of *Cassia glauca* was collected from the local area. The flowers of *Cassia glauca* was dried crushed and was mixed into 500 ml of methanol extract was prepared using steam distillation method.

Determination of Antioxidant Activity

The antioxidant activity was evaluated by the following methods.

Free radical scavenging activity (DPPH* method):

The hydrogen atom or electron donating ability of the compounds and standard - BHT was determined from bleaching of purple colored methanol solution of DPPH*. This spectrophotometric assay uses the stable radical DPPH* as a reagent. The diluted working solutions of essential oils of both plants were prepared in methanol (0.062, 0.25, 0.5, 1 and 2 mg/ml).

Different concentrations of methanloic and aqueous stock solutions of beetroot were taken in each test tube and volume was made up to 2ml. Then 2ml of DPPH* solution was added in each test tube and these solutions were kept in dark for thirty minutes. DPPH* was prepared at a concentration of 0.002%. The same procedure was followed for BHT as well. All the samples were tested in triplicate. Later optical density was recorded at 517nm using UV- visible spectrophotometer. Methanol with DPPH* was used as a

control. The method was same as used by Kahalaf et al.,[6] with slight modifications. The formula used for the calculation is

% inhibition of DPPH* activity= (A - B / A) X 100

Where A= optical density

B = optical density of sample.

Reducing Power Assay

The reducing antioxidant activity of the beetroot has been analysed by the method given by Huda Fajan et al.[7] with slight alterations. In this method different concentrations of methanloic stock solutions of both essential oils (0.062, 0.25, 0.5, 1 and 2 mg/ml) were taken in different test tubes and volume of all the working solution is made upto 1 ml by adding distilled water, in these added 2.5ml of phophate buffer (0.2M, pH - 6.6) and 2.5ml of potassium ferricyanide (1%). The mixture was incubated for 20 min at 50 degrees. Then 2.5 ml trichloroacetic acid (TCA, 10%) was added to each mixture and these were centrifuged for 10 min at 3000 rpm. Then 2.5 ml of the upper layer was mixed with distilled water (2.5ml) and 0.5 ml ferric chloride (0.1%). Then absorbance was recorded at 700nm against a blank using UV - Visible spectrophotometer. The same procedure was repeated with BHT used as standard and sample without plant extract was used as control. Increased absorbance of reaction mixture indicates increase in reducing power.

Nitrogen Oxide scavenging method

Nitric oxide was generated from sodium nitroprusside (SNP) and was measured by Griess reagent. SNP in aqueous solution at physiological pH spontaneously generates NO, which interact with oxygen to produce nitrite ion that can be estimated by use of Griess reagent, Sodium nitroprusside (5mM) in phosphate buffer saline (PBS) was mixed with different concentrations (0.062, 0.25, 0.5, 1 and 2 mg/ml) respectively and volume was made upto 3 ml. The solution was kept at 25 degrees for 180 min. Then the samples from the above were reacted with Griess reagent (a solution of 1% sulphanilic acid in 2% phophoric acid and 0.1% napthylamine in distilled water). The absorbance of the chromophore produced by diazotization of nitrite ion with sulphanilic acid and subsequent coupling with napthylamine was recorded at 546 nm. BHT and gallic acid were used as standards. The method used has been taken from Rumi Ghosh et al[8].

Nitric oxide scavenged (%) = (A -B / A) X 100

Where A- Optical density of control;

B- Optical density of sample.

Result and Discussion

Antioxidant activity of methanolic extract of flowers of *Cassia glauca* was evaluated by DPPH* assay.

Figure 1 shows that percentage inhibition of methanloic extract of flowers of *Cassia glauca* is in increasing order with the increase in concentration more precisely 30.4 %, 48.2 %, 60.4 %, 74.4 %, 85 %. Similar concentration standard BHT exhibited percent inhibition of 29.1%, 40 %, 55.6 %, 68.2% and 76.1% respectively. IC_{50} value was found to be 50µg/ml.

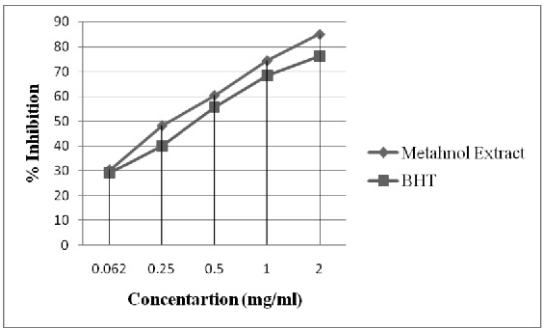

Fig.1: Antioxidant potential of methanolic extract of flowers of *Cassia glauca*

Reducing power characteristic of any compound serves as a significant indicator of its potential as an antioxidant and is a supporting feature for its antioxidant activity. Reducing power was found to be significant and the values were found to be (Figure 2) 0.988, 1.0, 1.150, 1.223, 1.350 for methanol extract.

The results were found to be better as compared with the standards BHT (0.890, 0.900, 0.903, 0.925 and 0.975) respectively.

The activities were statistically significant (Figure 2) when compared with control.

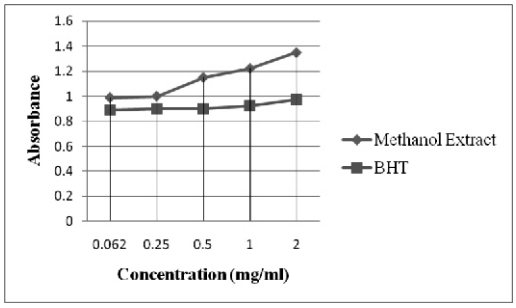

Fig. 2: Reducing power ability of methanolic extract of flowers of *Cassia glauca*

Nitric oxide radical generated from nitroprusside at physiological pH was found to be inhibited by the methanolic extract of flowers of *Cassia glauca* as shown in Figure 3. The inhibition percentage was found to be 25.5%, 38%, 43.7%, 50%, and 56% respectively. Similar concentration standard BHT exhibited percent inhibition of 20.1%, 29 %, 35.5 %, 40% and 47% respectively. IC_{50} value was found to be 50µg/ml.

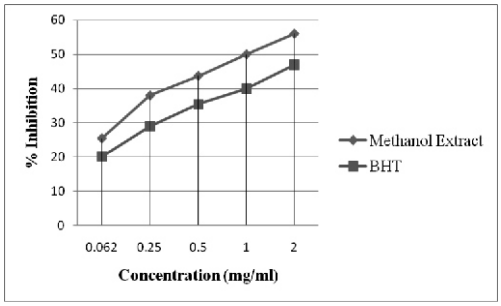

Fig. 3: Nitric oxide assay showing antioxidant activity of methanolic extract of flowers of *Cassia glauca*

Conclusion

From the results we can conclude that the methanolic extract of flowers of *Cassia glauca* showed significant antioxidant and reducing ability in both the extracts in comparison to standard BHT. The highest activity may be due to the rich content of phenolic compounds and flavonoids. Plant materials rich in phenolics are increasingly being used in the food industry because they retard oxidative damage and improve the nutritive value. Thus the major constituents of the flowers of *Cassia glauca* can also be isolated and can be utilized for prevention of various diseases.

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MANGO MALFORMATION DISEASE AND ROLE OF PLANT GROWTH REGULATORS IN ITS MANAGEMENT

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Role of Plant Growth Regulators have been acknowledged since decades. No doubt the fungus seems to be potential cause to mango malformation. PGR have been found to be of great significance with this disease .Following description will prove this.

Auxins: Generally, higher level of auxins occur in healthy panicles and shoot bearing them as compared to malformed panicles and shoot bearing them. It was reported that healthy panicles as compared to malformed contained higher level of acidic, non acidic and total auxins. It was found that levels of IAA and IAN also decrease in bunchy top affected tissue by 98.4 and 92.6% respectively ; suggested that malformation may be due to decreased level of auxins resulting in the hormonal imbalance. Contrarily to this, higher levels of auxins have also been observed in malformed panicles. The developmental stages appear to affect the nature and content of auxin in the panicles. Acidic auxins showed higher activity in malformed bud at the initial (balloon) stage but become lower than the normal ones at the rapid growth phase of panicles and increased again 32 days later. None acidic auxin, 3-indol acetonitrile (IAN) was 50 times more in malformed panicles at 48 days after bud burst .

Cytokinins: The qualitative and quantitative changes in cytokinins of healthy and malformed panicles at different periods of their growth were studied and cytokinin concentration was found to be higher in malformed panicles than in healthy ones . Malformed mango inflorescence contained higher levels of endogenous cytokinins than that from healthy inflorescence. The cytokinin compliment extracted from malformed flowers was different from that isolated from healthy flowers, the most striking difference being that transzeatin, dehydrozeatin and ribosyldihydrozeatin were not detected in malformed flowers and isopentenyladenine was undetectable in healthy flowers but also present in malformed flowers. The reasons for these differences were postulated to be related to the fungal infection responsible for flower malformation and could be mediated through effects of cytokinin biosynthesis and/or metabolism.

Gibberellins: The lower levels of gibberellins were observed in the malformed shoots than the normal ones in the susceptible cultivar Hindy in Egypt. Contrarily, there are also reports on the presence of higher levels of gibberellins in the malformed panicles in cv. Dashehari. Gibberellins activity was also found to be affected by developmental stages, location and variety. Its activity was more in normal buds from balloon to full bloom stage, which declined subsequently (Singh and Dhillon, 1989b).

A reduction in malformation of panicles was observed by the use of GA3 at the flower bud differentiation stages . Gibberellins like substances increased in malformed panicles and induced production of male flowers and in due course, the growth of malformed panicles increased tremendously (Mishra and Dhillon, 1978). Malformed panicles contain lower levels of gibberellins in February and higher in March-April than healthy panicles. The hormone content in malformed panicles increased sharply at full bloom in March, declined in April and reached a minimum in the first week of May, when flowering still continue in malformed panicles. The gibberellic acid content of cultivar Dashehari was higher in malformed panicled/shoots, at bud inception (Stage II) panicles fully grown prior to full bloom (Stage III) and full grown panicle (Stage IV) except in stage I i.e, fully swollen bud stage when it was higher in healthy panicles and shoots (Singh and HYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23"DhillonHYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23", 1989b).

Ethylene: As some of the symptoms of mango malformation resemble with those of ethylene effects, several workers have implicated a role for ethylene in mango malformation (Singh and HYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23" DhillonHYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23", 1989b). Significantly higher levels of ethylene (46,

145, 67 and 34%) were detected in malformed panicles of Dashehari compared to the healthy ones at the development stages (1) fully swollen buds (2) bud inception (3) full grown panicle prior to full bloom and (iv) full grown panicle and full bloom, respectively. Similarly, shoots bearing malformed panicle show significantly higher levels of ethylene (110, 90, 106 and 104%) over those bearing healthy panicles at the four developmental stages mentioned above. Leaves borne on shoots bearing malformed panicles also had significantly more ethylene (198, 120, 79 and 159%) than the leaves on shoots bearing healthy panicles at the mentioned stages. It was suggested that the higher levels of ethylene in malformed panicles could be suppressing apical dominance of panicles, increasing isodiametric growth of rachises and thickening the secondary branches of malformed panicles producing overcrowding of flowers. The higher endogenous levels of ethylene in malformed panicles were suggested to be induced by malformin and abscisic acid (Singh and Dillon, 1989HYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23"b).

Growers in India sometimes maintain smoky fires in mango orchards for several days during the vegetative flush to induce good flowering. This results in reduced malformation. This traditional practice has its own scientific merit. Smokes elevate both temperature and CO2, which in turn result in lessened ethylene production. Vegetative malformation could be induced by smudging. Furthermore, malformed panicles treated with 600 ppm AgNO3 were found to grow into fruit bearing healthy panicles .The effect may certainly be due to the inhibitory effect of Ag+ in ethylene action. The success in reducing malformation by spraying 100-200 ppm naphthalene acetic acid (NAA) in the first week if October decidedly supraoptimal level of auxin, and the reduction of floral malformation by the spray of 400 ppm 2-Chloroethyl-PhosphonicAcid (CPA). Prior to flower bud differentiation and at bud inception may in part be due to auto inhibition by ethylene .All these reports directly/indirectly propose a role for ethylene in malformation.

Abscisic acid: Inhibitory activity of ABA was reported more in malformed panicles rather than in healthy panicles. The malformed panicles were treated with different concentrations of ABA (100-500 ppm) at the end of February during early stages of panicle growth. From the data it was postulated that ABA treatment decreased panicle length and girth without any effect on sex ratio. However, 220 ppm ABA brought early anthesis in the malformed panicles and 200-300 ppm ABA decreased some external symptoms of malformation in the panicles. However, higher concentration of ABA (400-500 ppm) did not show such an effect and none of the ABA treated panicles fruited.

Hydrogen cyanide: Cyanide derived from ethylene biosynthesis could contribute to the development of tissue necrosis during hypersensitive response of plants . Increased levels of cyanide due to 'stress etylene' may result in the accumulation of toxic level of cyanide resulting in the necrosis and death of malformed tissue of mango. Hydrogen cyanide applied as Dormex increased the incidence of floral malformation, suggesting therefore, an involvement of hydrogen cyanamide or like substances in causing malformation .

Other Factors Responsible for Mango Malformation

Malformin: The presence of malformin-like substances in fully grown malformed panicles has been reported. The stem and root of malformed vegetative seedlings contain a high level of malformin-like-substances and other malformins as against none in healthy seedlings. Malformin like-substances somehow appear to be involved in causation of malformation, with the malformin-stimulating ethylene production, manifest into hormonal imbalance, consequently disturb metabolism and induce malformation. Application of antimalformins like glutathione, ascorbic acid and silver nitrate caused disappearance of malformin from panicles which fruited like healthy controls. Malformins may cause imbalance of growth substances and conditioning of host cells to produce malformed growth . Fusarium moniliforme var. intermedium and F. moniliforme var. subglutinans and F. moniliforme Sheld secreted malformins into their culture filtrates which were similar to mango malformins. Mango malformin treated mango seeds and branches of bearing trees produced malformed seedlings and shoots. The exact mechanism of ethylene synthesis in plant system, its chemical nature and whether ethylene production is a cause or consequence of malformation are yet to be fully worked out.

Mangiferin: Mangiferin, a non-toxic polyphenol and normal metabolite in mango was reported to play a significant role in the disease. Mangiferin is either absent or is present only in traces in healthy mango panicles but in malformed ones its concentration is high Enhanced production of mangiferin and increase in the activity of polyphenol ozidase in infected tissues was recorded. Poliphenol oxidase was considered as mangiferin degrading enzyme (R Pandey,D Rathore & R Singh(1974).

Management

Along with the attempts to determine the etiology of mango malformation numerous control measures have been tried but the results are neither successful nor reproducible. Various approaches to control the disease are discussed below:

Disease management through plant Growth regulators: Reduction in the malformation of panicles was observed by the use of GA3

at flower bud differentiation stage (K A Mishra & B S Dhillon (1978)). Further it was reported that 200 or 500 ppm chlormequat mixed with 100 mL Bayfolan treatment reduced%age of malformed panicles (B-Abi-Les,Husselin & Fadi (1973)). The application of NAA, 100-200 ppm, at flower bud differentiation stage reduced malformation considerably (M R Anou-Husselin, Fadi, Beyer & Morgan (1970)). Spraying 200 ppm NAA in first week of October followed by sparaying of 500 ppm etherel at bud inception stage during February was highly effective in reducing floral malformation (Singh and HYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23"DhillonHYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23", 1986a).

Treatment with anti malformins like glutathione (560 ppm), ascorbic acid (1055 ppm), K2S2O5 (560 ppm), silver nitrate (2400 ppm) and NAA (200 ppm) resulted in 87, 93, 80 and 40% conversions to healthy panicles respectively (Slominski & Rejowski (1986). Substantial reduction in floral malformation by antimalformin spray at but inception stage was observed (Singh and HYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23"DhillonHYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23", 1989a). Sparaying 1000 ppm paclobutrazol (10-60 g-1tree), prior to FBD, during the first week of October, reduced malformation, increased number of healthy flowers and increased yield (Singh and HYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23"DhillonHYPERLINK "http://www.scialert.net/fulltext/?doi=ajps.2011.1.23", 1989b).

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FOODBORNE DISEASES : RAW VEGETABLES AS VEHICLE OF PATHOGENS

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Introduction

Food is an essential public requirement. Fresh fruits and vegetables are an important part of a balanced diet providing vitamins, minerals, bioflavonoids and fibers. Regular consumption of vegetables in the diet provides various health benefits, as it improves health of cardiovascular systems, eyesight, digestive system, immunity and protects from cancers (4). Although vegetables are being used in various dishes, the consumption of raw vegetables, mainly used in the form of salad. The trend of using processed, packed salad is also increasing in urban areas. The vegetables such as tomato, onion, cucumber, cabbage, lettuce, carrot, radish, beat root, spinach, and coriander are either preferred for raw consumption as salad or consumed with sprouts. However, these vegetables are increasingly being observed as a vehicle for the transmission of pathogenic microorganisms. Various pathogenic bacteria, viruses, protozoa and helminths may transmit by the consumption of raw vegetables, those can cause a serious health hazard. The spread of foodborne diseases such as typhoid fever, food poisoning, meningitis, gastroenteritis, hepatitis and neurocysticercosis etc. are linked to the consumption of raw vegetables. The introduction of pathogenic microbes in vegetables may caused by use of contaminated animal manure, water, seed, etc. Unhygienic processing and packaging of vegetables may also be associated with many diseases. Proper soil and irrigation management, seed treatment, hygienic vegetable processing, packaging and consumption may be helpful to avoid vegetable associated infections.

Foodborne pathogens associated with raw vegetables

There are various foodborne pathogens associated with the diseases caused by consumption of raw vegetables. These pathogens can cause serious illness or mortality.

1. **Escherichia coli O157: H7:**

   E coli is a gram negative lactose fermentar bacteria, naturally found in the intestine of human and animals as normal flora. However, some strain are highly pathogenic such as *E coli O157: H7*. It can cause life threatening enteric infection. It can also produce potent toxins that damage linings of intestine. Its infection may include diarrhea, hemorrhagic colitis, hemolytic uremic syndrome (HUS). HUS mostly affects children and associated with renal failure. Consumption of unwashed raw leafy green vegetables has been linked with E coli O157: H7 outbreaks.

2. **Campylobacter jejuni**

   Bacteria *Campylobacter jejuni* is one of the most common cause of bacterial infections and food poisoning among humans worldwide. *C. jejuni* spread through the contamination of animal fecal material. *Campylobacter* is a helical, microaerophilic, Gram-negative, oxidase-positive, motile rod bacterium. The optimal temperature for growth is 37 to 42 °C. In presence of oxygen, *C. jejuni* changes itself into a coccal form. This pathogen is a common cause of gastroenteritis, characterised by diarrhea abdominal pain, malaise, fever and some time bloody stools. Food poisoning may also caused by *Campylobacter* species. It has been linked with subsequent development of Guillain–Barré syndrome. Fecal contaminated vegetables as lettuce, green onion, mushrooms, parsley, spinach may carry this pathogen.

3. **Aeromonas**

Aeromonas, a gram-negative, facultative anaerobic, rod-shaped bacteria is responsible for two major diseases- gastroenteritis and wound infections. Gastroenteritis typically occurs with ingestion of contaminated water or food. Fecal contaminated vegetables such as *broccoli, celery, cauliflower, lettuce, spinach may also cause aeromonas associated gastroenteritis.*

4. **Salmonella spp.**

Salmonella, a rod-shaped, Gram-negative bacteria belongs to the family Enterobacteriaceae. Consumption of raw vegetables such as cabbage, cauliflower, *chili, lettuce, mustard, cress, green onion, parsley, tomato, spinach* contaminated with bacteria *Salmonella* may cause salmonellosis disease, including symptoms- nausea, abdominal cramps, vomiting, fever, headache, mild diarrhea. Increasing risk of multiple drug resistant strains may cause more complicated disease.

5. **Shigella spp.**

Shigella is a gram-negative, nonmotile, rod- shaped bacteria. Lack of personal hygiene of food processing workers may increase the contamination of *Shigella* bacteria in food products. The pathogen causes shigellosis. The common symptoms of the disease are abdominal pain, diarrhea, cramp, fever, vomiting and bloody stool. The outbreaks of shigellosis have been associated to the consumption of raw vegetables as green onion, potato salad, lettuce and parsley.

6. **Listeria monocytogenes**

Listeriosis disease cause by this pathogen, especially among pregnant women and individual with weak immunity. The common symptoms of listeriosis are flu like illness, fever, gastrointestinal complications such as vomiting and diarrhea. The outbreaks of listeriosis, have been associated to the consumption of raw vagetables. Unlike other bacteria, *Listeria* can grow and survive in moist and dark environments with colder temperatures of refrigerators. This pathogen frequently associates with processed refrigerated vegetables.

7. **Hepatitis A**

This is a non-enveloped single stranded RNA virus belongs to the family picornaviridae. This virus can cause acute liver infection, especially among children with sudden onset of malaise, fever, nausea, abdominal discomfort followed by jaundice. The hepatitis A virus infection may linked with consumption of unwashed root vegetables such as carrot, radish, beat root, irrigated with sewage contaminated water.

8. **Norovirus**

Norovirus is a food-borne enteric virus that has small infectious dose (<10 particles) and high stability in the environment conditions. Nearly 90% of nonbacterial gastroenteritis outbreaks can caused by human norovirus. Typical symptoms of norovirus associated gastroenteritis are nausea, vomiting, watery diarrhea and stomach cramps. Raw vegetables such as lettuce, tomatoes and spinach are major vehicles for transmission of human enteric viruses as they get easily contaminated at pre and post harvest stages.

9. **Cyclospora *cayetanensis***

Cyclospora *cayetanensis* is a pathogenic protozoan transmitted by fecal contaminated food and water, causes disease Cyclosporiasis. Humans and other primates are mainly affected by *Cyclosporiasis*. The person with Cyclospora infections experiences fever, severe watery diarrhea, bloating, muscle aches, stomach cramps, nausea, vomiting, weight loss and fatigue. Recent Outbreaks of cyclosporiasis have been reported due to consumption of contaminated fruits and vegetables.

10. **Helminthic infection**

Neurocysticercosis the most common type of helminth associated infection that affects nervous system, is also one of the major cause of acquired epilepsy globally. The disease may initiate after ingesting the eggs of tapeworm (*Taenia solium)*. Parasites may locate Within the nervous system, in parenchyma, ventricular system, subarachnoid space of brain or spinal cord, causing several pathological changes in the infected individual. Uncooked leafy vegetables may contain the live eggs of *Taenia solium, these eggs can infect the healthy individual consuming the raw vegetables.*

Table : 1 - Vegetable Sources of Microbial Pathogens and Associated Disease

S. N.	Microbial Pathogens	Source (Vegetables)	Disease
1.	*Escherichia coli*	Cabbage, celery, alfalfa sprouts, coriander, lettuce, carrot, radish	Diarrhea, food poisoning, urinary tract infection
2.	*Campylobacter jejuni*	Lettuce, green onions, mushroom, Parsley, potato, spinach, peeper	Diarrhea or dysentery syndrome
3.	*Aeromonas*	Asparagus, alfalfa sprouts, broccoli, celery, cauliflower, peeper, lettuce, spinach	Gastroenteritis and wound infections
4.	*Salmonella spp.*	Cabbage, beet leaves, celery, cauliflower, chili, eggplant, fennel, lettuce, mustard cress, green onion, parsley, tomato, peeper, spinach	Typhoid fever, food poisoning, gastroenteritis
5.	*Shigella spp.*	Parsley, lettuce, radish, beet root, carrot	Shigellosis, food poisoning
6.	*Listeria monocytogenes*	Bean sprouts, cucumber, cabbage, lettuce, eggplant, potatoes, tomato, radish	Listeriosis
7.	Hepatitis A	Lettuce, onion, carrot, radish	Acute viral hepatitis
8.	Norovirus	Veg. Salad, lettuce, tomato, carrot	Viral diarrhea
9.	*Cyclospora cayetanensis*	broccoli, cauliflower, carrots, radish	Cyclosporiasis
10.	Taenia solium	Cauliflower, cabbage, spinach, kale and broccoli.	Neurocysticercosis

Sources of vegetables contamination:

1. Organic fertilizers

*Organic fertilizer*s as animal manures, sewage sludge, abattoir waste may carry harmful human pathogens, those can directly contaminate the agricultural lands. Many bacterial pathogens such as *E. coli*, *Salmonella*, *Shigella*, *Aeromonas*, viral pathogens- Hepatitis A, Hepatiti E, Enteroviruses etc. can directly introduce to the farms using untreated animal manure and sewage sludge as organic fertilizers to the vegetable crops.

2. Irrigation water

The quality of irrigation water drastically affects the microbiota of agricultural lands. Harmful human pathogens may contaminate vegetable crops, through the introduction of irrigation water having fecal material, animal dead bodies, leather industry wastes, hospitals and research lab wastes, wastes from poultry forms etc. Many contagious and life threatening diseases may spread among the individuals consuming raw vegetables irrigated with sewage contaminated water.

3. Soil

Soil may be a natural habitat for many pathogens such as Listeria spp. and Clostridium botulinum. These pathogens may also incorporate with organic matrix present in soil. These soil pathogens can directly contaminate the crop through the flow of air or water droplets emerge during water gun irrigation. The survival of soil pathogens depends upon the organic matter present in soil, pH of soil, water content in soil, environmental temperature, etc. The contamination of soil bacteria in crop also depends upon the type of crop.

4. Post harvest sources of contamination

After harvesting, field crops pass though series of post harvest processing steps, including peeling, trimming, shredding, cutting, washing, packaging and storing. Although vegetables may previously carry pathogens, the processing operations also cause microbial contamination in processing facilities through contaminated equipment surfaces, contaminated water used for washing of vegetables, contaminated hands and unhygienic practices of processing plant workers.

Prevention of vegetables associated infections:

Vegetables associated infections can cause serious health hazard. Prevention of these infections is important to avoid community health risks. Improved agriculture practices, proper crop management, awareness among farm workers, proper washing, cleaning and disinfection of raw vegetables before consumption may be helpful to prevent vegetables associated infection. The following methods can be applied to manage these infections-

- Animal manure as organic fertilizer is a major food safety risk. Manure sources should be selected carefully. Manure originated from unhealthy animals and poultry farms should be avoided. Use of compost is safe for human health in organic farming.
- Irrigation water quality management is required for healthy crop production. Using untreated sewage water, tannery water, water originated from hospitals for irrigation of agricultural lands may cause contamination of enteric pathogens in vegetable crops.
- Hygienic practices during planting, weeding and harvesting are required to prevent outbreaks of foodborne pathogens.
- Use of clean hands, tools and machinery during harvesting and post harvesting processes is a important factor in preventing foodborne disease.
- Proper washing and use of chlorine or ozone based agents to clean and disinfect raw vegetables before consumption may reduce the risk of vegetable associated foodborne infections.

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DIVERSITY AND DISTRIBUTION OF LEAFHOPPERS (INSCETA : HOMOPTERA: CICADELLIDAE) OF MAHARASHTRA, INDIA

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Abstract

This paper deals with a comprehensive account on Cicadellidae of Maharashtra. This paper represents 37 species under 27 genera of 6 subfamilies belonging to the family Cicadellidae. The surveys conducted between 2012-2015 to various protected areas like Radhanagari Wildlife Sanctuary, Nadur Madhmeshwar Bird Sanctuary also designated as Ramsar Site and Satpuda Botanical including other local areas of various districts of Maharashtra.

Introduction

The family Cicadellidae belongs to the superfamily Membracoidea under the Infraorder Cicadomorpha of the suborder Auchenorrhyncha under the order Hemiptera. Cicadellids are usually known as Leafhoppers can be easily recognised by their wedge-shaped body, size 3-22 mm and two or more parallel rows of spines on their hind tibiae and they have been considered insects of economic importance. This group shows species richness in the tropical areas. They are common seasonal insects of rice fields in India. Cicadellids cause considerable damage by sucking the sap as well as by transmitting different viral diseases to the infected plant and therefore these insects are considered as one of the most economically important insects from agricultural point of view.

The Indian Cicadellidae are known through the works of Fabricius (1794), followed by Atkinson (1885), W.L. Distant (1908.1916 & 1918), Pruthi (1930-40), Ramakrishna and Menon (1972), Rao (1967), Datta & Ghosh (1973) and voluminous contribution of Viraktamath (since 1973) on the Indian leafhopper has given new dimension to this group.

Materials and Methods

The specimens of new species were collected from Maharashtra India during a survey 2018-19. The collected specimens were processed by the different methods. Figure was taken by a Nikon digital camera (D-7000) and the other figures were obtained by a digital camera attached to a Leica stereo-zoom Microscope (Leica M205A).

SYSTEMATIC LIST

Order: HEMIPTERA

Suborder: AUCHENORRHYNCHA

Infraorder: CICADOMORPHA

Superfamily: MEMBRACOIDEA

Family: Cicadellidae

Subfamily I: Cicadellinae

Tribe: Cicadellini

Genus 1: *Cofana* Melichar, 1926

1. *Cofana spectra* (Distant)
2. *Cofana lineata* (Distant)
3. *Cofana subvirescens* (Stål)

Genus 2: *Kolla* Distant, 1908

4. *Kolla insignis* Distant
5. *Kolla ceylonica* (Melichar)

Subfamily II. Deltocephalinae

Tribe: Hecalini

Genus 3: *Hecalus* Stal, 1864

6. *Hecalus facialis* Distant

Genus 4: ***Linnavuoriella* Evans, 1966**

7. *arcuata* (Motschulsky)

Genus 5: *Thomsonia* Signoret, 1879

8. *porrecta* (Walker, 1858)

Tribe: Drabescini

Genus 6: *Dryadomorpha* Kirkaldy, 1906

9. *Dryadomorpha pallida* Kirkaldy

Tribe: Chiasmini

Genus 7: *Aconurella* Ribaut, 1948

10. *Aconurella prolixa* (Lethierry)

Genus 8: *Exitianus* Ball, 1929

11. *Exitianus indicus* (Distant)
12. *Exitianus nanus* (Distant)

Genus 9. *Nephotettix* Matsumura, 1902

13. *Nephotettix nigropictus* (Stal)
14. *Nephotettix* virescens (Distant)

Tribe: Opsiini

Genus 10. *Masiripius* Dlabola, 1981

15. *Masiripius lugubris* (Distant)

Genus 11. *Orosius* Distant, 1918

16. *Orosius albicinctus* Distant, 1918

Genus 12. *Hishimonus* Ishihara, 1953

17. *Hishimonus viraktamathi* Knight

Tribe: Scaphoideini

Genus 13. *Scaphoideus* Uhler, 1889

18. *Scaphoideus insignis* (Distant)

Genus 14: *Mimotettix* Matsumura, 1914

19. *Mimotettix alboguttulatus* (Melichar)

Tribe: Athysanini

Genus 15: *Tambocerus* Zhang & Webb, 1996

20. *Tambocerus disparatus* (Melichar)

Tribe: Mukariini

Fig.1. *Cofana spectra* (Distant)

Fig.2. *Cofana lineata* (Distant)

Fig.7. *Linnavuoriella arcuata* (Motschulsky)

Fig.8. *Thomsonia porrecta* (Walker)

Fig.3. *Cofana subvirescens* (Stal)

Fig.4. *Kolla insignis* Distant

Fig.9. *Dryadomorpha pallida* Kirkaldy

Fig.10. *Aconurella prolixa* (Lethierry)

Fig.5. *Kolla ceylonica* (Melichar)

Fig.6. *Hecalus facialis* Distant

Fig.11. *Exitianus indicus* (Distant)

Fig.12. *Exitianus nanus* (Distant)

Fig.13. *Nephotettix nigropictus* (Stal)

Fig.14. *Nephotettix virescens* (Distant)

Fig.15. *Masiripius lugubris* (Distant)

Fig.16. *Orosius albicinctus* Distant

Fig.17. *Hishimonus viraktamathi* Knight

Fig.18. *Scaphoideus insignis* (Distant)

Genus 16. *Mukaria* Distant, 1908

21. *Mukaria penthimioides* Distant

Genus 17. *Mohunia* Distant, 1908

22. *Mohunia splendens* Distant

Tribe: Stenometopiini

Genus 18. *Stirellus* Osborn & Ball, 1902

23. *Stirellus indra* (Distant)

Tribe: Deltocephalini

Genus 19. *Maiestas* Dist, 1917

24. *Maiestas distincta* (Motschulsky)

25. *Maiestas dorsalis* (Motschulsky)

26. *Maiestas pruthii* (Metcalf)

Tribe: Penthimiini

Genus 20: *Neodartus* Melichar, 1903

27. *Neodartus acocephaloides* Melichar

Tribe: Macrostelini

Genus 21: *Balclutha* Kirkaldy, 1900

28. *Balclutha punctata* (Fabricius)

29. *Balclutha rubrostriata* (Melichar)

Tribe: Goniagnathini

Genus 22: *Goniagnathus* Fieber, 1866

30. *Goniagnathus (Tropicognathus) punctifer* (Walker)

Subfamily III: Idiocerinae

Tribe: Idiocerini

Genus 23: *Amritodus* Anufriev, 1970

31. *Amritodus atkinsoni* (Lethierry)

Genus 24: Idioscopus Baker, 1915

32. *Idioscopus clypealis* (Lethierry)

33. *Idioscopus niveosparsus* (Lethierry)

Subfamily IV: Iassinae

Tribe: Batracomorphini

Genus 25: *Batracomorphus* Lewis, 1834

34. *Batracomorphus chlorophana* (Melichar)

Subfamily V: Megophthalminae

Tribe: Agallini

Genus 26: *Hemagallia*Viraktamath, 2011

35. *Hemagallia biplagiata* (Melichar)

Subfamily VI: Ledrinae

Tribe: Ledrini

Genus 27: *Petalocephala* Stål, 1854

36. *Petalocephala granulosa* Distant

37. *Petalocephala uniformis* Distant

Fig.19. *Mukaria bilobatulata* (Melichar)

Fig.20. *Tamboceras disparatus* (Melichar)

Fig.26. *Maiestas dorsalis* (Motschulsky)

Fig.27. *Maiestas purthii* (Metcalf)

Fig.21. *Mukaria penthimioides* Distant

Fig.22. *Mohunia splendens* Distant

Fig.28. *Neodartus acocephaloides* Melichar

Fig.29. *Balclutha punctata* (Fabricius)

Fig.23. *Stirellus indra* (Distant)

Fig.24. *Maiestas distincta* (Motschulsky)

Fig.25. *Balcluha rubrostriata* (Melichar)

Fig.30. *Goniagnathus punctifer* (Walker)

Fig.31. *Amritodus atkinsoni* (Lethierry)

Fig.31. *Idioscopus clypealis* (Lethierry)

Fig.33. *Idioscopus nitidulus* (Walker)

Fig.34. *Batracomorphus chlorophana* (Melichar)

Fig.35. *Hemagallia biplagiata* (Melichar)

Fig.36. *Petalocephala granulosa* Distant

Fig.37. *Petalocephala uniformis* Distant

SYSTEMATIC ACCOUNT

Order: HEMIPTERA

Suborder: AUCHENORRHYNCHA

Infraorder: CICADOMORPHA

Superfamily: MEMBRACOIDEA

Family: Cicadellidae

Genus 1. *Cofana* Melichar, 1926

1926. *Cofana* Melichar, *Ann. Mus. Nat. Hist*., **23**: 245.

1. *Cofana spectra* (Distant, 1853)

1908. *Tettigoniella spectra* Distant, *Fauna Brit. India, Rhynchota*, 4: 211

1910. *Cicadella spectra* Distant, *Insecta. Trans*, 10: 234.

1979. *Cofana spectra* Young, *Proceedings of the Entomological Society of Washington,* 81(1): 1-21.

***Material examined*:** 24 exs., Satpura Botanical Garden, Dist. Nagpur, 17.ix.2013, Coll. M.E. Hassan and party; 11 ex., Kalmeshwar, Dist. Nagpur, 19.ix.2013, Coll. M.E. Hassan and party. 3 ex., Digraj, 20.vi.2014, Coll. M.E. Hassan and party; 1 ex., Sangliwadi, Dist. Sangli, 20.vi.2014, Coll. M.E. Hassan and party; 2 exs., Belati, Dist. Solapur, 16.vi.2014, Coll. M.E. Hassan and party.

***Distribution*:** India: Maharashtra (Nagpur, Sangli, Solapur), Andhra Pradesh, Assam, Bihar, Chhattisgarh, Karnataka, Madhya Pradesh, Manipur, Meghalaya, Orissa, Sikkim, West Bengal. *Elsewhere*: Bangladesh, Nepal, Sri Lanka.

2. *Cofana lineata* (Distant, 1908)

1908. *Kolla lineatus* Distant, *Fauna Brit. India, Rhynchota*, 4: 224

1986. *Cofana lineata* Young, *North Carol. Agril. Res. Serv. Tech. Bull.* 281: 614.

***Material examined*:** 2 exs., Tapwan, Dist. Nasik, 4.iii.2013, Coll. M.E. Hassan and Party, 2 ex., Sangliwari, Dist. Sangli, 20.vi.2014, Coll. M.E. Hassan and Party,

***Distribution*:** India: Maharashtra (Nasik, Sangli), Chhattisgarh, North & Central India. *Elsewhere:* Sri Lanka.

3. *Cofana subvirescens* (Stål, 1870)

1870. Tettigoniella subvirescens Stål, *Ofv. Vet.-Ak. Forh.* 734

1986. Cofana subvirescens (Stål): Young, *Tech. Bull.* **281**: 613

***Material examined*:** 1 ex., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Kolhapur), Assam, West Bengal. *Elsewhere:* Philippines

Genus 2: *Kolla* Distant, 1908

1908. *Kolla* Distant, *Fauna Brit. India, Rhynchota*, **4**: 223

4. *Kolla ceylonica* (Melichar)

1903. *Tettigonia ceylonica* Melichar, *Hom. Faun. Ceylon*: 156.

1986. *Kolla ceylonica* Young, *NorthCarol. Agril. Res. Serv. Tech. Bull*. **281**: 135

***Material examined*:** 5 ex., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Kolhapur), Chhattisgarh, Tamil Nadu (South Eastern Ghats), Mysore, *Elsewhere:* Ceylon.

5. *Kolla insignis* Distant

1908. *Kolla insignis* Distant, *Fauna Brit. India, Rhynchota*, **4**: 223

1965. *Kolla insignis*: Metcalf, *Gen. Cat. Hom.,* **6** : 441

***Material examined*:** 17 exs., Nandur Madhmeshwar Bird Sanctuary, Dist, Nandurbar, 3.iii.2013, Coll. M. E. Hassan and Party, 2 exs., Mohagaon, Dist. Yawatmal, 11.ix.2013, Coll. M. E. Hassan and Party, 1 ex., Paladi, Dist. Bhandara, 3.ix.2013, Coll. M. E. Hassan and Party.

***Distribution*:** India, Maharashtra (Bhandara, Nandurbar, Yawatmal), Chhattisgarh, Uttarakhand, Manipur, Meghalaya, Sikkim, Uttarpradesh, West Bengal.

Subfamily II. Deltocephalinae

Tribe: Hecalini

Genus 3: *Hecalus* Stål, 1864

1864. *Hecalus* Stål, *Ann.Soc. Ent.Fr*., **4** (4): 65.

6. *Hecalus fascialis* Distant, 1918

1918. *Hecalus fascialis* Distant, *Fauna Brit. India. Rhynchota*, **7**: 29

1973. *Hecalus fascialis*: Morrison, *Pacific insects,* **15**(3-4): 428

***Material examined*:** 1 ex., Babulgaon, Dist. Washim, 06.xii.2014, Coll. Coll. M. E. Hassan & P, 2 ex., Bujwade, Dist. Kolhapur, 23.vi.2014, Coll. M. E. Hassan & P, 1 ex, Orwanti, Dist. Osmanabad, 03.iii.2015, Coll. M. E. Hassan & P.

***Distribution*:** India: Maharashtra (Kolhapur, Osmanabad, Washim), Chhattisgarh), Tamil Nadu, West Bengal.

Genus 4: *Linnvuoriella* Evans, 1966

1966. *Linnavuoriella* Evans, *Memoirs of the Australian Museum*, **12**: 1-347

7. *Linnavuoriella arcuata* (Motschulsky, 1859)

1859. *Acocephalus arcuata* Motschulsky, *Etud. Ent.,* **8**: 15

2019. *Linnavuoriella arcuata* : He *et al., Zootaxa*, **4679**(2): 257-285

***Material examined*:** 1 ex., Digraj, Dist. Sangli, 20.vi.2014, Coll. M. E. Hassan & Party; 1 ex., Wagoli, Dist. Akola, 26.x.2014, Coll. M. E. Hassan & Part; 1 ex., Sagona, Dist. Buldhana, 30.x.2014, Coll. M. E. Hassan & Party; 1 ex., Tandarwadi, Dist. Buldhana, 30.x.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Akola, Buldhana, Sangli), Chhattisgarh, South India. *Elsewhere*: Australia, Ceylon, Maldives Islands.

Genus 5: *Thomsonia* Signoret, 1879

8. *Thomsonia porrectus* (Walker, 1858)

1858. *Acocephalus porrectus* Walker*, List . Hom . Br . Mus . Suppl*, : 262 .

1973. *Hecalus porrectus* Morrison, *Pacif. Insects*, **15** (3-4) : 421 .

2019. *Thomsonia porrecta* : He *et al., Zootaxa*, **4679**(2): 257-285

***Material examined*:** 2 exs., Radhanagari W. L. S., Dist. Kolhapur, 24.vi.2014, Coll. M. E. Hassan & P, 2 exs., Kathoda, Dist. Amravati, 8.vi.14, Coll. M. E. Hassan & P, 1 ex., Digraj, Dist. Sangli, 20.vi.2014, Coll. M. E. Hassan & P.

***Distribution*:** India: Maharashtra (Amravati, Kolhapur, Sangli), Tamil Nadu (South Eastern Ghats), Andhra Pradesh, Manipur, Meghalaya, Mizoram, Orissa, Punjab, Tripura, Uttar Pradesh, Sikkim, West Bengal. *Elsewhere*: Burma, Formosa, Maldives, Java, Philippines.

Tribe: Drabescini

Genus 6: *Dryadomorpha* Kirkaldy, 1906

1906. *Dryadomorpha* Kirkaldy, *Bull. Hawaii Sug. Ass. Exp. Sta*. **1**(9): 335

9. *Dryadomorpha pallida* Kirkaldy, 1906

1917. Paganalia virescens Distant, *Linn. Soc. London Trans. Zool*. **17**: 314

1906. Dryadomorpha pallida Kirkaldy, Bull. Hawaii Sug. Ass. Exp. Sta. **1**(9): 336

***Material examined*:**1 ex., Sangliwari, Dist. Sangli, 20.vi.2014, Coll. M. E. Hassan & Party, 2 exs., Mahisang, Dist. Akola, 25.x.2014, Coll. M. E. Hassan & Party, 1 ex., Asgaon, Dist. Parbhani, 10.iii.2015, Coll. M. E. Hassan & Party.

***Distribution*:** India : Maharashtra (Akola, Parbhani, Sangli), Punjab, Tamil Nadu, West Bengal. *Elsewhere:* Australia, Africa, Japan, Java, Malaysia, Palestine, Philippines.

Tribe: Chiasmini

Genus 7: *Aconurella* Ribaut, 1948

1948. *Aconurella* Ribaut, *Soc. d'Hist. Nat. Bul.* 83: 57

10. *Aconurella prolixa* (Lethierry, 1885)

1885. *Thamnotettix prolixa* Lethierry, *Rev. de Ent*. **4**: 102

2012. *Aconurella prolixa*: Yani Duan & Yalin Zhang, *Zootaxa:* **3397**: 29

***Material examined*:** 2 exs., Digraj, Dist. Sangli, 20.vi.2014, Coll. M. E. Hassan & Party, 3 exs., Degaon, Dist. Solapur, 16.vi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Sangli, Solapur), Andhra Pradesh, Central India, Punjab, Western Himalayas, West Bengal. *Elsewhere:* China, Ethiopia, France, Italy, Japan, Pakistan, Russia, Saudi Arabia, Serbia, Spain.

Genus 8: *Exitianus* Ball, 1929

1929. *Exitianus* Ball , *Trans . Amar. Ent . Soc.* , **55** : 5.

11. *Exitianus indicus* (Distant, 1908)

1908. *Athysanus indicus* Distant , *Fauna Brit. India . Rhynchota* , **4** : 344 .

1938. *Exitianus indicus* Oman , *Kan . Univ . Sci. Bull* , **24** : 383 .

2010. *Exitianus indicus* : Ghosh & Animesh Bal, *State Fauna Series*, 18 : *Fauna of Uttarakhand*, Part – **2** : 189

***Material examined*:** 22 exs., Ukshi, Dist. Ratnagiri, 1.vii.2014, Coll. M.E. Hassan and party, 16 exs., Sangliwadi, Dist. Sangli, 20.vi.2014, Coll. M. E. Hassan and Party.

***Distribution*:** India : Maharashtra (Ratnagiri, Sangli), Andhra Pradesh, Assam, Chhattisgarh, Manipur, Meghalaya, Mizoram, North India, Orissa, Punjab, Sikkim, Tamil Nadu, Tripura, Uttarakhand, Uttar Pradesh, West Bengal. *Elsewhere*: Australia, China, Philippines.

12. *Exitianus nanus* (Distant, 1908)

1908. *Athysanus nanus* Distant, *Fauna Brit. India . Rhynchota* , **4** : 345

1938. *Exitianus nanus* Oman , *Kan . Univ . Sci. Bul* , **24** : 383 .

2010. *Exitianus nanus* (Distant): Ghosh & Animesh Bal, *State Fauna Series 18 : Fauna of Uttarakhand, Part-2: 189*

***Material examined*:** 1 ex., Bhosa, Dist. Parbhani, 8.iii.2015, Coll. M.E. Hassan and party.

***Distribution*:** India: Maharashtra (Parbhani), Andhra Pradesh, Telengana, Bihar, Himachal Pradeh, Manipur, Meghalaya, Orissa, Sikkim, Uttarakhand, *Elsewhere*: Australia, China, Philippines.

Genus 9. *Nephotettix* Matsumara, 1902

1902. *Nephotettix* Matsumura, *Term Fuzetek*, **25**: 356.

13. *Nephotettix nigropictus* (Stål, 1870)

1859. *Pediopsis apicalis* Motschulsky, *Eutd. Ent.,:* 110

1870. *Nephotettix nigropictus* Stål, *Ofv.-Vet.-Ak. Forh.* **27**: 740

***Material examined*:** 2 exs., Vishnupuri, Dist. Nanded, 24.ii.2015, Coll. M. E. Hassan and Party, 5 exs., Shirur, Dist. Latur, 28.ii.2015, Coll. M.E. Hassan and Party, 2 ex., Belati, Dist. Solapur, 16.vi.2014, Coll. M.E. Hassan and Party,

***Distribution*:** India: Maharashtra (Latur, Nanded, Solapur), All over India.

Australia, China, East Africa, Hong Kong, Indonesia, Malaysia, Myanmar, Nepal, New Guinea, Pakistan, Philippines, South Vietnam, Sri Lanka, Thailand.

14. *Nephotettix virescens* (Distant, 1908)

1803. *Cicada biuncptatus* Fabricius, *Syst. Rhyng*.,: 78

1908. *Nephotettix virescens* Distant, *Fauna. Brit. India, Rhynchota* , 4: 291

1971. *Nephotettix virescens* (Distant): Ghuari, *Bull. Ent. Res*., 60: 481- 512

***Material examined*:** 9 exs., Datara, Dist. Chandrapur, 6.ix.2013, Coll. M.E. Hassan and Party, 4 exs., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M.E. Hassan and Party, 2 exs., Ukshi, Dist. Ratnagiri, 1.vii.2014, Coll. M.E. Hassan and Party.

***Distribution*:** India: Maharashtra (Chandrapur, Kolhapur, Ratnagiri), All over India. *Elsewhere*: China, Hong Kong, Indonesia, Japan, Laos, Malaysia, Myanmar, Pakistan, Philippines, South Vietnam, Sri Lanka, Thailand.

Tribe: Opsiini

Genus 10. *Masiripius* Dlabola, 1981

1981. *Maisiripius* Dlabola , *Acta. Entomologica Musea Naturalis Pragae,* **40**: 273

15. *Maisiripius lugubris* (Distant)

1918. *Mahalana lugubris* Distant, *Fauna Brit. India . Rhynchota*, **7**: 64

1999. *Maisiripius lugubris*: Viraktamath C.A. & Anantha Murthy, *Senckenbergiana biologica*, **79** (1): 44

***Material examined*:** 1 ex., Bujwade, Dist. Kolhapur, 23.vi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Kolhapur), Chhattisgarh, Delhi, Karnataka, Tamil Nadu.

Genus 11: *Orosius* Distant, 1918

1918. *Orosius* Distant, *Fauna Brit. India . Rhynchota*, **7**: 85

16. *Orosius albicinctus* Distant, 1918

1918. *Orosius albicinctus* Distant, *Fauna Brit. India . Rhynchota*, **7**: 85

1988. *Orosius albicinctus* Distant: Datta, *Rec. zool. Surv. India, Occ.paper* 90: 155

***Material examined*:** 2 exs., Bor WLS, Dist. Wardha, 13.ix.32013, Coll. M. E. Hassan & Party, 1 ex., Datara, Dist. Chandrapur, 6.ix.2013, Coll. M. E. Hassan & Party, 1 ex., Tuljapur, Dist. Osmanabad, 04.iii.2015, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Chandrapur, Osmanabad,Wardha), Chhattisgarh, Punjab Tamil Nadu, Uttar Pradesh.

Genus 12: *Hishimonus* Ishihara, 1953

1953. *Hishimonus* Ishihara, *Matsuyama Agr. Col. Sci.* Rpt. **11**: 10

17. *Hishimonus viraktamathi* Knight, 1973

1973. *Hishimonus viraktamathi* Knight: 153

2014. *Hishimonus viraktamathi* Knight: C. A. Viraktamath & H.V. Anantha Murthy, *Zootaxa*, **3785**: 116.

***Material examined*:** 1 ex., Wagoli, Dist. Akola, 26.x.2014, Coll. M. E. Hassan and Party.

***Distribution*:** India: Maharashtra (Akola), Karnataka.

Tribe: Scaphoideini

Genus 13. *Scaphoideus* Uhler, 1888

1888. *Scaphoideus* Uhler, Trans. Maryl. Ac. Sci: 33

18. *Scaphoideus insignis* (Distant)

1918. *Hussa insignis* Distant, *Fauna Brit. India, Rhynchota* , **7**: 68

1977. *Scaphoideus insignis*: Barnett, *Trans. of Ameri. Entomo. Soc.* **102**: 494

***Material examined*:** 2 exs., Kankawali, Dist. Sindhudurg, 29.vi.2014, Coll. M. E. Hassan & Party, 1 ex., Aundha, Dist. Hingoli, 11.iii.2015, Coll. M. E. Hassan & Party, 1 ex., Bhimashankar W. L. S., Dist. Pune, 1.xi.2012, Coll. M. E. Hassan & Party,

***Distribution*:** India: Maharashtra (Hingoli, Pune, Sindhudurg), Chhattisgarh, Tamil Nadu.

Genus 14. *Mimotettix* Matsumura, 1914

1914. *Mimotettix* Matsumura, *Sapporo Col. Agr. Jour.* 5: 197

19. *Mimotettix alboguttulatus* (Melichar, 2010)

1903. *Thamnotettix alboguttulatus* Melichar, *Hom. Faun. Ceylon* 184

2010. *Mimotettix alboguttulatus* Wu Dai, Yalin Zhang & M. D. Webb, *Zootaxa,* **2651**: 4

***Material examined*:** 3 exs., Belati, Dist. Solapur, 16.vi.2014, Coll. M. E. Hassan & Party; 1 ex., Sangliwari, Dist. Sangli, 20.vi.2014, Coll. M. E. Hassan & Party; 1 ex., Gayanganga WLS, Dist. Buldhana, 29.x.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Buldhana, Sangli, Solapur), *Elsewhere*: Africa China, Japan, Sri Lanka, Thailand, Vietnam.

Tribe: Athysanini

Genus 15: *Tambocerus* Zhang & Webb, 1996

1996. *Tambocerus* Zhang & Webb, *Bulletin of the Museum (Entomology)*, **65**: 1-103.

20. *Tambocerus disparatus* (Melichar, 1903)

1903. *Selenocephalus disparatus* Melichar, *Hom. Faun.Ceylon,*: 169

1996. *Tambocerus disparatus* Zhang & Webb: Viraktamath, *Zootaxa*, **3385**: 43

***Material examined*:** 2 exs., Pipalkhuta, Dist. Amravathi, 9.xi.2014, Coll. M. E. Hassan & Party, 1 ex., Gayanganga W. L. S., Dist. Buldhana, 29.x.2014, Coll. M. E. Hassan & Party, 1 ex., Dongergaon, Dist. Bhandara, 7.ix.2012, Coll. M. E. Hassan & Party,

***Distribution*:** India: Maharashtra (Amravathi, Bhandara, Buldhana), Chhattisgarh, Karnataka, Tamil Nadu. *Elsewhere*: Srilanka.

Tribe: Mukariini

Genus 16. *Mukaria* Distant, 1908

1908. Mukaria Distant, *Fauna Brit. India. Rhynchota* 4: 269

21. *Mukaria penthimioides* Distant, 1908

1908. *Mukaria penthimioides* Distant, *Fauna Brit. India. Rhynchota* **4**: 270

1988. *Mukaria penthimioides* Distant: Bimal Datta, *Rec . Zool .Surv. India*. Occ. Paper No 90: 62

***Material examined*:** 23 exs., Belati, Dist. Solapur, 16.vi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Solapur), South India, *Elsewhere* : Sri Lanka.

Genus 17. *Mohunia* Distant, 1908

1908. Mohunia Distant *Fauna Brit. India . Rhynchota* , **4**: 272

22. *Mohunia splendens* Distant, 1908

1908. *Mohunia splendens* Distant, *Fauna Brit. India, Rhynchota* **4**: 272

***Material examined*:** 16 exs., Nidana, Dist. Jalna, 1.xi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India : Maharashtra (Jalna)

Tribe: Stenometopiini

18. *Stirellus* Osborn & Ball, 1902

1902. *Stirellus* Osborn & Ball, *Mun. Ent. Zool.* **5** (2): 821

23. *Stirellus indra* (Distant)

1908. *Typhlocyba indra* Distant, *Fauna Brit. India Rhynchota*, **4**: 415

***Material examined*:** 4 ex., Niphad, Dist. Nasik, 03.iii.2013, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Nasik), Chhattisgarh, West Bengal.

Tribe: Deltocephalini

Genus 19. *Maiestas* Distant, 1917

1917. *Maiestas* Distant, *Linn. Soc. London Trans. Zool. **17***: 312

24. *Maiestas distincta* (Motschulky, 1859)

1859. *Deltocephalus distinctus* Motschulsky, *Etud. Ent.* :112

2009. *Maiestas distincta* (Motschulsky): Webb & Viraktamath, *Zootaxa,* **2163**:18

***Material examined*:** 5 exs., Ukshi, Dist. Ratnagiri, 1.vii.2014, Coll. M. E. Hassan & Party, 1 ex., Naruhal, Dist. Dhule, 8.iii.2013, Coll. M. E. Hassan & Party, 2 exs., Belati, Dist. Solapur, 16.vi.2014, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Dhule, Ratnagiri, Solapur), Chhattisgarh, South India. *Elsewhere*: Sri Lanka, Palearctic region, Pacific region.

25. *Maiestas dorsalis* (Motschulsky, 1859)

1859. *Deltocephalus dorsalis* Motsch. *Etud. Ent.* 114

2009. *Maiestas dorsalis* (Motsch.): M.D. Webb & C.A. Viraktamath, *Zootaxa,* **2163**: 18

***Material examined*:** 1 ex., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M. E. Hassan & Party, 1 ex., Bhosa, Dist. Parbhani, 08.iii.2015, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Kolhapur, Parbhani) West Bengal. *Elsewhere*: Japan, Sri Lanka.

26. *Maiestas pruthi* (Metcalf, 1967)

1936. *Deltocephalus notatus* Pruthi, *Mem. Ind. Mus*. XI: 128

1967. *Deltocephalus pruthi* Metcalf,*Gen. Cat. Hom*., **6**(10): 1173

2009. *Maiestas pruthi* (Metcalf): M.D. Webb & C.A. Viraktamath, *Zootaxa,* **2163**: 20

***Material examined*:** 3 exs., Degaon, Dist. Solapur, 16.vi.2014, Coll. M. E. Hassan & Party, 2 exs., Belati, Dist. Solapur, 16.vi.2014, Coll. M. E. Hassan & Party, 1 ex., Sangliwadi, Dist. Sangli, 20.v.2014, Coll. M. E. Hassan & Party, 3 exs., Rakaswara, Kalyani Park, Dist. Nandurbar, 11.iii.2013, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Nandurbar, Solapur)

Tribe: Penthimiini

Genus 20: *Neodartus* Melichar, 1903

1903. *Neodartus* Melichar, *Hom. Faun. Ceylon*: 162

27. *Neodartus acocephaloides* Melichar, 1903

1903. *Neodartus acocephaloides* Melichar, *Hom. Faun. Ceylon*: 163

2010. *Neodartus acocephaloides* Melichar: Ghosh & Animesh Bal, *State Fauna Series* 18: *Fauna OfUttarakhand*, Part-2: 186

***Material examined*:** 6 exs., Mohari, Dist. Dhule, 8.iii.2013, Coll. M. E. Hassan and party, 2 exs., Adharpur, Dist. Nanded, 25.ii.2015, Coll. M. E. Hassan and party, 1 ex., Satpur Botanical Garden, Dist. Nagpur, 17.ix.2013, Coll. M. E. Hassan and party,

***Distribution*:** India: Maharashtra (Dhule, Nagpur, Nanded), Chhattisgarh ,Punjab, Uttarakhand, Tamil Nadu, Tripura, West Bengal. *Elsewhere*: Sri Lanka.

Tribe: Macrostelini

Genus 21. *Balclutha*Kirkaldy, 1900

1900. *Balclutha* Kirkaldy, *Entomologist,* 33: 243

29. *Balclutha rubrostriata* (Melichar, 1903)

1903. *Gnathodus rubrostriata* Melichar, *Hom. Faun. Ceylon*: 208.

1908. *Balclutha rubrostriata* Distant, *Fauna Brit. India . Rhynchota*, **4**: 370.

***Material examined*:** 2 exs., Naruhal, Dist. Dhule, 8.iii.2013, Coll. M.E.Hassan and Party, 1 ex., Rakaswara, Dist. Nandurbar, 11.iii.2013, Coll. M.E.Hassan and Party, 1 ex., Degaon, Dist. Solapur, 16.vi.2014, Coll. M.E. Hassan and Party.

***Distribution*:** India: Maharashtra (Dhule, Solapur, Nandurbar) *Elsewhere*: Palestinae

29. *Balclutha punctata* (Fabricius, 1775)

1784. *Cicada punctata*: Thunb., *Act. Ups.* **4**: 21

1908. *Balclutha punctata* Distant, *Fauna Brit. India . Rhynchota*, **4**: 369.

***Material examined*:** 3 exs., Kusumba, Dist. Dhule, 7.iii.2013, Coll. M.E. Hassan and Party, 1 ex., Lohara, Dist. Osmanabad, 4.iii.2015, Coll. M.E. Hassan and Party,

***Distribution*:** India: Maharashtra(Dhule, Osmanabad) *Elsewhere* : Japan ,New Guinea,.

Tribe: Goniagnathini

Genus 22: *Goniagnathus* Fieber, 1866

1866. *Goniagnathus* Fieber, *Verh. z.b. Ges. Wien*, xvi: 506

30. *Goniagnathus (Tropicognathus) punctifer* (Walker, 1858)

1858. *Bythoscopus punctifer* Walker, *Ins. Saund., Hom.,*: 104

2009. *Goniagnathus (Tropicognathus) punctifer* Walker: Viraktamath, *Zootaxa,* **2224**: 53

***Material examined*:** 3 exs., Kusumbe, Dist. Jalgaon, 24.ii.2013, Coll. M. E. Hassan and Party, 1 ex., Phonda, Dist. Sindhudurg, 25.vi.2014, Coll. M. E. Hassan and Party,

***Distribution*:** India: Maharashtra (Jalgaon, Sindhudurg) Bihar, Chhattisgarh, Gujarat, West Bengal. *Elsewhere*: Sri Lanka, Myanmar, Maldive Islands.

Subfamily III: Idiocerinae

Tribe: Idiocerini

Genus 23: *Amritodus* Anufriev, 1970

1970. *Amritodus* Anufriev, *J. Nat. Hist. Soc*., **4**: 375-376

31. *Amritodus atkinsoni* (Lethierry, 1889)

1889. *Idiocerus atkinsoni* Lethierry, *J.A.S.B.* **18**: 252

1970. *Amritodus atkinsoni* Anufriev, *J. Nat. Hist. Soc.,* **4**(3): 375-380

***Material examined*:** 1ex., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M. E. Hassan & Party, 2 exs., Krishnapur, Dist. Nanded, 25.ii.2015, Coll. M. E. Hassan & Party, 2 exs., Sokher, Dist. Nanded, 24.ii.2015, Coll. M. E. Hassan & Party.

***Distribution*:** India: Maharashtra (Kolhapur, Nanded), Chhattisgarh, Delhi, West Bengal. *Elsewhere*: Sri Lanka.

Genus 24: *Idioscopus* Baker, 1915

1915. *Idioscopus* Baker, *Philippine Jour. Sci*. 10: 320

32. *Idiscopus clypealis* (Lethierry, 1889)

1889. *Idiocerus clypealis* Leth., *J. Asiatic Soc. Beng*. 58: 252

1988. *Idioscopus clypealis* (Leth.): Datta, *Rec. zool. Surv. India, Occ.paper* 90: 232

***Material examined*:** 1 ex., Pathari, Dist. Nandurbar, 10.iii.2013. Coll. M.E.Hassan and Party.

***Distribution*:** India: Maharashtra (Nandurbar),Assam, Bihar Sri Lanka, Tamil Nadu West Bengal. *Elsewhere*: Formosa, Java, Luzon, Malaysia, Southern China.

33. *Idioscopus nitidulus* (Walker, 1870)

1870. *Iassus nitidulus* Walker, *Jour. Linnean Soc. Zool.* **10**: 276-330.

1973. *Idioscopus nitidulis* Maldonado-Capriles, *Proceedings of the Entomological Society of Washington*, **75**(2): 179-181.

***Material examined*:** 1 ex., Lalkheri, Dist. Amaravathi, 10.xi.2014, Coll. M.E.Hassan and Party.

***Distribution*:** India: Maharashtra (Amaravati), Tamil Nadu, U.P., West Bengal. *Elsewhere*: Hong Kong, Java, Japan, Malaysia Myanmar Philippines, Sri Lanka, Singapore.

Subfamily IV: Iassinae

Tribe: Batracomorphini

Genus 25: *Batracomorphus* Lewis, 1834

1834. *Batracomorphus* Lewis, *Tr. E.S.,* **1**:51.

34. *Batracomorphus chlorophana* (Melichar, 1903)

1903. *Bythoscopus chlorophana* Melich*., Hom. Faun.Ceylon,*: 153.

1966. *Batracomorphus chlorophana*: Metcalf, *General catalogue of Homoptera,* **6** (15): 53.

***Material examined*:** 1 ex., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M.E. Hassan and Party, 1 ex., Dist. Nagpur, 18.ix.2013, Coll. M.E. Hassan and Party, 6 exs., Sangliwadi, Dist. Sangli, 20.vi.2014, Coll. M.E. Hassan and Party; 1 ex., Pawnar, Dist. Wardha, 14.IX.2013, Coll. M.E. Hassan and Party, 1 ex., Bor WLS, Dist. Wardha, 13.ix.2013, Coll. M.E. Hassan and Party,

***Distribution*:** India : , Nagpur, Sangli, Wardha), Andhra Pradesh, Karnataka, Tamil Nadu , Uttarakhand, West Bengal, *Elsewhere*: Sri Lanka, Myanmar.

Subfamily V: Megophthalminae

Tribe: Agallini

Genus 26. *Hemagallia* Viraktamath, 2011

2011. *Hemagallia* Viraktamath, *Zootaxa*, **2844**: 58

35. *Hemagallia biplagiata* (Melichar, 1903)

1903. *Agallia biplagiata* Melichar, *Hom. Faun. Ceylon* : 50

2011. *Hemagallia biplagiata* Viraktamath, *Zootaxa,* **2844**: 58

***Material examined*:** 1 ex., Gyanganga WLS, Dist. Buldhana, 29.x.2014, Coll. M. E. Hassan and Party.

***Distribution*:** India: Maharashtra (Buldhana), Karnataka. *Elsewhere* : Sri Lanka.

Subfamily VI: Ledrinae

Tribe: Ledrini

Genus 27: *Petalocephala* Stål, 1854

1854. *Petalocephala* Stål, *Öfversigt af Kongliga Svenska Vetenskaps-Akademiens Förhandlingar*, **11**: 231-255.

36. *Petalocephala granulosa* Distant, 1910

1910. *Petalocephala granulosa* Distant, *Entomologist*: 196

***Material examined*:** 3ex., Gayanganga W. L. S., Dist. Buldhana, 29.x.2014, Coll. M. E. Hassan & Party,

***Distribution*:** India: Maharashtra (Buldhana), Bihar,Tamil Nadu, West Bengal.

37. *Petalocephala uniformis* Distant, 1908

1908. *Petalocephala uniformis* Distant, *Fauna Brit. India . Rhynchota* , **4** : 165

1988. *Petalocephala uniformis* Distant: Datta, *Rec. zool. Surv. India, Occ.paper* 90: 43

***Material examined*:** 1 ex., Radhanagari WLS, Dist. Kolhapur, 24.vi.2014, Coll. M. E. Hassan & Party,

***Distribution*:** India: Maharashtra (Kolhapur), Tamil Nadu.

Conclusion

This paper reports 37 species of cicadellids under 27 genera belonging to 6 subfamilies from the state of Maharashtra.

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ORGANIC FARMING : ANSTRONG TOOL FOR SUSTAINABLE AGRICULTURE

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Concept of Organic Farming

The term organic agriculture was coined by Lord Northbourne, an agriculturist motivated by Steiner's biodynamic approach in 1940 while Albert Howard firstly applied principles and scientific knowledge in organic agriculture and he is known as 'Father of Organic farming'. The concept of organic agriculture has been perceived differently by different people. But organic agriculture described by Lampkin (1990) appears to be most comprehensive covering it's all the aspects. As per his description, organic agriculture is a production system which avoids or largely excludes the use of synthetic compound fertilizers, pesticides, growth regulators and live-stock feed additives. To the maximum extent feasible, organic system relies on crop rotations, crop residues, animal manures, legumes, green manures, off-farming organic wastes and aspect of biological pest control to maintain soil productivity and tilth, to supply plant nutrients and to control insects, weed and other pests.

As per International Federation of Organic Agriculture Movement (IFOAM) an international umbrella organization for organic farming, "Organic agriculture is production system that sustains the health of soils, ecosystem and people. It relies on ecological process, biodiversity and cycle adapted to local conditions rather than the use of inputs with adverse effects. Organic agriculture combines tradition; innovation and science benefit the shared environment and promote fair relationship and a good quality of life for all involved."

In simple words, organic farming is a form of agriculture that relies on techniques like crop rotation, green manuring, use of FYM/vermi-compost, and biological pest control. In organic farming fertilizers, herbicides, insecticides and fungicides are put to use which are considered natural such as bone meal from animals or pyrethrin from flowers and it excludes or strictly limits the use of synthetic fertilizers and pesticides; plant growth regulators; antibiotic use in livestock; genetically modified organisms; human sewage sludge; and nano-materials for reasons including sustainability, openness, independence health, and safety. Organic agriculture aims at a sustainable production system based on natural process. Key characteristics of organic agriculture are:

- relies primarily on sustainable use of local and renewable resources;
- minimal use of purchsed inputs, only as complementary to local resources;
- makes efficient use of solar energy and potential of biological systems;
- maximizes recycling of plant nutrients and organic matter; maintains diversity in the production systems;
- ensuring the basic biological functions of soil-water-nutrient-human continuum and,
- provides farm animals natural conditions according to their ecological role and behaviour.

Why Organic Farming?

Green revolution technologies involving greater use of synthetic agrochemicals such as fertilizers and pesticides with adoption of nutrient-responsive, high-yielding varieties along with expansion of irrigated area under crops have led to substantial increase in the productivity of crops, especially food grains just from 582 kg/ha in 1950-55 to 1598 kg/ha in 1996 to 2000 culminating into the change from 'ship to mouth' India to "food exporter' country (Panda, 2011 and Ravisankar*et. al.*, 2016).). However, this increase in production has slowed down and in some cases there are indications of decline in productivity and production. Besides,

damage to natural resources, loss of biodiversity, nutritional imbalance in soils, less nutrient use efficiency, increased cost of cultivation, unsustainability in agriculture and environmental and human health problems are some other ill effects of green revolution technologies in the country. (Ramesh *et. al.,* 2016).

Increasing awareness about conservation of environment as well as health concerns caused by harmful synthetic agro-chemicals has resulted in paradism shift in consumers' preference towards safe food with niche markets promoting organic agricultural produce. The scientists are more concerned about harmful impacts of pesticides on human and environmental health. However, once again the need for an appropriate technology suitable to our requirements is being felt. The practice of organic farming said to the best known alternative to the conventional method and is based on the similar principles underlying our traditional agriculture.

Present Status and Future Prospects

As per FIBL survey (2011), 1.8 million farmers across 162 countries are now growing organically produced commodities on more than 37.2 m ha. The countries with large acreage under organic agriculture are Australia, Argentina and China (Ganai*et. al.*, 2016). The demand has increased at a compounding rate of 8.9% per annum from 2001 to 2011. India has brought 4.9 m ha area under organic certification process. Out of this cultivated area accounts for1.18 m ha (24.1%) while remaining 3.71 m ha (75.9%) is wild forest harvest collection area. Currently India ranks 10th among the top ten countries having the cultivable land under organic certification. Sikkim state has been declared as organic state from January, 2016 and has the highest net sown area (100%) under organic certification while Madhya Pradesh is having largest area (2,32,887ha) under organic production system. The domestic market for organic products in the year 2014-15 wasestimated at rupees 875 crores. Different parts of India have developed their own local or regional system for ecological agriculture that is now gathered in one umbrella *term 'JaivikKheti' or 'Jaivikkrishi*(Ravisankar*et. al.,* 2016).

It is estimated that various organic resources having the total nutrient potential of 32.41 m tonnes will be available for use in 2025. Out of these organic resources, a large quantity of tapable potential of major nutrients viz., N, P and K from human excreta, livestock dung and crop residues have been worked out to be only 7.75 m tonnes.

Principles of Organic Farming

The concept of organic farming in India is based on the following major principles:

1. The principle of health- farming should sustain or enhance soil health, plant animal and human.
2. The principle of ecology- farming should be based on ecological system and cycle, emulate and help sustain them.
3. The principle of fairness- farming should have equipped, respect and justice for all living things.
4. The principle of care- farming should protect the health and wellbeing of current and future generations and environment.

Basic Steps of Organic Farming

Organic farming approach involves following major steps (Pandey*et. al.*, 2014):

1. Conversion of land from conventional management to organic management.
2. To enrich biodiversity and sustainability of the production system.
3. Crop production with the use of alternative sources of nutrients like adoption of suitable crop rotation, residue management, organic manures and other required biological inputs.
4. Management of weeds and pests by integration of physical, mechanical, biological and other possible ways.
5. Maintenance of livestock in tandem with organic concept and make them an integral part of the entire system.

Components of Organic Farming

The organic farming is an integrated management approach of some essential components in effective ways which are as follows:

A. Organic Manures

(a) Bulky organic manure: It generally contains fewer amounts of plant nutrients as compared to concentrated organic manure. It includes FYM, compost and Green manure.

Farm yard manure (FYM)/composts: FYM is the decomposed mixture of dung and urine of farm animals along with litter and left out materials of fodder or roughages. On an average, it contains 0.5% N, 0.25% P_2O_5 and 0.5% K_2O. In addition to these nutrients, it also contains a number of other plant nutrients such as Ca, Mg, S, Zn, Cu Fe, Mn etc.

Large quantities of waste material are available as vegetable refuse, farm litter, such as weeds, stubble, *bhusa*, sugarcane

trash, sewage sludge and animal waste in houses and in areas like human and industrial refuse; therefore, excreta can be converted into useful compost manure.

(b) Concentrated organic manure: Concentrated organic manures are those materials that are organic in nature and contain higher percentage of essential plant nutrients such as nitrogen, phosphorous and potash, as compared to bulky organic manures. These concentrated manures are made from raw materials of animal or plant origin. The concentrated organic manures commonly used are oilcakes, blood meal, fishmeal, meat meal and horn and hoof meal.

(c) Green manuring: Green Manuring, wherever feasible, is the principal supplementary means of adding organic matter to the soil. The green manure crop supplies organic matter as well as additional nitrogen, particularly if it is legume crops which fix nitrogen from the air with the help of its root-nodule bacteria. A leguminous crop producing 25 tones of green matter per hectare will add about 60 to 90 kg of nitrogen when ploughed under. The green manure crops also exercise a protective action against erosion and leaching. The most commonly used green manuring crops are: Sunhemp (*Crotalaria juncea*), Dhaincha (*Sesbaniaaculeata*), Cluster bean (*Cyamopsistetragonoloba*), Senji*(Melilotusparviflora*), Cowpea (*Vignacatjang*/*V. sinensis*), Berseem (*Trifoliumalexandrium*) etc.

B. Suitable Crop Rotation: The selection of optimal crop rotation is important for successful sustainable agriculture. Crop rotation is very important for soil fertility management, weed, insect and disease control. Legumes are essential in any rotation and should occupy 30 to 50 per cent of the land or growing of any pulse cropat least once in every three years.

C. Intercropping and Mixed Cropping: Intercropping is growing of two or more crops in same piece of land in definite row arrangement. This practice ensures better utilization of natural resources viz., land, sunlight, moisture, nutrients and provide more net profit, serves as insurance against crop failure and ultimately food and environment and livelihood security. Intercropping also plays a vital role in effective management of weeds. Mixed cropping is growing of two or more crops in same piece of land without any row ratio Mixed /intercropping with legume crop is most suitable for fertility restoration point of view (Mahapatra*et. al*., 2005)

D. Crop Residue Management: In India there is a great potential for utilization of crop residues/ straw of some of the major cereals and pulses. About 50% of the crop residues are utilized as animal fed, the rest could be very well utilized for recycling of nutrients. Adequate attention is required to use the residues after proper composting with efficient microbial inoculants.

E. Mulching: Mulches contribute to weed management in organic crops by reducing weed seed germination, blocking weed growth and favouring the crop by conserving soil moisture and maintaining favourable soil temperature.

F. Wastes: Industrial, Municipal and Sewage wastes: Among the industrial by products, spent wash from ditilisers and molasses and pressmud from sugar industry have good manurial value. Addition of pressmud improves the soil fertility and enhances the activity of microbes. In India, the total municipal refuse is about 12 m t/annum containing about 0.5% N, 0.3% P_2O_5 and 0.3% K_2O. Sewage sludge is available to an extent of 4 million tons per annum containing 3% N, 2% P and 0.3% K. Separation of the toxic wastes at the source will minimize the concentration of heavy metal elements in the sludge.

G. Biofertilizers: Bio-fertilizer offers an economically attractive and ecologically sound means of reducing external inputs and improving the quality and quantity of internal sources. These are less expensive, eco-friendly and sustainable. The beneficial micro-organisms in the soil that are greater significance to horticultural situations are biological nitrogen fixers, phosphate solubilisers and mycorrhizal fungi.

Types of Biofertilizers: There are two types of bio-fertilizers-

a. Symbiotic N-fixation- These are Rhizobium culture of various strains which multiply in roots of suitable legumes and fix nitrogen symbiotically. Almost 50% demands of N are met by these microorganisms in legumes.

Rhizobium: It is the most widely used biofertilizers, which colonizes the roots of specific legumes and can fix upto 100-280 kg N/ha in one crop season.

b. Asymbiotic N-fixation- This includes *Azotobacter*, *Azospirillium*, BGA, *Azolla* and *Mycorrhizae*, which also fixes atmospheric N in suitable soil medium. They grow on decomposing soil organic matter and produce nitrogen compounds for their own growth and development, besides that they leave behind a significant amount of N in surroundings.

H. Vermi-compost and Vermiwash: also known as 'worm compost' which is produced by the activity of earthworms. It is a nutrient rich, natural fertilizer and soil conditioner, it contains nearly 0.5-1.5% N, 0.1-0.3% P_2O_5 and 0.15-0.5% K_2O as well as various vitamins, growth hormones and immobilized micro flora. Either natural or exotic species of earthworm like *Eudrilluseuginae*are normally used. the process of producing vermin-compost is called as vermicomposting while liquid fertilizer collected after the passes od water through a column of worm activation is called as vermiwash. Vermiwash contains many microorganisms like

*Rhizobium sp., Azotobacter*and phosphate solubilizes and is effectively used as foliar spray (Dikshit,1998).

I. Bio-pesticides: Bio-pesticides are natural plant products that belong to the so-called secondary metabolites, which include thousands of alkaloids, terpenoids, phenolics and minor secondary chemicals.Botanical insecticides are ecologically and environmentally safer generally affect the behaviour and physiology of insects rather than killing them. Among them Neem (*Azadirachtaindica*) has justifiably received the maximum attention. All parts of the Neem tree possess insecticidal property but seed kernel is most active. Some of other commonly used botanical insecticides are Nicotine, Pyrethrum, Rotenone, Subabilla, Ryanin, Quassia, Margosa, Acorus etc.

J. Non-chemical Weed Control: Weed control is an important aspect in organic farming because the use of chemical herbicides leads to environmental pollution. Hence, its use to control weeds in organic farming is totally prohibited. In organic farmingmore emphasis is given on crop rotation, green manuring, tillage operations, mulching, soil solarisation and adoption of biological control measures to manage weed infestation (Pandey*et al*., 2014).

Looking at the tremendous increase of population in the country, our compulsion would be not only to stabilize the agricultural production but to increase it further in a sustainable manner. The scientists are realizing the fatigue of green revolution in the country in the form of stagnation in crop yields plateaue and diminishing return of falling dividends. In this situation, Indian agriculture must move towards adoption of organic farming approach in intensive agriculture areas and 'certified organic farming' with a combination of tradition, innovation and modified scientific cultivation in drylands and rainfed areas for agricultural sustainability and increase farmers income.

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ROLE OF RURAL WOMEN IN ECONOMIC ACTIVITIES

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There is a common feeling that the women are the key factors in the process of the change and the development of a family of a society of Malian. There is a Maximum number of adult Education campaigns that to educate the male to educate the individuals there as to educate, female is to educate a family the maternal leader and our first prime minister of India Mr. J.L. Nehru observed "In order to awaken the people it is the female who has to be awakened. Once she is an the make the house hold moves, the villages makes and the community maves and through the women and the children are brought into the picture and given the opportunists of heathen life and better trainity".

Today's smart and Educated women -

The majority of the rural families work in occupation and styles where men women and the children combines their efforts to produce from the laud. Still the women's states is directly related to the quantum of work she does. The labour inputs of female into house hold affairs and its reward even if in identifiable is a writes ingredient of female status & rural women in our country shows abundant responsibilities and performance a decide spectrum of duties in running the family maintaining the house hold attending to farm labour, alternating domestic animals and the like. They work shoulder to shoulder with the men fale in the fields in the scorching seen and in passing rain. They do so many things exclusively which men do not do.

Participations in Economy :-

Women constitute 48.2% [33 crores out of 684 crors] of the total population in India as per 2011 census, But the percentage of women in the total labour force in only 20.85% who as in other developed country it ranges from 30 to 45%.

The work participation rate for females increased from 15.9% in rural areas of the country showing then by increased participation of women in economic activities during the decade 2001-2011.

Roughly fifth women in a worker as against every second of man. Agricultural labour and cultivation and besides animal rearing crops and the main areas of economic activities for rural women. The prime sector family livestock forestry, fishery, plantations, ordered, etc. Procides work for about 79-80% of women and 45% of them work as agricultural laborites 33% are cultivators, while workers in the secondary and tertiary sectors accounted for 4% and 15% respectively more then 74% joining rural women belong to the families of small and marginal farmers. About 2/3rd to one half of the manual labour as farms is done by women and men than 2/3rd number of population of rural women one illiterate, particularly in Uttar Pradesh the Industry wise distribution of female workers to total population can be seen as under.

Table Particulars Male and Female in work

		Female	Male
	Total workers - 402235	127220	275015
1.	Cultivator	41896	85417
2.	Agricultural Labourer	49446	57329
3.	House Holds Industry workers	8213	8744
4.	Ohters	27665	123525

PCA India

Sources : census of India 2001-2011 Eco-Tables

As per the census 2001 the India work force is 400 million strong which constitutes 39.1 of the total population of the country. The workers comprise 312 million main workers and 88 million marginal workers see differential among the need of male and female worker in the total males and 25.6 percent of the total females and worker in about lets then holy number of male workers.

Main worker constitute 77.8% of the total worker is farms of proportion. The remaining are marginal workers among the main workers female workers are only 23.3% and 76.7% and male workers majority of female workers (87.3)% are from rural areas. This is also twice that of male worker which may be due to their being employed predominately in activities and agricultural labour in the urban areas. Majority of female workers are engaged in House Hold Industries and the other works.

The worker has been classified by the type of economic activity into broad types of Economic activity in Nine categories as per National Industrial classification. In the country main worker 166 million 56.6% has been engaged in agriculture and allied activities. There are 31.1 million worker in the services sector forming 10% of the total main workers wide similar number angered in whole sale and the fallen occupations. In table shows extent of female employment reflects social wakening against the traditional majority of society. They are very prompt in their prevailing activities.

Even the employment of women in developing countries remain Isolated from the process of Economic development because of their engagement in domestic management Mr. G mydral and A mydral in their Book : The Population Crisis " Exprossed in their view that value built round the system of keeping women confined to home making were essentially the creation of the middle class families. The product of Industrial revolutions, to present competitions between the men and the women of the same class for scaice job are the Higher level they are heat considered to be gainfully employed and are even categorised as out side the available labour force at they do not activity sick work women are made to work for less number houses in the fields compared to their men counter parts an account of the work done by them in house. The addition to participation inform activities and the physical work women also help in decision making with regard to farm precious and agricultural operation women as views and mothers have a considerable part in decision making at home and even in farm matters. Dewdas P.R. worked that farm women and almost always consulted in making decision with regard to various forms operations like getting seeds selecting crops getting fertilizers and pesticides appointing labourers.

Rural Evil :

In rural characters the rural women born and bread to the traditions of work and are a real symbol of dedication patinas and societies it has been recanded that the school attendance rate through out the third world is town for girls than for boys. It is correct that women's role in modernization has been most grossly unrecognised. Some statistical indicators reflect as the how in adequate equalipped women are; resulting present state of affairs.

A. The rate of skill formasian amongest female in the rural areas have been estimated at 3.3% thus 97% of female in rural areas are without skill where the skill are defiend to Incirde wearing shoe making, wooden basket (tokary) making made house making capacity black smiley and various than services of the craft.

B. The female work force participation rate in rural areas according to censeas 2001 is low as against males due to social evils. The female can'not migrate the outside village for economic opportunities

C. The incidence of unemployment among rural female 9.2% an against 7.1% in rural males.

D. The percentage of female literature in rural areas according to the 2001 senseas was about 18% as against 40% for male.

Proceeding Productive employment of Women :

Economic development of rural women will reguise Inter disciplinary approach with appropriate technology and necessary financial and infra structural support we should provide the economic opportunities in agriculture, animal husbandry, Dairy form, Fisheries horticulture, Floriculture rural Industries as cottage, Industries, Khadi and village Industries a grow based industries. Handlooms, Handicrafts and the other Industries like readymade, garments, wood work, Bambo-work Textile Printing, Food Preservation making plastic, goods, matchines, assembling, floor mills, oil mills, rice miles, and Khandsari and sugar mills, soap, chemical industries wood industries and leather industries etc. Thus Khadi and village Industries are most appropriate and for rural women where than is ample scope for them.

Let it be known very clearly to all concerned that rural women process the key to the rapid and sustained economic development of the rural are as and the ultimate prosperity of the Malian. Prosperity by rural women will remark the poverty of the country. Rural women stand distinctively for rationality and work devotion without which no nation can progress. Now our motion should be develop rural women for the development of the country and the work others to words this end should be seated in reality.

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AN INTRODUCTION ABOUT MILKY MUSHROOM : THEIR CULTIVATION AND DISEASE MANAGEMENT

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Abstract

Milky mushroom (*Calocybe indica*) has become the third commercially grown mushroom in India after button and Pleurotus mushrooms. This mushroom is fast reputation due to its attractive robust, white sporocarps, long shelf life, sustainable yield, delicious taste, unique texture and cholesterol free foods with certain important medicinal properties including their antiviral effect. Mushrooms are very good source of protein, vitamins and minerals with attracting flavours and are cholesterol free foods with several important medicinal properties together with antiviral effect. Milky mushroom is also an excellent source of thiamine, riboflavin, nicotinic acid, pyridoxine, biotin and ascorbic acid. The locally available substrates for its cultivation, the paddy straw substrates are very suitable for the milky mushroom cultivation. The higher yield of quality mushroom depends upon proper maintenance of pure culture as well as purity and quality of the spawn used. Hence, low cost and quality spawn is the basic requirements for mushroom growers. Several harmful fungi are encountered in compost and casing soil throughout the cultivation and many of these acts as competitor moulds thereby harmfully affecting spawn run whereas, others assail the fruiting bodies at various stages of crop growth producing dissimilar disease symptoms. Sometimes, there is complete crop failure depending upon the stage of infection, superiority of compost and environmental conditions. The methodical characterization of fungal communities in casing soil, a functional analysis is needed to highlight potentials and applications.

Introduction

In India, mushrooms commonly known as “Khumbi”, “Chhatra”, “Kukurmutta”, “Dhengri”, “Dharti ka phool” etc. belongs to ascomycotina or basidiomycotina and unlike green plant they lack chlorophyll thus they cannot utilize the solar energy to manufacture their food as of green plants, having various shape, size and colours are very important food crop and can be produced in varied situations. These could be either epigeal or hypogeal. **(Chang and Miles, 1991).** Mushrooms are very good source of protein, vitamins and minerals with attracting flavours and are cholesterol free foods with certain important medicinal properties including the antiviral effect. Milky mushroom is also an excellent source of thiamine, riboflavin, nicotinic acid, pyridoxine, biotin and ascorbic acid **(Breene,1990)**. In addition to this, the majority of the mineral salts required by human body such as potassium, sodium, phosphorus, iron and calcium. Due to its alkaline and higher fiber content it is highly suitable for people with hyperacidity and constipation **(Doshi and Munot, 1988).**

Mushroom cultivation offers an excellent means for recycling agro wastes presently available in India **(Sohi, 1988)**. Though, we have virtually witnessed a revolution in mushroom cultivation, in order to bring our country on the mushroom map of the world serious efforts are needed to perfect the cultivation technologies of newer edible mushrooms including *Calocybe indica* **(Chadha, 1994).**

Milky mushroom (*Calocybe indica*) has become the third commercially grown mushroom in India subsequent to button and

oyster mushrooms. This mushroom is gaining attractiveness due to its attractive robust, white sporocarps, long shelf life, sustainable yield, delicious taste, exclusive texture and cholesterol free foods with certain significant medicinal properties including their antiviral effect. The diverse production potential of diverse substrates is due to the variations in their physical properties and nutritional composition. Locally available substrates likewise, wheat straw, paddy straw, pea straw, cotton waste, maize straw, sugarcane bagasse and wheat straw in combination with paddy straw were evaluated to find out the best appropriate substrate for cultivation of milky mushroom ©. *indica*). Likely the reason for this study may be that paddy straw has high water holding capacity, porosity and bulk density. Paddy straw was found to be the best substrate for cultivation of milky mushroom **(Maurya *et al.*, 2019).**

Successfully production of mushroom and higher yield of quality mushroom depends upon proper maintenance of pure culture as well as purity and quality of the spawn used. Hence, low cost and quality spawn is the basic requirements for mushroom growers **(Maurya *et al.*, 2019).**

Like all additional crops, mushrooms are also affected unfavorably by a large number of biotic and abiotic factors. Among these biotic agents, like fungi, bacteria, viruses, nematodes, insects and mites cause damage to mushrooms directly or indirectly. Various harmful fungi are encountered in compost and casing soil during the farming and many of these acts as competitor moulds thereby adversely affecting spawn run whereas, others attack the fruiting bodies at various stages of crop growth producing different disease symptoms. At times there is whole crop failure depending upon the stage of infection, superiority of compost and environmental conditions.

Materials and methods

Preparation of substrate:

Fifty liter of water was taken in rust proof drum of 100 liter capacity and 6 kg of wheat straw was slowly stepped in water. An extra plastic bucket, 4gm Carbendazim 50% WP and 75ml Formaldehyde (40%) was mixed in 10 liter of water and slowly poured on the previously soaked wheat straw (Fig. 1). Straw was pressed and water tank was closed with polythene sheet and kept as such for 18 hours. After wetting, straw was removed from water tank and put on clean concrete floor for removing excess water till b/w 65-70% moisture stage **(Maurya *et al.*, 2016).**

Spawning:

The spawning was done through freshly prepared, 10 to 15 days old spawn. A moisture content of about 65% was maintained in the wet substrate prior to spawning. Spawning was done @ 5% by wet weight basis of the ready substrate in polypropylene bags of 60 × 40 cm size with 100 gauge thickness. The spawn bags were tricked by the help of sterilized needle to allow the air flow. After spawning, the bags were shifted in to cropping room and kept in dark place where temperature in between (25-30 0C) and relative humidity (85-90%) were maintained till mycelium colonized the substrates and then the substrates were ready for casing. **(**Fig.2)

Opening of bags:

When the mycelium fully colonized on the substrate and form mycelial mat fit ready for fruiting. Now the mouth of polypropylene was gently opened, and all the bags were arranged on platform or shelves with a minimum distance of 20-25 cm between two bags in tiers and provided the light spray of fresh water twice everyday on regular basis. The relative humidity and proper ventilation was allowed to avoid high level of CO_2 concentration in cultivation room, within few days after casing the fruiting bodies were initiated and ready for picking (Fig.3).

Casing:

Casing means covering the compost with a thin layer of soil or soil-like substance after the spawn has spread in the compost (spawn run) **(**Fig.4**)**. It's provided physical sustain, moisture and allows gases to escape from the substrates. Casing material was prepared by using garden loam soil (50%), sand (25%) and FYM (25%). The casing soils were prepared by methodical mixing of the preferred casing soils in the proper ratio. All type of casing soil was chemically sterilized with 4 per cent formalin solution @ 500ml/cubic feet and covered with plastic sheet for 72hours**. (** Fig. 5**)**

Harvesting:

After 10-12 days of casing, fruit primordial formed and within 5-6 days, mature fruit bodies of the mushroom become ready for harvest. The bags should not be opened before the mycelial growth completion. The bags can be arranged on aluminium racks at a distance of 5 to 10 cm. The cropping room should be properly ventilated and adequately lighted. The harvesting of fruiting bodies was done at proper maturity stage by holding the cap and twisting to get fruiting body (Fig.6).

Fig.1. Removing excess water

Fig.2. Spawning

Fig.3. Complete spawn run

Fig.4. Casing of milky mushroom

Fig.5. Complete spawn run on casing soil

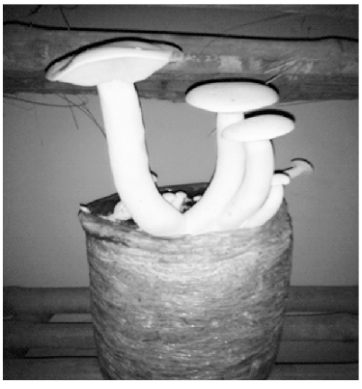

Fig.6. Mushroom ready for harvest

Important disease

At any phase of growth an unwanted growth of certain moulds can occur and harmfully affect the mushroom yield (Fig. 7). The occurrence of pathogenic fungi in the cultivation halls at the beginning of the production cycle is a grave threat to the cultivation of milky mushroom because their rapid development shortens the span of fruiting body harvests. Along with the methodical characterization of fungal communities in casing soil, a practical analysis is needed to highlight potentials and applications **(Murmu *et al*., 2020)**.

Each mushroom species in a specific environment has different pest/disease complex. Even a little carelessness in the cultivation of mushroom can cause havoc in the mushroom industry. Improper pasteurization of compost and casing becomes a major source of infection of fungi and bacteria. Once the disease has been introduced, it attracts mushroom flies, a common pest among cultivated mushroom species, on the smell of decaying mushroom **(Maurya *et al*., 2019)**.

General distribution of diverse competitor moulds and pathogenic fungi is as follows:

1. Fungi occurring in compost and in casing soil:

a. White plaster mould (*Scopulariopsis fimicola*)
b. Brown plaster mould (*Papulospora byssina*)
c. Lipstick mould (*Sporendonema purpurescens*)
d. False truffle (*Diehliomyces microsporus*) and green moulds.

2. Fungi occurring on the growing mushrooms:

a. Cinnamon mould (*Peziza ostracoderma*),
b. Wet bubble (*Mycogone perniciosa*)
c. Dry bubble (*Verticillium fungicola*)
d. Cobweb (*Cladobotryum dendroides*)
e. Pink mould (*Trichothecium roseum*)

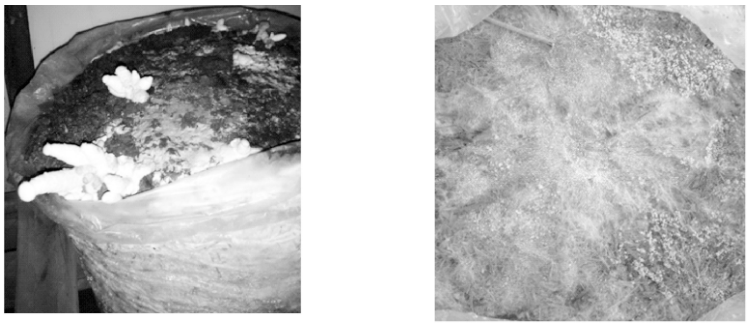

Fig.7. Bag heavily contaminated by plaster mould and green mould

Management:

(a) Precautions:

The mushroom requires high temperatures and high humidity along with good light and aeration. Yield as adversely affected when these conditions are not provided. While mycelia growth occurs between 20-37^{0}C for fruiting the temperature requirement is from 25 to 35^{0}C. The pH of the casing material should be around 7.0 so that competitor moulds do not attack the beds. Fungus is favored by improperly pasteurized compost and high humidity in mushroom house, therefore humidity should be maintained. Very good hygiene, Proper pasteurization and conditioning of compost. Using the correct concentration of formalin (maximum 2%).

(b) Chemical control: Weekly sprays of mancozeb (0.2%) or bavistin (0.1%) TBZ (0.2%) or treatment with zineb dust or Calcium hypochlorite (15%) have given effective control of the disease.

Conclusion

For the mushroom cultivation, the paddy straw substrates are very suitable for the milky mushroom cultivation. The higher yield of quality mushroom depends upon proper maintenance of pure culture as well as purity and quality of the spawn used. Hence, low cost and quality spawn is the basic requirements for mushroom growers. For the prevention of various disease contamination, maintain the balanced temperature and humidity and avoid the direct entry into cropping room without sanitize.

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EXTENDING GREEN REVOLUTION THE WAY FORWARD DOUBLING FARMERS INCOME IN EASTERN UTTAR PRADESH'

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Eastern Uttar Pradesh consists of 27 district, of Uttar Pradesh. It lies the northern sub-continental interior of the sub-tropical climate belt .The region is flood prone. Poverty is acute in this region. Therefore, household food security is the primary concern of the farm households in this region. To meet the household food security, as high as 91 per cent of all agricultural land has allocated to food grain crops. In Pulses chickpea, pigeon pea, lentil and green gram are the main pulses in the region. Among oilseeds rapeseed, mustard and castor seed are the major ones. These crops are cultivated in areas which were earlier kept fallow. It could possibly be due to the availability of short duration varieties and irrigation.

Agricultural Profile of Uttar Pradesh VS Eastern U P:

S.No.	Item	Area of Eastern U.P. (Lakh ha.)	Area of U.P. (Lakh ha.)
1.	Reported Area	65.80	241.70
2.	Forest	7.80	16.57
3.	Barren and unculturable Land	1.40	5.07
4.	Permanent Pastures	0.16	0.64
5.	Culturable waste land	1.23	4.40
6.	Fallow land		
a.	Old fallow	1.90	5.42
b.	Current fallow	5.45	12.85
7.	Net area sown	55.00	165.73
8.	Gross cropped area	85.30	254.15
9.	Area sown more than once	30.30	88.41
10.	Cropping Intensity	155.60	153.54
11.	Net irrigated area	40.70	133.13
12.	Gross irrigated area	58.17	192.18
13.	Total problematic area	12.79	45.83
a.	Flooded area/submerged area	3.48/6.00	4.84/8.20
b.	Sodic area	1.60	6.75

Salient Features Of Eastern Utter Pradesh:

S.N.	**Particulars**	**% value**
1	Average per cent of small & marginal farmers in Eastern UP and Utter Pradesh	94.6 and 91.1%
2	Highest per cent of small and marginal farmers in Eastern UP (S.R.Nagar, Jaunpur & Varanasi)	97.7 %
3	Per cent net area sown of reporting area in Eastern UP and Utter Pradesh	63.8 and 67.9 %
4	Per cent net irrigated area in Eastern UP and Utter Pradesh	76.2 and 79.7 %
5	Cropping Intensity of Eastern UP and Utter Pradesh	155.6 and 154.2 %

District Covered Under Eastern Utter Pradesh :

27 districts are covered under Eastern UP are- Allahabad, Kaushambi, Pratapgarh, Varanasi, Chandauli, Ghazipur, Jaunpur, Mirzapur, Sonbhadra, Sant Ravidas Nagar, Azamgarh, Mau, Ballia, Gorakahpur, Mahrajganj, Deoria, Kushinagar, Basti, Siddarth Nagar, Sant Kabir Nagar, Faizabad, Ambedkar Nagar, Sultanpur, Gonda, Balrampur, Bahraich and Shravasti.

Districts Under Different Agro Climatic Zones of Eastern Utter Pradesh:

S.N.	Agro climatic Zones	Districts
1	Central Zone (3 district)	Allahabad,Kaushambi and Pratapgarh
2	Eastern Zone (11 district)	Varanasi,Chandauli,Ghazipur,Jaunpur, Faizabad,Ambedkar Nagar,Sultanpur, Azamgarh,Mau,Ballia, and Sant Ravidas Nagar
3	Vindhyan Zone (2 district)	Mirzapur and Sonbhadra
4	North Eastern Zone (11 district)	Gorakahpur, Mahrajganj, Deoria, Kushinagar, Basti, Siddarth Nagar, Sant Kabir Nagar, Gonda, Balrampur, Bahraich and Shravasti

Characteristics and Constraints of Zones of Uttar Pradesh:

1. Central Plain Zone:

1. Soils are highly productive, vary from sandy loam to clay loam.

Constraints:

a.) Sodicity, poor water management and deficiency of micro nutrients.

b.) Lower organic carbon.

2. Eastern Plain Zone:

1. Sodic and Diara land.

2.Plenty of ground water but surface water is scanty.

Constraints:

1. Poor water management in canal command area.
2. Low seed replacemement rate (SRR).
3. Late sowing of wheat in Paddy-Wheat crop sequence

3. Vindhyan Zone:

1.Most of the lands are undulating and rocky besides alluvial in plain area.

Constraints:

1. Low fertility and irrigation problem
2. Low seed replacemement rate (SRR).

4. North Eastern Zone:

1. Abundant surface and ground water.
2. Soils are alluvial and calcareous.

Constrains:

1. Flood and poor drainage.
2. Late sowing of wheat in Paddy-Wheat sequence.
3. Lack of adoption of hybrid rice and maize.

Productivity of Rice / Wheat / Maize & Sugarcane in Eastern U P:

Rice:	Data
Average Productivity in Eastern Region	19.9 Qtl/ha
Average Productivity in Uttar Pradesh	20.3 Qtl/ha
No.of districts below states average	21
Wheat:	
Average Productivity in Eastern Region	26.0 Qtl/ha
Average Productivity in Uttar Pradesh	28.6 Qtl /ha
No.of districts below states average	14 district
Maize:	
Average Productivity in Eastern Region	29 Qtls/ha
Average Productivity in Uttar Pradesh	29 Qtls/ha
Cultivation of Rabi Maize	7 districts, viz.Ballia, Deoria, Kushinagar, Gonda, Behraich, Sultanpur and Faizabad
Area in Eastern UP	12296 ha
Area in entire UP	12445 ha
Sugarcane:	
Average Productivity in Eastern Region	481.6 Qtl/ha
Average Productivity in Uttar Pradesh	565.4 Qtl/ha
No.of districts below states average	12

Fertility Status of Primary and Micro Nutrients in Eastern U P:

Nitrogen	Three districts have very low status. 24 districts have low status
Phosphorus	15 districts have very low status. 11 districts have low status.
Potash	21 districts have medium status. Only 6 districts have high status of Potash.
Sulphur	4 districts have deficient status Remaining 23 districts have marginal status
Zink	12 districts have deficient status Remaining 15 districts have marginal status
Iron	Only 6 districts have sufficient status. Remaining 21 districts have marginal status
Manganese	13 districts have sufficient status. Remaining 14 districts have marginal status
Copper	20 districts have sufficient status. Remaining 7 districts have marginal status

Source: Directorate of Agric. Govt. of UP

Major Concern of the Region:

1. Fragmented and small size of land holdings.
2. Seeds
   a) Low Seed Replacement Rate.
   b) Inadequacy of suitable genotypes.
3. The deteriorating soil health.
   a) In sufficient use of organic manure and less adoption of Green Manureing.
   b) Imbalanced use of chemical fertilizer.
   c) Inadequacy of beneficial Micro-flora.
4. Inadequate credit flow.
5. Depleting ground water.

Strategy For Extending Green Revolution to Eastern U P:

The following steps needs to be taken to hasten agricultural production in the region are discussed below:

1. Increasing Seed Replacement Rate.

2. Restoring Soil health

- **a.** Strategic campaign for Green Manuring and Composting.
- **b.** Use of quality bio fertilizers.
- **c.** Balanced use of chemical fertilizer.

3. Water Management

- **a.** Judicious and timely use of irrigation water
- **b.** Efforts to reduce dependence on rain

4. Management of Problemetic Soil

- **a.** Improvement of Sodic lands with use of Gypsum.
- **b.** Strengthening of drainage system.

5. Technology dissemination

- **a.** Organizing mega farmers fare in each districts of agro climatic zone.
- **b.** Involvement of input dealers in technology dissemination may helpful tool in technology dissemination**.**
- **c.** Exposure visit, Kisan Mela and Farmer-Scientist –Extension Worker Interface programmes.

6. Mechanization in Agriculture

- **a.** Popularization of modern agricultural implements and their distribution
- **b.** Demonstration of new agricultural implements

7. Establishment of modern Mandi within the reach of farmers

8. Minimizing cost of cultivation

- **a.** Promote line sowing
- **b.** Adoption of IPM and IPNM technique
- **c.** Use of Zero till
- **d.** Promotion of SRI technique of rice cultivation
- **e.** Maximize use of Organic/Green manure.

9. Research and Technology Development

- **a.** Release of high yielding varieties and hybrid rice strain
- **b.** Release of thermo- tolerant varieties
- **c.** Increase of self life of produce

10. Paddy crop:

- **a.** Increasing SRR/VRR.
- **b.** Distribution / Promotion of hybrid rice seed.
- **c.** At least 20 per cent area of paddy under hybrid rice.
- **d.** Cultivation of Summer Paddy in flooded land of eastern UP.

11. Wheat crop:

- **a.** Timely sowing and proper placement of seed and fertilizer by use of zero till.
- **b.** Promotion of line sowing.
- **c.** Judicious and timely use of irrigation water, especially at critical growth stages of crop.
- **d.** Increasing SRR/VRR.

12. Sugarcane crop:

- **a.** Increasing seed and varietal replacement rate.

b. Adoption of crunch method of planting.

c. Promotion of Intercropping with Sugarcane.

d. Growing mixed seed of pulses in rows of sugarcane crop and pull out the pulses after 35 -45 days of sowing and press it in between the two rows of sugar cane, act as green manure for sugarcane.

13. Maize crop:

a. Increase area under hybrid and high yielding vatrieties.

b. Extension of area under Rabi Maize in Eastern UP.

14. Pulses and Oilseed crops:

a. Use healthy seeds of improved varieties

b. Use insect pest resistant / tolerant varieties

c. Seed treatment with fungicide/culture

d. Incorporate Pulses/Oilseed in Rice-Wheat Cropping system

How to Make Extending Green Revolution a Success in Eastern U P :

1. Precision Agriculture:

- The wealth of data if harnessed appropriately can help farmers make the most efficient use of vital inputs such as water and fertilizer by applying them in precise amounts.
- Testing of samples of soil from agricultural fields is vital for achieving nutrient stewardship.
- Mobile-based applications for farmers will form an important part of the data-driven precision agriculture approach.

2. Efficient Use of Water:

- Laser leveling is a technology that can grade an agricultural field to a flat surface by using a laser-guided scraper.
- Laser leveling has been shown to improve crop yields, reduce labour time spent weeding, and in particular, reduce water use for irrigation by up to 20-25 per cent.
- Developing additional water sources through tube wells, dug wells and farm ponds.
- Promotion of Flood, Drought, and Salinity tolerant rice varieties.
- Use of Drum seeders for timely planting of direct seeded rice.

3. Sustainable Agricultural Practices:

- Cultivation practices to increase biological and economic stability.
- Selection of improved varieties to suit the need.
- Soil management by proper method of tillage.
- Organic farming.
- Adoption of Integrated Farming System.
- Popularise Intercropping .
- Adoption of crop rotation.

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WILT DISEASE OF TOMATO (*LYCOPERSICON ESCULENTUM* L.) AND THEIR MANAGEMENT

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Abstract

Tomato crops are one of the most essential vegetable cultivated for its fleshy fruits. Tomato is measured as important profitable and dietary vegetable crop. Botanical name of tomato is *Lycopersicon esculemtum* and belongs to family Lycopersicae. Tomatoes are capable to make people healthier and condense the risk of diseases such as cancer, osteoporosis and cardiovascular diseases. Numerous diseases and disorders can harm tomatoes during the growing season. *Fusarium oxysporum* f. sp. *Lycopersici* is an extremely distractive pathogen of both green house as well as field condition grown tomatoes in worm vegetable production areas. Several procedures have been followed to control Fusarium wilt in the green house and in field conditions. Resistant cultivars have been most efficient way of control wilt disease of tomatoes. The bio-agents were better than botanical in reducing disease incidence and also promoted growth and gave good yield. Therefore chemical fungicides can be replaced by bio- agents, as they are cheap and safe for the environment and for the humans as well.

Introduction

Vegetable crops are cultivated and consumed worldwide and leafy vegetables and fruits in individual impart a source of nutrients and fibre in the human diet. Along with all vegetable crops, tomato rank next to potato in world and ranks first among the processed vegetables. These vegetables might be consumed fresh or after processing. Tomato crops are one of the most essential vegetable cultivated for its fleshy fruits. Tomato is measured as important profitable and dietary vegetable crop. Botanical name of tomato is *Lycopersicon esculemtum* and belongs to Lycopersicae family. Tomato is defensive supplementary food. Because it is short period crop and gives high yield, it is very important from economic point of view and hence day by day area of tomato cultivation is increasing. It is used in preserved products like ketch-up, sauce, chutney, soup, paste, puree etc. Tomato is a heavy source of minerals, vitamins and organic acid, necessary amino acids and dietary fibers. Tomato is renowned as productive as well as protective food. It is a good source of vitamin A and C; it also contains minerals like as iron, phosphorus. Tomato contains Lycopene and Beta-carotene pigments.

Tomato has remedial values which are pulp and juices are eatable, mild aperients, a promoter of gastric secretion and blood purifier. It has antiseptic properties aligned to intestinal infections. It is very useful against cancer of the mouth, sore mouth, etc. Dried juice of tomato retains vitamin C. It stimulates torpid liver and is superior in chronic dyspepsia. The tomato is one of the most excellent vegetables which keep our stomach and intestine healthy. A number of processed items are prepared on large scale for consumption as well as for export purpose.

Advantages of tomato:

Tomato is moderately short duration vegetable crop. It can be grown as an uncovered field crop as protected cultivation. Tomatoes easily fit into different cropping systems. Give more yield, hence has high profitable value. Tomato contains high

micronutrient content. (Wageningen, 2005).

Medicinal properties of tomato:

Tomatoes are capable to make people healthier and condense the risk of diseases such as cancer, osteoporosis and cardiovascular diseases. By intake of tomato on a regular basis, the risk of cancer diseases such as lung, prostate, stomach, cervical, breast, oral, colorectal, oesophageal, pancreatic, and various other types of cancers can be reduced. Lycopene and the recently discovered bioflavonoids in tomato are accountable as cancer hostility agents. Not only uncooked tomato but also cooked and tomato products: ketchup, sauce, and paste, are also an excellent source of cancer avoidance. Tomatoes are also helpful for liver health and also have detoxification effect on human body. Consistent with various studies, 51 mg of chlorine and 11 mg of sulfur in 100 gram of tomato have an essential role in detoxification system (Bhowmik *et al.*, 2012).

Tomatos wilt disease caused by *Fusarium oxysporum* f. sp. *lycopersici* :

Tomato crops are largely grown as Rabi crop in the plains of India. Through, the hilly region it can also be grown as a summer as well as rainy season crop. Numerous diseases and disorders can harm tomatoes during the growing season. *Fusarium oxysporum* f. sp. *Lycopersici* is an extremely distractive pathogen of both green house as well as field condition grown tomatoes in worm vegetable production areas. The wilt disease caused by the pathogen is characterized by wilted plants, yellowed leaves and negligible or absent crop yield (Asha *et al* 2011). Wilt is one of the most economically important diseases world-wide (Alexander and Tucker, 1945; Cal *et al*., 2004; Srinon *et al*., 2006). *Fusarium* wilt is soil borne in nature; it produces two dissimilar kinds of conidia which is micro and macro conidia correspondingly. During unfavorable situation it has been survive in the form of chlemydospore. *Fusarium* belongs to the sub division Deuteromycotina and the perfect stage of pathogen has been seen under Ascomycotina which is *Mychospherela* sp. (Ramezani 2010).

The vascular wilt caused by *Fusarium oxysporum* f. sp. *Lycopersici* is the major disease that causes problems in the cultivation of this crop (Pareja *et al.*, 2008) which it has become one of the most prevalent and injurious diseases, where tomatoes crop are grown intensively because the pathogen persists in ever in infested soil (Sibounnavong *et al.*, 2009). In general, this pathogenic fungus is a limiting factor in the cultivation of many crops and accounts for 10 to 20 percent yield losses annually which can reach as high as 100 per cent (USDA, 2009).

Fusarium species causes an enormous range of diseases on an extraordinary range of host plants. The fungus spread through soil borne, airborne or in plant residue and can be recovered from any part of the plant from the earnest root to the highest flower (Booth 1971). The wilt pathogen of tomato caused by *Fusarium oxysporum* f. sp. *lycopersici* is a disease that causes serious economic loss (Agrios 2005). The *Fusarium oxysporum* pathogen causes vascular wilts by infecting plants through the roots and growing inside through the cortex to the stele (Bowers and Locke 2000).

Symptoms:

The first symptom of wilt disease appears as slight yellowing, subsequently the yellow leaves wilt and die, often prior to the plant reaching to maturity. At the younger stage, infected plant may wilt and die soon once symptoms appear but older plant wilt and die gradually. As the disease progresses, growth is characteristically shortened, and develops little or no fruit. If the central stem is cut, open dark brown streaks may be seen running longitudinally through the pith of stem. This discoloration frequently extends up to thestem and particularly noticeable in petiole scar. The browning of the vascularsystem is the main characteristic of this disease and usually is used for its recognition. The symptoms soon extend to the rest of the plant and finally kill it.

Fig.1. Wilted tomato plant

Systematic Position of Pathogen:

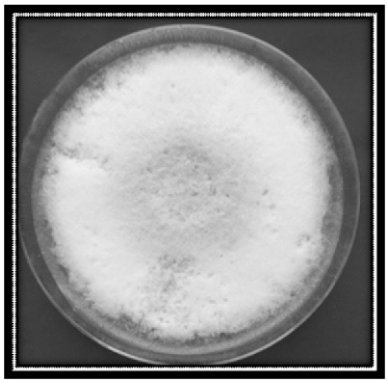
Kingdom	:	Fungi
Division	:	Eumycota
Subdivision	:	Deuteromycotina
Class	:	Hyphomycetes
Order	:	Tubercularíales
Family	:	Tuberculariaceae
Genus	:	*Fusarium*
Species	:	*oxysporum* fs.sp *lycopersici*

Cultural studies:

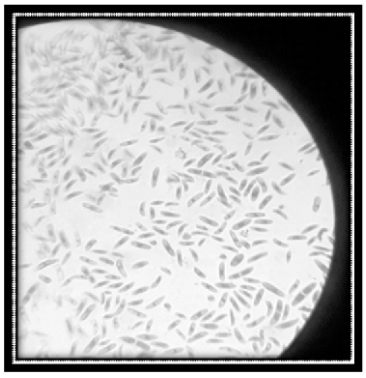
Growth characters were studied on potato dextrose agar media. The radial growth of *F. oxysporum* f.sp *lycopersici* was measured when the maximum growth was attained in any of the plate. The results of cultural studies on potato dextrose agar media indicated that, the radial growth of *F. oxysporum* f.sp*lycopersici* was on potato dextrose agar (9 cm) after seven days of incubation. In potato dextrose agar media good radial growth was observed. Colony margin was smooth in potato dextrose agar media and mycelium was initially whitish in color (Fig. 2).

Microscopic characteristics of Pathogen:

Mycelium is branched, septate and hyaline which inhabits the vessel of the roots. Conidia are two type's macro conida and micro conida, whereas chlamydospores are the resting spores. Macro conidia are borne on cushion-like sporodochia and are long and multi-septate& slightly curved (Fig. 3). Micro conidia are very small having one or two septa, spherical elongated and are borne on simple or branched single hyphae Ainsworth *et al*. (1973).



(Fig.2) Pure culture of *F. lycopersici*



(Fig.3) Microscopic view of *F.lycopersici*

Management:

Several procedures have been followed to control Fusarium wilt in the green house and in field conditions. Resistant cultivars have been most efficient way of control wilt disease of tomatoes (Backman, 1987). However, new-races of the pathogen have led to break down of resistance in locally grown cultivars (Tello-Marquin and Lacasa, 1988).

Fungicide management:

The carbendazim (methyl-2-benzimidazole carbamate) is a systemically vigorous benzimidazole fungicide that suppresses the configration of β-tubulin. It has been used to manage many plant pathogens caused by Deuteromycetous pathogens (Delp and Klopping, 1968), because of its universal properties and immense effectiveness in the management of plant diseases. Management of *Fusarium oxysporum* f. sp. *Lycopersici* has always been problematic for the reason of its soil borne nature. Fungicides considerably reduce the wilt incidence of tomato, but no fungicide is feasible for soil treatment at field level and also environmentally undesirable.

Bio-control agents:

Biological control of Fusarium wilt has attracted attention all over the globe. Though, quite a few strategies with biological control have been anticipated for the management of soil pathogens (Hibar*et al*., 2007), fungi such as *Aspergillus flavus, A. ochraceus, Penicillium aurantiogriseum, Coniothyrium minitans, Alternaria alternata, Epicoccum purpurascens, Coniothyrium olivaceum,*

Gliocladium sp. and *Trichoderma* sp. (Royse and Ries, 1978; Sinaga, 1986; Adebanjo and Bankole, 2004; Rabeendran *et al.,* 2006) be used as biocontrol agents.

Among the fungal biocontrol agents, *Trichoderma* spp. are the most extensively used to manage the soil borne diseases. For example, *T. harzianum, T. koeningii* and *T. viride* followed by *Pseudomonas* spp. are known to manage damping-off caused by *Rhizoctonia* spp. and *Pythium* spp. in lab and in field conditions (Papavizas, 1985). Among the antagonistic fungi, *T. harzianum* has shown its potential as a biocontrol agent of *F. oxysporum* f. sp. *Lycopersici* in tomato wilt (Christopher *et al*., 2010). *Pseudomonas fluorescens* has been known as promising biological control agents against *F. oxysporum* in tomato (Duijff *et al.,* 1998).

Botanical management:

Plant extracts may be an option on behalf of fungicides for controlling pathogenic fungi because they constitute a rich source of bioactive chemicals (Wink, 1993). Uses of neem for manage of plant pathogenic fungi are known and have been fully documented. Khan *et al.,* (1973) were used neem cake against *R. solani, F. oxysporum, Alternaria tenuis, Helminthosporium nodulosum* and *Curvularia tuberculata*. (Locke 1995) Antifungal compounds of botanicals have been recognized and can be used for managing plant diseases (Kagale *et al*., 2004). The most effective bio-control agent *Trichoderma viride* which inhibited the growth of pathogen completely. The antagonist *Trichoderma viride* grew very fast than *F. oxysporum lycopersici* (John *et al*., 2019). Carbendazim were found the best in disease inhibition and also gave the maximum yield of tomato followed by *Trichoderma viride, Trichoderma harzianum, P. fluorescens, combination of Trichoderma harzianum, P. fluorescens,* neem leaf extract, but in other parameters like plant height fresh and dry shoot weight, fresh and dry root weight (John *et al*., 2019).

Botanicals and micro-organisms are a rich source of secondary metabolites which are potential sources of useful bioactive products (Dung and Loi, 1991). The biosynthesis of the metabolites is synchronized genetically and pretentious by environmental influences and consequently, there are fluctuations in the concentration and quantities of secondarymetabolites (Deans and Svoboda, 1990; Vining, 1990; Steele).

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Three Major dimensions of life : Environment, Agriculture and Health ISBN : 978-81-923535-7-9
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Jyoti Verma, Sandeep Kushwaha, Shishu Pal Singh and Piyush Raman Pandey

DIMENSIONS OF INDIA'S ECONOMY DIPLOMACY

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The developmental strategy of India after Independence was to become a self reliant and self sustaining economy. India always believed in the maintenance of autonomy and stayed away from either the communist bloc or the wester'n capital bloc.[1]

In diversified country like India cultural factor ever the brodest and deepest influence on consumer behavior culture influences consumer's through the norms the values established by the society in which the live. The impact of culture is automatic and almost invisible.

Culture not only influences consumer behavior but also reflect it. It is the mirror of both the values and possessions. Marketing strategies are unlikely to change cultural values, but marketing does influence culture. Culture influences what people wear, what and how they eat, where they live etc.[2] It has broad influence on their buying and usage behavior of products and services and the extant of their satisfaction India basically had three broad considerations one for adopting such a strategy.

Ideological

Immediately after independence India adopted a socialist model for the development of its economy. As part of this strategy, emphasis was given to the public sector. The impact of socialistic principles had an indelible mark on the Indian nationalist rhetoric since the early thirties. The concept of socialism is a system wherein the principal means of production are under social ownership and there is an equitable distribution of national wealth. Although there were certain ambiguities involved in the definition of socialism, it was frequently announced by all the mainstream Indian political leaders that socialism is certainly the main goal of India.[3]

Political

There was a general belief among the Indian leadership that excessive interaction with the developed economies would make India inevitably dependent upon the powerful external forces. India opposed any external power interference in its economic affairs. According to Harish Kapur. “The asymmetrical patterns of International economic relations clearly argued against any excessive interaction with the dominant international economic system, since the dangers of absorption by the global economy were perceived as substantial. India, in fact, was reluctant to build up relations with free market oriented economics owing to the core periphery theories expounded by many political scientists.[4]

Economical

Indian policy maker's perceived that international trade would hardly be an engine of growth for developing countries like India, as it exports only primary goods in the international market because of inelasticity of demand. It was perceived that import. Substitution policy, as a viable solution, ensures rapid prospects and all, Round development of the country. India, thus adopted a middle path between the two growth models namely, the communist and the capitalist moreover, India's development strategy was based on a broad national consensus. Practically, all the major political parties approved of it. All the leaders were of the opinion that with a large area, vast population, natural resources, and the like, the only option to meet the growing needs of the people was the state intervention.[5]

Economic reforms : Post 1990

In the early 1990 India embarked upon the path of economic reforms by liberalizing its economy, the radical liberalization measures adopted by the Narasimha Rao government brought about a great change in the Indian economy.[6] The Policy changes that were adopted by the government were :-

Devaluation of the Rupee.

Full convertibility of rupee on trade accounts.

Condensation of Licence and control requirements.

Liberalization of Import technology, raw materials and control requirements.

Repatriation of Profits and royalties and capital exit.

Removal of capital threshold limits under the monopolies and Restrictive trade practices act (MRTP) where in firms no longer needed prior approval for the expansion of production, new production or mergers.

Closure of comptroller general of imports and exports.

Expedited clearance of foreign investment proposals by which foreign firms were allowed to won more than 50 percent of their Indian subsidiaries.

Entry of Reputable foreign investors such as pension fund into the Indian market.

To attract foreign firms, import tariffs were reduced and rupee was made fully convertible for trade payments. The convertibility of rupee itself is a strong indication that India is committed to integration in to the world economy. In order to save money, subsidiary loans to public enterprises were terminated and were encouraged to turn to capital markets in. Government's planning shifted from state sector manufacturing social welfare programmes. Import duties were cut from a maximum rate of 10 to 80 percent. Tariff an agricultural machinery was reduced to almost 25 percent.[7]

By 1993, the economic reforms began to pay dividends. The FDI that was only 150 million per year during 1980s increased to 2.2 billion by march 1993. That GDP which was 2.1 percent in 1991, increased modestly to 4.2 percent during 1992-93. The deficit budget decreased from 8.3 percent of GDP in June 1991 to 4.7 percent in 1993. Inflation rate reduced from 17 percent in 1991 to 6.1 percent by mid-1993.Between April and June 1993, exports increased by 27 percent and imports declined from $ 2.1 billion dollar in 1992 to $ 438 million by 1993. Foreign exchange reserves had **risen** from $ 6.3 billion to $ 7.1 billion. This new situation reiterated that western donors strongly supported India's economic reforms.

India's Role in the international financial Institutions-

The process of globalization resulted in the flow of global capital, technology services, and labour. Further, transnational corporations with their branches cutting across borders accelerated the process of globalization. At the same time, countries that were lagging behind in economic development took advantage of the ongoing Scientific and technological advancement and began to open up their economies for trade purposes. Further, due to the globalization of financial markets, there has been more competition among the developing countries to secure financial assistance from institutions such as the World Bank, International Monetary Fund, FDIs from the MNCs.[8]

In the changed global Scenario, India undertook a series of both short- term and long- term economic policy measures. Short-term measures included solving external debts, controlling internal inflation, and reducing fiscal deficits. The long-term measures related to restructuring of Public Sector undertakings, deliessing of Industries, foreign exchange rate adjustment, Promotion of exports and encouragement of Private Sector.[9] In order to achieve these objectives Public Undertakings were restructured by means of disinvestment and private sectors were encouraged. Attempts were also made to attract foreign capital and improve the balance of trade with other countries and to maintain good foreign exchange reserves. It is in this context, that the role played by the financial institutions and their umpact an India becomes relevant .

India's Role-

India emphasized on the relevance and salience of development issues of the LDC_s in the world order of the 20th century. First, India aimed at a policy that world enable socio-cultural and economic potential of all the newly independent LDC_s and their development as a responsibility of all nations in the world.[11] Secondly India, In the creation of a global civil Society, believed in imparting certain critical Values and norms that world lead to a liberal international economic order. As regards the principle of sovereign equality of all nations. It was interpreted by India as ensuring value of jurtice and norm of equity for all the nations of the world. Thirdly, India emphasized that the LDC_S must be given international assistance for economic development.[12]

India's main objective of economic development was influenced by the political priorities of the newly independent state of LDC_S India always aimed at achieving self-sufficiency in key economic matters as a part of independent foreign policy. Though foreign did is essential for the development of economies of the LDC_S, India also wanted access to the market of the developed countries (DC_s), both primary and manufactured. India further wanted certain changes in the international trading and financial system

that would be beneficial to the LDC_S.[13]

In 1964, at the United Nations conference on Trade and development held in Geneva, the interest of the third word were well articulated at the conference. The LDC_S called for a UN special fund to aid economic development. The conference enabled the third world nations to utilize institutional procedures in order to promote their interests. The LDC_s preferred broad based institutional settings as they could draw the attention of global community and increase their Stake in the outcomes of negotiations on any particular issue but the first world belived in smaller specific forums where in only those nations could participate that had a stake from the deliberation. Thus, there has always been a difference of opinions between the two different worlds on developmental issues and global problems as a early as 1960_s.[14]

India's commitments to development was further enhanced where when India's chief spokesmen to UN called upon the UN to declare 1960_s as the development Decade, and thereby channelize energies of the organs and specialized agencies of LDC_s.

India called for the creation of a fund by the North that would compensate the countries that suffered miserably due to increase in oil prices. As a major oil importer, India was keen as getting assistance to meet the rising oil import prices. India further demanded for more freedom as regards the issue of commodities. At the UNCTAD-II meeting. India represented the G-77. At the UNCTAD-IV, India negotiated for a common fund. Indian representative, who was the Director of the commodities Division of UNCTAD played a crucial role in formulating the integrated Program of commodities. Although India was vociferous in achieving the demands of the third world by late 1970_s, the radical posture of NIEO began to soften.

With regard to trade matter's India primarily concentrated on four points in their economic relations with the developed world and these are as follows:-

- The world is divided into broad groups namely exporters of primary goods and exporters of manufactured goods.
- The dverse terms of trade for the products of the developing countries.
- The dependence of the developing countries on the developed for monetary benefits.
- The dependence of the developing countries on the developed world for their growth.

India's position in the NIEO has changed since the late 1980_s. India, today, has adopted a market-driven foreign and domestic economic policy ; a position that was very much different to that of the 1970_s. At the same time, India's concern and policy rationale for building an equitable and efficient international political and economic order seems to sustain India's guest for a humane world order. Moreover, during the last few years, India has taken a series of initiatives in the helm of economic diplomacy. In order to prevent marginalization in the context of the trend towards regionalism. It has established contacts with most of the important regional groupings and sought association or special relationship with them. Consequently, it has become a sectoral dialogue partner of ASEAN.

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INDICES OF AGRICULTURAL SUSTAINABILITY

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About 65-70 per cent Indian population is engaged in agricultural occupation. We obtained food, fodder, feed,fibre and fuel from agriculture. There is a quantum jump in the Indian population during last few decades; hence, the demand of food and otherrequirements has also increased. Due to limited cultivable land and continuous shrinking of land resource, intensive farming approach came into the existence and fulfilling these very objectives. Modern agriculture is based on intensive farmingwhich largely depends upon excessive use of agro-chemicals. It caused several challenges which together manifest into sustainability issues (Nandeha, 2012).

The symptoms of agricultural instability are sub-optimal growth, absence of desirable profits and direction or movement of farmers away from the agriculture sector. This causes lie in the depleting status of natural resources and socio-economic conditions of the farmers. Sustainable agriculture is the efficient production of safe, high quality agriculture products in a way that protects and improves the natural environment, the social and economic conditions of the farmers, their employees and local communities, and safeguards the health and welfare of all farmed species. Several frame works and models on measuring agricultural sustainability have been proposed under various production ecosystems.

Therefore, it is inferred that sustainability in agriculture is a complex concept and there is no consensus among scientists about its dimensions. Concerns about sustainability in agriculture systems centre around the need to develop technologies and practices that do not have adverse effects on environmental goods and services, are accessible to and effective for farmers, and lead to improvements in food productivity. It is also acknowledged that sustainability in agriculture systems incorporates concepts of both resilience (the capacity of systems to buffer shocks and stresses) and persistence (the capacity of systems to continue over long periods), and addresses many wider economic, social and environmental challenges.

India has great diversity in agro-climatic zones with as many as 127 zones under five agro-ecosystems such as rainfed, arid, irrigated, coastal and hilly systems. However, data regarding various parameters that are used for sustainability are generally available for the administrative units such as districts and political boundaries such as watersheds or agro-climatic zones. The spatial and temporal changes in sustainability indicators would throw light on the diverse and complex issues of agricultural sustainability in India. Therefore, quantification of sustainability is essential to assess the impact of management practices on actual and potential productivity and environment (Reddy and Nagmani, 2017). The following indices are used to assess agricultural sustainability-

1. Productivity Index

Productivity per unit of resource can be assessed as:

$$P = Tp / R$$

Where, P = productivity,
Tp = total production,
R = resource used.

2. Total factor Productivity

Total factor productivity (TFP) is defined as the productivity per unit cost of all factors involved (Herdt, 1993).

$$TFP = \frac{Tp}{\sum_{i=1}^{N} (Ri \times Ci)}$$

Where, Tp = total production,

R = Resource used,

C = cost of the resource,

n = number of resources used in achieving total production.

3. Coefficient of Sustainability

Coefficient of sustainability (Cs) is a measure of change in soil properties in relation to production under specific management system (Lal, 1993).

Cs = f (Oi x Ad x Om) t

Where, Oi = output per unit that maximises per capita productivity or profit,

Ad = output per unit decline in the most limiting or non-renewable resource,

Om = minimum assured output and

t = time (time scale must be carefully selected)

4. Index of Sustainability

Index of sustainability (Is) is a measure of sustainability relating productivity to change in soil and environment characteristics (Lal and Miller, 1993),

Is = f (Pi x Si x Wi x Ci) / t

Where, Pi = productivity per unit input of the limited or non-renewable resource,

Si = Alteration in soil properties,

Wi = change in water resource and quality,

Ci = modification in climatic factor and

t = time.

5. Agricultural Sustainability

Agricultural sustainability (As) is a broad based index based on several parameters associated with agricultural production (Lal, 1993).

As = f (Pt x Sp x Wt x Cl) t

Where, Pt = productivity per unit input of the limited or non-renewable resource,

Sp = critical soil property of rooting depth,

Wt = available water retentive capacity of soil,

Cl = climatic factor and

t = time

6. Sustainability Coefficient

Sustainability coefficient (Sc) is a complex and a multipurpose index based on a large number of parameters.

Sc = f (Pi x Pd x Sp x Wt x Ci) t

Where, Pi = productivity per unit input of the limited or non-renewable resource,

Pd = productivity per unit decline in soil property,

Sp = critical level of soil property,

Wt = available water retentive capacity of soil,

t = time

Crop Productivity as an Indicator of Sustainability

Measurement of crop productivity is a very good indicator of soil, water, climate and biotic factors which play key role in sustainability. It is important to assess potential as well as actual productivity. If land availability is limiting factor, appropriate indices of productivity are Land use factor (L), Land Equivalent Ratio (LER) and Area Time Equivalent Ratio (ATER).

a. Land Use factor (L)

The Land use factor is defined as the ratio of cropping period Cplus fallow period F to cropping period C (Okigbo, 1978).

L = C + F / C

The factor L is, generally higher to low intensity system (shifting cultivation).

b. Land Equivalent Ratio (LER)

LER is the relative land area under sole crop that is required to produce the yields achieved in intercropping. It can be calculating with the help of following formula (Willey and Osiru, 1972) as-

$$LER = \sum_{i=1}^{N} \left(\frac{Yi}{Ym} \right)$$

Where, Yi and Ym = yields of component crops in the intercrop and monoculture systems respectively.

n = number of crops involved.

Or

LER =	**Yield of component crop A in intercropping**	**+**	**Yield of component crop B in intercropping**
	Yield of component crop A in sole cropping		**Yield of sole crop B in in sole cropping**

If LER is less than 1 inter cropping is harmful. If LER is 1 there is no advantage and if LER is more than 1, intercropping is advantageous.

c. Area Time Equivalent Ratio (ATER)

As the crops involved vary widely in their maturity period, ATER index considers the crop duration (Heibsch and McCollum, 1987).

$$ATER = \frac{1}{t} \sum_{i=1}^{n} \left(\frac{d * Yi}{Ym} \right)$$

Where, d = growth period of crop in days and

T = time in days for which the field remain occupied (growth period of the longest diatom crop).

Numerical values of ATER approaches that of LER for a mixture consisting of crops of approximately identical growth periods i.e. when t = d in comparison, productivity can also be expressed in terms of the resource use efficiency of the most limiting resource, (water, nutrients, labour etc.).

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IMMUNOMODULATORY ACTIVITY OF MADHUCA LONGIFOLIA

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Abstract

The present study was undertaken to evaluate the effect of Madhuca latifolia on immunomodulatory activity that comprises of screening to identify the activity of ethanolic extract of Madhuca latifolia on humoral and cell mediated immunity (specific immune response). Experiments were conducted in vivo in Swiss albino mice. Madhuca latifolia ethanolic extract was found to enhance humoral immune response on 7th day by 13 % as compared to the standard control cyclophosphamide that exhibited 54% humoral immune response, where as cell mediated immune response was observed with an enhancement in the values (20.27%) in comparison with control cyclosporine (37.63%).

Introduction

A large number of plants and their isolated constituents have been shown to have potential immunity. Some medicinal plants have been shown to exert immunomodulatory and anti-cancer activity [1, 2,3]. *Madhuca latifolia* commonly known as mahua belongs to the family Sapotaceae. Mahua is a large, shady, deciduous tree doting much of the central Indian landscape, both wild and cultivated. In the folk medicinal system of India,various parts of the tree are used, namely whole young plants, leaves, stems, barks, roots, fruits, flowers, and seeds. The different ailments treated with these parts include tuberculosis, rheumatoid arthritis, cholera, paralysis, snake-bite, debility, tonsillitis, influenza, piles, arthritic pain, helminthiasis, low semen count, headache, flatulency, and infections, besides being used as a blood purifier and as an antidote to poison.

In the present communication, authors have set forth the objective of screening the immunomodulatory potential of this valuable plant in mice.

Materials and Methods

Plant material and preparation of extracts

Madhuca latifolia plant parts (flower,fruit,bark and leaf) were collected from February to March 2009, from Allahabad. The whole plants ethanolic extract was used for studying the immunomodulatory properties. Plant materials were dried at 37^{0}C, powdered and extracted in alcohol. Extract was fine-filtered and freeze dried. For the preparation of the extracts, dried ground plant material was percolated with 95% alcohol and concentrated to dryness under reduced pressure. The samples were prepared in double distilled water along with 0.1% acacia gum for immunomodulatory test. Swiss mice were obtained from the Central Drug Research Institute (CDRI), Lucknow (average weigh 25$\pm$3 g). The animals were housed in standard environmental conditions.

Preparation of sheep red blood cells (SRBC) antigen

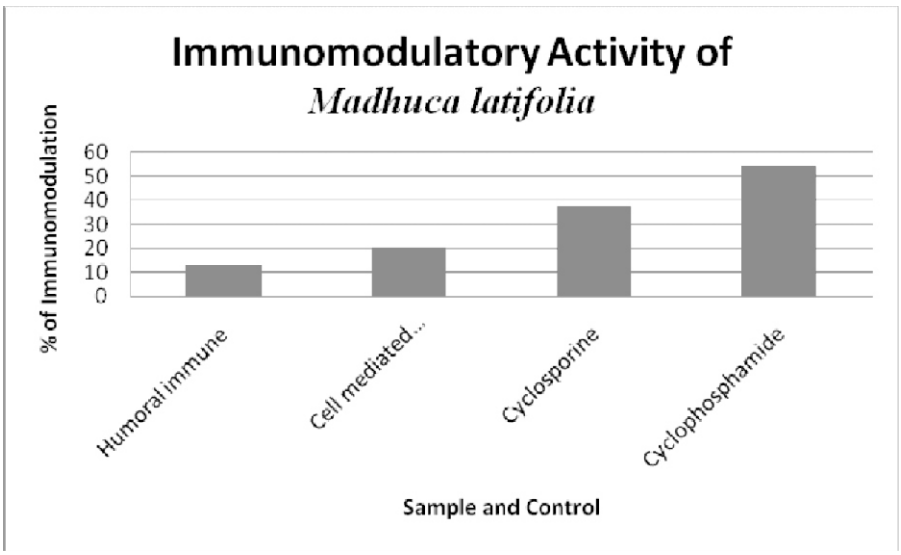
SRBC were collected aseptically from Jugular vein of sheep, stored in cold sterile Alsever's solution for immunization and challenge, at required time schedule. Stored sheep blood cells were centrifuged and washed three times with pyogen free sterile normal saline (0.85% NaCl w/v) and adjusted to a required concentration for immunization. Humoral antibody response (Hab) was analyzed using standard method. The mice were immunized by injecting 0.2 ml of 5×10^9 SRBC / ml i.p. and plant extracts were administered

orally (100mg/Kg body. wt.) for 5 consequent days after immunization. Two parallel controls were run simultaneously. One of them received only normal saline water, named 'Normal Control', while the other received Levamisole (2.5 mg / Kg body wt.) and Cyclophosphamide (250 mg/Kg body wt. post oral). The mean titre values of the drug treated groups were compared with the normalcontrol.

Delayed type hypersensitivity (DTH-CMI) method was employed to access SRBC induced DTH response in mice. Mice were immunized by injecting 20µl of 5×10^9 SRBC/ subcutaneously into the right hind footpad. The day of sensitization was designated as day 0. Seven days later the thickness of the left hind footpad was measured using a spheromicrometer (0.01mm pitch) and considered as control. Then the sensitized mice were challenged with the same amount of SRBC i/m into the left hind footpad. The test materials (doses= 100 mg/Kg body weight) were administered orally with a metal feeding cannula for 7 days from the day of immunization. The control animals were given an equal volume of 1% Gum acacia as vehicle. The challenging dose of 20µl of 5×10^9 SRBC/ml in mice were injected to assess the standard control response for DTH[4,5]. Swiss mice (n=6) were treated daily with *Madhuca latifolia* extract (100mg/kg) ip for 5 days. Blood samples were collected by puncturing the retro-orbital plexus. Total WBC and RBC count was determined using a hemocytometer. A normal control group received normal saline (5mg/kg/ip) and positive control group treated with 5-Fluorouracil (5-FU), an anticancer drug.

Results and Discussion

Madhuca latifolia commonly known as mahua is a highly valued medicinal plant with diverse therapeutic uses in the traditional Indian systems of medicines such as Ayurveda, Unani and Siddha. There are several medicinal plants that are considered to possess immunomodulatory properties [6,7]. *Madhuca latifolia* ethanolic extract was found to enhance humoral immune response on 7th day by 13% as compared to the control cyclophosphamide (54%), where as cell mediated immune response was enhanced to 20.27% in comparison with control cyclosporine (37.63%). The effect of methanolic extract of the plant on the hematological parameters of the tumour bearing mice showed an increase in number of RBCs but a decrease in WBCs compared to the control mice. These data were based on the differential leucocyte count by Leishman staining. A number of plants used in traditional medicines have been shown to stimulate or inhibit immune responses, and several active principles have been isolated and characterized from plants[8].



Mahua seeds are of economic importance as they are good source of edible fats. The distilled juice of the flower is considered a tonic, both nutritional and cooling and also in treatment of helminthes, acute and chronic tonsillitis, as well as bronchitis [9]. The leaves are applied as a poultice to relieve eczema. The aerial parts are used for treatment of inflammation [10]. The bark is a good remedy for itch, swelling, fractures and snake-bite poisoning, internally employed in diabetes mellitus. Previous phytochemical studies on *Madhuca indica* included characterization of sapogenins, triterpenoids, steroids, saponins, flavonoids and glycosides [11, 12].

Two protobassic glycosides, namely madhucosides A and B have been isolated from the bark of this tree [13]. The two compounds showed significant inhibitory effects on both superoxide release from polymorphonuclear cells, and hypochlorous acid generation from neutrophils.like hepatic disorders, rheumatoid arthritis, constipation, diabetes, coughs, asthma, itches, wounds, stomachache,diarrhea, dysentery, pain, typhoid, pneumonia, toothache, cancer, flatulency, body ache, and bone fractures.

Plant contains saponia barriania. Bark contain cupeol acetate, b - amyrn acetate, a spinasterol, erythrodidlamonocaprytase, betulinic and oleunollic acids, caprylaises, xylose, rhamnose, glucose, galactose leaves contains b - esosteroles acid, myricelin. Seeds contain saponions, Mi-Saponin A, Mi Saponins B seeds, Kernal contains protobassic acid, prosopogenol, Mi Saponin C. Seeds contain semisolid fixed oil 50-55 persent which yield eleic acid 13.5 persent myrestic acid 16 persent. Air dried flowers contain inverse sugar 52.6 persent cane sugar 2.2 persent albuminoid 2.2 persent and other substances.From the fruit coats of the medicinal plant *Madhuca latifolia* were isolated three new compounds, the triterpenoid madhucic acid (3 -(octanoyloxy)-11-oxoolean-12-en-28-oic acid), the untypical isoflavone madhushazone(9-methoxy-7-(2,3,6-trimethoxyphenyl)-[1,3]dioxolo[4,5- *g*][1]benzopyran-8(8*H*)-one), and a bis(isoflavone) named madhusalmone (5,14-dimethoxy-3,12-bis(3,4,5- trimethoxyphenyl)-1,6,8,10,15,17 hexaoxanaphtho [2,3,: 6,7] cyclodeca [1,2*b*] naphthalene-4,13 (4*H*,13*H*)-dione), as well as eight known constituents, and their structures were elucidated by spectral analysis, including 2D-NMR techniques[14].

Alkoids are the chief constituents that seem to be most likely candidates eliciting immunostimulating effects. However, the available evidence is not adequate to allow their use in clinical practice. There is a need for comprehensive, systematic, multi-disciplinary evaluation of various claims to make effective use of these products.

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PROCESSING AND PACKAGING OF VEGETABLES

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Processing of Vegetables

Vegetable supply many nutrients besides providing variety to the diet. It make food attractive by their colour, texture and flavour. Vegetables and fruits have many similarities with respect to their composition, method of cultivation and harvesting, storage properties and processing. In fact, many vegetables are considered fruits in the true botanical sense.

However, the important and generalize distinction between fruits and vegetables has come to made on a usage basis; those items that are generally eaten with main course of meal are often considered to be vegetables; those that commonly are eaten alone or as a dessert are considered as fruits. This is the distinction made by food processor, certain marketing laws and the consuming public.

Though Indian population is mostly vegetarian, the intake of vegetable has been too low in daily diet. People do not eat vegetables or eat less in quantity because they are expensive, need more preparation time, or due to ignorance of importance of vegetables.

Sometimes unavailability in a particular place or season results in less consumption of vegetables.As they are perishable, the consumption would be limited if storage facilities are not available.So far increasing consumption ,better availability, reducing preparation time, reduced prices, better availability, better production in farms, processing of vegetables would be necessary. Data shows:

- India is the second largest producer of fruits and vegetables next to China.
- Fruits and Vegetables are exported 45.5 million tones annually from area of 3.8. million hac.

Present Scenario of Processed Fruits and Vegetables

India	-	2-3%
Malasia	-	83%
Thailand	-	72%
Brazil	-	70%

India had expended 1,206 crores to 2,050 crores rupees at the end of the tenth 5 year plan in processing.

Vegetable Processing

Consumers prefer vegetables that are convenient to prepare, yet maintain a fresh like quality while containing only natural ingredients. The food processing service industry want readily available vegetables that are minimally processed (e.g. already peeled, sliced grated or shredded) for reason of cost ,labour and food safety.

Commercial post harvest treatment and food preservation systems often combine various methods, an approach called "**Hurdel Technology**".

Processing Technology Of Vegetables

Varietal Differences

Vegetables processors must appreciate the substantial differences that varieties of a given vegetable will possess. In addition to variety and genetic strain differences with respect to weather, insect and disease resistance, varieties of a given vegetable will differ in size, time of maturity and resistance to physical damage.

This should expected since different varieties of a given vegetable will vary some what in chemical composition, cellular structure and biological activity of their enzyme system.

Harvesting and Preprocessing

When vegetables are maturing in the field they are changing from day to day. There is a time when vegetable will be at peak quality from the stand point of colour, texture and flavor.

This peak quality is quick in processing and may last only a day. Harvesting and processing of several vegetables, including tomatoes, corn and peas are rigidly scheduled to capture this peak quality.

After the vegetable is harvested it may quickly pass beyond the peak quality condition. This is independent of microbial spoilage, these main deteriorations are related to:

a) Loss of sugar due to their consumption during respiration or their conversion to starch, losses are slower under refrigeration but there is still a great change in vegetable sweetness and freshness and flavor day to day within 2 or 3 day.

b) Production of heat when large stockpiles of vegetables are transported or held prior to processing. At room temperature some vegetable liberate heat at a rate of 127,000 KJ/ton/day. This is enough for each vegetable to melt 363 kg ice per day. Some the heat further deteriorates the vegetables and speeds of microorganism growth, the harvested vegetable must be cooled if not process immediately.

But cooling only slows down the rate of deterioration, it does not prevent it, vegetable differ in their resistance to cold storage. Each vegetable has its optimal cold storage temp.

Each type of vegetables has its optimal cold storage temperature which may be between about and $10^{o}C$.

c) The continual loss or water by harvested vegetables due to transpiration respiration and physical drying of cut surfaces resulting in wilting of leaf Vegetables, loss of plumpness of fleshy vegetables and loss of weight of both.

Moisture loss cannot be completely and effectively prevented by hermatic packaging. This was tried with plastic bags for fresh vegetables in supermarket but the bags become humid and deterioration of certain vegetable was accelerated because of building up of CO_2 and decrease of O_2 in the packaging. It is therefore common to perforate such bags to prevent there defect or such as to minimize high humidity in the package.

Shipper of fresh vegetables and vegetable processors whether they can freeze, dehydrate or manufacture soup or ketchup adopt scientific measures to prevent perisability of vegetables and so do everything they can minimize delays in processing of fresh product.

d) To ensure steady supply of top quality produce during the harvesting period the large food processor will employ trained men, they will advise on growing practice and soon spacing of planting so that vegetable will mature and can be harvest in time with the processing plant capabilities. This minimize stockpiling and need of storage.

Post Harvest Processing of Vegetable

Cooling of the harvested vegetable in the field is common practice. In some areas liquid nitrogen cooled truck may needed to prescribe transportation of fresh produce to the processing plant or directly to market.

Upon arrival of vegetable at the processing center the usual operations of cleaning, grading, peeling, cutting are performed using a moderate amount of equipment but a good deal of hand labour also still remains.

Common steps of post harvest processing are given below-

1. Washing
2. Skin removal / peeling
3. Cutting and Trimming
4. Blanching
5. Canning
6. Packaging

1. Washing:

Washing is used not only to remove field soil and surface microorganism but also to remove fungicide, insecticide and other pesticides, since there are laws specify maximum levels of their materials that may be retained on the vegetable and in most vegetable

the allowable residual level is virtually zero. Washing water contains detergents or other sanitizer that can essentially completely remove that residues.

The washing equipment, like all equipment subsequently used, will depend upon the size, shape and fragility of particular kind of vegetables.

- Floation cleaner for peas and other small vegetables.
- Rotary washer in which vegetables are tumble while they are sprayed with jet water, this types of washer should not be used to clean fragile vegetable.

Sorting :

This step of processing has two separate operations

i) Removal of nonstandard and possible foreign bodies remaining after washing.

ii) Quality grading based on verities, dimensional, organoleptical and maturity stage criterion.

2. Skin Removal/ Peeling:

Several methods are used to remove skin from those vegetables requiring skin removal. Skin removal can be done by three methods.

a. Chemical
b. Mechanical
c. Thermal

a). Chemical :

Skin can be soften from the underlying tissue by submerging vegetables in hot alkali solution. Alkali may be used at concentration by 1% at about 93°C. In spite of using lye skin can also be removed by various chemicals.

b). Mechanical:

Vegetable with lossened skins are conveyed under high velocity heats of water.

Processor some timer use less expensive hot water scalding followed by a machine that slits the skin, gently squeezes the vegetable, such as tomatoes.

c). Thermal:

Vegetables with a thick skin such as beets and sweet potatoes may be peeled with steam under pressure as they pass through cylindrical vessels. (Wet heat)

Onion and peeper are best skinned by exposing them to direct flame or to hot gasses in rotary tube flame peelers (dry heat).

Losses at vegetable peeling in%

	Peeling Method		
Vegetables	**Thermal**	**Mechanical**	**Chemical**
Potatoes	15-19	18-28	-
Carrot	13-15	16-18	8-10
Beets	14-16	13-15	9-10

4. Cutting & Trimming:

Many vegetables require various kinds of cutting, steaming, pitting or coring according to their use.

5. Blanching:

The special heat treatment to inactivate enzyme is known as blanching. Most vegetables that do not receive a high temperature heat treatment (as in normal canning) must be heated to minimal temperature to inactivate natural enzymes before processing or storing. So blanching is best suited for those vegetables.

Blanching is not indiscriminate heating, too little is ineffective and too much damages vegetables by excessive cooking, especially when fresh character by the vegetable is to be preserved by freezing. Blanching is essential for vegetables that are to be of

frozen because freezing only slows enzyme action, it does not destroy or completely stop it. If blanching does not proceed freezing, then the product, which is often held in the frozen state for many months, will slowly develop off flavors and colours and other kind of enzymatic spoilage may occur.

Two more heat resistance enzyme in vegetables are catalase and peroxidase. If these are destroyed thus other enzymes that contribute to deterioration will be inactivated also.

Effective heat treatments for destroying catalase and peroxidase in different vegetable are known and sensitive chemical tests have been developed to detect the amount of those enzymes that might survive during blanching treatments.

Because various types of vegetables differ in size, shape, heat conductivity and the natural level of these enzymes, blanching treatment had to be established on an experimental basis.

- The larger the food items, the longer it takes for heat to reach the center.
- Small vegetables may be adequately blanched in boiling water in a minute or two.

Blanching with steam under pressure at higher temperature requires shorter times but runs at greater risk, heat damage to the vegetable.

Blanching with microwave energy, to rapidly heat the center of large items before the surface overcooked, can be effective in applications of blanching of the hard skin device such as corn.

The table shows the blanching temp, and time of selected vegetables.

Vegetable	Temperature in ^{o}C	Times
Green beans	90-95	2-5
Cauliflower	Boiling	2
Carrot	90	3-5
Pepper	90	3

6. Packaging:

Large quantities of processed vegetable are packaged. Packaging are of following types.

i. Modified atmospheric packaging (MAP)

ii. Moderate vacuum packaging (MPV)

iii. Active Packaging

i. Modified atmospheric packaging (MAP)

The basic principle in MAP is that a modified atmospheric can be created either passively by using properly permeable packaging materials, or actively by using a specified gas mixture together with permeable packaging materials. The aim of both principles is to create an optional gas balance inside the package, where the respiration activity of a product is as low as possible, but the level of O2 & CO2 are not detrimental to the product. In general, the aim is to have a gas composition of 2-5% CO_2, 2-5%O_2 and the rest N_2.

ii. Moderate Vacuum Packaging (MVP)

One more method of modified atmospheric packaging is moderate vacuum packaging. In this system respiring produce is packaged in a rigid air thigh container under 40 Kpa of atmospheric pressure & stored at refrigeration temp (4-7^{o}C). The initial gas compositions is that of normal air (21% O_2, 0.03% CO_2 and 78% N_2) but at reduced partial gas pressure. The lower O_2 content stabilizes the quality of the produce by slowing down metabolic activity and the growing of spoilage microorganism.

iii. Active Packaging

Active Packaging is packaging that includes various gas absorbent and emitters, is another interesting packaging method for minimally processed fruits and vegetables. It is possible to affect respiratory activity, microbial activity and plant hormone activity by correct activity packaging. A commercial gas absorbent based on potassium permanganate and active aluminum for packing diced onion was tried.

7. Canning:

This is the best method of vegetable processing. Process of hermatically (air tight) sealing the food stuffs in containers and

sterilizing them with heat for long storage.

Consumption:

From the above process, processed vegetable came into market for consumption. Per capita consumption of fruits and vegetables in India was 88 kg per year in comparison to 136.2 kg for the developing countries and 148.3 kg for the world (FAO).

Challenge in vegetable processing

- Unprocessed foods are susceptible for spoilage
- Right post harvest practices
- Good processing technology
- Proper packaging
- Transportation and Storage

Some Processed vegetable products

- Pickles
- Vegetable Juices
- Sauces
- Purees
- Ketchups
- Chutney

Food Processing Industries (FPI)

- FPI adds value to the food
- Enhances shelf-life of the product
- The FPI is a labour intensive industry and create large employment per processing unit.

Example of Value addition in vegetable processing

- Preparation of baddi - Pulses + Vegetables
- Preparation of sabbhar - Pulses + Vegetables
- Preparation of Mathri - Cereal + Vegetables

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CERTAIN FUNGAL DISEASES OF PLANTS BELONG TO CUCURBITACEAE FAMILY

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Abstract

Plants belong to family Cucurbitaceae play a very important role in human life. These are important source of vegetables. Our population are increasing rapidly so it is essential to protect our plants from certain pathogen so that we obtain maximum yields. Main purpose of this work was to observation and identification of different fungal diseases of cucurbitaceous plants of Uttar Pradesh.

Introduction

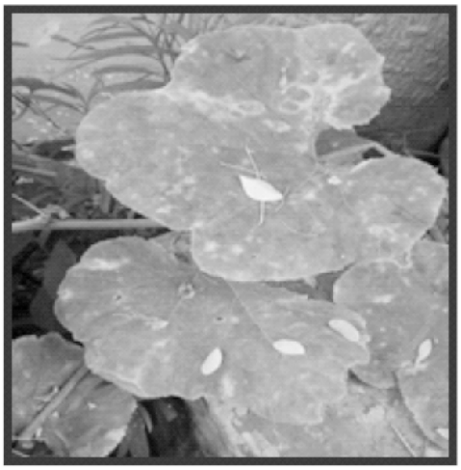
Cucurbits are vegetable crops belonging to family Cucurbitaceae which primarily comprised species consumed as food world wide .The family consist of about 118 genera and 825 species, in which we have studies two plants species which is Pumpkin (*Cucurbita pepo*) and Sponge gourd (*Luffa aegyptiaca*).There is a tremendous genetic diversity within the family and the range of adaptation for cucurbits species includes tropical and subtropical regions, arid deserts and temperate regions.

Powdery mildews (Ascomycotina, Erysiphales) are some of the world's most frequently encountered plant pathogenic fungi. They are often conspicuous owing to the profuse production of the conidia with powdery appearance that give them their common name Powdery mildew. They infect leaves, stems, flowers and fruits of certain Cucurbitaceous plant.

A symptom of the disease on pumpkin and sponge gourd occurs in the form of white powdery fungal growth on leaf surfaces, and petioles. This growth is primarily due to asexual spores called conidia. It usually develops first on crown leaves, on shaded lower leaves and on leaf under surfaces. Yellow spot may form on upper leaves surfaces opposite powdery mildew colonies .Older plants are affected first .Infected leaves usually wither and die. Fruit infection occurs rarely on pumpkin and sponge gourd .Clestothecia formed is dark brown, small structures that are rarely discernable without a hand lens. They develop late in the growing season. The sexual spores within these structures are protected from adverse condition. Powdery mildews develop quickly under favourable conditions because the length of time between infection and symptom appearance is usually only 3 to 7 days and a large no. of conidia produced in a short time.

Favourable conditions include dense plant growth and low light intensity. Infection can also take place at comparatively low humid conditions with RH as low as 50%. Dryness is favourable for colonization, sporulation and dispersal. Rain and free moisture on the plant surface are unfavourable; however disease development occurs in the presence or absence of dew.Mean temperature 20 -27 degrees Celsius is favourable, infection can occur at 10 - 32 degree Celsius. Powdery mildew is serious disease and causes considerable loss to the number of Cucurbitaceous crops grown in different states of India and world. Its distribution and relative occurrence varies throughout the India. Powdery mildew adversely affects the fruit quality. The disease is caused by three obligate biotropic ectoparasites i.e *Erysiphe cichoracearum*, *Podosphaera xanthii* and *Leucillula taurica* .

In *Luffaa egyptiaca* commonly called as Sponge gourd or bath sponge gourd is a member of Cucurbitaceae family cultivated in different district of U.P and overall India. Severely infected leaves of *Luffa* sp. may become chlorotic or even necrotic and brittle. Consequently it decreases the photosynthetic potential and lowers the food quality and yield. Symptoms of powdery mildew are often easier to identify than symptoms of other disease because powdery mildew form obvious patches of whitish mycelium on upper and lower leaf surfaces, petioles and stems. First noted on older leaves, affected leaves become dull, chlorotic and may show some degree of wilting in the afternoon heat, eventually they become brown and papery.



Powdery mildews are a group of pathogens that can cause disease over a wide range of environmental conditions. However several environmental factors may directly affect the development of this disease in Cucurbits like temperature relative humidity and light.

High levels of relative humidity (80-95 %) in the absence of rainfalls promote the development of this disease. It can become a severe disease when rainfall is low and conditions are dry.

Powdery mildew is more prevalent in shade than in full direct sunlight. Therefore this disease in sponge gourd and pumpkin is more profuse under the large overlapping leaves than the new sun exposed leaves.

The section of leaf which we have cut is also seen some spot of *Alernaria* which cause leaf spots of Cucurbits caused by the fungal pathogen *Alternaria cucumerina*. This fungus can over winter in garden contact with infected garden surfaces and the splashing of rain and watering.

The first symptom of Cucurbit *Alternaria sp.* leaf spot is small 1-2 mm. Light brown spots on the upper sides of older leaves on Cucurbit plants. As the disease progresses this spot grow in diameter and begin to display a ring or target like pattern with lighter brown rings in the centre and darker ring around them.

Materials and Methods

Plants of cucurbitaceae family - The Cucurbitaceous family commonly known as the gourd family is an excellent example of a plant family with many economically useful species. They are native in most countries of the world, especially in the tropics, where they are cultivated in every country, state, and province. The Cucurbitaceae consists of many important food plants such as melon, pumpkin, squash, cucumber; useful plants for the production of items of utility such as bottle gourds, loofah, ornamental gourds, etc. Some species, example, bitter melon, cucumber, musk melon, etc are considered to have medicinal properties due to the presence of cucurbitacins, etc. Others such as *Luffa, Cucurbita*, etc are used as complementary dietary ingredient of feed for poultry and increasingly as a protein and vitamin supplement to aqua feeds. Members of this family such as *Momordica, Cucurbita, Cucumis* etc are also used as remedies for livestock.

A Pumpkin is a cultivar of winter squash that is round with smooth, slightly ribbed skin, and most often deep yellow to orange in coloration. The thick shell contains the seeds and pulp. The name is most commonly used for cultivars of Cucurbita pepo, but some cultivars of Cucurbita maxima, C. argyrosperma, and C. moschata with similar appearance are also sometimes called "pumpkin".All pumpkins are winter squash, mature fruit of certain species in the genus Cucurbita. Characteristics commonly used to define "pumpkin" include smooth and slightly ribbed skin, and deep yellow to orange color. In a 100-gram amount, raw pumpkin provides 110 kilojoules (26 kilocalories) of food energy and is an excellent source (20% or more the Daily Value, DV) of provitamin A beta-carotene and vitamin A (53% DV). Vitamin C is present in moderate content (11% DV), but no other nutrients are in significant amounts (less than 10% DV). Pumpkin is 92% water, 6.5% carbohydrate, 0.1% fat and 1% protein . Pumpkin leaves, usually of C. moschata varieties, are eaten as a vegetable in Korean cuisine.In various parts of India and Madheshis prepare saag and kachri/pakoda of the leaves and flowers.

Luffa is a genus of tropical and subtropical vines in the cucumber family (Cucurbitaceae).In everyday non-technical usage, the luffa, also spelled loofah, usually refers to the fruit of the two species Luffa aegyptiaca and Luffa acutangula. The fruit of these species is cultivated and eaten as a vegetable. The fruit must be harvested at a young stage of development to be edible. The vegetable is popular in India, China and Vietnam. When the fruit is fully ripened, it is very fibrous. The fully developed fruit is the source of the loofah scrubbing sponge which is used in bathrooms and kitchens. Luffa is not frost-hardy, and requires 150 to 200 warm days to mature.The name luffa was taken by European botanists in the 17th century from the Egyptian Arabic name. Luffa species are used as food plants by the larvae of some Lepidoptera species, including Hypercompe albicornis.

Table 1: After survey following cucurbitaceous fungal plants diseases observed

Host	Disease observed	Type of pathogen	Causal organism
Pumpkin *Cucurbita pepo* L. Family Cucurbitaceae	Leaf spot	Fungi	*Alternaria cucumerina*
Pumpkin *Cucurbita pepo* L. Family Cucurbitaceae	Leaf spot	Fungi	*Curvularia* sp.
Pumpkin *Cucurbita pepo* L. Family Cucurbitaceae	Gummy leaf blight	Fungi	*Didymella bryoniae*
Pumpkin *Cucurbita pepo* L. Family Cucurbitaceae	Powdery mildew diseases	Fungi	Members of Erysiphales
Pumpkin *Cucurbita pepo* L. Family Cucurbitaceae	Downy mildew	Fungi	*Pseudoperonospora cubensis*
Nenua *Luffa aegyptiaca* Mill. Family Cucurbitaceae	Powdery mildew diseases	Fungi	*Pseudoperonospora cubensis*

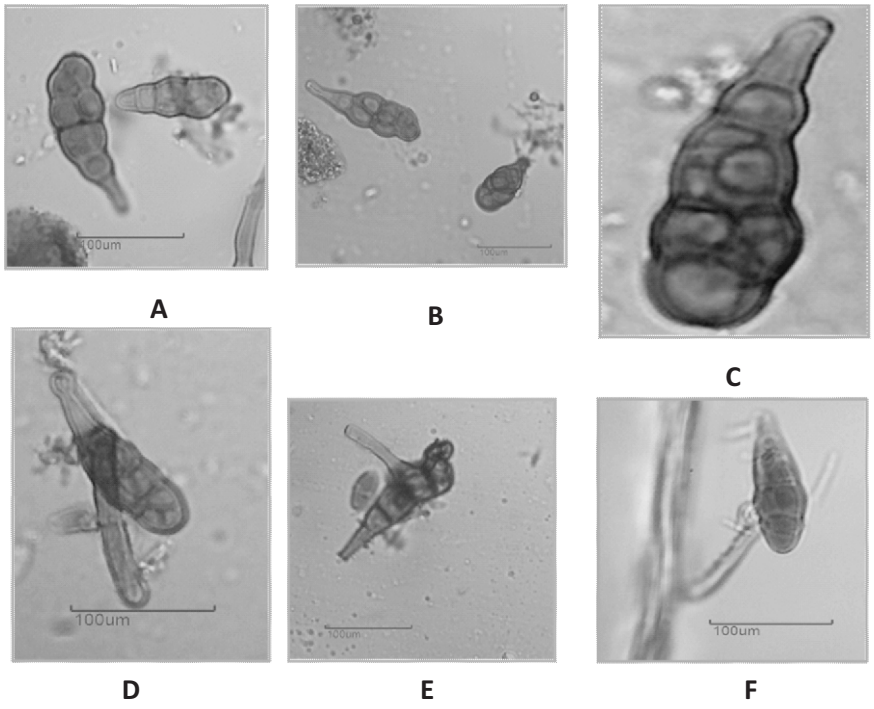


Figure 1 : **Conidia of *Alternaria* sp.**

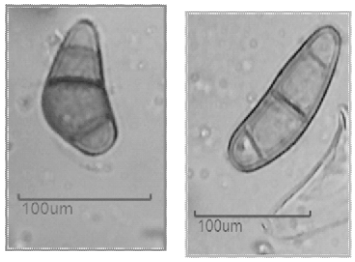


Figure 2 : *Curvularia* sp. leaf spot

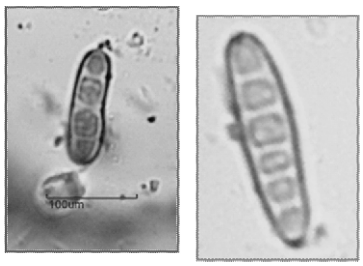


Figure 3 : Gummy leaf blight of Cucurbits (***Didymella bryoniae***)

Figure 4 : Conidia and conidiophores of *Erysiphae* sp.

Discussion & Conclusions

Main purpose of this work was to observation and identification of different fungal diseases of cucurbitaceous plants of Uttar Pradesh. First we selected the appropriate sites like urban area of Allahabad (Tagore town). We observed that fungal diseases were more prominent than Bacterial, Viral and mcoplasmal diseases. We selected two important cucurbitaceous plants of urban area like Pumpkin (*Cucurbita pepo* L. family Cucurbitaceae) and Nenua (Luffa sp. (Mill.) family Cucurbitaceae) which commonly grown in urban area in fields and in home garden. We observed vast fungal infection on that plants like Alternaria leaf spots (Caused by Alternaria), Powdery mildew disease (Caused by members of Erysiphales), Downy mildew disease (Caused by *Pseudoperonospora cubensis*), Gummy leaf blight (Caused by *Didymella bryoniae***),** Leaf spot (Caused by *Curvularia*) (Table 1). This study and observation is very valuable because after observation we clearly identified diseases and apply certain protective solution for those diseases.

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IMPORTANCE AND HIGHER SCOPE OF STAR ANISE SPICE FOR WEST KAMENG DISTRICT OF ARUNACHAL PRADESH

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Introduction

The state Arunachal Pradesh is located "Land of rising sun" (Lat $27^0$and 29^0 30'N and long 92^0 8' 57" and $97^0$12'E) and West Kameng District, is located at 91^0 30" to 92^0 40"E longitudes and 26^0 54"to 28 01" N latitudes. Kiwi grown in warm temp to Sub-tropical regions laying 3000 to 5500 feet a.m.s.l. The Arunachal Pradesh bio-diversification state. In some part of Arunachal Pradesh good scope of spice crop. The Star anise is important spice of India but cultivation in some small area of West Kameng District of Arunachal Pradesh.

It was first introduced into Europe in the seventeenth century. The star anise is today grown almost exclusively in southern China, Indo-China, and Japan. Star anise, Illicium verum, is sometimes called Chinese star anise.

The Commercial produce of star anise in China and Vietnam but In India produce to a small extent in Arunachal Pradesh. The crop requires specific agro climatic conditions available only in the traditional growing areas, which has prevented repeated attempts of other countries to grow star anise. However it prefers woodlands, sunny edges, and dappled shade. The plant grows well in humus rich, mildly acidic to neutral soils, which are light to medium and having good drainage. It tolerates temperatures down to –10 degree C.

Spice Description

Star anise is the unusual fruit of a small oriental tree. It is, as the name suggests, star shaped, radiating between five and ten pointed boat-shaped sections, about eight on average. These hard sections are seed pods. Tough skinned and rust coloured, they measure up to 3cm (1-1/4") long. The fruit is picked before it can ripen, and dried. The stars are available whole, or ground to a red-brownpowder.

Plant Description

Star anise is the dried, star shaped fruit of Illicium verum. It is an evergreen tree attaining a height of 8-15 meters and a diameter of 25 cm. The leaves are entire, 10-15 cm long, 2.5 – 5 cm broad, elliptic, flowers are solitary, white to red in colour. Fruits are star shaped, reddish brown consisting of 6-8 carpels arranged in a whorl. Each carpel is 10 mm long, boat shaped, hard and wrinkled containing a seed. Seeds are brown, compressed, ovoid, smooth, shiny and brittle.

A small to medium evergreen tree of the magnolia family, reaching up to 8m (26ft). The leaves are lanceolate and the axillary flowers are yellow. The tree is propagated by seed and mainly cultivated in China and Japan and some part of Arunachal In India, for export and home markets. The fruits are harvested before they ripen, then sun dried.

Uses

Star anise is one of the signature flavours of Chinese savory cooking. The five-spice powder mix common in China contains star anise. It is used to flavour vegetables, meat, and to marinate meat. It is used as a condiment for flavouring curries, confectionaries, spirits, and for pickling. It is also used in perfumery. The essential oil of star anise is used to flavour soft drinks, bakery products and liquors. The fruit is anti-bacterial, carminative, diuretic and stomachic. It is considered useful in flatulence and spasmodic.

Star anise is used in the East as aniseed is in the West. Apart from its use in sweetmeats and confectionery, where sweeteners must be added, it contributes to meat and poultry dishes.

Benefits of Star Anise

The star anise has carminative, stomachic, stimulant and diuretic properties. In the East it is used to combat colic and rheumatism. It is a common flavouring for medicinal teas, cough mixtures and pastilles. star anise is prescribed as an digestive aid, promoting health of female reproductive organs and for lactating mothers to increase breast-milk secretion. It is used to promote appetite, to treat abdominal pain, digestive disturbances including colic, complaints caused by cold weather such as lumbago, and to relieve flatulence.

The anti-bacterial and anti-fungal properties of star anise is useful in the treatment of asthma, bronchitis and dry cough. For this reason, some cough mixtures contain star anise extract.Star anise, in its natural form, can help the body's immune system fight off many strains of flu, as well as many other health challenges. Shikimic acid, a compound present in star anise is used for preparing drug for curing influenza or the flu virus. Star anise can also be used as for its sedating properties to ensure a good sleep. The oil of star anise is useful in providing relief from rheumatism and lower back pain. Star anise can also be used as a natural breath freshener. Linalool, a compound present in star anise contains anti-oxidants properties

Cultivation Method of Star Anise:

Carefully preparing and planting the seeds will give the best chance of success. Because they need to be planted soon after harvesting, try to get the process started as soon as you have the seeds. Or, store the seeds in moist sand in a sealed plastic bag or container in the refrigerator for up to a month.

1. Pour seed-starting potting mix into 4- to 6-inch-diameter plastic pots. Fill them to 1 to 1 1/2 inches from the top. Moisten the mix with room-temperature water. Use pots that have drainage holes in them.

2. Place the seeds into a bowl filled with water. Throw away any seeds that **float** to the surface. They are not viable. Plant only the seeds that sink to the bottom.

3. Place two or three seeds per pot on top of the moistened potting mix, spaced evenly apart. Cover the seeds with a 1/4 to 1/2 inch of moistened seed-starting mix. Firm it gently with your fingers to remove air pockets. Set a plastic water or soda bottle with the bottom cut out over the seeds. Leave the screw caps on.

4. Put the containers in bright, indirect light where temperatures stay around 70 degrees Fahrenheit. Moisten the potting mix using a spray bottle with room-temperature water if it begins to dry or set the containers in 1 to 2 inches of room-temperature water for an hour or two. The water will soak up into the germination mix through the holes in the bottoms of the containers.

5. Remove the screw caps from the tops of the bottles after the seeds germinate. Remove the bottles a week later. The seeds should germinate in **one to two months**.

6. Pot the star anise tree seedlings up in individual 6- to 8-inch pots when they are 3 to 4 inches tall. Use pots with drainage holes. Pot them up using **peat-based** potting soil. Set them in bright, indirect light and water them with room-temperature water when the top of the potting soil begins to dry.

7. Grow the star anise plants in their containers for one year. Repot them into containers 1 inch larger when they become pot-bound or when you can see the roots through the drain holes in the bottom of the container. **Set them outdoors** during the day in the summer when there is no danger of frost and the weather is calm and pleasant. Put them in bright shade in an area that is protected from strong winds. Continue to water them when the top of the soil begins to dry.

8. Plant them outdoors in their permanent positions the following spring after any danger of frost has passed. Begin to get them used to direct sunlight two weeks before planting. Start with an hour of direct morning sunlight and increase the duration by 30 minutes or so every two days. Water them when the top 2 inches of soil feel dry. Plant multiple trees 15 to 20 feet apart. Water them generously right after planting and continue to water them as often as necessary to keep the soil lightly moist.

Preparation and Storage

The whole stars can be added directly to the cooking pot; pieces are variously referred to as segments, points and sections. Otherwise, grind the whole stars as required. Small amounts are used, as the spice is powerful. Stored whole in airtight containers, it keeps for well over a year.

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ORGANIC FARMING IN INDIAN AGRICULTURE

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India is a land of agriculture with its two third of population directly or indirectly depend upon agriculture. The origin of organic farming goes back to 1940s. During this period, the path breaking literature on the subject published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India contributed to the cause of organic farming.

The conventional farming had helped India not only to produce enough food for own consumption but also generated surpluses for exports. However, the increasing population lead to further increases in demand for food and also for raw materials for industry. The modern system of farming, it is increasingly felt, is becoming unsustainable as evidenced by declining crop productivities, damage to environment, chemical contaminations, etc. The necessity of having an alternative agriculture method which can function in a friendly eco-system while sustaining and increasing the crop productivity is realized now. Organic farming is recognized as the best known alternative to the conventional agriculture.

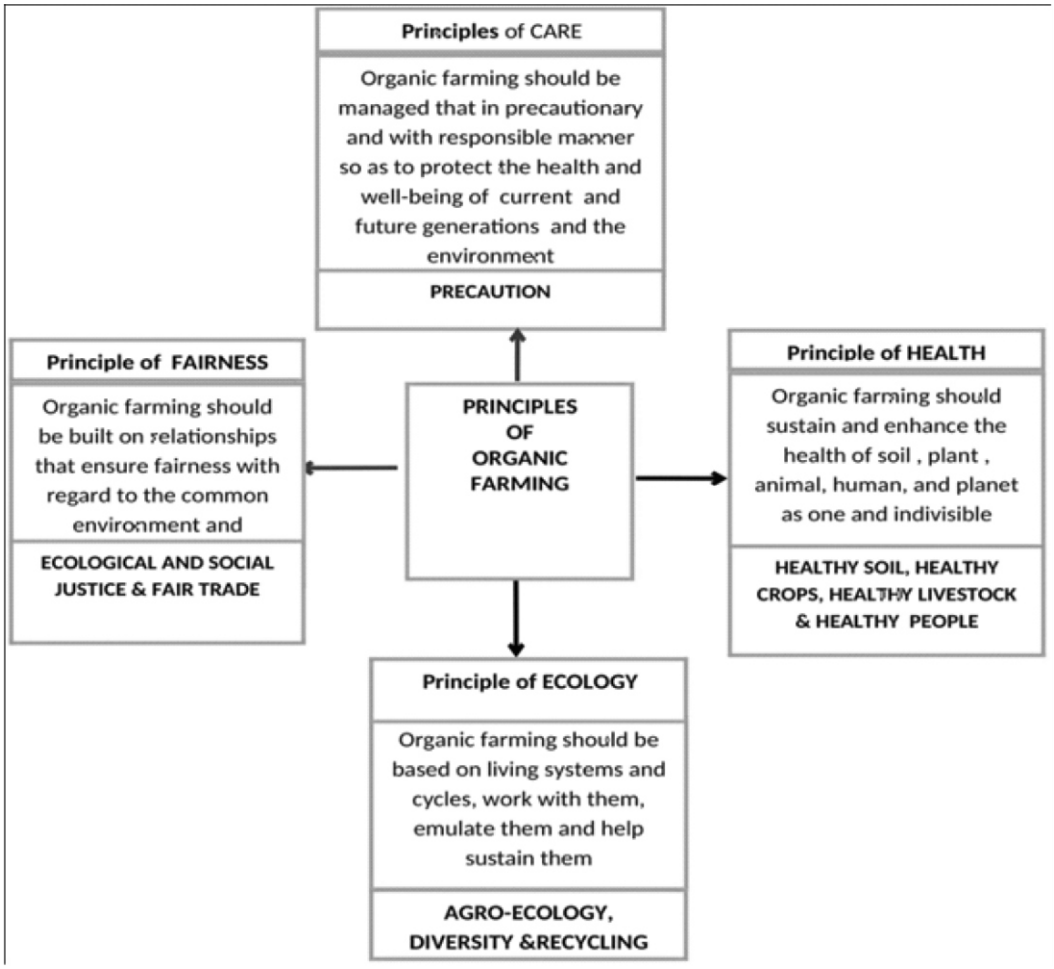
Organic farming is one of the several approaches found to meet the objectives of sustainable agriculture. Many techniques used in organic farming like inter-cropping, mulching and integration of crops and livestock are not alien to various agriculture systems including the traditional agriculture practiced in old countries like India. However, organic farming is based on various laws and certification programmes, which prohibit the use of almost all synthetic inputs, and health of the soil is recognised as the central theme of the method.

The system of our agriculture based on the traditional knowledge and practices handed down from generation to generation could not produce enough to feed the increasing population. The dependence for food from agriculture needed urgent attention and modernization. The green revolution fulfilled the need of our aspirations. India became a country from food importing to a food exporting nation. However, this achievement was at the expense of ecology and environment and to the well being of the people.

Organic agriculture aims at the human welfare without any harm to the environment which is the foundation of human life itself.

Principals of organic farming –

1. **Principal of Health:** Organic agriculture enhances the health of soil, plant, animal and human beings. Use of fertilizers, pesticides etc is minimized in organic farming.
2. **Principal of Ecology:** Farming systems should be designed in accordance to the ecosystems and various biogeochemical cycles. Organic farming should sustain them and then only an ecological balance will be achieved.
3. **Principal of Fairness:** Organic agriculture should be built on fairness with environment, fairness to farmers, fairness to workers, fairness to traders and consumers. The aim is to build a relationship that ensures fairness with regards to the common environment and life opportunities and to provide everyone involved with good quality of life.
4. **Principal of care:** Organic farming should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.



Principles of organic farming (adapted from IFOAM, 1998)

Advantages of Organic Farming:

1. Organic fertilizers are completely safe and do not produce harmful chemicals.
2. Chemical fertilizer needs huge quantities of water to activate its molecules whereas; organic fertilizers do not need such conditions.
3. Chemical fertilizers always have harmful effect on the farm produce and on the environment and human being.
4. Consumption of chemical fertilizers is more in comparison to organic fertilizers.
5. Organic farming contributes to preserve biodiversity. It has a positive effect on ecosystem. It provides safe pasture lands for grazing. Cattles grazing on organic farmlands has been found to be less prone to diseases and they yield more milk.
6. It produces healthy farm products.
7. It improves soil, water and air health as less toxic substances are released.
8. Organic farming is very cost effective, as it does not involve the use of synthetic fertilizers and pesticides. It has been found that in organic farming cost is reduced by 25-30%.
9. Due to awareness, there is a high demand of organic vegetables, fruits etc. A foodstuff produced from organic farming does not contain any artificial flavours or harmful chemicals. The original nutritional content of food is preserved due to the absence of synthetic fertilizers and pesticides.
10. High yield, improves economic status.

11. Huge export potential.
12. Organic farming also enables the farmers to use soil for a longer period of time to grow crops, as soil fertility is maintained for a longer time.
13. Consumption of organic products minimizes the risk of physical ailments such as allergies, cancer, tumours etc.

Demerits of Organic Farming:

To become an organic farmer, it requires patience and skills. They have to be always on a lookout for weeds, insects and parasites as chemical pesticides are not used. All organic products are expensive and it is difficult for common people to afford it. Expensive because organic farming involves lot of labour. And also farmers do not have ideas for fixing up the various problems they encounter. The time period to develop a healthy ecosystem in a conventional farm is a long and time-consuming. New organic farmers would require a lot of help from the farmers who are doing organic farming from a long time.

Constrains of Organic Farming:

1. Low yield.
2. Lack of awareness.
3. Lack of financial support.
4. Lack of quality standards of manure
5. Lack of good marketing policies.
6. Lack in government policies to promote organic agriculture.
7. Inappropriate marketing.

Conclusion:

Organic farming yields more nutritious and safe food. The popularity of organic food is growing dramatically as consumer seeks the organic foods that are thought to be healthier and safer. Thus, organic food perhaps ensures food safety from farm to plate. The organic farming process is more eco-friendly than conventional farming. Organic farming keeps soil healthy and maintains environment integrity thereby, promoting the health of consumers. Moreover, the organic produce market is now the fastest growing market all over the world including India. Organic agriculture promotes the health of consumers of a nation, the ecological health of a nation, and the economic growth of a nation by income generation holistically. India, at present, is the world's largest organic producers (Willer and Lernoud, 2019) and with this vision, we can conclude that encouraging organic farming in India can build a nutritionally, ecologically, and economically healthy nation in near future.

The paper presents a critical review on organic farming that has been present in our ancient farmers and is already known for its overall healthier environment and biodiversity.

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USE AND IMPORTANCE OF BIO FARTILIZER

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Indian economy is based on agriculture play vital role in Indian GDP. Indian Agriculture has seen major technological advances since late 19600s and has succeeded in enhancing food production and in achieving self sufficiency. The introduction of high yielding varieties of seed and the increased use of fertilizers and irrigation fallowed by revolution in Indian agriculture .The total fertilizers requirement in India would be 24 million tones and against the present consumption level of 14 million tones. Which by beyond any single type of nutrient source to accept the challenge of appropriate nutrient supply. Integrated use of all the sources such as mineral fertilizers, organic manures, biofertilizers etc. are the only alternate for improving soil fertility.

India is fourth largest user of chemical fertilizers in the world. The strategy for sustaining satisfactory Yield levels envisages nutrient balance and efficient nutrient cycling .This can be achieved through integrated use of mineral, fertilizers, compost, organic manures, green manures and biological inoculants etc.

However ,such indiscriminate use of chemical fertilizers also led to environmental pollution ,erosion of soil quality and contamination of farm produce and ground water by chemical fertilizers residues and consequent health hazards .Chemical fertilizers have affected the environment through nitrate poisoning and experimentation of beneficial micro flora and micro fauna by adversely affecting the physical and chemical structure of the soil .It has been observed that the concentration of chemical ground water has reached levels ,which are hazardous to human ,and live stock population. Post green revolution has experienced continuous decline in food grain production against consumption of NPK. The NPK consumption in India is above the world average consumption, however the average yield per hectare is much below the world average.

The term bio fertilizers are which can be more appropriately called 'microbial inoculants 'can be generally defined as a preparation containing live or latent cells of efficient strains of nitrogen fixing,

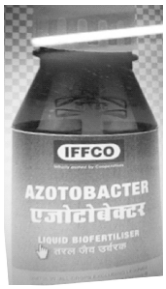
Phosphate solubilizing or cellulytic microorganisms used for application of seed ,soil or composting areas with the objective of increasing the number of such microorganisms and accelerated certain microbial process to argument the extent of the availability of nutrients in a form which can be easily assimilated by plant in large sense the term may be used to be include all organic resource for plant growth ,which are rendered in an available form for plant absorption through microorganisms or plant association. The potential of biofertilizers for promoting sustainable agriculture gas been known for many years." Microbial inoculants" or culture is the most appropriate name of fertilizers.

Important microorganisms used as biofertilizer-

Rizobium: This is a soil bacteria that fix nitrogen after becoming established inside root nodules of legumes characterized by their unique ability to infect root hairs of legume and induce effective N2-fixing nodules to form on the roots. They ar rod shaped living plants which exist only in the vegetative growth stage. Unlike many other soil microorganisms rizobium produce number no spores and they are aerobic and motile. Symbiotically it fix nitrogen 50-100 kg/ha with legumes like chickpea red gram, Pea, Lentil, green gram etc. Oil seed legumes like soyabean, ground nut and forage legumes like berseem and Lucerne.

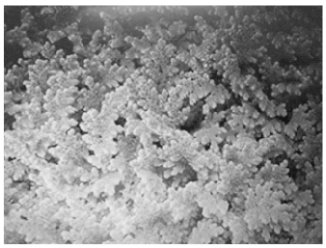
Azotobactor- Azotobactor is free living aerobic nitrogen –fixing bacteria, which can substitute part of inorganic fertilizers. It save nitrogenous fertilizers by 10 to 20 perecent apart from its ability to produce antifungal antibiotics and fungistic compound against

pathogen like fusarium, Alternaria and Trichoderma. Vegetable crop in general response better to azotobactor inoculation than other crops.



Azolla- It is small aquatic fern with a branched stem and bi-lobed leaves having association Anabaena that fixes atmospheric nitrogen. When it dies and decays in the soil, nitrogen becomes available to the plant, It contains 45 percent nitrogen, 2.6 percent phosphorous and 0.9 percent Potash and fixes about 30-40 kg nitrogen per hectare. It survives well in temperature range of 20 to 30 0c and suitable with 5.5 to 7.5 PH of soil. Azolla can double its body weight in 3-5 days. Azollapinnata is the common species.

Azospirillum- Azolla are group of bacteria found in association with the root system many vegetable crops plant. It is type of symbiosis where the bacterial cells are found colonizing the root cortical cell or the intercellular space in the cortex. These bacteria grow better under reduce oxygen levels. It increase the yield mainly due to release of growth promoting substance and protection from disease than from the contribution of nitrogen fixation. The fix nitrogen10-40kg per hectare. Azosprillium inoculation helps the plant in better vegetative growth and also save nitrogen fertilizer up to 25-30 percent. Its effect is well pronounced in summer under irrigated conditions, where the optimum temperature of 32-35 0c is available for good growth its mainly used for oil seeds.



Blue green Algae (BGA)- it is most common species are Anabaena and Nostoc. It can be grown in temperature range of 25 to 45^0 C. Standing water of 2-10 cm in the field is prerequisite for its growth, it fix about 20-45 kg nitrogen per hectare.It grow well in PH 7-8 and soil high in organic matter.

Mycorrhizal fungi- it is most common fungal association among angiosperms. It is prepared by fungifungj belonging to genera, Gigaspora, Glomus etc. The VAM(vesicular Arbuscular Myrrihza) fungi makes more nutrient available to the plant . it is also helpful in the biological control of root pathogen. Mycorrhiza increases capacity of root absorbing surface and reaches outside the root depletion zones. It is directly trance located nutrient like Zinc Phosphorus, copper ,Potassium, Aluminum, magnesium and magazine from the soil to the root.

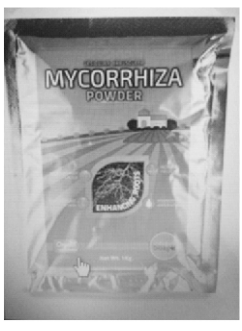
Phosphate Solubilizing Microorganisms(PSM)PSM – PSM are one of the most important elements required for plant growth and yield .Pseudomonas ,Bacillus produce organic acid and enzymes like acid phosphatases and phytoses to solubilize insoluble inorganic phosphate compound such as di-calcium phosphate ,tri –calcium phosphatehydroxcyapatite and rock phosphate .Many species of Penicillium are capable of production of organic acids like fumaric, gluconic , citric ,oxalic acids which may dissolve

Application methods of Bio -fertilizer

Bio -fertilizer is used in three way for example,

1-Soil application –It is very useful for control to soil prove pathogens. 500ml phosphorus soluble mychorriiza is sufficient for one hectare 1200-1300 kg FYM mix with 500 ml PSM and have to keep under tree shade for 12 hrs and spraying water to maintain moisture .then use the mixture as soil application after last ploughing .That the very effective bio fertilizers for plant growth.

2-Root Treatment-It is required for transplanting crop for example paddy and vegetable nursery .PSM/Azosiprillum is used for treatment of vegetable and paddy crop .The required quantify of PSM or azospirillum mixed with 10-15 liters of water in a can and root of seedling has to dipped for a minimum half hour before transplanting .It is effective and economic for farmers.



3-SeedTreatment – It is very important methods used for healthy seedling and crops .The seed treatment is benefited and effective for farmers .Seed treatment with Azotobacter, Azosprillum, Rizobium along with SPM can be done .The seed treatment can be done with any tow are more bacteria. There is no side and antagonistic effect.

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ROLE OF AGRICLINICS AND AGRIBUSINESS IN INDIAN AGRICULTURE

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Abstract

Ministry of agriculture, Government of India in association with National Bank for Agriculture and Rural Development (NABARD) has launched a unique program to apply better farming methods to each farmer across the country. The program aims to tap the expertise available in the large pool of Agricultural graduates who set-up their own Agri-clinic and agribusiness centre (ACABC) and offer professional extension services to innumerable farmers. Committed to this purpose, the government is now providing a start-up training and financial assistance as loan up to Rs 5 lacs for individual activity (Rs. 25 lacs in case of extremely successful individual project) and Rs 100 lacs (maximum) for group activity. The criteria of subsidy to ACABCs is 44 per cent for women, SC/ST and all categories of candidates from North Eastern & Hill regions and 36per cent of project cost for all others. No interest is charged on subsidy portion of the loan as the subsidy is released up front with lock in period of 3 years.

Introduction

Agricultural development is the result of continuous agriculture skill generation programs such as trials, experiments and experiences over years, learned first through behavioral changes, psychic reoccurrences, memories passed thorough parents to children and later on through learning by doing and now through sharing experiences and writing or dotting them as an entrepreneurship concern as well as its popularization. In, India, rapid agricultural growth continues to be the key to poverty alleviation and overall economic development. In the years to come, the increase in agricultural production will mainly come from the growth in productivity which will invite intervention of agricultural extension activities in providing information to the farmers, vocational training and support for adopting improved or proven production technologies. In order to strengthen the extension services further and at the same time tap the potential of the un-employed agricultural graduates and provide them with employment opportunities by adoption of entrepreneurs. The scheme of Agri-clinic and Agribusiness Centers (ACABC) was launched on April 09, 2002. The project was designed to help farmers and develop opportunities for private extension in order to lower the burden on public funding and to offer a wider range of advice in specific area through the scheme.

The un-employed agriculture graduate or allied professional will opt agri-clinic and agribusiness center (ACABC) for his carrier as service provider through laboratory testing and/or field based agricultural extension services in a common area. These ACABCs provide clinical services in the area of soil and water quality –cum –inputs testing laboratory, pest surveillance, diagnostic and control services through seed health testing laboratory, plant pathology laboratory, micro-propagation through plant tissue culture lab and hardening , animal health with veterinary dispensaries and services including frozen semen bank and liquid nitrogen supply center with livestock health practices , engineering workshop for maintenance, repairs and custom hiring of agricultural implements or machineries including plant protection, micro-irrigation system and seed processing unit etc. as well as field extension services such as diagnosis of problems related to soil health, plant health ,cropping practices, facilitation and agency of agriculture insurance services, information technology Kiosks or portal for rural marketing of farm inputs and outputs.

Agri-clinics are envisaged to provide expert advice and services to farmers on various aspects to enhance productivity of

crops or animals and ensure increase the income of farmers. Agri-clinics provide services in the area of soil health, cropping practices with 3G3R, plant protection services as survey & surveillance, diagnosis and management practices including therapy, animal and crop insurance facilitation centers, post-harvest management centers, setting of metallic or non-metallic storage structures (group activities), food processing and testing units, clinical services for health of livestock and pet animals with nutrition management as well as weather forecasting services through internet or e-mail etc.

Agribusiness centre are commercial units of agri-ventures established by trained agricultural graduates or allied professionals. Such ventures may include agri-junction or one-stop-shop as single window availability of farm inputs viz. seed, fertilizers, pesticides and veterinary medicines including feed and fodder supplements, maintenance and custom hiring of farm equipments including delivery services, information technology Kiosk or portals, market linkages for income generation and entrepreneurship development.

Objectives

1. Provide accountable extension services to farmers through technically trained agricultural graduate at the village level for support of agriculture development and
2. Change the attitude of farmers and motivate them to avail innovative technical knowledge through private sources for their prosperity.

   The ACABC program accept the challenges of the changing the attitude of agricultural graduates from being job-consumers to job-producers. These agri. Graduates earn money and prestige by becoming a consultant to farmers in two ways: (i) they provide paid services for enhancement of farm production and income of farmers and (ii)they advice on crop selection for best harvest, value added options, key agriculture information (including perhaps even internet based weather forecast), price trends of farm commodities, market news, risk mitigation and crop insurance, credit and input access, critical sanitary and phyto-sanitary considerations etc.

Swot Analysis

All entrepreneurs have some strengths, weaknesses, opportunities and threats. SWOT analysis of an ACABC is given below:

Strengths

1. A scope of work opportunity to agric. graduates on agri-clinics and agribusiness within area of choice.
2. Press and media are creating awareness at district, state or national level.
3. Information on Government policy and innovative farming available through ACABC
4. Availability of seeds, fertilizers, pesticides and other farm inputs at single window.
5. A unique centre with market links through e-mail or internet services
6. Provide technical support for best quality higher production and profit to concerned farmers.

Weaknesses

1. Initial cost of ACABC is higher
2. Process is time consuming and tedious in loaning or license issue from competent authorities
3. Expert knowledge and skill on ACABC or commercial farming is less in relation to laboratory or field exercises.

Opportunities

1. Wide scope of business work in selected area as laboratory testing and consultancy services
2. Absence of competitors
3. Low initial investment due to banking facilities and government subsidies
4. A government support to establish specific ACABC in the rural area, town or city.

Threats

1. Government procedures long and tedious
2. Low awareness and education level in Indian farmers

Project Components of Acabc :

1. **Laboratory apparatus and equipments**: Soil testing lab, seed testing lab, plant health testing lab, veterinary clinic or dispensary requires specific testing materials viz. apparatus, machines or equipments, glass wares and chemicals and testing kits.

2. **Building**: A cumulative office and store area of around 600 sq. feet shall be sufficient for the purpose of an ACABC establishment.
3. **Office**: The requirement of an office is telephone/mobile, vehicle, audio-visual aids or LED screen with projector, display and sale counter and air conditioner etc.
4. **Furniture**: Tables, chairs, racks and other office furnishing furniture items are necessary to enhance the efficiency of operations and quick service to the farmers
5. **Transport**: Such kind of business shall require small vehicle like motor cycle for the purpose of conveyance.
6. **Operational cost**: In order to operate the ACABC unit, expenditure on some items has to be incurred on a recurring basis. These expenditures include salaries of the staff, cost of raw material, fuel cost on transport of raw or finished items ,repair and maintenance, power, insurance of goods and staff or worker etc.

Location and Area of Operation

The ACABC should be located in rural area in order to have close interaction with farmers and facilitate on the basis of their requirement time to time.

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EFFICACY OF DESERT MADAR – CALOTROPIS PROCERA

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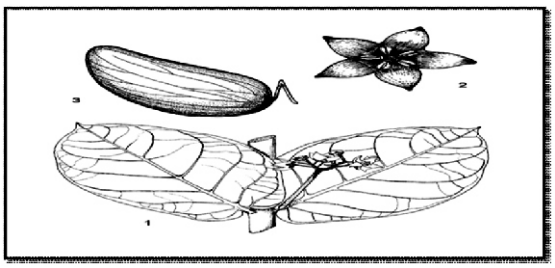
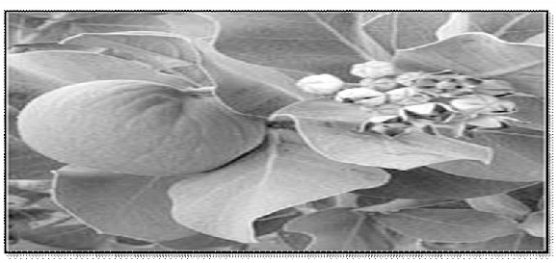
Abstract

Calotropis procera is widely used medicinally, to treat boils, infected wounds and other skin problems in people. Calotropis procera is regarded as useful medicinal plant and used in folk medicine. This plant is popularly known to produces large quantity of latex, which is major sources of traditional medicine worldwide. The present review is an attempt to highlight the various ethnobotenical and traditional uses.

Introduction





It is mentioned by the earliest Hindu writers and in the vedic literature, Arka alluding in the form of leaves, was used in the sacrifical cremation. Aak is used in many ayurvedic formulations like Arkelavana etc.

Calotropis procera is widespread and very common throughout the drier parts of India, in semi-arid conditions on deep, sandy soils, sand dunes, roadsides, rubbish heaps, cultivated on fallow land, disturbed land and waste places, It grows mostly with mean annual rainfall of 300–400 mm, also occurs in areas with up to 1000 mm/yea, even been recorded in excessively drained soils in areas with as much as 2000 mm/year.

It is a small erect and compact shrub covered with cottony tomentum, up to 5.4 m in height, found growing wild in drier and warmer areas of India, up to an altitude 1050 m. Calotropis procera has, the life span 12 years.

Traditional Uses

Root and stem bark, latex, leaves and flowers of plant was used in many and varied ways in traditional medicine. It was used to treat common diseases such as fever, rheumatism, indigestion, cold, eczema, diarrhoea, also for the treatment of boils and for the treatment of jaundice. Plant parts wise uses are as under:

Root

Ground roots or the ash of the burnt roots are applied as a salve or rubbed in to treat skin rash, skin infections, venereal diseases and leprosy. Dried root powder in water is taken to increase milk flow of nursing mothers and is given to women to ease in child birth. Root powder mixed with *Capsicum* pepper is put in a bath to treat rheumatism and arthritis. Root bark from older plants has a higher percentage of acrid and bitter resinous matter than that from younger plants.

Bark

A decoction or infusion of the stem bark and root bark, or the powdered bark in water is taken to cure diarrhoea, dysentery, intestinal worms, colic, spleen complaints, stomachache, cardiovascular problems, pneumonia, fever, jaundice, elephantiasis and leprosy. Especially the root bark are used to treat a variety of illness including leprosy, fever, menorrhagia, malaria and snake bite.The stem bark is considered as an aphrodisiac.

Stem

The stem is used for the treatment of skin diseases, intestinal worms, leprosy and cure Analgesic activity. The stems are termite proof.

Leaves

A leaf decoction or infusion is drunk to treat colds, whoopingcough, oedema, intestinal worms, psychosis and absence ofmenstruation. Leaf extract is taken as a cardio tonic, and also to treat high blood pressure and palpitations. Leaf juice is used as a poison antidote, rubbed on scorpion stings and wounds infected by poisoned arrows, leaf pulp is taken to treat snake bites. Fresh leaves grinded in milk are taken to treat guinea worm infections and leaf infusion is taken to treat dysentery. Pounded fresh leaves are put under the pillow to treat insomnia.

Latex

Wet latex is antiseptic, vermifuge, purgative, used in treating toothache, leprosy and syphilis diseases. Wet latex with gur & oil used on dog bite. Dry latex is anti -inflammatory, anti-diarrheal and hepato protective

Other Uses

Plant is good soil binder and recommended for deserts. A decoction or infusion of the whole plant is taken as a tonic and purgative in small doses, and as an emetic in larger doses.

The stems produce a smoky fire, suitable for drying purposes. The stem pith makes good tinder. The stems are used for roofing and building huts. The very light wood can also be used to make net floats.

The stem bark is considered to stimulate lactation in cattle. A macerated stem bark extract is used for removing hairs from hides and also for tanning; it can also be used as a dye.

Leaf juice sometimes taken by women to induce abortion and for utero-tonic purpose. Leaves are used as mattress stuffing to keep insects away.

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ROLE OF PLANTS TO BEAT COVID-19

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Coronaviruses cause disease among human and animals such as camels, cattle, cats, bats etc. A few animal coronaviruses evolve to infect humans such as those that cause SARS, MERS and COVID-19 outbreaks. The outbreak is believed to originate from a local market in Wuhan City in China that sells wild animal as food. On March 11th, 2020, the WHO characterized COVID-19 as a pandemic. Today the number of reported cases globally reached close to 11 Million with about 535,098 deaths.

COVID-19 virus spreads through droplets of saliva or nasal discharge. Infected individuals experience mild to moderate respiratory illness and can recover without medications. However, older patients with underlying medical concerns such as heart disease, diabetes, cancer, hypertension disease are more likely to develop serious illness.

Thus scientist from various fields all over the world are working hard to come up with effective treatments to curb the pandemic.

Many medicines, we use today are extracted from plants. Thanks to biotechnology that enables us to manufacture other substances from plants, different from those which they produce naturally. We do that by introducing genetic material into their genome. This contains information that enables the production of medicines such as antibodies, vaccines and other products.

Diagnostics: Test Kit using CRISPR and Algae:

COVID-19 testing is conducted through various means in different countries. Some methods detect the presence of the Virus itself through RT-PCR and isothermal nucleic acid amplification while others tests detect antibodies produced as a reaction to infection. However these require expensive equipment and knowledgeable manpower.

AIOD-CRISPR is a low cost diagnostics platform to detect COVID-19 virus. This technology used in all organisms but its early application is in plants. The AIOD-CRISPR Test Kit is intended for use at home or in small clinics, reducing disease transmission risk. Compared to PCR, AIOD-CRISPR system has better sensitivity and specificity. The Test Kit successfully detected the DNA & RNA of SARS-COV. 2.

Serological Test Kits for COVID-19 are developed using algae as a production factory for making the vital proteins for antibody identification. Current tests rely on proteins developed in insect or mammalian cell, which are expensive. Algae is a better bio factory alternative because they are easy to grow & can easily be modified to produce viral proteins.

Therapeutics: Potential plant based treatment:

Potential phytochemicals may be used to develop antiviral drugs against COVID-19. Bioactive compounds from medicinal plants have the best potential to act as COVID-19 M Pro inhibitors.

Vaccines: Using plants as bio factories:

Experts are striving towards developing on effective vaccine to combat the spread of COVID-19. This includes plant derived vaccines which can be produced with less cost in high amounts. The genome sequence of the plant Nicotiana benthamiana is used for the development of vaccine for COVID-19. The plant is a good candidate as bio factory because of its potential to make large quantities of high-quality vaccine and antibodies considering it has 60,000 genes which is double the number of genes of an ordinary plant.

Genetic sequence of interest can be inserted into Agrobacterium a common soil bacterium that is taken up by plants. Then the plant produces the protein that can serve as vaccine.

Use of tobacco as a bio factory is considered safer because the plants cannot host pathogens that can cause human diseases and allergies. The vaccine formulation can be stored at room temperature, unlike conventional vaccines which must be stored in low temperature.

Immunity Boosters:

Medicinal herbs provide timely and adequate remedies to several health disorders. It is necessary to understand the correlation among medicinal herbs, immune system and COVID-19 in the present times.

When a pathogen breaches the body's barriers, the immune system churns out a variety of immune molecules to fight it off. The infected cells make the ultimate sacrifice and invite their own destruction by displaying distress signal for T-Cells which swiftly detect and kill them. T-Cells are cytotoxic powerful serial killers that can recognize peptide fragments of virus displayed on the infected cell surface. They release toxic enzymes that kill the infected cells. This strategic martyrdom is organized by the immune system to deprive the virus of its replication factories. It also leads to reduction of viral load in the patient. It takes several days for antiviral T-Cells to expand and generate the antibodies. Vaccination alone does not guarantee immunity. Natural immunity happens only after recovery from the actual disease. The microorganism usually passes through many of the bodies natural immune defense system in the nose throat, lungs, digestive tract & lymph tissue before it reaches the blood stream. The immune system remains sound when people are healthy. They are able to fight off infection faster and better. The immune system becomes weaker and more susceptible to fight off infection in the absence of sound health.

Plant based foods increases & help in the formation of beneficial bacteria and the overall gut micro biome health which makes to 85% of the body's immune system. Foods and vegetables rich in Vitamin C are good for immunity. Zn is very crucial micronutrient used in DNA synthesis and cell proliferation, which regulate innate and adaptive immune responses. Vitamin D improves cellular resistance partially by raising the cytokine storm that the innate immune system causes. Omega-3 fatty acids reduce inflammation inside the body. Drinking water helps the cells to oxygenate and they can compete at their best. Staying hydrated enables to transmit nutrients to all parts of body. Glutathione a powerful antioxidant in the body scavenges damaging free radicals and is involved in tissue repair and builds chemical and protein used for the immune system.

Active life, physical exercise, healthy diet, stress free life, relaxation and sound sleep resist infection faster and better.

According to WHO 80% of the world's population uses herbal medicines for primary health care, particularly across Europe and South Asia. Many of the herbs have anti-inflammatory properties, they also help build up the body's immunity and unlike allopathic medicines like antibiotics, which can have serious side effects most of these herbs are relativity safe. Ayurveda had stated long ago that plant extracts could do a lot to strengthen the body. Plants and plant products can build ojas to empower our immunity.

List of few herbs to keep COVID-19 at bay:

1. Moringa oleifera (Drumstick): Contains 7 times more Vitamin C than Oranges, has high level of Potassium, Iron, Calcium and amino acids.
2. Azadirachta indica (Neem): Has antiviral, antibacterial and antifungal properties, purifies blood, flushing away toxins.
3. Ocimum tenuiflorum (Tulsi): Powerful germicides because of its phytochemicals and antioxidants, Immuno modulator, used in treatment of respiratory, digestive and skin diseases.
4. Withania somnifera (Ashwagandha): Adaptogen (decrease stress level)
5. Triphala: Anti oxidative property of three fruits:
6. Haritaki (Terminalia chebula)
7. Bibhitaki (Terminalia belleria)
8. Amla
9. Zingiber officinale (Ginger): Contains Gingerol, an antioxidant particularly good in preventing respiratory tract infection, anti-inflammatory, antifungal, anticancer property.
10. Allium sativum (Garlic): Contains allicin that act as germicide, antioxidant, reduces stress and high B.P., enhances Vitamin B1, absorption. Prevents Beri-Beri.

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ZERO BUDGET NATURAL FARMING

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Zero Budget Natural Farming is a unique method of farming which requires absolutely no monetary investment for purchase of key inputs like seeds, fertilizers and plant protection chemicals from the market.

ShriSubhashPalekar is known as the Father of ZBNF in India. He found that there is a self-developing, self-nourishing & totally self-reliant natural system without any human existence.

❖ **Concepts of ZBNF**

The followings are the basic concepts of ZBNF

- ZBNF means for all the crops the overall production cost will be zero or minimal.
- An approach towards sustainability.
- No purchase from outside the farm unit.
- Only 10% water & 10% electricity of present usage of these resources is sufficient.
- Numbers of microorganisms are decreasing due to use fertilizers, pesticides & cultivation of tractor.

❖ **Principles of ZBNF**

There are four main principles of ZBNF

- Low Input Farming
- Natural Inputs
- Soil Mulching
- Multi cropping

Low Input Farming - The production cost for the farmer is zero as no input needs to be purchased. As 1.5 to 2.0 % of the nutrients are taken from the soil by the plant, there is no need to add fertilizers. These nutrients provided by nature (as in the forest) are totally free of cost.

Natural Inputs - Natural farming does not require chemicals inputs or organic compost like vermiculture (S. Palekar considers these external inputs as destructive as chemicals) but promotes a natural catalyst of biological activity in the soil and natural protection from diseases.

Soil Mulching - It is necessary to create the micro-climate under which micro-organisms can best develop, that is 25 to 32 °C temperature, 65 to 72 % moisture and darkness and warmth in the soil. Mulching indeed conserves humidity of the soil , cools it and protects its micro-organisms.

Multi Cropping - Multi cropping is a good way to minimize the risks for the farmer who is able to enjoy continuity of yield throughout the year. In case of a crop's failure he can also rely on the other crops.

❖ **Practices of ZBNF**

There are four main elements that supports the sustainability of ZBNF:

- Jeevamrita – Soil Fortification
- Beejamrita – Seed treatment
- Aachadana – Mulching
- Whapasa – Soil Aeration

Jivamrita/Jeevamruthais a fermented microbial culture that provides nutrients and acts as a catalytic agent promoting the microorganism's activities in the soil.In simple words it's a method to add the required nutrients to the soil without the use of any chemical fertilizers. Its main ingredients are Cow dung, Cow urine, Jaggary, Pulse flour and Farm soil.

Bijamrita/Beejamruthais a treatment used for seeds, seedlings or any planting material. Bijamrita is effective in protecting young roots from fungus as well as from soil-borne and seed-borne diseases.It is composed of similar ingredients as jeevamrutha - Cow dung, Cow urine, Lime and Soil.

Acchadana is the process of "Mulching".The process of covering the soil surface around the plants to create a congenial conditions for the crop growth.It helps in reduction of moisture loss from soil by evaporation, hampers weed growth.

According to Palekar, there are three types of Mulching:

Soil Mulch: This protects topsoil during cultivation and does not destroy it by tilling. It promotes aeration and water retention in the soil. Palekar suggests avoiding deep ploughing.

Straw mulch: Straw material usually refers to the dried biomass waste, it can be composed of the dead material of any living being (plants, animals, etc).

Palekar's approach to soil fertility is very simple – provide dry organic material which will decompose and form humus. Straws traps air easily, effectively moderating soil temperature. It is also extremely porous.

Live mulch: A cover crop interplanted or undersown with a main crop & intended to serve the functions of a mulch which also helps in weed suppression &regulation of soil temperature.

According to Palekar, it is essential to develop multiple cropping patterns of monocotyledons &dicotyledons, to supply all essential elements to the soil and crops.

Whapasa:According to Palekar, what roots need is water vapor. Whapasa is the condition where there are both air molecules and water molecules present in the soil, and he encourages reducing irrigation, irrigating only at noon, in alternate furrows. ZBNF farmers report a significant decline in need for irrigation in ZBNF.

SubhashPalekar's Zero Budget Natural Farming is a unique method of farming which requires absolutely no monetary investment for purchase of key inputs like seeds, fertilizers and plant protection chemicals from the market. The farmer can grow hardy local varieties of crops without application of fertilizers and pesticides. Since it is a zero budget farming no institutional credit would be required and dependence on hired labour is also reduced to bare minimum. All that the system requires is native breed of cattle which in any case forms an integral part of farming families in rural areas. It is claimed that one cow is sufficient to take up this method of farming on thirty acres of land.The whole philosophy behind this system is to make the farmer self-reliant so that he is freed from the clutches of money lenders and market dispensed high cost inputs.

Zero Budget Natural Farming advocates cultivation of diverse species of crops depending on site specific agro climatic conditions. In the scheme of mixed cropping- cereals, millets, leguminous crops, horticulture crops particularly vegetables and even medicinal plants can be included to make farming more lucrative. The system also advocates wider spacing of crops to facilitate inter cropping. Palekar has repeatedly stressed that just as diversity is the rule of nature, the farm should also have diverse species.

The system of zero budget natural farming is eminently suited to the farmers, particularly small and marginal farmers because of its simplicity, adoptability and drastic cut in cost of cultivation of crops. The appeal to the farming community lies in the fact that maintaining optimum levels of production and keeping the cost of cultivation to the bare minimum will substantially enlarge the profit margin. However, patience and perseverance are required on the part of farmers during the initial period of transition to the new system as results from lingering effects of chemical farming will not be encouraging and it will evidently improve only after adequate mulching and restoration of biological activity in the

The yields are optimal with possibly no decline in future, because of continuous incorporation of organic residues and replenishment of soil fertility. This system of farming has freed the farmers from the debt trap and it has instilled in them a renewed sense of confidence to make farming an economically viable venture. This is a noteworthy feature in the dark horizon of many farmers committing suicide across the country. The 'Zero Budget Natural Farming' so far clearly points to its eminent feasibility for different agro climatic conditions, for different crops and different category of farmers. It has found favor with the farming community because it perfectly blends with their life style which is dependent on land, vegetation and livestock.

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