Degradation means decay and bio refers to the decay being carried out by living organisms such as bacteria, fungi, insects and worms. These living organisms eat the dead material and recycle it into new forms. Biodegradation is the natural process involved in recycling waste or breaking down organic matter into nutrients that can be used by other living organisms. (http://1800recycling.com/green-glossary/b/biodegradation)

The decomposition products of plant residues in soil may become toxic to growth of plant under certain conditions. The absence of satisfactory extraction procedures and bioassay methods have come in the way of identifying the nature and extent of phytotoxic principles produced by plant remains which undergo decomposition have been detected through seed germination tests, growth of radicles and seedling injury under laboratory conditions which have been supported by field observation like stunted overall growth of plant, chlorosis, slow maturation, premature leaf abscising and failure of flowering and seed setting.

**MATERIALS AND METHODS:**

*Celosia argentea,* (4cm × 0.5cm) were collected from cultivated fields and these stem bits were kept in the soil up to six months period. Biodegradation of *Celosia argentea* in soil at different time intervals was carried out in laboratory conditions by serial dilution methods using soil extract agar medium (Martin 1950).

Serial dilutions were made with sterile water in sterilized testtubes. 10ml, 9ml, 9ml and 9ml of deionised water was poured into the testtubes respectively. All the testtubes were kept in an autoclave at 15lbs pressure for 15 minutes. The partially degraded stem bits after immersion in garden soil was transferred into 10ml of sterile water to get 10⁻¹ dilution. After the preparation from this dilution further serial dilutions made upto 10⁻⁴. 0.2ml of each diluent was poured in sterile petriplate Medium was poured over it. Soil extract Agar media and Martin rose Bengal Agar media were prepared and used to isolate and enumerate the bacteria and fungi from the stem bits.

**Preparation of soil extract agar medium:**

About 200gms of garden soil was extracted from cultivated fields and the soil was passed through 2mm sieve and mixed with 150ml of deionised water. 0.1g of soil was taken as 10⁻¹ dilution. Serial dilutions were made in sterile distilled water.

**Key words:** Biodegradation, *Celosia argentea* L., mycological succession.
mixed with 100ml of tap water and it was sterilized in autoclave at 15lbs pressure for 30 minutes. After autoclaving a small quantity of CaCO₃ was added to it and soil suspension was filtered through a double filter. The turbid filtrate was then poured into a clean glass conical flask and sterilized at 15lbs pressure for 30 minutes. After sterilization 100ml of soil extract was taken, and to this glucose 1.0gms, K₂HPO₄ 0.5gms KH₂PO₄ 0.5gms, MgSO₄ 7H₂O 0.25gms, agar 7.5gms, deionised water 500ml and rose Bengal 0.0175gms were added. The petriplates were incubated. Bacteria were isolated after two days growth. Fungi were isolated after four to five days growth.

RESULTS

After one month of immersion of the stem in the soil, *Fusarium, Aspergillus* were isolated. In the second month, *Bacillus subtilis* bacteria developed along with the existing two microorganisms. After third month, *Penicillium* was grow an around the stem bits. All the six species viz *Aspergillus, Fusarium, Rhizopus, Penicillium, Curvularia* and Bacillus *subtilis* continued to grow after fourth, fifth and sixth months and caused complete degradation of the stem bits. The stem got crushed due to mycological succession.

<table>
<thead>
<tr>
<th>S. No</th>
<th>Name of the Fungi</th>
<th>One Month</th>
<th>Two Months</th>
<th>Three Months</th>
<th>Four Months</th>
<th>Five Months</th>
<th>Six Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><em>Aspergillus</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>2</td>
<td><em>Fusarium</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td><em>Rhizopus</em></td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>4</td>
<td><em>Penicillium</em></td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>5</td>
<td><em>Curvularia</em></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>6</td>
<td><em>Bacillus Subtilis</em></td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

Table Showing mycological succession in the serial dilutions after different time interval

DISCUSSION

Most of this produced biomass exists out of recalcitrant, woody stem tissue accounting for about 50% of the total mass (Granéli 1990, Meganck 1998, Gessner 2000). This huge amount of dead plant matter enters the detritial system and becomes available for fungal saprotrophic colonization first in a standing decay phase of variable length and subsequently in the litter layer (Haslam 1972;
Pieczyńska 1972 Granéli 1990). Both of these habitats are characterized by a different mycota (Apinis et al. 1972a, b, 1975, Luo et al. 2004 Van Ryckegem and Verbeke 2005a, b)

Plant remains contain organic compounds: sugars, starches, proteins, carbohydrates, lignins, waxes, resins, and organic acids. The process of organic matter decay in the soil begins with the decomposition of sugars and starches from carbohydrates, which break down easily as detritivores initially invade the dead plant organs, while the remaining cellulose and lignin break down more slowly. (Berg and McClaugherty 2007) Simple proteins, organic acids, starches and sugars break down rapidly, while crude proteins, fats, waxes and resins remain relatively unchanged for longer periods of time. Lignin, which is quickly transformed by white-rot fungi,(Levin, Forchiassin and Ramos 2002) is one of the main precursors of humus,(González-Pérez, Vidal Torrado and Colnago 2008) together with by-products of microbial( Knicker and Almendros 1995) and animal (Muscolo and Bovalob 1999) activity. The end-product of this process, the humus, is thus a mixture of compounds and complex life chemicals of plant, animal, or microbial origin that has many functions and benefits in the soil. The size of particles of microorganisms involved, the extent of availability of C,N,P and K, the moisture content of soil, its temperature, pH and aeration, presence of inhibitory substances (such as tannins) etc. are some of the major factors which influence the rate of organic matter decomposition.(Subba Rao 1999).

Plant residues contain 15-60 percent cellulose, 10-30 percent hemicellulose, 5-30 percent lignin, 2-15 percent protein and 10 percent sugars, aminoacids and organic acids. Cellulose occurs in a semicrystalline form with a molecular weight of 10 and has glucose units with β(1-4) linkages. The individual chains of glucose are held together by hydrogen bonds.

Cellulase enzyme complex decompose cellulose into disaccharide cellobiose which is hydrolyzed by the enzyme cellobiase to glucose. Hemicelluloses are various polymers of hexoses, pentoses and sometimes uronic acids with commonly occurring monomers such as xylose and mannose. Pectin is an example of hemicelluloses and is an important constituent of the middle lamella of cell walls. Pectin is degraded by the enzyme pectinase which is a complex than cellulases and is formed by chemical reaction involving phenols and free radicals without any specific order. Lignin gets encrusted on the cellulose and hemicellulose matrix. Compounds like caffeic acid and ferulic acid have structures similar to lignin and they have been used in studies on degradation of lignin.(Subba Rao 1999). Plant debris containing higher amounts of lignin are resistant to microbial attack and hence mineralization proceeds slowly in organic materials like sawdust. The lignin content of plant residues may serve as an index of the vulnerability of organic residues to microbial attack. (Subba Rao 1996)

The relationship between organic matter and plant growth may be direct or indirect. Organic matter is a natural substrate for saprophytic microorganisms and provides nutrition to plants indirectly through the activity of soil microorganisms. It is essential for the formation of soil aggregates and hence soil structure which ultimately determines the extent of soil aeration and rooting habit of plants. Organic matter helps in the conservation of soil nutrients by preventing erosion and surface run-off of nutrients.

While soil microorganisms in general take part in humus formation, some fungi such as Penicillium, Aspergillus and also Actinomycetes produce dark humus like substances (amino acids, peptides and
polyphenols) which serve as structural extracts of spores of *Aspergillus niger* possess properties similar to those of humic acids.

When microorganisms grow and multiply on organic debris, carbon is utilized for building the cellular material of microbial cells with the release of carbon dioxide, methane and other volatile substances. In this process, microorganisms also assimilate nitrogen, phosphorus, potassium and sulphur which get bound in the cell protoplasm. Therefore the C/N, C/P, C/K or C/S ratios in soil are governed by the extent of organic matter utilized by soil microorganisms depending on the oxygen content and the microbial biomass at a particular stage in decomposition.

1) Degradation of plant and animal remains by cellulases and other microbial enzymes.

2) The increase in the biomass of microorganisms which comprises polysaccharides and protein and

3) The accumulation or liberation of end product. The term 'mineralization' is used to designate the conversion of organic complexes of an element to its inorganic state. The second process which involves the microbial uptake of nutrients such as nitrogen, phosphorus and sulphur is opposite in magnitude to mineralization and is known as immobilization. Immobilization reduces the availability of nutrients of plant growth, the intensity of which is related to the total microbial biomass at a given time. The last of these processes provides an index of microbial activity in soil and is interlinked with nitrification and denitrification processes which are also mediated by microorganisms. If degradation may not occur properly, the plant debris in soil may become toxic to growth of plant. It affects the germination of the seed and overall growth of plant.

**CONCLUSION**

In the present investigation, the stem material of *Celosia argentea* L. was degraded by soil microorganisms, within 6 months the stem got complete degradation due to microbial succession by *Fusarium*, *Aspergillus*, *Bacillus*, *Penicillium* and *Rhizopus* species.

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