Chapter VI
SUMMARY

1. The Production of four different species of oyster mushroom viz. *P. sajorcaju* (Fr.) Singer, *P. cornucopiae* (Panlet ex Pers.) Rolland, *P. sapidus* Kalchb, and *P. flabellatus* (Berk and Br.) Sacc. were studied on five different substrates of plant waste such as Paddy straw, Paddy husk, Saw shaving, Sugarcane bagasse and Water hyacinth. The samples of various species were made pure culture on PDA medium using the method of tissue culture. Mother culture as well as spawn were prepared on 1/2 boiled rice grain. At the time of preparation of spawn calcium carbonate (CaCO₃) and gypsum (CaSO₄) were used to adjust the pH at 6.6 of rice grain.

2. The total amount of production of all the four species of *Pleurotus* was found to be recorded a maximum 51.393 kg from the conventional substrate of Paddy straw and in case of non-conventional substrate from water hyacinth 51.093 kg followed by from paddy husk 36.140 kg, saw shaving 35.392 kg and sugarcane bagasse 33.492 kg. The yield pattern shows almost the same result from the substrate of Paddy straw and water hyacinth (Table 15).

The result showed that the mean production was found to be maximum from the species of *P. sajorcaju* with 2342 gm which was followed by *P. flabellatus* 2329 gm, *P. cornucopiae* 2100 gm and *P. sapidus* 1962 gm (Table 16).

The efficiency of the production of different species of *Pleurotus* at different season were studied. The faster spawn and highest mushroom production were
recorded in the months of December, January and February of Winter season, which was followed by September, October and November of Autumn and March, April and May of Spring season. The maximum yield was recorded 2.58 kg and 2.716 kg from the species of *P. sajorcaju* from the substrate of paddy straw and it was followed by the 2.348 kg and 2.542 kg on the substrate of water hyacinth in the winter season. The effect of different substrates on the production of mushroom was studied. The total highest mean production of mushrooms from all five different substrates in two consecutive years found from the species of *P. sajorcaju* 615 gm followed by 565 gm *P. flabellatus*, 460 gm *P. sapidus* and 393 gm *P. cornucopiae* in the winter season. In the autumn it was recorded 510 gm *P. sajorcaju*, 487 gm *P. flabellatus*, 367 gm *P. cornucopiae*, 360 gm *P. sapidus* and in the spring 517 gm *P. cornucopiae*, 457 gm *P. flabellatus*, 457 gm *P. sajorcaju* and 407 gm *P. sapidus* and in the rainy summer 403 gm *P. cornucopiae*, 343 gm *P. sapidus*, 355 gm *P. flabellatus* and 291 gm *P. sajorcaju*. It appears from the results that *P. sajorcaju* favours the winter where as *P. cornucopiae* spring and summer seasons.

3. The effect of biotic factors such as parasitic and antagonistic fungi and bacteria in the production of Oyster mushrooms was studied. The experimental results show that altogether 22 different fungal types belonging to 16 different genera, of which *Aspergillus niger*, *A. flavus*, *Curvularia lunata*, *Cladosporium herbarum*, *Fusarium oxysporum*, *Mucor spp.* *Penicillium citrinum*, *Rhizopus nigricans* and *Trichoderma viride* were the most dominating fungal types isolated from different substrates. Out of five different substrates viz Paddy straw, Water hyacinth, Paddy husk, Sugarcane bagasses and Saw shaving, Paddy straw harbours maximum number of fungal colonies. The maximum number of
colonies (289 colonies) recorded from the bed of *P. cornucopiae* followed by *P. sajorcaju* (271 colonies), *P. flabellatus* (146 colonies) and *P. sapidus* (76 colonies) from the substrate of Paddy straw. Among the fungal types *Trichodema viride* showed the dominance of fungal colonies of 68 numbers with 23.52%. In case of the substrate of water hyacinth the highest fungal population (167 colonies) was recorded from *P. cornucopiae* followed by *P. sajorcaju* (130 colonies) *P. flabellatus* (74 colonies) and *P. sapidus* (59 colonies). Here also *Trichoderma viride* showed the highest numbers of colonies with 17.36%. The maximum numbers of mycoflora isolated from the substrates of Paddy straw ie 289 colonies *P. cornucopiae*, 271 colonies *P. sajorcaju*, 146 colonies *P. flabellatus* 76 colonies *P. sapidus*. During the investigation maximum number of colonies were isolated at the 1st harvesting period. The above findings were similar with the findings of Thakur *et. al* (2001), Sharma and Vijay (1996). The quantitative analysis of bacteria associated with different substrates, maximum bacterial counts were recorded 126 colonies from the the substrate of Paddy straw at the cultivation of *P. cornucopiae*. Followed by 86 colonies *P. sajorcaju* from the substrate of water hyacinth, 75 colonies from sugarcane bagasses, 31 colonies from Paddy husk, 22 colonies Saw shavings during the cultivation of *P. cornucopiae*. Again highest bacterial counts were recorded from the substrate of Paddy straw and Water hyacinth at the 3rd harvesting and in case of sugarcane bagasses, saw shaving and paddy husk it was 2nd harvesting period. The bacterial findings were similar with the findings of Singh *et. al* (2002).

4. The biodegradability of Cellulose and Lignin of various substrate by four different species of *Pleurotus* was studied. The quantitative analysis of cellulose and lignin at 10, 20, 30 and 40 days of incubation were determined using the
method developed by 'Von Soest and Wine 1968' based on detergent. Initial cellulose concentration was recorded 40.60% paddy straw, 40.15% water hyacinth 34.25% sugarcane bagasse; 32.50% saw shavings and 30.45% paddy husk, and again Lignin was found 23.50% paddy straw, 15.20% water hyacinth, 24.20% sugarcane bagasse, 28.50% saw shavings and 20.60% paddy husk. All the species of *Pleurotus* shown significant cellulose and lignin reduction in all the five substrates. After 40 days of incubation, the percentage of cellulose reduction was recorded 26.75% Paddy straw, 26.30% water hyacinth, 22.60% sugar cane bagasse, 18.42% paddy husk and 18.00% saw shavings by the species of *P. sajorcaju*. The other species showed the maximum reductional activity in the substrate of water hyacinth (25.45%) by *P. cornucopiae*, 26.10% by *P. flabellatus* and 25.25% by *P. sapidus*.

The maximum percentage of lignin reduction was recorded after 40 days 43.65%, 41.35%, 42.20%, 43.45% from the species of *P. sajorcaju*, *P. cornucopiae*, *P. flabellatus* and *P. sapidus* respectively in the substrate of paddy straw followed by 41.35%, 38.50%, 40.15% and 39.60% respectively in water hyacinth, 35.30%, 34.90%, 35.00%, 35.25% in sugarcane bagasse 32.30%, 33.40%, 33.70% and 34.60% in saw shaving and 22.45%, 23.55%, 22.30% and 22.95% in paddy husk. The magnitude of the reduction of lignin found to be maximum within 10 to 20 days interval where as the cellulose reduction activity found to be maximum within the period of 20 to 30 days interval. The results show that among all the species of *Pleurotus*, *P. sajorcaju* was inferred to be the most efficient lignocellulose degrader. Among the different substrates with high percentage of cellulose and the lower percentage of lignin paddy straw and water hyacinth found to be most suitable substrate for the production of Oyster mushroom. In case of other substrates lignin was found to be affected adversely in the activity
production cellulases which might be reason for poor growth and yield of mushroom in saw shavings, sugarcane bagasse and paddy husk.

5. The effect of medium for the mycelial growth and incubation period were studied. Potato dextrose agar medium, Czapek's dox agar medium and Richard's agar medium were studied for different species of Pleurotus. The isolates of different species exhibited wide variation in the mycelial growth in different media. The highest mycelial mean growth was recorded 87.4 mm in Potato Dextrose agar medium, followed by 74.6 mm in Richard's agar and 70.1 mm in Czapek's dox agar medium. Individually the highest mean growth was recorded from P. sajor-caju, 79.6 mm followed by P. sapidus 79.5 mm P. flabellatus 78.6 mm, 73.6 mm P. cornucopiae. Among the four species highest growth was recorded 90.0 mm P. sajor-caju in PDA medium and lowest 68.0 mm P. cornucopiae in the Richard's agar medium.

Again as per dry weight of mycelium best growth was recorded in PDA medium at the incubation period of 15 days with 754.5 mg P. sajor-caju, 694.5 mg P. flabellatus, 676.0 mg P. sapidus and 578.6 mg P. cornucopiae per 50 ml of liquid media. After 15 days all the species shows gradual declination in growth.

6. The effects of temperature and relative humidity on the production of various Oyster mushroom were studied. The maximum production recorded from all four different species is P. sajor-caju, P. sapidus, P. flabellatus and P. cornucopiae between the temperature range of 10.8-26.8°C and relative humidity 60-89%. The production shown to be slowly declining at the increase of Temperature range between 15-30°C and RH 80%. The production was recorded minimum within the temperature range above between 25.4 to 33.3°C and the relative
humidity range between 80 to 83%. The results also indicate that *P. sajorcaju*, *P. flabellatus* and *P. sapidus* preferred the cooler climatic condition (ie temperature 10.8-26.8°C) with higher moisture content ie. Relative humidity 60 to 89% where as *P. cornucopiae* preferred higher temperature ie. temperature range between 15 to 31°C and relative humidity range below 80%. The results show that the best environmental condition for the production of Oyster mushroom was temperature range between 10.8 to 26.8°C and relative humidity between 60 to 89%.

The effects of inorganic nutrients in the form of commonly used fertilizers Urea for Nitrogen (N), Murate of Potash (K) and Super phosphate (P) in the production of various oyster mushrooms were carried out. The application of Super phosphate from the concentration 0.02% to 0.16% found to be increased in production of various Oyster mushroom and there after it declines. The maximum production was recorded in the substrate of paddy straw, followed by water hyacinth, sugarcane bagasse, saw shavings and paddy husks from all the species of *Pleurotus*. Individually maximum production was recorded 464 gms in the substrate of paddy straw followed by 434 gm in the substrate of water hyacinth from the species of *P. sajorcaju* at the concentration of 0.16% super phosphate (P). The application of murate of Potash (K) has shown the influence in the production of mushroom at the concentration level of 0.02% to 0.016%, on various substrates. The maximum total production 3167 gm was recorded from the substrate of water hyacinth followed by Paddy straw 3075gm, Sugarcane bagasse 2652 gm, Saw shavings 2182 gm and Paddy husk 2152 gm. The maximum in production was recorded of 210 gms from the species of *P. sapidus* in the substrate of water hyacinth followed by 208 gm *P.*
sajorcaju from the substrate of Paddy straw. The application of Urea (N) was found to be less effective in the production of mushroom.

8. The effect of auxins and vitamins i.e. IAA, IBA, GA-3 and Ascorbic acid was studied. The yield was recorded maximum 685 gm from *P. sajorcaju* followed by 645 gm *P. sapidus*, 632 gm *P. cornucopiae* and 562 gm *P. flabellatus* at the concentration of 5 ppm IAA in the substrate of Paddy straw. In the application IBA maximum yield was recorded 588gm *P. sajorcaju*, 546 gm *P. sapidus*, 505 gms *P. flabellatus* at the concentration of 10 ppm and 545 gms *P. cornucopiae* at the concentration of 5 ppm in the substrate of Paddy straw. Again in GA-3 maximum yield was recorded 525 gm *P. sapidus*, 395 gm *P. cornucopiae*, 385 gm *P. flabellatus* 342 gm *P. sajorcaju* on the substrate of Paddy straw at the concentration of 5 ppm. In case of Ascorbic acid 20 ppm concentration found to be effective with the production of 675 gm *P. sajorcaju*, 535 gm *P. cornucopiae*, 455 gm *P. flabellatus* and 435 gms *P. sapidus* in the substrate of paddy straw. The mean production of various species of Pleurotus on the substrate of Water hyacinth found to be recorded more or less similar with the production of Paddy straw. The size and numbers of sporophore also found to be increased at the lower concentration level of Auxin and higher concentration level of vitamins. The influence of Ascorbic acid found to be recorded maximum in the production of Oyster mushroom followed by IAA and IBA.

9. In the investigation of nutritional status of various species of *Pleurotus*, there was no significant differences in the value of crude protein, carbohydrates and fats in all five different substrates of Paddy straw, Water hyacinth, Paddy husk, Sugarcane bagasses and Saw shavings. The investigation revealed 49% carbohydrates, 29% protein, fats below 3% and several minerals such as
Potassium, Phosphorous, Calcium, Magnesium, Iron, Zinc, Copper etc. Again twelve numbers of amino acid including five essential ones (Isoleucine, Lysine, Methionine, Tyrosin and Tryptophan) detected by paper chromatographic method.

It may be assumed that the mushroom supplementation to the cereal diet is effective to supplement the necessary deficient amino acid. FAO has recommended mushroom as supplementary food to the growing population of developing and underdeveloped countries, who are mainly dependent on the cereals.