STATUS OF EDIBLE AND MEDICINAL MUSHROOM RESEARCH IN SRI LANKA

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ABSTRACT

Sri Lanka is an island situated 32 km away from southern most part of India. This paper discusses the present status of edible and medicinal mushroom research in Sri Lanka and suggests the future needs for a sustainable expansion of the mushroom sector. Commercially cultivable mushrooms were introduced to Sri Lanka in 1985, under the auspices of the UNDP and oyster mushrooms (*Pleurotus ostreatus*) are acclaimed as the first domesticated species. Although *Pleurotus* mushrooms are the preferred species in terms of production and consumption, straw, milky and button mushrooms are also popular though cultivated on lesser enormities. In view of the scarcity of mostly used softwood sawdust used for *Pleurotus* cultivation, several cost effective substrate mixtures have been formulated as potential alternatives. Novel technologies have been introduced for the cultivation of straw, button, milky and medicinal mushroom *Ganoderma lucidum*. Major pests of mushrooms have been identified and measures have been advocated to effectively control them through integrated management. Strategies are in place for efficient utilization of spent mushroom substrates. Several value added mushroom products have been produced to prolong the shelf life of mushrooms. As a future strategy, comprehensive ethno mycological studies are needed to explore the indigenous mushrooms in Sri Lanka and to investigate their nutritional and therapeutic properties. Accurate identification tools need to be formulated for the identification of mushrooms and to develop genetic relationship between different species. Introduction of exotic culinary and medicinal mushrooms, suitable for tropical climates is a perquisite for the expansion of the mushroom industry.

Keywords: culinary, medicinal, mushrooms, ethno mycological

INTRODUCTION

Sri Lanka is an island country situated 32 km away from southern most part of India. It lies between latitudes 5º 55'N and 9º 51'N and longitudes 79º 41'E and 81º 5'E, covering an area of 65,610 square kilometers. Despite its relatively small land area, Sri Lanka is blessed with exceptionally high bio diversity, similar to that of Western Ghats of India. Located in low latitudes and surrounded by the Indian Ocean, Sri Lanka shows very typical maritime-tropical temperature conditions. Edible and medicinal mushroom cultivation has come to light as one of the strategies in livelihood development programs to revitalize the country's economy, which was ravaged due to 30 years of civil strife. This paper discusses the present status of edible and medicinal mushroom research in Sri Lanka and suggests the future needs for the sustainable expansion of the mushroom sector.

Commercial mushroom cultivation was first introduced to Sri Lanka in 1985 under UNDP funded program. Sri Lanka Export Development Board took the initiative to set up state of the art spawn laboratories and mushroom houses for spawn production and mushroom cultivation. Subsequently, the Department of Agriculture as the state institution responsible for food crop production took over the responsibility of spearheading R&D activities connected to mushroom cultivation.

Cultivation Technology

Oyster mushrooms (*Pleurotus* species)

Pleurotus ostreatus is the most preferred cultivated species across the country, in terms of production and consumption. *P. cystidiosus* and *P. eous* can be ranked in the second and third places, respectively. Although technology was perfected by researchers [1] for the cultivation of *P. eryngii*, this has been confined to mid and up country. In Sri Lanka, for the cultivation of oyster mushrooms, soft wood saw dust has been popularly used as the basal medium. However, dwindling

supplies of sawdust during recent times makes it imperative to search for alternative substrates. Arulnandhy and Gayathri [2] reported significantly higher yields obtained from mixed substrates where sawdust and paddy straw were used at 1:1 ratio. The yields realized from single basal substrates were inferior. Lokuge and Rajapakse [3] included paddy husk in oyster mushroom substrate in an attempt to partially replace saw dust as reported by Hanai *et al*. [4]. Economical yields and biological efficiencies derived from this study reported significantly higher yields from mixed basal substrates (paddy husk and sawdust) compared to individual basal substrates. Bringing in slight modifications, the positive impact of utilizing banana pseudo stems for yield enhancement in oyster mushroom cultivation [5] was also reported by Rajapakse and Lokuge [6]. This technology was disseminated mainly in major banana growing areas of the dry zone where farm women were encouraged to use banana pseudo stem with sawdust in 1:1 ratio as oyster mushroom substrate for significantly higher yields. Preparation of different compost mixtures using 6 per cent well decomposed poultry manure or 2.5 per cent *Gliricidia* leaf powder to replaceone percent legume powder requirement, which is the current recommendation have been reported by Rajapakse *et al*. [7]. Amarasiri and Alahakoon [8] reported the advantage of adding *Lantana camara* leaf extract @ 20 per cent, to prepare paper beddings with 1 kg weight with a resultant 18 per cent yield increase. The above investigations enumerated the advantage of cost effective mixed basal substrates as growing media for oyster mushrooms ensuring higher yields.

Paddy straw mushroom

Outdoor cultivation is the common practice of paddy straw mushroom production in Sri Lanka. Rajapakse[2][9] developed an indoor cultivation method for paddy straw mushroom production using cotton waste and paddy straw and reported the significantly higher yields obtained at 5.38 kg/sqm and 4.71kg/sqm, respectively compared to 1.79 kg/sqm and 1.73 kg/sqm obtained from the same substrates using the outdoor cultivation method thus emphasizing the advantage of the indoor cultivation.

Button mushroom

The protocol developed for cultivation of button mushroom (*Agaricus bisporus*) by Wijesinghe *et al*. [10] was further improved with the expertise received from the Directorate of Mushroom Research (DMR) India.

Milky mushroom (*Callocybe indica*) and black ear mushrooms (*Auricularia* spp.)

Cultivation was first introduced by Udugama and Wickramarathna [11] using paddy straw as the main substrate.

Medicinal mushrooms

Cultivation protocol for indigenous *Ganoderma lucidum* was perfected by Rajapakse *et al*. [12]. Subsequently, Bandaranayaka *et al*. [13] reported the technology for the cultivation of domesticated *G. lucidum*.

Lentinus giganteus (*Pleurotus giganteus* (Berk.) Karunarathna & K.D.Hyde.)

This Sri Lankan endemic edible mushroom was identified as *Lentinus giganteus* (Berk.) by Udugama [14] and technology was developed for artificial cultivation [14] using sawdust. However, based on molecular evidences this was positioned under *Pleurotus* and renamed as *Pleurotus giganteus* by Karunaratna *et al*. [15].

Crop Protection

Pest infestations have been identified as one of the major constraint for the expansion of cottage mushroom enterprises in Sri Lanka. Thus the effectiveness of pest exclusion and sanitation methods has been identified as remedial measures. *Cyllodes bifacies* has been identified as the major pest of oyster mushrooms in the central region [16]. Although mycophagous mites have been recorded elsewhere in the world, mites that belong to only *Lasioseius* species is found in Sri Lanka [17]. According to Sirisena *et al.* [18] inclusion of citronella leaf powder in the saw dust based growth substrate @ 2.5 per cent, effectively controlled the beetle infestation. Rove beetle infestation (*Gyrophanena* spp.) was reported by Wegiriya [19] as the major pest problem in the southern region of Sri Lanka. Wickremasinghe *et al*. [20] identified four fungi namely

Aspergillus fumigates, Chetomium thermophium, Mucor pusillus and *Trichoderma harzianu*m from straw and oyster compost substrates which exhibited anti bacterial activity against three human pathogenic bacteria at relatively low (10-40 µg) concentrations. Significant anti bacterial activity exerted by *Volvariella volvacea* against *E.coli* was also reported [21]. Manikpurage *et al*. [22] observed anti oxidative activity as well as cytotoxicity of the *P. cystidiosus* extract against Hep-2 cancer cells. In addition, Manikpurage *et al*. [23] reported the existence of activity in *P. cystidiosus* against *C. gloesporioides* causing anthracnose. Pain alleviating properties of *P. cystidiosus* has also been validated [24].

Spent Mushroom Substrate (SMS)

Invitro investigations carried out by Rajapakse *et al*. [25] on oyster mushroom SMS reported the presence of antagonistic bacteria in spent mushroom substrate and their high efficacy against red leaf spot pathogen of *Alternantherasessilis*. Concurrent *invivo* study on SMS, *visa vis* cattle manure, poultry manure and recommended dosages of fertilizer when each applied @ 1 kg/sqm reported no significant difference between the 4 treatments implying the usefulness of SMS as a manure, particularly in urban agriculture. Furthermore mixing oyster mushroom SMS @ 50% w/w with sawdust in the growth substrate to attain significantly higher yields and its advantage to decrease the recommended legume powder amendment by 50% has also been reported by Karunatilaka and Rajapakse [26]

Mushroom Spawn

Rajapakse [27] introduced saw dust spawns for oyster mushroom cultivation and emphasized its cost effectiveness, particularly for the rural poor in Sri Lanka. However, the most sought after spawn type remained as grain spawns in Sri Lanka. Pathmashini *et al*. [28] tested four types of grains namely finger millet, paddy, sorghum, and maize for oyster mushroom cultivation and observed the highest biological efficiency and yield from the substrates inoculated with finger millet grain spawns thus reporting it as the best.

Value Addition

A mushroom sandwich spread with *Pleurotus ostreatus* mushroom powder and different levels of chicken flavor (w/w) was developed by Rajanayaka *et al*. [29] and the best ratio was reported [29] as 40:1, based on sensory properties and overall acceptability. A mushroom sausage with required sensory attributes was developed [30] using *P. ostreatus* mushroom with a shelf life of more than four months. Sarananda *et al*. [31] manufactured a rice flour biscuit incorporating different levels of *P. ostreatus* mushroom flour (w/w). Based on the nutritive value and overall acceptability, the five percent inclusion was reported as an acceptable level. Mushroom burgher was also developed by Farhana *et al*. [32] using *P. ostreatus* mushrooms.

Future strategy

In order to diversify the mushroom sector in Sri Lanka, it is necessary to introduce new mushroom varieties and also different species of the popular *Pleurotus* spp. Investigations are needed to formulate cost effective cultivation technologies for the new introductions and dissemination of proven technologies to the farmers. Systematic investigations on medicinal mushrooms are a necessity as the relevant information (anti oxidant, antimicrobial, anti tumor) is scarce in Sri Lanka. Ethno-mycological studies need to be carried out to explore the diversified indigenous macro fungi in Sri Lanka and to investigate their nutritional and therapeutic properties. Accurate identification tools need to be introduced for the identification of mushrooms and to develop genetic relationship among different species. Mushroom derived product development is to be further explored to popularize mushroom consumption.

CONCLUSION

Mushroom farming is a burgeoning agriculture based enterprise in Sri Lanka and has tremendous scope to improve the food and livelihood security of the people. Ministry of Agriculture has implemented several livelihood development programs during recent times, particularly to the reawakened northern region, which was devastated due to 30 years of civil strife.

Comprehensive scientific research is needed to enlighten the value of edible mushrooms and to dispel the mycophobic attitude from certain sections of the society.

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