Research & Reviews: Journal of Microbiology and Biotechnology

Role of Endophytes in Pharmaceutical Industry

Sunil Kumar Singh
School of Biosciences and Technology, VIT University, Vellore, Tamil Nadu, India

Commentary Article

Received date: 02/20/2015
Accepted date: 03/23/2015
Published date: 03/28/2015

***For Correspondence**

Sunil Kumar Singh, School of Biosciences and Technology, VIT University, Vellore, Tamil Nadu, India, Tel: +91 9966661052;

E-mail: singhsunil.kumar2012@vit.ac.in

ABSTRACT

Endophytic fungi live inside plants, apparently do not cause any harm to their hosts and may play important roles in defense and growth promotion. Endophytes have been proved to be a rich source of novel chemistry and biological molecules. Secondary metabolites produced from endophytes have been widely used in pharmaceutical industry. The review highlights some of its uses in pharmaceutical industry.

INTRODUCTION

The search for new and useful compounds to provide assistance and relief in all aspects of the human condition is ever growing. Drug resistance in bacteria, severe infections caused by various pathogens, the increased human population and environmental degradation, loss of biodiversity and pollution of land and water added problems to society. The microbes residing within plant tissues 'the endophytes' are also important sources of secondary metabolites with immense implications in agriculture and medicine [1]. Endophytes may contribute to their host plant by producing a plethora of substances that provide protection and ultimately survival value to the plant. Endophytes have proved to be a rich source of novel chemistry and biological molecules [2]. Numerous studies of the diversity of endophytic microbes in plants suggest that these microbes are diverse enough and occur in high enough numbers as to constitute communities. Various reports indicate that endophytes exist in a variety of tissue types within numerous plant species, suggesting a ubiquitous existence in most plants. The endophytic population may originate from the usual soil community and a great diversity has been reported in diverse plant community [3]. It showed that endophytic fungi are microorganisms that can be an alternative source of bioactive secondary metabolites [4].

Distinguished Role of Endophytes

Enzyme producer

Enzymes are specific, often stereo selective, catalysts which do not produce unwanted by products. The first fungal enzyme amylase was produced via SSF (Solid State Fermentation) from Aspergillus oryzae on moist rice or wheat bran. The process was initially developed by Jokichi Takamine and patented in the USA in 1884. However the large-scale production of microbial enzymes was carried out by submerged fermentation technology in 1940 [5]. Acid, alkaline, neutral proteases, cellulose, diastase, invertase, lactase, lipase, pectinase has been widely produced using endophytes.

Antiviral activity

The charming use of antibiotic products from endophytic fungi is the inhibition of viral growth. Two novel human cytomegalovirus protease inhibitors, cytonic acids A and B were elucidated by mass spectrometry and NMR methods and found to be effective against virus growth. Some metabolites from endophytic fungi of desert plants serve as a viable source for identifying potent inhibitors of HIV-1 replication [6].

Anticancer activity

The important plant-derived anticancer drugs Taxol®, vincristine, vinblastine, podophyllotoxin and camptothecin are still isolated from the source plants, thus bearing a high ecological cost, however many of the endophytic fungi have also been shown to possess associated plant active principles such as Taxol®, vincristine, podophyllotoxin, camptothecin [7] Taxol (paclitaxel) is an attractive invention from an endophytic fungus generated more attention in the treatment of various cancers because of its unique mode of action as compared to other anticancer agent.

Anti TB

Tuberculosis is a potentially deadly infectious disease caused by Mycobacterium sp. There were approximately 8.8 million cases of active TB in 2010. Endophytes have served the purpose for production of compound such as phomoenamide, calpinactum, nocarditthiocin, trichoderin, sensamycin, mollicellin, ramariolide etc. which are highly active against TB.

Anti-fungal

endophytes under optimum condition have shown to produce large number of secondary metabolites which are highly active against other harmful microorganism. Endophyte derived anti-fungal compounds identified include pestacin, hydroxyjesterone, cytosporone, cryptocin, trichodermin, griseofulvin, brefeldin, dinemasone, botryorhodine and many more.

Apart from these a lot number other bioactive compounds have been identified like endophyte derived cholesterol inhibitors like lovastatin, simvastatin. Immunosupressent, psychotropic isolates anti-malarial compounds has been identified. It is believed there is yet lot more untapped source of active principles that lies in endophytes which may come as potent drugs in near future.

CONCLUSION

Endophytic fungi are a noble and consistent source of unique natural amalgams with a high level of biodiversity and may also yield several compounds of pharmaceutical significance, which is currently attracting scientific surveys worldwide. The symbiotic association of host–endophyte relationships at the molecular and genetic levels will be helpful for enhancing secondary metabolite production by endophytic fungi under laboratory conditions. The quest novel niches useful endophytic microorganisms can be an active area for future investigations.

REFERENCES

1. Manasa. Endophtyic fungi from Tabernaemontana heyneana Wall. (Apocynaceae) and their L-asparaginase activity. Biodiversity & Sustainable Energy Development. 2012.
2. Prakash V. Endophytic Fungi as Resource of Bioactive Compounds. International Journal of Pharma and Biosciences. 2015; 6(1): (B) 887–898.
3. Dalal GM, Kulkarni NS. Population Variance and Diversity of Endophytic Fungi in Soyabean (Glycine max(L) Merril). Journal of Botanical Sciences. 2014; 3(4): 33-39.
4. Elvira Hermawati, Euis H Hakim and Lia D Juliawaty. Secondary metabolites of endophytic fungi from Morus plant. Pharmacognosy, Phytochemistry & Natural Products. 2014.
5. Tiwari K. The Future Products: Endophytic Fungal Metabolites. J Biodivers Biopros Dev. 2015; 2: 145.
6. Mishra Y, Singh A, Batra A, Sharma MM. Understanding the Biodiversity and Biological Applications of Endophytic Fungi: A Review. J Microb Biochem Technol. 2014; S8: 004.
7. Kuriakose GC, Singh S, Rajvanshi PK, Surin WR, Jayabaskaran C. In Vitro Cytotoxicity and Apoptosis Induction in Human Cancer Cells by Culture Extract of an Endophytic Fusarium solani Strain Isolated from Datura metel L. Pharm Anal Acta. 2015; 5: 293.