



Trends in Biological Research

APPLICATIONS AND SIGNIFICANCES



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TRENDS IN BIOLOGICAL RESEARCH

Applications and Significances

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Chapter 1

HYPOCHOLESTEROLAEMIC POTENTIAL OF S-(2-CARBOXYPROPYL)-GLUTATHIONE AND S-ALLYL-MARCAPTO-GLUTATHIONE FROM *ALLIUM SATIVUM* (LINN.): A MOLECULAR DOCKING SIMULATION STUDY

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SUMMARY

Hypercholesterolemia and oxidative stress are now considered to be one of the major contributors for atherosclerosis progression. The major cause of mortality in developed as well as developing countries due to cardiovascular disease (CVD). The raised lipid level, like total cholesterol (TC), triglyceride (TG), and low-density lipoprotein (LDL) cholesterol, and a decrease in high density lipoprotein (HDL) cholesterol are directly connected with hyperlipidemia and atherosclerosis. The β -hydroxy- β -methylglutaryl-CoA reductase (HMG-R), rate limiting enzyme in cholesterol synthesis via catalysing the conversion of HMG-CoA to mevalonic acid. There are different drugs such as statins are used to treat the CVD. Long term use of

Chapter 2

APPLICATION AND PERSPECTIVE OF PLANT GROWTH PROMOTING MICROBES IN DEVELOPMENT OF SUSTAINABLE AGRICULTURE

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SUMMARY

Microbial communities in natural soil environments exhibit a cooperative link with crop productivity *via*. Plant Growth Promoting Microbes (PGPMs). One particular group of microbes known as Plant Growth Promoting Rhizobacteria (PGPR) is capable of alleviating the effects of biotic and abiotic stress factors either directly or indirectly. The PGPR injections have emerged as a beneficial tool for environmental sustainability as these are efficient in increasing seedling growth matrices as well as against certain plant infections that too with minimum usage of toxic pesticides. Plant Growth Promoting Bacteria (PGPB) have the ability to chelate iron, phosphate solubilization, creation of ACC deaminase enzyme under saline stress, generation of phytohormones and many others. This enormous potential makes them a truly unique microbiological candidate for

Chapter 3

EXPLORING THE ANTIOXIDANT AND ANTI-DIABETIC POTENTIAL OF *NYCTANTHES ARBORTRISTIS*

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SUMMARY

The present study on *Nyctanthes arbortristis* (*N. arbortristis*), known traditionally for its remedial potential, this article provides descriptions of the antioxidant and inhibition of α -amylase enzyme activity as well as kinetics study. Our results illustrated that *N. arbortristis* leaf methanol extract exhibited strong antioxidant and oxidative DNA damage protective activity than other extracts. In addition, *N. arbortristis* leaf EtOAc, methanol and aqueous extract of leaf strongly inhibited DPPH property, while the EtOAc and methanolic stem extract showed best inhibition of DPPH. Similarly, our results showed aqueous and methanolic leaf extract have high potency to inhibition of α -amylase activity by scoring the IC₅₀ 12.44 and 12.44 $\mu\text{g/mL}$, respectively), in a competitive manner, while the

Chapter 4

INVESTIGATING THE MEDICINAL PROPERTIES OF *TABERNAEMONTANA DIVARICATA*

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SUMMARY

The present study on *Tabernaemontana divaricate* (*T. divaricata*), traditionally, known for its medicinal properties. We investigated the antioxidant and α -amylase inhibitory potential by *in-vitro* analysis. Our results illustrated that among all the stem and leaves fractions of *T. divaricata* extracts, TDSE (IC₅₀ 129.2 μ g/ml) and TDLM (IC₅₀ 69.83 μ g/ml) showed the highest antioxidant potential, whereas, TDLA (IC₅₀ 9.89 μ g/ml) and TDSE (IC₅₀ 11.62 μ g/ml) showed the highest inhibitory activity of α -amylase than other extracts. In the fractions of stem and leaves TDSE, TDSD, TDLM, TDLA and TDSE, TDSA, TDLD, TDLE showed competitive and mixed type of inhibition, respectively. The antioxidant and α -amylase inhibitory potential of various stem and leave fractions of *T. divaricata* may be attributed to the presence of various bioactive secondary metabolites. However, these findings from *in-vitro* assays may further be validated

Chapter 5

A STUDY ON MUCUS TRANSPORT IN HUMAN LUNG AIRWAYS

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SUMMARY

Here, we have studied mucus transport in the lung airways which will give a better understanding of hydro-dynamical and some physiological aspects of mucus transport in the human respiratory tracts. The study will be helpful in gaining insight into the pathogenesis of the respiratory diseases, by applying the different aspects of mucus clearance altered in health and disease or by physical or pharmacologic intervention. We may gain tools for diagnosis, prognosis and for evaluation of therapy for some airway diseases and thus have much intrinsic scientific interest.

Keywords: Mucus Transport, Human Lung, airways.

1. Introduction

Applying Mathematics to Biological Sciences has long history. The application of Mathematics to Biological Sciences had been mentioned in the literature as early as 1922. In 1930's there were perhaps a lot of works on Mathematical Biology. The human body is supposed as a wonderful machine created by God having a lot of

Chapter 6

SYNTHESIS OF CEFIXIME LOADED GOLD NANOPARTICLES & ITS ANTIBACTERIAL POTENTIAL ANALYSIS

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SUMMARY

Cefixime (CFX) is a third-generation cephalosporin antibiotic that has wide antibacterial action against both Gram-negative and Gram-positive bacteria. However, its effectiveness, like that of other third-generation cephalosporin antibiotics, is falling owing to the rising frequency of multi drug resistant (MDR) infections. Recent advancements in nanotechnology have been predicted as a viable way towards combating MDR bacteria. As a result, gold nanoparticles (GNPs) were synthesised in the present work utilising cefixime, which functioned as a reducing and capping agent having well-established antibacterial action. Cefotaxime loaded gold nanoparticles (C-GNPs) were also tested for antibacterial activity *in vitro* against Gram-positive and Gram-negative bacteria. The synthesis of C-GNPs was confirmed by UV-Visible spectroscopy, when compared to pure CFX, the synthesised C-GNPs demonstrated

Chapter 7

EGG CANNIBALISM STRATEGIES FOR NUTRITIONAL BALANCE IN THE POPULATION DYNAMICS OF LADYBIRDS

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SUMMARY

Cannibalistic behaviour is usually more intense for survival and growth when other food sources are scarce. We hypothesized that the effect of conspecific egg density on egg cannibalism and aphid consumption rates in a mixed diet depends, and whether the rate of egg cannibalism is also dependent on the body size of the predator. To test this prediction, we used a large *Coccinella septumpunctata* and a smaller *Milochinus sexmaculata* ladybird adult. The rate of egg cannibalism increased steadily with an increase in egg density, and the maximum number of eggs consumed by larger ladybirds at higher egg densities. Egg cannibalism was not dependent on the presence of aphid density in the diet mixed by both ladybirds. The consumption rate of aphid has steadily decreased with an increasing the density of

Chapter 8

METAL NANOPARTICLES (MNPS): THE FAR REACHING IN ADVANCED BIOMEDICAL RESEARCH

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SUMMARY

In recent years, the study of metal nanoparticles (MNP's) has been increased among researchers due to their excellent physiochemical, biocompatibility, optical, electrical and thermal properties. These remarkable properties of MNP's have potential for use in biomedical, drug delivery and in cancer therapy. Here in, we have discussed different types of MNP's, synthesis, physical and chemical properties and also used in bio imaging and nano-sensing. AuNP's are being religiously used in biomedical applications because of their small size, easy surface, functionalization and biocompatibility. In biological and medical research, AgNP's have been most fascinating. Due to their magnetic properties, FeONP's are extensively used in cancer treatment. PtNP's are most fascinated for researchers because

Chapter 9

INSECTICIDAL ACTIVITY OF ESSENTIAL OILS AGAINST MUSEUM PESTS

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SUMMARY

Prolonged use of synthetic pesticides in museums has resulted in the accumulation of residues in various environmental components, adversely affecting non-target organisms. Hence there is a need to develop alternative, safe and eco-friendly methods for the control of museum pests. Natural products derived from plants have shown some biogeochemical activity against museum pests. Plant essential oils (EOs), a mixture of bioactive volatile compounds, have been one of the focal points of botanical insecticides due to their environmental friendliness, safety to non-target organisms, and low-level resistance. Essential oil-based insecticides are of great importance in museums because they are active against a wide variety of insects, are fast-penetrating and active against treated products as well as less toxic residues in users. The study presented here focuses on the review of various essential oils used as biopesticides for insect pest management in museums. Clove oil and clove bud are highly toxic against drywood termite *Went*. When treated with peppermint and