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Suryawanshi Rahul, Patil Chandrashekhar, Borase Hemant, Salunke Bipinchandra, Elisabeth Mouray, Philippe Grellier, Patil Satish

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In vitro antiparasitic activity of microbial pigments and their combination with phytosynthesized metal nanoparticles.

Suryawanshi Rahul[1], Patil Chandrashekhar[1], Borase Hemant[1], Salunke Bipinchandra[1], Elisabeth Mouray[2], Philippe Grellier[2] and Patil Satish[1]*

[1]School of Life Sciences, North Maharashtra University, Jalgaon, 425001, Maharashtra, India.

[2]Muséum National d'Histoire Naturelle, UMR 7245 CNRS Molécules de Communication et Adaptation des Microorganismes, Paris, France

(* Corresponding author) satish.patil7@gmail.com

Tel. : +91 257 2257421 -25, Fax : +91 257 2258403

Abstract

Bioactive pigments were extracted and purified from cultures of *Serratia marcescens* and C*hromobacterium. violaceum*. Spectroscopic, FTIR analysis, and HPLC showed prodigiosin and violacein as a principle molecule in the extract. Bioactive microbial pigments prodigiosin, violacein and their combinations with phytosynthesized silver and gold nanoparticles were studied for *in vitro* growth inhibition of *Plasmodium falciparum* and *Trypanosoma brucei gambiense*. Prodigiosin has found to be more effective than violacein for inhibition of both parasites *in vitro*. Specifically, combinations of the microbial pigment prodigiosin with metal nanoparticles showed a significant decrease in the IC_{50} values on both parasites (2.7 to 3.6 fold) without increase of cytotoxicity upon mammalian cells. The data may be useful for the designing of microbial pigment based drug designing.

Keywords Prodigiosin; violacein; *Trypanosoma brucei gambiense*; *Plasmodium falciparum*; antimalarial

1. Introduction

Malaria and Human African Trypanosomiasis (HAT) are two important vector borne diseases caused by parasitic protozoa. Sleeping sickness is caused by protozoan parasites belonging to genus *Trypanosoma.* Tsetse fly (*Glossina* genus) is the principal vector responsible for spread of infection from infected human beings or from animals harbouring the human pathogenic parasites to the normal ones. Mother to child spread and transmission by other blood sucking insects has also been reported.

T. brucei gambiense causes a chronic infection and accounts for over 98% of reported cases of sleeping sickness, other reported cases being caused by *Trypanosoma brucei rhodesiense*. The fatality of the disease lies in the ability of this pathogen to maintain asymptomatic stage till it crosses blood brain barrier and affects central nervous system. Without treatment, sleeping sickness is considered as fatal.

Out of four registered drugs [1] Melarsoprol is the only one for effectively treating both subspecies of HAT in its advanced stage; however, the drug's potency is constrained due to unacceptable side effects. All drugs used against HAT are suffering with undesirable effects and development of parasite drug resistance. In addition lack of new molecules to treat the disease has become a major issue [2].

On the other side in 2013, 97 countries had ongoing malaria transmission. An estimated 3.4 billion people are at risk of infection, of whom 1.2 billion are at high risk. The darker side of this disease is parasite resistance to the natural product artemisinin – the core drug of new chemotherapeutic treatments developed by WHO (ACTs) – that has been detected in South-East Asia. Similarly parasite resistance to chloroquine, the standard antimalarial drug used during decades, has been confirmed in many countries. For both of these diseases emergence of drug