

ANTIBACTERIAL ACTIVITY OF SERICIN FROM ECONORM TREATED SILKWORM COCOON AGAINST HUMAN PATHOGENS

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ABSTRACT

Numerous substances and compounds extracted from insects have been studied and tested as important resources for the discovery of new drugs (Feng *et al.*, 2009). Mulberry silkworm, *Bombyx mori L.* is to be one of the commercial insects that have high medicinal value and are usually used to reduce blood pressure, diabetes, nerve disorders and heart problems. The ingenuity of science continues to amaze with silk recently produced as biomaterials for the transport and delivery of drugs around the human body and for tissue engineering (Numata and Kalpan, 2010). The present study is therefore used to investigate the antibacterial activity of sericin extracted from econorm treated silkworm against some human pathogens such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Klebsiella pneumoniae*. Among all the bacterial pathogens tested, maximum activity was found (15.6±0.2mm) against *P.aeruginosa* at 5% concentration and the minimum activity was found against *E. coli* (11.6±0.2mm zone of inhibition) at 5% concentration of econorm treated silkworms.

Key words: *Bombyx mori L.*; antibacterial activity; sericin; econorm; biomaterials.

INTRODUCTION

Mulberry silkworm, *Bombyx mori L.* is to be one of the commercial insects that have high medicinal value and are usually used to reduce blood pressure, diabetes, nerve disorders and heart problems. Numerous substances and compounds extracted from insects have been studied and tested as important resources for the discovery of new drugs

(Feng *et al.*, 2009). In Chinese medicine, silk has been used for a variety of human conditions including the relief of flatulence. Interestingly, a vasodilator compound extracted from *Bombyx mori L.* larvae were used for the therapeutic treatment of vascular impotency (Ahn *et al.*, 2008). Silk is not prescribed in modern medicine, however it was used previously for medical sutures but now has been replaced by synthetic polymers. The ingenuity of science continues to amaze with silk recently produced as biomaterials for the transport and delivery of drugs around the human body and for tissue engineering (Numata and Kalpan, 2010). The present study is therefore used to investigate the antibacterial activity of sericin extracted from econorm treated silkworm against some human pathogens such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Klebsiella pneumoniae*.

MATERIALS AND METHODS

Econorm treatment of silkworm cocoon for sericin extraction

Disease free layings (DFLs) of PM x CSR2 multivoltine race was purchased from Government sericulture farm and reared in the laboratory by improved method of silkworm rearing (Krishnaswami, 1978). The econorm was prepared in different concentrations such as 1%, 3% and 5 % and sprayed uniformly on mulberry leaves followed by air drying. Then the leaves were fed at one of the feeding schedules from the first day of third instar larvae. After fifth instar, the silkworm larvae start to spin the cocoon. After 5-6 days the cocoons were collected for the isolation of sericin.

Extraction of sericin

Silkworm cocoon shells were cut into pieces of 1x1 cm and boiled in distilled water for 60 minutes. The degumming solution obtained from this process was subjected to salting out of sericin by 80% (NH₄)₂ SO₄. The precipitate was dissolved in distilled water, then underwent dialysis and freeze dried to yield wet degummed sericin powder. Once the powder was dissolved in distilled water it was sterilized by 0.22µm pore sized membrane filter and was used for antibacterial analysis. The antibacterial activity was carried out by using standard filter paper disc diffusion method.

RESULTS

In the present study, the antibacterial activity of sericin from econorm treated silkworm against five human bacterial pathogens such as *Escherichia coli*, *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Streptococcus pyogenes* and *Klebsiella pneumoniae* were investigated. Among all the bacterial pathogens tested, maximum activity was found (15.6±0.2mm) against *P.aeruginosa* at 5% concentration and the minimum activity was found against *E. coli* (11.6±0.2mm zone of inhibition) at 5% concentration of econorm treated silkworms (Figure. 1 and Table. 1).

Figure. 1 Antibacterial activity of sericin obtained from silkworm cocoon treated with different concentration of econorm against human pathogens

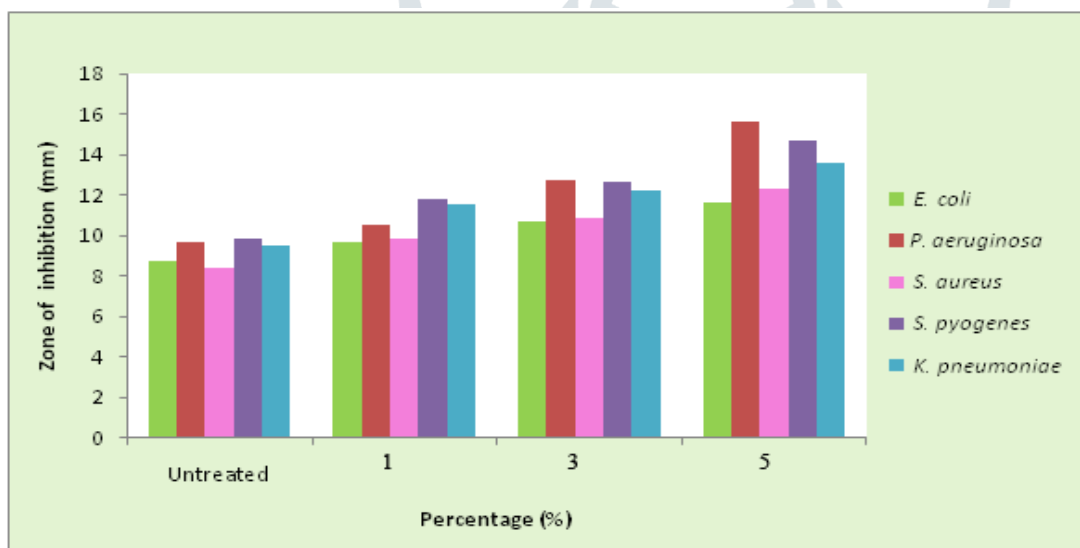


Table.1 Antibacterial activity of sericin obtained from silkworm cocoon treated with different concentration of econorm against human pathogens

Organisms	Zone of inhibition in diameter(mm)/concentration of sporlac treated silk worm			
	Untreated	1%	3%	5%
<i>Escherichia coli</i>	8.7 ± 0.2	9.6 ± 0.2	10.7 ± 0.1	11.6 ± 0.2
<i>Pseudomonas aeruginosa</i>	9.6 ± 0.2	10.5 ± 0.4	12.7 ± 0.2	15.6 ± 0.2
<i>Staphylococcus aureus</i>	8.4 ± 0.09	9.8 ± 0.1	10.8 ± 0.09	12.3 ± 0.2

<i>Streptococcus pyogenes</i>	9.8 ± 0.1	11.8 ± 0.09	12.6 ± 0.1	14.7 ± 0.2
<i>Klebsiella pneumoniae</i>	9.5 ± 0.04	11.5 ± 0.3	12.2 ± 0.3	13.6 ± 0.2

Each value represents the mean ± SD of 3 replications

DISCUSSION

Medicinal value of cocoon was also reported by Soong and Kenyon in the year 1984. Pandiarajan *et al.* (2011) has investigated the antibacterial activity of cocoon shell extract and proved that the cocoon shell extract inhibited the growth of micro organisms such as *E.coli*, *B. cereus*, *P. aeruginosa*, *S. aureus* and *K. pneumoniae*. The antibacterial activity of eri sericin against gram negative *E.coli* was investigated by Senakoon *et al.* (2009) and found that the more susceptible to the 90 min Na₂CO₃ degummed eri sericin with an effective dose initially at 30µg. . Kumar (2014) had investigated on the biological activities of silk protein (sericin) and reported that the silk protein was also effective against a human pathogenic protozoan, *Leishmania donovani*. In the present study, treated groups are found to be more susceptible against *S. pyogenes* (14.7mm of inhibition zone) when compared to other pathogens. Similarly, Hara and Yamakawa (1995) worked on moricin, a novel type of antibacterial peptide isolated from silk worm *B. mori* and found that the peptide showed high activity against *S. pyogenes*.

CONCLUSION

The protein sericin was examined for antibacterial property on *M. leutus* by modified agar diffusion method and found that the antibacterial efficiency of sericin against *M. leutus* increases when the concentration of sericin increases. Antibacterial and antioxidant activities of sericin powder from eri silkworm cocoons were also reported. In sericulture industry supplementary feeding increases the income of the farmer and the production of new drugs can generate extra income in addition to the silk. Thus it is inferred that silkworm larvae fed with econorm beneficially influence the silk production and the production of new drugs.

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