The antimicrobial effects of animal venom

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Abstract

Antibiotic resistant infections are an increasing health issue worldwide. The search for new molecules to treat infections that have acquired resistance to our current antibiotics is crucial for our future survival. Antimicrobial peptides (AMPs) have been discovered in a number of animal venoms including scorpions (Ortiz *et al.,* 2015). In this study a diverse collection of venoms from snakes and scorpions have been screened at multiple concentrations using a range of methods including investigating the zones of growth inhibition. Dosing bacterial cultures has elucidated venoms that kill or inhibit the growth of both gram positive and gram negative bacterial species including; *Escherichia coli K12 strain, Bacillus subtilis, Erwinia carotovora, Micrococcus luteus, Staphylococus albus* and *Pseudomonas aeruginosa*. Venoms were then fractionated and the fractions tested to determine which were responsible for the effects seen. Components of these venoms thus have the potential to be new drug candidates and will be part of further work on this project, including identification using mass spectrometry and selectivity testing against human cells.

Introduction- The antimicrobial crisis

Antibiotic resistance is now a significant global problem. Without effective antibiotics minor surgery and routine operations could become high risk procedures. Recently MRSA has been detected in supermarket pork. Venoms are proving to be a rich source of novel molecules to help combat this threat. Venoms have been around for millennia and are completely different from current therapeutics which is hoped will defeat the resistance.

Methods

A proof of concept study was undertaken to demonstrate the antibacterial activity of a selection of venoms from snakes, scorpions and theraphosids. Venomtech antimicrobial T-VDA microbial consisting of nine venom species was tested in the agar diffusion assay on five bacterial species. Nutrient agar plates were exposed to venom fractions and incubated on at 37°C temperature for 24hrs.

Results and Conclusions

- Seven of the nine venoms tested displayed antibacterial activity
- Two of the nine venoms were not selective and displayed activity against all bacteria tested.
- Most venoms showed selective antibacterial activity.
- Activity was shown to occur in a dose-dependent manner
- The next step is to identify the components in the venom responsible for this effect

Fig 1. Effect of 3 venoms on *M.luteus* (Gram +ve) growth

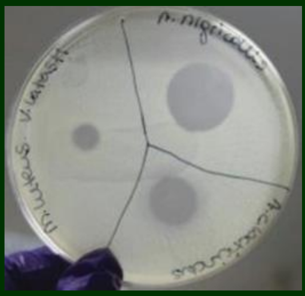

Fig 2. Effect of 3 venoms on *E coli* (gram -ve) growth.

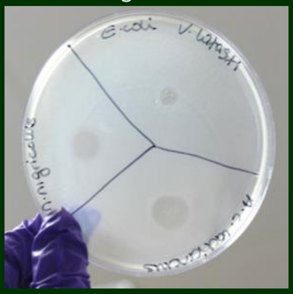

Fig 3. Effect of 3 venoms on *S.albus* (gram +ve) growth.

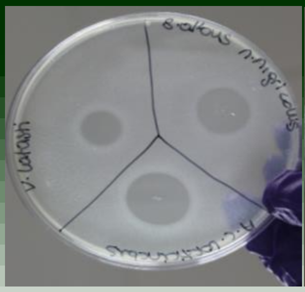

Fig 4. Dose response of *A. contortrix* venom against *S. albus* growth

Figure 5. This summarises the raw data of mean Inhibition values (mm) as the graph variable against the categorical variables of bacteria and scorpion venom species, with 95% confidence intervals supporting the error bars. B.s = *B.subtilis*, E.f = *E.facaelis*, M.l = *M.luteus*, S.a = *S.albus* . This displays the relationship between the venom species and variation of inhibition zones, relative to each bacteria species

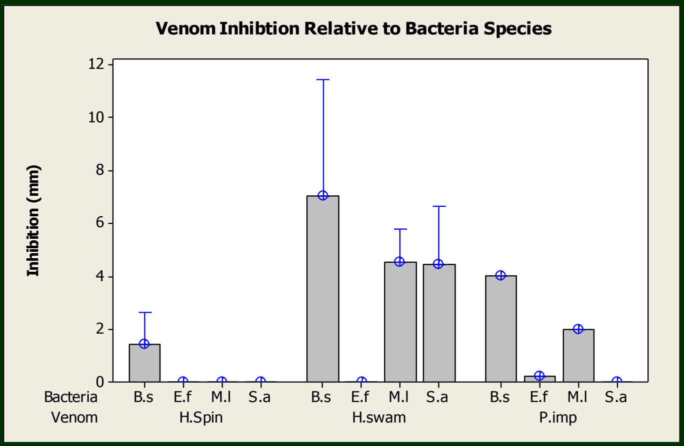

Table 1 – Seven venoms show antibacterial activity against 5 bacterial species

	Venom Species						
Bacteria	*N.nigricolis*	*A.contortrix*	*V.latasti*	*P.regalis*	*H.spinifer*	*H.swammerdami*	*P.imperator*
Escherichia coli	X	X	X				
Bacillus subtilis	X	X	X		X	X	X
Micrococcus luteus	X	X				X	X
Staphylococcus albus	X	X	X	X		X	
Enterococcus facaelis	NOT TESTED	NOT TESTED					X

Acknowledgements