



Antibacterial Activities in Eastern Subterranean Termite against Human and Animal Pathogens

Xing Ping Hu and Zeng Yuan, Auburn University, U.S.A.
 huxingp@auburn.edu



Introduction

Antimicrobial resistance (AMR) is a growing public health issue that affects more than 2 million people annually. Termites have been of interest for drug exploration. This study was to investigate constitutive and induced antibacterial activities in *Reticulitermes flavipes* against a panel of 8 infectious bacterial pathogens including 3 MDRs

Methods

Treatments: Cell-free crude body extractions (CFE) were obtained from termite workers fed with filter paper moistened with MQ water, MRSA, or PAO1.

Hemolymph collection and hindgut extraction

CFEs were size fractionated to obtain 4 fractions

Heating protein denaturation

Gel Electrophoresis analysis of proteins

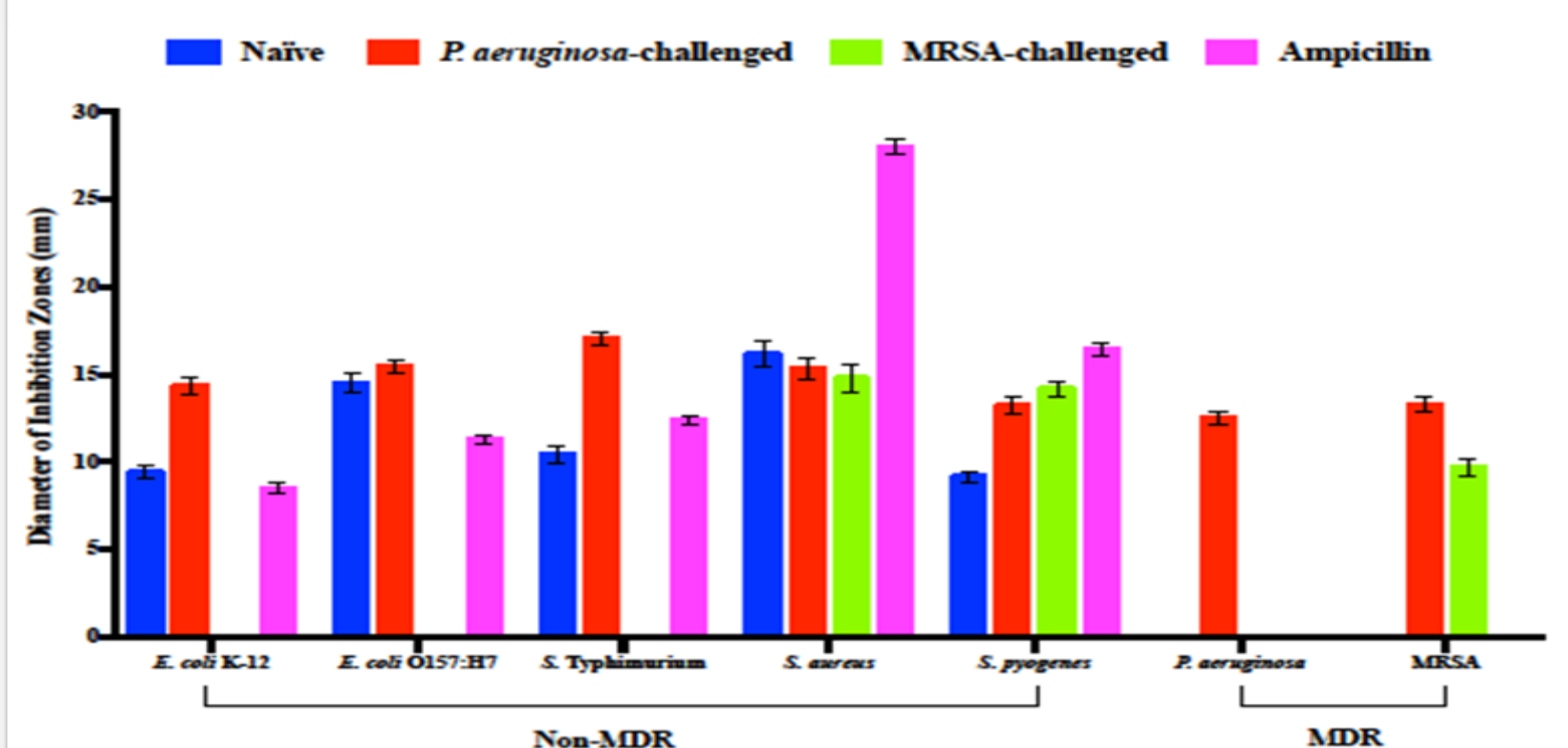
2-D gel electrophoretic analyses

Results

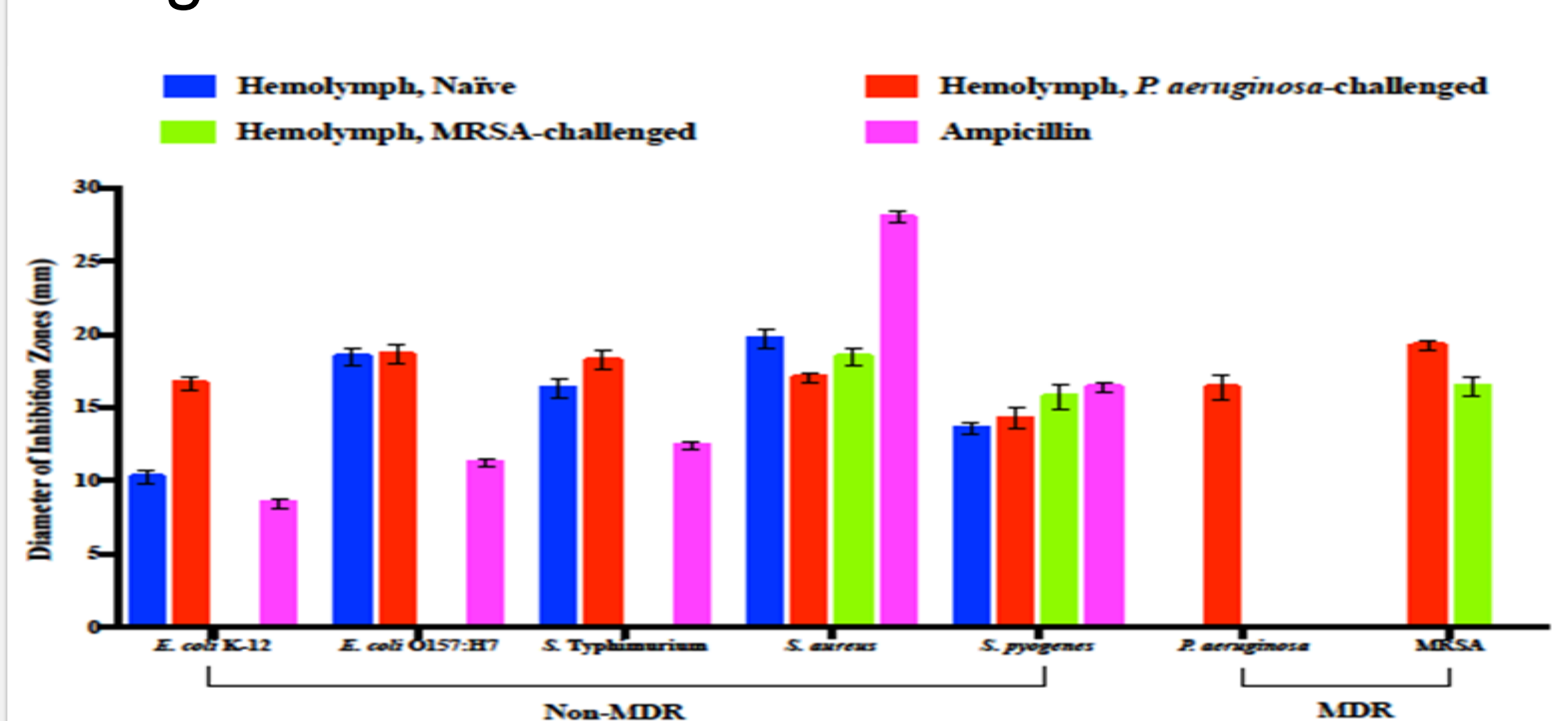
Constitutive antibacterial activities of body CEF and their protein nature

Bacteria	Gram Stain	Naive termite (400 µg)	Ampicillin (25 µg)	Heat-treated (Naive)	Trypsin digestion	Tris-NaCl Buffer
Infectious but Non-MDRs	<i>Staphylococcus aureus</i>	16.16 ± 0.73 ^b	27.99 ± 0.4 ^a	0	0	0
	<i>Streptococcus pyogenes</i>	9.14 ± 0.30 ^d	16.41 ± 0.36 ^a	0	0	0
	<i>Escherichia coli</i> O157:H7	14.51 ± 0.57 ^b	11.28 ± 0.24 ^c	0	0	0
	<i>Escherichia coli</i> K-12	9.41 ± 0.37 ^b	8.49 ± 0.33 ^c	0	0	0
	<i>Salmonella</i> Typhimurium	10.42 ± 0.50 ^c	12.39 ± 0.28 ^b	0	0	0
MDRs	MRSA	0 ^c	0 ^c	0	0	0
	<i>P. aeruginosa</i>	0 ^b	0 ^b	0	0	0
	<i>Acinetobacter baumannii</i>	0	0	0	0	0

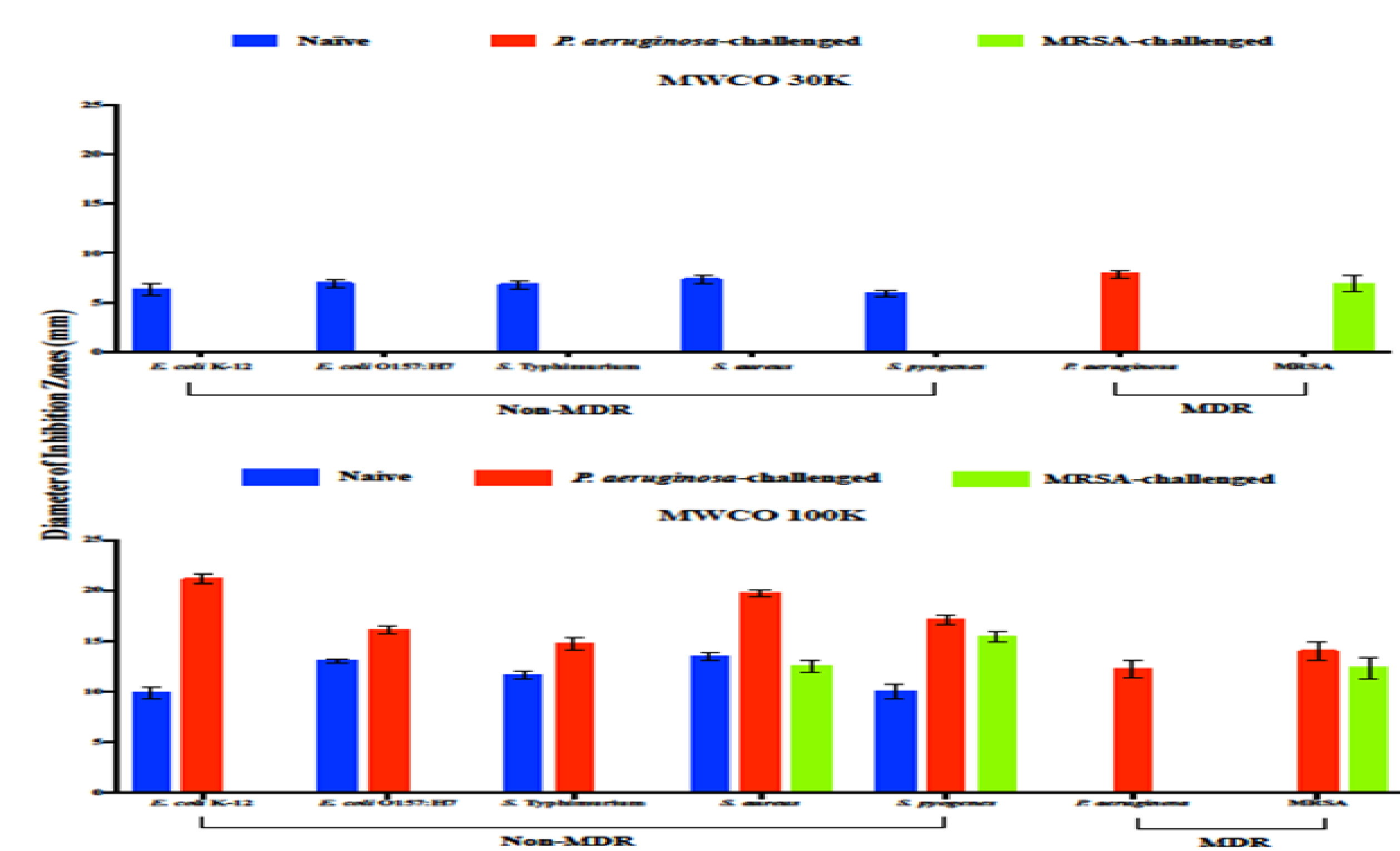
MDR-Induced antibacterial activities of CFE



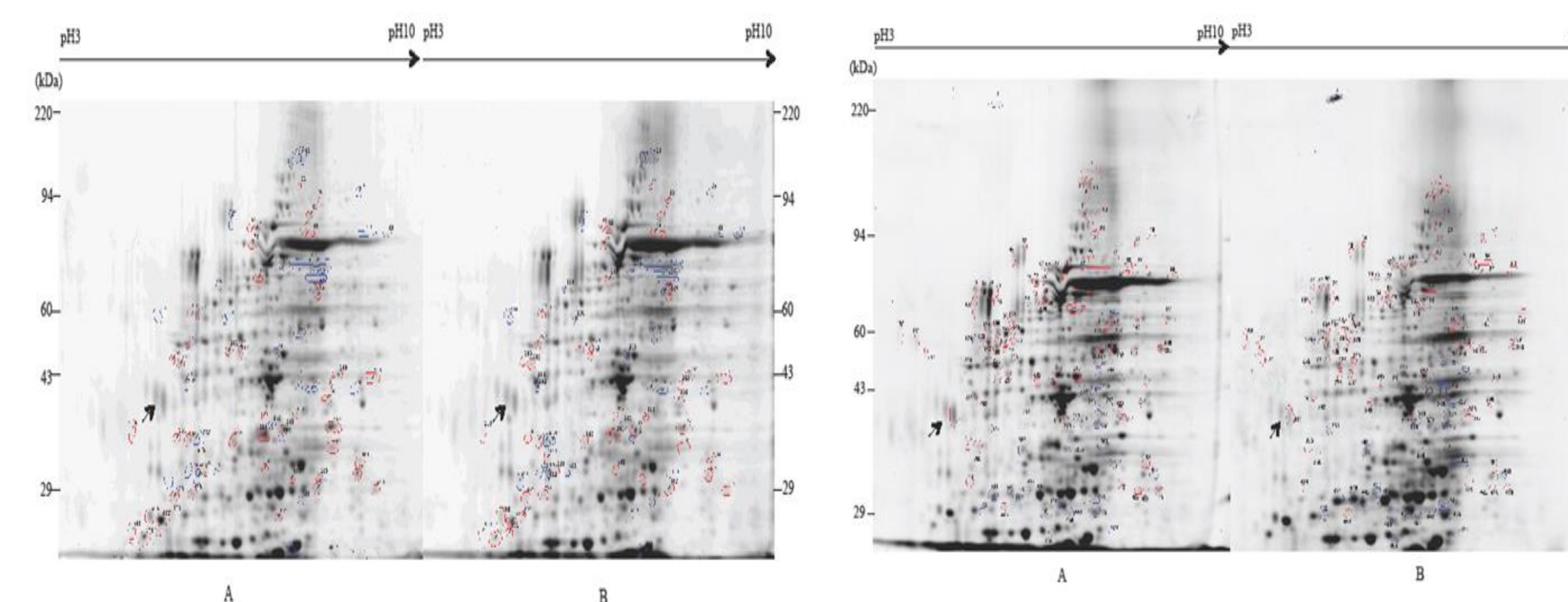
Origin of antibacterial activities



Activities of CFE fractions



2-D analyses of hemolymph protein regulation by MDR-induction



Naive (A) vs. *P. aeruginosa*-challenged (B)

Naive (A) vs. MRSA-challenged (B)

Conclusions

The crude extract of naïve (control) termites showed a broad activity against the non-MDR bacteria

The crude extract of MDRs-I challenged termite maintained or slightly increased activities on most of the non-MDRs, also demonstrated dramatic induced-activities against MDRs.

The activities were expressed by multiple proteins and those proteins of ≥90 kDa are possible new active compounds.

The hemolymph, not the hind-gut, was the primary source of antibiotic activities.

No known insect immune proteins of >90 kDa has the similar pI and MW as we identified.

Further Research

We are currently working on identifying potential anti-MDR proteins and determining the changes of hemolymph protein profiles. The results could lead to developing novel effective drugs and free millions of MDR sufferers around the world.

References and cited literature

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