

## ACKNOWLEDGEMENT

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## LIST OF ABBREVIATIONS

%	percentage
ANOVA	Analysis of variance
ATCC	American Type Culture Collection
ALA	Alanin
BME	$\beta$ -mercaptoethanol
C	Casein
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$	Cuprum sulphate pentahydrate
$\text{CaCl}_2$	Calcium chloride
$\text{CO}_2$	Carbon Dioxide
CFE protease	Cell-free extract protease
cfU/mL	colony forming unit per milliliter
DTT	Dithiothreitol
EDTA	Ethylenediaminetetraacetic acid
$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$	Ferrous sulphate
GC	Gas chromatography
GLY	Glycine
GLU	Glutamine
HCl	Acid hydrochloric
ILE	Isoleucine
$\text{KH}_2\text{PO}_4$	Monosodium phosphate
$\text{KNaC}_4\text{H}_4\text{O}_6 \cdot 4\text{H}_2\text{O}$	Sodium Potassium tartrate
kDa	kilo dalton
LC	Lethal concentration
$\text{LC}_{50}$	Lethal concentration require to eradicate 50% of population
$\text{LC}_{95}$	Lethal concentration require to eradicate 95% of population

LEU	Leucine
MET	Methionine
MgSO <sub>4</sub> .7H <sub>2</sub> O	Magnesium sulphate
MnSO <sub>4</sub> .7H <sub>2</sub> O	Mangan sulphate
MgSO <sub>4</sub>	Magnesium sulphate
Na <sub>2</sub> CO <sub>3</sub>	Sodium carbonate
NaOH	Sodium Hydroxide
PDA	Potato Dextrose Agar
PRO	Proline
PHE	Phenylalanine
rpm	rotation per minute
SEM	Scanning Electron Microscope
SDS	Sodium Dodecyl Sulphate
SDS-PAGE	Sodium Dodecyl Suphate-Polyacrylamide Gel Electrophoresis
SmF	Submerged Fermentation
SSF	Solid State Fermentation
TEM	Transmission Electron Microscopy
TYR	Tyrosine
TRP	Tryptophan
TCA	Trichloroacetic acid
UV	Ultraviolet
U/mL	Enzyme unit per mililiter
Val	Valine
ZnSO <sub>4</sub>	Zinc sulphate

## LIST OF SYMBOL

$R_f$	Relative mobility of protein
C	Casein
CE	Casein reacts with enzyme
PBS	Phosphate buffer
PBS-E	Phosphate buffer reacts with enzyme
E	Eggs
20E	20U/mL protease
$x_{i+1}$	x- coordinates
$x_i$	x- coordinates
$y_{i+1}$	y- coordinates
$y_i$	y- coordinates
Y	Norminvert number used in LC analysis
x	Concentration of protease or urea used in LC analysis

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## **Kebolegunaan protease dan urea sebagai racun siput untuk *Pomacea canaliculata* (Siput Gondang Emas)**

### **ABSTRAK**

*Pomacea canaliculata* adalah salah satu perosak utama kumpulan siput kerana ia menyebabkan kerosakan besar pada padi. Kebiasaannya siput ini dikawal dengan menggunakan kawalan secara kimia seperti metaldehide yang telah diketahui sebagai bahan kimia yang toksik, yang seterusnya menyebabkan kesan negatif kepada pesawah dan alam sekitar. Oleh itu, keperluan kepada racun siput yang selamat kepada pengguna dan alam sekitar adalah amat perlu untuk mengurangkan populasi *P. canaliculata*. Kajian yang dijalankan mengkaji kebolegunaan enzim protease dan urea sebagai racun siput alternatif untuk memusnahkan telur dan isi siput *P. canaliculata*. Kajian-kajian kesan setiap agen ini terhadap telur siput merangkumi sifat-sifat kimia dan fizikal iaitu perencatan penetasan, profil protein kutikel, kadar kehilangan air, kadar konduktiviti, kadar pernafasan dan perubahan morfologi telur. Selain itu, kajian mengenai isi siput meliputi kajian berkenaan biologi, kimia dan fizikal iaitu perencatan, kadar pernafasan, pengambilan makanan, respon, pergerakan, kandungan protein, ammonia dan tahap enzim peroxidase. Kajian lanjutan dijalankan dengan menghasilkan enzim daripada larutan tanpa sel protease (protease CFE) menggunakan bahan sedia ada seperti ubi kayu dan diaplikasikan sebagai racun siput biologi. Selain itu, kajian berkenaan dengan urea juga dilanjutkan dengan menghasilkan urea yang dilapisi dengan sekam padi dan tepung kanji. Ianya diaplikasikan sebagai racun siput pada plot padi. Untuk kajian isi siput *P. canaliculata*, penemuan yang diperolehi adalah perencatan adalah sebanyak 31% dan 90% selepas masing-masing di dedahkan dengan 3.9U/mL CFE protease dan 0.02M larutan urea selama 20 jam. Selain itu, kadar pernafasan juga telah didapati meningkat selari dengan peningkatan kepekatan urea. Tambahan, hasil pendedahan terhadap protease CFE dan urea telah mengurangkan pengambilan makanan, respon dan pergerakan siput berbanding dengan siput kawalan. Lanjutan kajian dengan menggunakan urea yang dilapisi dengan sekam padi dan kanji telah menyelamatkan 93% padi daripada serangan siput. Bagi kajian perencatan telur *P. canaliculata*, sebanyak 71%, 52% dan 35% telur-telur telah direncatkan selepas masing-masing dirawat dengan 0.75U/mL protease komersial, 0.19U/mL CFE protease dan 0.02M larutan urea. Selain itu, kadar konduktiviti, kehilangan air dan pertukaran gas telah meningkat sejajar dengan peningkatan keaktifan protease komersial atau kepekatan urea. Hasil-hasil penemuan ini menunjukkan kebolegunaan enzim protease dan urea sebagai racun siput untuk *P. canaliculata*.