Annexure-III

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002.

Final Report of the work done on the Major Research Project.

1. Project report : Final

2. UGC Reference No. : F. No. 39-590/2010 (SR), dt. : 12 Jan., 2011

3. Period of report : from February 2011 to February 2014.

4. Title of research project : "Studies on the Synergistic molluscicidal activity of *Mimusops elengi* (Linn.) and *Bauhinia variegata* (Linn.) with Plant Molluscicide, piperonyl butoxide and MGK-264 against harmful snails".

5. (a) Name of the Principal Investigator : Dr. Vinay Kumar Singh
   (b) Deptt. and University where work has progressed : Department of Zoology, D.D.U. Gorakhpur University, Gorakhpur-273009, U.P., INDIA.
   (c) Effective date of starting of the project: 01.02.2011

6. Grant approved and expenditure incurred during the period of the report:
   a. Total amount approved : Rs. 7,44,800/-
   b. Total expenditure : Rs. 7,44,800/-
   c. Report of the work done : (Attached)

   i. Brief objective of the project :

1. Toxicity of water extracts and different organic solvent extracts of parts of both *Mimusops elengi* (Linn.) and *Bauhinia variegata* (Linn.) plants were studied against harmful snails. Most potent organic solvents were used as column chromatography and TLC.
2. Toxicity of different combinations of above plants with other plants molluscicides were studied against harmful snails.
3. Toxicity of different combinations of above plants with synergist PB and MGK 264 are studied.
4. Toxicity of Potent combination has to be studied on mixed populations of snails and certain fishes, which share same habitat. This will monitor the toxic effect, if any.
5. Effect of active component of above plants (Sublethal treatment 40% and 80% of LC_{50}) of certain enzymes – AChE, LDH and phosphatases has to be studied.

ii. Work done so far and results achieved and publications, if any, resulting from the work (Give details of the papers and names of the journals in which it has been published or accepted for publication : 5 papers published in International journals. (Copies Attached)

iii. Has the progress been according to original plan of work and towards achieving the objective. if not, state reasons : YES
(The Project is completed according to the original plan of work.)

iv. Please indicate the difficulties, if any, experienced in implementing the project : No Difficulties.

v. If project has not been completed, please indicate the approximate time by which it is likely to be completed. A summary of the work done for the period (Annual basis) may please be sent to the Commission on a separate sheet : Project Completed Successfully.

vi. If the project has been completed, please enclose a summary of the findings of the study. Two bound copies of the final report of work done may also be sent to the Commission : Final Technical Report Attached.

vii. Any other information which would help in evaluation of work done on the project. At the completion of the project, the first report should indicate the output, such as

(a) Manpower trained : N/A
(b) Ph. D. awarded : One
(c) Publication of results : Five
(d) Other impact, if any : -----

SIGNATURE OF THE PRINCIPAL INVESTIGATOR **REGISTRAR**

SIGNATURE OF THE CO-INVESTIGATOR

Annexure - IV

UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002
Utilization certificate

Certified that the grant of Rs. 5,50,800/- (Rupees Five Lacs Fifty Thousands Eight Hundred only) received from the University Grants Commission under the scheme of support for Major Research Project entitled: "Studies on the Synergistic molluscicidal activity of *Mimusops elengi* (Linn.) and *Bauhinia variegata* (Linn.) with Plant Molluscicide, piperonyl butoxide and MGK-264 against harmful snails" vide UGC letter No. F.No. 39-590/2010(SR), Dated: 12 January, 2011 has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

SIGNATURE OF THE PRINCIPAL INVESTIGATOR **REGISTRAR** **STATUTORY AUDITOR**

SIGNATURE OF THE CO-INVESTIGATOR

Annexure - V

UNIVERSITY GRANTS COMMISSION,
BAHADUR SHAH ZAFAR MARG, NEW DELHI – 110 002
STATEMENT OF EXPENDITURE IN RESPECT OF MAJOR RESEARCH PROJECT

1. Name of Principal Investigator : Dr. Vinay Kumar Singh
2. Deptt. of University : Department of Zoology,
   D.D.U. Gorakhpur University,
   Gorakhpur-273009, U.P., INDIA.
3. UGC approval No. and Date : F. No. 39-590/2010(SR), Dt. 12.01.2011.
4. Title of the Research Project : "Studies on the Synergistic molluscicidal activity of *Mimusops elengi* (Linn.) and *Bauhinia variegata* (Linn.) with Plant Molluscicide, piperonyl butoxide and MGK-264 against harmful snails".
5. Effective date of starting the project : 01.02.2011
6. a. Period of Expenditure : From 01.02.2011 to 31.01.2014.
   b. Details of Expenditure :

S.No.	Items	Amount approved (in Rs.)	Amount Received (in Rs.)	Expenditure incurred so far (in Rs.)
1.	Books and Journals	20,000.00	20,000.00	19,041.00
2.	Equipment's	3,00,000.00	3,00,000.00	2,99,250.00
3.	Honorarium	00.00	00.00	00.00
4.	Contingency	40,000.0	20,000.00	39,361.00
5.	Travel / Field work	20,000.00	10,000.00	11,941.00
6.	Chemicals and glassware	30,000.00	15,000.00	15,000.00
7.	Hiring Services	10,000.00	05,000.00	10,000.00
8.	Overhead	36,800.00	36,800.00	36,800.00
9.	Any other items (Please specify)	00.00	00.00	00.00
10.	Honorarium to principal investigator	00.00	00.00	00.00
11.	Staff (date of appointment) (from 26.02.2011 to Feb. 2014) (Please give details of staff appointed in the prescribed format Annexure IX as per XI plan guide lines of MRP.)	2,88,000.00	1,44,000.00	1,37,066.00
	TOTAL	7,44,800.00	5,50,800.00	5,68,459.00

1. It is certified that the appointment(s) have been made in accordance with the terms and conditions laid down by the Commission.
2. It as a result of check or audit objective, some irregularly is noticed, later date, action will be taken to refund, adjust or regularize the objected amounts.
3. Payment @ revised rates shall be made with arrears on the availability of additional funds.
4. It is certified that the grant of Rs. 5,50,800/- (Rupees Five Lacs Fifty Thousands Eight Hundred only) received from the University Grants Commission under the scheme of support for Major Research Project entitled "Studies on the Synergistic molluscicidal activity of *Mimusops elengi* (Linn.) and *Bauhinia variegata* (Linn.) with Plant Molluscicide, piperonyl butoxide and MGK-264 against harmful snails" vide UGC letter No. F. No. 39-590/2010(SR), dated 12.01.2011 has been fully utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions laid down by the University Grants Commission.

SIGNATURE OF THE PRINCIPAL INVESTIGATOR **REGISTRAR**

SIGNATURE OF THE CO-INVESTIGATOR

Annexure - VI

UNIVERSITY GRANTS COMMISSION,
BAHADUR SHAH ZAFAR MARG
NEW DELHI – 110 002

STATEMENT OF EXPENDITURE INCURRED ON FIELD WORK

Name of the Principal Investigator : Dr. Vinay Kumar Singh

Name of the place visited	Duration of the visit		Mode of Journey	Expenditure incurred (Rs.)
	From	To		
UGC New Delhi	02.12.2011	02.12.2011	Rail	3,638.00
ICAR Pusa New Delhi	09.07.2013	09.07.2013	Rail	3,838.00
Jammu University, Jammu	24.12.2013	27.12.2013	Rail	4,465.00

Certified that the above expenditure is in accordance with the UGC norms for Major Research Projects.

SIGNATURE OF THE PRINCIPAL INVESTIGATOR **REGISTRAR**

SIGNATURE OF THE CO-INVESTIGATOR

DEPARTMENT OF ZOOLOGY, DDU GORAKHPUR UNIVERSITY, GORAKHPUR – 273 009, U.P.
UGC Major Project Reference No. and Date: F No. 39-590/2010 (SR) Dated 12 Jan 2011.

Statement of Expenditure

Date of Implementation- 01 Feb, 2011

Item	Amount Approved	Amount Received	Expenditure incurred	Balance Amount	Total Amount
Books & Journals	Rs. 20,000=00	Rs. 20,000=00	Rs. 19,041=00	(+) Rs. 959=00	(+) Rs. 1709=00
Equipment	Rs. 3,00,000=00	Rs. 3,00,000=00	Rs. 2,99,250=00	(+) Rs. 750=00	
Project Fellow	**Rs. 2,88,000=00**	**Rs. 1,44,000=00**	**Rs. 1,37,066=00**	**(-) Rs. 1,45,066=00**	(-) Rs. 1,87,007=00
Contingency	Rs. 40,000=00	Rs. 20,000=00	Rs. 39,361=00	(-) Rs. 20,000=00	
Chemicals and Glasswares	Rs. 30,000=00	Rs. 15,000=00	Rs. 30,000=00	(-) Rs. 15,000=00	
Travel/ Field work	Rs. 20,000=00	Rs. 10,000=00	Rs. 11941=00	(-) Rs. 1941=00	
Hiring Services	Rs. 10,000=00	Rs. 5000=00	Rs. 10,000=00	(-) Rs. 5000=00	
Overhead	Rs. 36,800=00	Rs. 36,800=00	Rs. 36,800=00	NIL	
Total Rs.	**Rs. 7,44,800=00**	**Rs. 5,50,800=00**	**Rs. 583459=00**	**Rs. 1,87,007=00**	**(-) Rs. 1,85,298=00**

Principal Investigator	Co-investigator	Head	Finance Officer	Registrar
Deptt.of Zoology	Deptt. of Zoology	Deptt. of Zoology	DDU Gkp Univ.	DDU Gkp Univ.
DDU GkpUniv	DDU GkpUniv	DDU GkpUniv		

AUDIT CERTIFICATE

Certificate issued by Local Fund Audit Department, U.P.

1. Certified that the grant has been utilized for the purpose for which it was sanctioned and in accordance with the terms and conditions attaching to the grant subject to compliance of the objection attached.
2. If as a result of check or audit objection some irregularity in notice at a stage action will be taken to refund, adjust or regularize the objected amount.

Senior auditor
Local Fund Audit Department
Conncorent Audit
DDU Gorakhpur University
Gorakhpur

Assistant Director
Local Fund Audit Department
Conncorent Audit
DDU Gorakhpur University
Gorakhpur

FINAL TECHNICAL REPORT OF THE PROJECT

F. No. 39-590/2010 (SR), Dt. 12-01-2011

Title of the Project:

"Studies on the Synergistic molluscicidal activity of *Mimusops elengi* (Linn.) and *Bauhinia variegata* (Linn.) with Plant Molluscicide, piperonyl butoxide and MGK-264 against harmful snails"

Collection of animals

Adult, *Lymnaea acuminata* (2.25 ± 0.20 cm in length) were collected locally from the ponds, pools and lakes of Gorakhpur district and used for the test animals. These snails are available throughout the year either adhering to the ventral surface of the leaves of aquatic plants or lying freely around the vegetation near the banks. Dead animals were removed immediately in order to prevent any contamination the aquarium water.

Plants Used: Fresh leaf of *Bauhinia variegata* and bark of *Mimusops elengi* were collected from Gorakhpur (India), washed thoroughly in running tap water and finally with sterile water, shade dried. The dried part of *B. variegata* leaf and bark of *M. elengi* were pulverized separately in the electric grinder and crude powders obtained, were then sieved with the help of fine mesh cloth. This fine powder was then used separately for toxicity experiments. The specimens were identified and authenticated by department of Botany DDU Gorakhpur University, Gorakhpur.

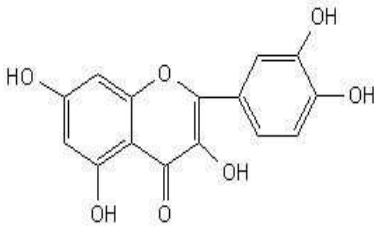
Solvent Extracts: Fifty gram of the leaf of *B. variegata* and bark of *M. elengi* were extracted separately with 100 ml of each solvent viz. ethanol (95%), acetone (99%), ether (99.5%) and chloroform (99%) at room temperature for 24 h. Each preparation was filtered separately through sterilized whatmann No.1 filter paper and the filtered extracts were subsequently evaporated under vacuum. The residues, thus obtained, were used for the determination of molluscicidal activity. The leaf of *B. variegata* yielded 220 mg chloroform extract, 250 mg acetone extract, 180 mg ether extract, 300 mg ethanol extract *M. elengi* bark powder yielded 180 mg chloroform extract, 175 mg ether extract, 190 mg acetone extract, 210 mg ethanol extract respectively.

Column Purification: Hundred milliliters ethanol extract of *B. variegata* leaf and *M. elengie* bark powder were subjected to silica gel (60-120 mesh, Qualigens glass, Precious Electrochemindus Private Limited, Mumbai, India) chromatography through 95×45cm

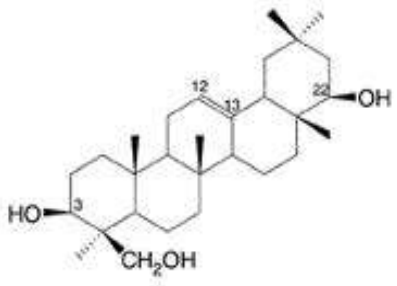
column. Seventy five fractions of five milliliters were eluted with ethanol (95%). Ethanol was evaporated under vacuum and the remaining solids obtained were used for the determination of molluscicidal activity of each fraction.

Thin Layer Chromatography: Thin layer chromatography (TLC) was performed by method of Singh and Singh (1995) as modified by Jaiswal and Singh (2008) to identify the active component present in the leaf powder of *B. variegata* and bark powder of *M. elengi*. TLC was done on 20×20 cm precoated silica gel (Precious Electrochemical Industry. Pvt , Ltd, Mumbai ,India). The solvent were used benzene/ ethyl acetate (9:1 v:v) as the mobile phase. Spots of column purified fractions of *B. variegata* leaf and *M. elengi* bark along with their respective active components quercetin and saponin were applied on TLC plates on with a micropipette. Further, the TLC plates were developed by iodine vapor. Copies of chromatogram were made by tracing the plates immediately and retardation factor (R*f*) were calculated.

Pure Compound: Quercetin (3,3,4,5,7–penta hydrooxyflavone) and saponin (Sapogenin~10-20%) were procured from Sigma Chemical Co. USA.



Chemical structure of Quercetin



Chemical structure of Saponin

Concentration-Response Relationship: The toxicity experiments were performed by the method of Singh and Agarwal (1984). Ten experimental animals were kept in a glass aquarium containing 3l of dechlorinated tap water. Snails were exposed continuously for 96h to different concentrations of *B. variegata* and *M. elingi* (Table-1). Six aquaria were setup for each concentration. The control animals were kept in the equal volume of water under similar conditions without treatment. Mortality of snails was recorded at interval of 24h each; upto 96h. The mortality of snails was established by the contraction of body within the shell; no response to needle probe was taken as evidence of death. The LC values lower and upper confidence limits (LCL and UCL), slope values, t- ratio, g-values and heterogeneity factor were calculated by using polo computer software of Robertson et al. (2007). The regression

coefficient between exposure time and different values of LC_{50} was determined by the method of Sokal and Rolf (1973).

RESULTS:

TOXICITY:

Molluscicidal activity of *Mimusops elengi* and *Bauhinia variegata* against harmful snails:

This section deals with the study of molluscicidal activity of *Mimusops elengi* and *Bauhinia variegata* leaf, bark and seed against the snails *Lymnaea acuminata* and *Indoplanorbis exustus*. Toxicity of different organic solvent extract, column purified fraction and their active components of both plants were also determined against both the snails. Snails were exposed to different concentrations of the treatment and control was without treatment with same condition. Mortality was recorded after 24h, 48h, 72h and 96h during the exposure periods. The data obtained were used to calculate the lethal concentration values (LC_{50}), lower and upper confidence limit (LCL and UCL) and slope values were determined by POLO Computer Program of Robertson et al., (2007).

Toxicity of the purified active molluscicidal component of both plants (24h LC_{50} against *L. acuminata*) was exposed to *Colisa fasciatus* for 96h to observe any toxic effect against non-target animals.

Mimusops elengi

The toxicity of different preparations of *Mimusops elengi* leaf, bark and seed powder against *L. acuminata* and *I. exustus* was time and concentration dependent. There was a significant ($P<0.05$) negative correlation in between the exposure time and LC_{50} of different preparations of *M. elengi* against *L. acuminata* and *I. exustus*. Toxicity of leaf powder of *M. elengi* against *L. acuminata* was (24h LC_{50} - 196.41mg/l and 96h LC_{50} - 68.47 mg/l) and *I. exustus* was (24h LC_{50} -521.12mg/l and 96h LC_{50} -138.87 mg/l), respectively (Table 1 and 7). Among the organic solvent, ethanol extract of leaf was more toxic. Toxicity of (96h LC_{50}) of ethanol extract of leaf powder (4.57 mg/l) was against *L. acuminata* and *I. exustus* was (61.49 mg/l), respectively (Table 1 and 7). The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was ethanol extract> ether extract> chloroform extract> acetone extract> leaf powder of *M. elengi* and *I. exustus* was ethanol extract> ether extract> chloroform extract> acetone extract> leaf powder of *M. elengi*, respectively.

Toxicity of bark powder of *M. elengi* against the snail *L. acuminata* was (24h LC_{50} - 91.19 mg/l and 96h LC_{50} - 36.37 mg/l) and *I. exustus* was (24h LC_{50} - 318.16 mg/l and 96h LC_{50} - 108.15 mg/l), respectively (Table 2 and 8). Ethanol extract of bark was more toxic.

Toxicity of ethanol extract of bark powder against *L. acuminata* was (24h LC_{50} - 44.61 mg/l and 96h LC_{50} -15.07 mg/l) and *I. exustus* was (24h LC_{50} - 91.44 mg/l and 96h LC_{50} - 37.46 mg/l), respectively (Table 2 and 8). The column purified fraction was highly toxic than other preparations of bark against both the snails. Toxicity of column purified fraction against *L. acuminata* was (24h LC_{50} - 18.34 mg/land 96h LC_{50} - 7.20 mg/l) and *I. exustus* was (24h LC_{50}- 41.61 mg/l and 96h LC_{50} -16.27 mg/l), respectively (Table 2 and 8). The order of toxicity of these treatments at 24h exposure period against snail *L. acuminata* was saponin> column purified fraction > ethanol extract> ether extract> chloroform extract> acetone extract> bark powder of *M. elengi*. The order of toxicity of these treatments at 24h exposure period against snail *L. acuminata* and *I. exustus* was saponin> column purified fraction > ethanol extract> ether extract> chloroform extract> acetone extract> bark powder of *M. elengi*. Toxicity of seed powder against *L. acuminata* was(24h LC_{50} - 221.11 mg/land 96h LC_{50} -72.77 mg/l) and *I. exustus* was (24h LC_{50} - 508.34 mg/l and 96h LC_{50} - 223.22 mg/l),respectively (Table 3 and 9). Among all the organic solvent ethanol extract of seed was more toxic. Toxicity of ethanol extract of seed powder against *L. acuminata* was (24h LC_{50} - 46.81. mg/land 96h LC_{50} - 13.01 mg/l) and *I. exustus* was (24h LC_{50} - 170.58 mg/l and 96h LC_{50} - 63.24 mg/l), respectively (Table 3 and 9). The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was ethanol extract> ether extract> chloroform extract> acetone extract> seed powder of *M. elengi*. The order of toxicity of these treatments at 24h exposure period against *I. exustus* was ethanol extract> ether extract> chloroform extract> acetone extract> seed powder of *M. elengi*.

Identification of active molluscicide in column purified fractions was performed by thin layer chromatography (TLC). TLC analysis demonstrated that the R*f* value of spot of column purified fraction of *M. elengi* bark (0.48) was equivalent to the R*f* value of saponin (0.48). Toxicity of saponin the active component of *M. elengi* against *L. acuminata* was (24h LC_{50} -15.57 mg/l and 96h LC_{50} - 1.30 mg/l) and *I. exustus* was (24h LC_{50} - 22.24 mg/l and 96h LC_{50} - 12.59 mg/l), respectively (Table 2 and 8). Toxicity experiment shows that the toxicity of active component (saponin) is higher than column purified fraction of *M. elengi* bark powder.

Bauhinia variegata

The toxicity evaluation of different preparations of *Bauhinia variegata* leaf, bark and seed powder against *L. acuminata* and *I. exustus* was time and concentration dependent. There was a significant ($P<0.05$) negative correlation in between the exposure time and LC_{50}

of different preparations of *B. variegata*. Toxicity of leaf powder of *B. variegata* against *L. acuminata* was (24h LC_{50} - 244.70 mg/l and 96h LC_{50} - 126.70 mg/l) and *I. exustus* was (24h LC_{50} - 518.07 mg/l and 96h LC_{50} - 238.17 mg/l), respectively (Table 4 and 10). Among the organic solvent ethanol extract of leaf was more toxic. Toxicity of ethanol extract of leaf powder against *L. acuminata* was (24h LC_{50} - 38.42. mg/land 96h LC_{50} - 14.42 mg/l) and *I. exustus* was (24h LC_{50} - 101.49 mg/l and 96h LC_{50} -46.69 mg/l), respectively (Table 4 and 10).The column purified fraction was highly toxic against both the snails. Toxicity of column purified fraction against *L. acuminata* was (24h LC_{50} - 20.30 mg/land 96h LC_{50} - 5.98 mg/l) and *I. exustus* was (24h LC_{50} - 51.20 mg/l and 96h LC_{50} - 19.72 mg/l), respectively (Table 4 and 10). The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was quercetin> column purified fraction> ethanol extract> acetone extract> chloroform extract> ether extract> leaf powder of *B. variegata*. The order of toxicity of these treatments at 24h exposure period against *I. exustus* was quercetin > column purified fraction> ethanol extract> acetone extract> chloroform extract> ether extract> leaf powder of *B. variegata*.

Toxicity of bark powder of *B. variegata* against *L. acuminata* was (24h LC_{50}- 319.06 mg/l and 96h LC_{50} - 180.80 mg/l) and *I. exustus* was (24h LC_{50} - 680.50 mg/l and 96h LC_{50} - 258.13 mg/l), respectively (Table 5 and 11). Among the organic solvent, ethanol extract of bark was more toxic. Toxicity of ethanol extract of bark powder against *L. acuminata* was (24h LC_{50} -51.97 mg/l and 96h LC_{50} - 15.62 mg/l) and *I. exustus* was (24h LC_{50} - 168.19 mg/l and 96h LC_{50} -54.16 mg/l), respectively (Table 5 and 11).The order of toxicity of these treatments at 24h exposure against *L. acuminata* was ethanol extract > acetone extract > chloroform extract > ether extract > bark powder of *B. variegata*. The order of toxicity of these treatments at 24h exposure against *I. exustus* was ethanol extract > acetone extract > chloroform extract > ether extract > bark powder of *B. variegata*. Toxicity of seed powder of *B. variegata* against *L. acuminata* was (24h LC_{50} - 350.21 mg/l and 96h LC_{50} - 164.92 mg/l) and *I. exustus* was (24h LC_{50} - 785.51 mg/l and 96h LC_{50} - 475.17 mg/l), respectively (Table 6 and 12). Among the organic solvent, ethanol extract of seed was more toxic. Toxicity of ethanol extract of seed powder against *L. acuminata* was (24h LC_{50} -50.27 mg/l and 96h LC_{50} - 14.75 mg/l) and *I. exustus* was (24h LC_{50} - 144.04 mg/l and 96h LC_{50} -49.27 mg/l), respectively (Table 12 and 18).The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was ethanol extract > acetone extract > chloroform extract > ether extract > seed powder of *B. variegata*. The order of toxicity of these treatments at 24h

exposure period against *I. exustus* was ethanol extract> acetone extract> chloroform extract > ether extract > seed powder of *B. variegata*.

Identification of active molluscicidal in column purified fractions was performed by thin layer chromatography. TLC analysis demonstrated that the R*f* value of spot of column purified fraction of *B. variegata* bark (0.52) was equivalent to the R*f* value of quercetin (0.52). Toxicity of quercetin the active component of *B. variegata* against *L. acuminata* was (24h LC_{50} - 12.13 mg/l and 96h LC_{50} - 5.39 mg/l) and *I. exustus* was (24h LC_{50} - 38.99 mg/l and 96h LC_{50} - 13.75 mg/l), respectively (Table 4 and 10).Toxicity experiment shows that the toxicity of active component (quercetin) is higher than column purified fraction of *B. variegata* leaf powder. In control group of animals there was no mortality up to 96h of exposure period. It was observed that there was no mortality in fish *C. fasciatus* exposed to 24h LC_{90} of all purified and active molluscicidal components against snails *L. acuminata and I. exustus*. The slope values were steep and separate estimates of LC based on each of the six replicates, were found to be within 95% confidence limit of LC_{50}. The t-ratio was higher than 1.96 and heterogeneity factor was less than 1.0. The g-value was less than 0.5 at all the probability level (90, 95, 99).

Table-1 Toxicity of *M. elengi* leaf powder and different organic solvent extracts against the snail *Lymnaea acuminata* at different exposure period.

Exposure period	Treatments	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero-geneity
			LCL	UCL				
24h	*M. elengi* leaf powder	196.41	145.85	447.75	2.53±0.74	3.41	0.32	0.32
	Ethanol extract	70.70	47.75	195.66	1.05±0.45	2.33	0.70	0.34
	Ether extract	77.31	48.86	306.60	1.29±0.41	3.09	0.40	0.15
	Acetone extract	123.00	105.95	163.71	2.82±0.65	4.09	0.22	0.29
	Chloroform extract	78.14	54.95	105.37	3.09±0.64	4.78	0.16	0.26
48h	*M. elengi* leaf powder	167.62	123.93	428.39	1.84±0.63	2.89	0.45	0.16
	Ethanol extract	45.37	33.43	94.33	1.29±0.38	3.34	0.34	0.16
	Ether extract	47.24	38.69	176.67	1.63±0.54	2.97	0.43	0.12
	Acetone extract	99.64	87.31	123.79	2.48±0.61	4.06	0.23	0.16
	Chloroform extract	52.16	36.16	174.56	1.10±0.38	3.34	0.34	0.16
72h	*M. elengi* leaf powder	101.50	92.21	177.99	1.91±0.60	3.17	0.38	0.15
	Ethanol extract	22.59	17.45	49.47	1.33±0.36	3.62	0.29	0.30
	Ether extract	30.27	20.16	58.71	1.33±0.53	2.49	0.62	0.16
	Acetone extract	77.64	67.08	98.46	2.38±0.59	3.98	0.24	0.14
	Chloroform extract	31.25	22.97	61.36	1.01±0.36	2.74	0.50	0.10
96h	*M. elengi* leaf powder	68.47	58.43	97.09	2.66±0.60	4.39	0.19	0.25
	Ethanol extract	14.57	11.27	17.36	1.98±0.38	5.18	0.14	0.58
	Ether extract	16.03	12.63	19.84	1.93±0.38	5.06	0.15	0.42
	Acetone extract	59.43	48.44	87.39	2.74±0.61	4.45	0.19	0.18
	Chloroform extract	20.25	14.97	43.85	2.61±0.57	4.52	0.18	0.49

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *M. elengi* Leaf powder = *Mimusops elengi* Leaf powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *M. elengi* Leaf powder – 11.86+; Ethanol extract – 6.61+; Ether extract – 7.69+; Acetone extract – 25.55+; Chloroform extract – 8.13+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-2 Toxicity of *M. elengi* bark powder and different organic solvent extracts, column purified fraction and saponin (active component) against the snail *Lymnaea acuminata* at different exposure period.

Exposure period	Tested materials	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero geneity
			LCL	UCL				
24h	*M. elengi* bark powder	91.19	75.77	130.60	2.50±0.53	4.72	0.17	0.20
	Ethanol extract	44.61	35.37	70.40	2.17±0.44	4.83	0.16	0.13
	Ether extract	45.09	39.93	54.67	3.49±0.63	5.48	0.12	0.13
	Acetone extract	58.29	48.79	85.22	3.25±0.69	4.65	0.17	0.30
	Chloroform extract	52.81	46.40	66.46	4.12±0.75	5.48	0.12	0.39
	Column purified	18.34	10.50	57.75	2.19±0.34	3.49	0.31	0.22
	Saponin	15.57	13.68	19.88	4.02±0.78	5.72	0.14	0.26
48h	*M. elengi* bark powder	69.65	58.04	92.84	2.06±0.48	4.29	0.20	0.25
	Ethanol extract	31.38	25.46	43.72	1.85±0.39	4.70	0.17	0.12
	Ether extract	36.90	32.49	43.20	2.99±0.58	5.13	0.14	0.15
	Acetone extract	46.26	39.67	61.75	2.71±0.60	4.52	0.18	0.22
	Chloroform extract	46.49	40.26	60.09	2.96±0.61	4.85	0.16	0.30
	Column purified	15.71	8.07	17.27	1.76±0.28	2.70	0.51	0.16
	Saponin	13.90	11.78	17.82	3.20±0.28	3.70	0.18	0.19
72h	*M. elengi* bark powder	47.24	38.46	55.18	2.44±0.48	5.09	0.14	0.42
	Ethanol extract	21.71	17.74	26.33	2.06±0.38	5.39	0.13	0.20
	Ether extract	29.38	24.68	33.60	2.83±0.57	4.94	0.15	0.18
	Acetone extract	34.09	29.57	39.63	2.86±0.57	4.89	0.16	0.23
	Chloroform extract	34.25	30.38	38.87	3.31±0.58	5.64	0.12	0.28
	Column purified	10.60	9.18	12.41	4.76±0.28	5.70	0.11	0.26
	Saponin	4.25	2.99	7.06	1.89±0.26	3.41	0.33	0.20
96h	*M. elengi* bark powder	36.37	28.59	42.43	2.87±0.50	5.66	0.12	0.72
	Ethanol extract	15.07	11.83	17.89	2.40±0.39	6.09	0.10	0.67
	Ether extract	23.49	19.77	26.33	3.93±0.63	6.23	0.09	0.49
	Acetone extract	25.78	21.72	29.00	3.43±0.59	5.75	0.11	0.56
	Chloroform extract	26.02	22.06	29.21	3.48±0.60	5.80	0.11	0.80
	Column purified	7.20	5.74	8.15	3.84±0.28	3.70	0.14	0.31
	Saponin	1.30	0.27	2.16	0.69±0.25	2.69	0.53	0.19

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *M. elengi* bark powder = *Mimusops elengi* bark powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *M. elengi* bark powder – 9.09+; Ethanol extract – 6.68++; Ether extract – 19.54+; Acetone extract – 16.80+; Chloroform extract – 12.09+; column purified – 12.02+; Saponin – 4.96+. +: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-3 Toxicity of *M. elengi* seed powder and different organic solvent extracts against the snail *Lymnaea acuminata* at different exposure period.

Exposure period	Treatments	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero-geneity
			LCL	UCL				
24h	*M. elengi* seed powder	221.11	201.72	376.37	1.86±0.43	4.25	0.21	0.19
	Ethanol extract	46.81	37.32	71.26	1.90±0.42	4.48	0.19	0.30
	Ether extract	49.57	39.43	75.95	2.01±0.44	4.56	0.18	0.23
	Acetone extract	56.92	49.15	74.30	3.20±0.67	4.74	0.17	0.54
	Chloroform extract	47.87	39.64	66.50	2.44±0.49	4.98	0.15	0.35
48h	*M. elengi* seed powder	151.74	133.19	212.83	1.58±0.38	4.82	0.16	0.24
	Ethanol extract	33.38	26.67	49.03	1.43±0.37	3.83	0.26	0.41
	Ether extract	39.25	29.91	70.54	1.27±0.37	3.40	0.33	0.22
	Acetone extract	46.83	40.68	59.78	2.48±0.58	4.27	0.21	0.37
	Chloroform extract	35.55	29.66	47.29	1.96±0.40	4.82	0.16	0.24
72h	*M. elengi* seed powder	121.89	146.46	278.64	1.49±0.37	4.03	0.23	0.32
	Ethanol extract	19.35	15.41	23.27	1.69±0.36	4.60	0.18	0.67
	Ether extract	20.34	15.93	25.01	1.52±0.36	4.18	0.21	0.35
	Acetone extract	33.14	29.57	37.01	2.94±0.56	5.19	0.14	0.58
	Chloroform extract	22.26	18.94	26.12	2.08±0.38	5.41	0.13	0.31
96h	*M. elengi* seed powder	72.77	93.93	167.45	1.89±0.38	4.93	0.15	0.79
	Ethanol extract	13.01	9.34	16.15	1.91±0.37	5.09	0.18	0.11
	Ether extract	13.55	10.26	16.26	1.99±0.37	5.27	0.13	0.88
	Acetone extract	26.60	23.50	29.23	3.57±0.58	6.10	0.10	0.99
	Chloroform extract	15.29	11.66	18.36	2.05±0.37	5.46	0.16	0.11

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *M. elengi* Seed powder = *Mimusops elengi* Seed powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *M. elengi* Seed powder – 9.05+; Ethanol extract – 9.12+; Ether extract – 7.97+; Acetone extract – 11.07+; Chloroform extract – 11.20+. +: linear regression between x and y; ++: non-linear regression between log x and log.

Table-4 Toxicity of *Bauhinia variegata* leaf powder and different organic solvent extracts, column purified fraction and quercetin (active component) against the snail *Lymnaea acuminata* at different exposure period.

Expos-ure period	Tested materials	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Heterog eneity
			LCL	UCL				
24h	*B. variegata* leaf powder	244.70	216.22	302.00	3.78±0.68	5.51	0.12	0.42
	Ethanol extract.	38.42	31.91	52.45	2.44±0.45	5.42	0.13	0.17
	Ether extract	57.19	40.90	134.30	1.77±0.44	4.02	0.23	0.18
	Acetone extract	38.64	32.78	50.35	2.84±0.49	5.76	0.11	0.56
	Chloroform extract	43.32	35.21	63.47	2.42±0.47	5.16	0.14	0.34
	Column purified	20.30	16.99	27.41	2.72±0.48	4.16	0.12	0.28
	Quercetin	12.13	10.42	24.73	2.19±0.62	3.59	0.32	0.16
48h	*B. variegata* leaf powder	203.45	179.12	245.20	3.03± 0.60	5.08	0.14	0.37
	Ethanol extract.	28.74	24.00	36.37	2.12±0.39	5.35	0.13	0.15
	Ether extract	34.78	27.91	51.28	1.84±0.39	4.63	0.17	0.25
	Acetone extract	30.09	25.41	37.95	2.31±0.41	5.64	0.12	0.40
	Chloroform extract	35.35	28.08	54.00	1.76±0.40	4.46	0.19	0.29
	Column purified	16.03	12.90	22.95	1.79±0.47	3.16	0.14	0.32
	Quercetin	9.86	8.45	13.75	2.16±0.60	3.60	0.29	0.13
72h	*B. variegata* leaf powder	155.94	137.78	174.18	3.52 ±0.58	5.97	0.10	0.40
	Ethanol extract	20.94	17.15	25.13	2.14±0.38	5.58	0.12	0.18
	Ether extract	20.74	17.13	24.66	2.25±0.38	5.82	0.11	0.34
	Acetone extract	21.47	17.75	25.70	2.20±0.39	5.69	0.11	0.40
	Chloroform extract	22.54	18.56	27.40	2.09±0.38	5.43	0.13	0.31
	Column purified	10.13	7.73	17.75	3.82±0.37	3.60	0.14	0.28
	Quercetin	6.82	4.79	9.93	4.75±0.60	3.39	0.25	0.10
96h	*B. variegata* leaf powder	126.70	110.93	139.72	4.35±0.63	6.85	0.08	0.57
	Ethanol extract	14.42	11.93	17.51	2.61±0.40	6.49	0.09	0.66
	Ether extract	15.03	12.00	17.67	2.57±0.40	6.43	0.09	0.64
	Acetone extract	15.50	12.52	18.00	2.70±0.40	6.67	0.08	0.73
	Chloroform extract	15.22	12.06	18.10	2.47±0.39	6.22	0.10	0.76
	Column purified	5.98	4.08	9.47	2.42±0.39	5.16	0.13	0.33
	Quercetin	5.39	4.81	8.41	3.96±0.64	4.55	0.12	0.24

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *B. variegata* leaf powder = *Bauhinia variegata* leaf powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *B. variegata* leaf powder – 16.79+; Chloroform extract – 15.91+; Ether extract – 10.18++; Acetone extract – 17.30+; Ethanol extract – 13.16+; column purified – 20.37+; quercetin – 6.55+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-5 Toxicity of *B. variegata* Bark powder and different organic solvent extracts against the snail *Lymnaea acuminata* at different exposure period.

Expos-ure period	Treatments	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero-geneity
			LCL	UCL				
24h	*B. variegata* Bark powder	319.06	288.39	379.55	4.63±0.91	5.05	0.15	0.19
	Ethanol extract	51.97	45.88	163.95	3.47±0.67	5.13	0.14	0.17
	Ether extract	88.20	57.98	259.56	1.87±0.52	3.54	0.30	0.39
	Acetone extract	61.95	46.43	113.12	2.04±0.48	4.20	0.21	0.30
	Chloroform extract	83.71	53.66	280.93	1.51±0.45	3.35	0.34	0.38
48h	*B. variegata* Bark powder	273.58	249.38	316.38	3.78±0.79	4.76	0.16	0.21
	Ethanol extract	44.11	38.62	114.77	2.56±0.58	4.37	0.20	0.21
	Ether extract	68.63	45.39	218.35	1.32±0.41	3.22	0.37	0.32
	Acetone extract	46.45	35.78	78.89	1.62±0.40	4.01	0.23	0.26
	Chloroform extract	63.31	41.43	236.11	1.16±0.39	2.95	0.43	0.29
72h	*B. variegata* Bark powder	222.04	205.54	270.56	4.26±0.77	5.52	0.12	0.26
	Ethanol extract	30.71	27.16	76.46	2.33±0.56	4.14	0.22	0.20
	Ether extract	33.06	25.28	56.66	1.19±0.37	3.20	0.37	0.28
	Acetone extract	29.76	24.35	40.05	1.58±0.38	4.16	0.22	0.26
	Chloroform extract	31.31	25.22	44.45	1.48±0.37	3.92	0.29	0.32
96h	*B. variegata* Bark powder	180.80	164.61	204.04	4.89±0.80	6.05	0.10	0.69
	Ethanol extract	15.62	12.14	48.62	1.88±0.37	4.98	0.15	0.50
	Ether extract	24.23	20.27	37.26	3.04±0.59	5.15	0.14	0.48
	Acetone extract	16.39	12.00	29.17	1.53±0.37	4.13	0.22	0.57
	Chloroform extract	17.71	13.59	24.56	2.08±0.38	5.44	0.13	0.57

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *B. variegata* bark powder = *Bauhinia variegata* bark powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *B. variegata* bark powder – 34.87+; Ethanol extract –10.42+; Ether extract – 6.56+; Acetone extract – 33.06+; Chloroform extract – 9.67+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-6 Toxicity of *B. variegata* seed powder and different organic solvent extracts against the snail *Lymnaea acuminata* at different exposure period.

Expos-ure period	Treatments	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero-geneity
			LCL	UCL				
24h	*B. variegata* seed powder	350.21	300.52	505.35	4.05±0.92	4.40	0.20	0.43
	Ethanol extract	50.27	40.56	74.12	2.33±0.48	4.81	0.16	0.41
	Ether extract	70.14	45.52	251.24	1.27±0.40	3.10	0.39	0.28
	Acetone extract	51.62	45.06	185.37	1.09±0.64	3.18	0.16	0.26
	Chloroform extract	63.89	47.16	122.74	1.97±0.48	4.09	0.22	0.29
48h	*B. variegata* seed powder	307.62	265.47	462.62	2.96±0.79	3.77	0.27	0.32
	Ethanol extract	38.45	34.67	53.78	3.10±0.59	5.23	0.14	0.34
	Ether extract	51.98	38.11	106.34	1.46±0.40	3.46	0.29	0.22
	Acetone extract	43.29	31.23	103.63	1.75±0.40	4.34	0.20	0.32
	Chloroform extract	40.23	32.33	95.63	1.73±0.30	3.45	0.43	0.26
72h	*B. variegata* seed powder	220.92	198.50	352.46	3.46±0.75	4.59	0.18	0.19
	Ethanol extract	22.59	17.45	39.47	1.33±0.36	3.62	0.29	0.30
	Ether extract	33.70	26.37	73.33	1.33±0.37	3.55	0.30	0.21
	Acetone extract	25.81	20.97	63.44	1.52±0.37	4.07	0.23	0.39
	Chloroform extract	31.19	27.66	76.83	2.99±0.57	5.18	0.14	0.18
96h	*B. variegata* seed powder	164.92	140.32	263.07	4.86±0.82	5.89	0.11	0.29
	Ethanol extract	14.75	9.53	37.75	1.49±0.37	4.00	0.23	0.24
	Ether extract	23.69	20.57	56.17	3.80±0.62	5.95	0.14	0.18
	Acetone extract	15.45	12.35	48.15	2.09±0.38	5.44	0.12	0.27
	Chloroform extract	19.02	15.10	61.23	1.68±0.37	4.51	0.18	0.17

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *B. variegata* seed powder = *Bauhinia variegata* seed powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *B. variegata* seed powder – 11.27+; Chloroform extract – 16.62+; Ether extract – 11.11++; Acetone extract – 7.48+; Ethanol extract – 12.79+

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-7 Toxicity of *M. elengi* leaf powder and different organic solvent extracts against the snail *Indoplanorbis exustus* at different exposure period.

Expos-ure period	Treatments	LC_{50} (mg/l)	Limits LCL	UCL	Slope value	t-ratio	g-value	Hetero-geneity
24h	*M. elengi* leaf powder	521.12	401.72	876.37	1.86±0.43	4.25	0.21	0.19
	Ethanol extract	136.36	117.05	181.25	3.34±0.71	4.70	0.17	0.25
	Ether extract	147.68	124.99	204.23	3.51±0.76	4.58	0.18	0.29
	Acetone extract	206.38	138.45	312.35	2.82±0.65	4.09	0.22	0.29
	Chloroform extract	173.90	136.96	304.96	2.86±0.75	3.80	0.26	0.27
48h	*M. elengi* leaf powder	351.75	283.19	212.83	1.58±0.38	4.82	0.16	0.24
	Ethanol extract	116.33	100.61	152.67	2.67±0.63	4.25	0.21	0.18
	Ether extract	135.22	112.08	204.14	2.48±0.64	3.85	0.25	0.15
	Acetone extract	152.88	119.47	297.64	2.10±0.64	3.28	0.35	0.26
	Chloroform extract	150.05	109.36	219.19	1.40±0.60	2.32	0.70	0.26
72h	*M. elengi* leaf powder	221.89	176.46	278.64	1.49±0.37	4.03	0.23	0.32
	Ethanol extract	84.21	71.11	105.10	1.88±0.59	3.19	0.37	0.13
	Ether extract	92.59	81.56	171.85	2.43±0.60	4.05	0.23	0.16
	Acetone extract	116.94	95.89	195.59	1.83±0.60	3.03	0.41	0.12
	Chloroform extract	107.09	91.57	146.62	2.16±0.60	3.58	0.29	0.12
96h	*M. elengi* leaf powder	138.87	103.93	197.45	1.89±0.38	4.93	0.15	0.79
	Ethanol extract	61.49	44.58	82.36	1.91±0.59	3.22	0.36	0.14
	Ether extract	72.48	61.33	103.08	2.29±0.59	3.85	0.25	0.19
	Acetone extract	82.76	68.99	153.28	1.84±0.59	3.11	0.39	0.13
	Chloroform extract	70.82	68.54	98.93	2.17±0.59	3.66	0.28	0.11

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *M. elengi* leaf powder = *Mimusops elengi* leaf powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *M. elengi* leaf powder – 9.34+; Ethanol extract – 16.29+; Ether extract – 6.84+; Acetone extract – 12.50+; Chloroform extract – 13.13+. +: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-8 Toxicity of *M. elengi* bark powder and different organic solvent extracts, column purified fraction and saponin (active component) against the snail *Indoplanorbis exustus* at different exposure period.

Exposure period	Tested materials	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero geneity
			LCL	UCL				
24h	*M. elengi* bark powder	318.16	280.70	510.60	2.70±0.91	2.94	0.44	0.24
	Ethanol extract	91.44	71.76	259.12	1.98±0.50	3.91	o.25	0.16
	Ether extract	164.95	133.26	362.11	2.32±0.68	3.39	0.33	0.09
	Acetone extract	183.58	137.02	634.42	1.88±0.65	2.86	0.46	0.16
	Chloroform extract	167.19	138.57	318.94	2.84±0.75	3.75	0.27	0.26
	Column purified	41.61	31.61	101.55	4.35±0.97	4.48	0.19	0.26
	Saponin	22.24	20.19	30.27	5.07±1.19	4.23	0.21	0.13
48h	*M. elengi* bark powder	271.47	140.37	415.92	1.98±0.80	2.46	0.63	0.15
	Ethanol extract	76.48	62.91	110.06	1.66±0.47	3.50	0.31	0.13
	Ether extract	139.40	107.60	332.43	1.67±0.60	2.75	0.50	0.17
	Acetone extract	156.69	121.20	320.24	2.07±0.64	3.22	0.37	0.14
	Chloroform extract	141.76	111.03	290.57	1.87±0.62	3.02	0.42	0.08
	Column purified	30.81	23.47	79.34	3.67±0.82	4.49	0.19	0.15
	Saponin	20.79	18.35	29.66	3.61±1.04	3.47	0.31	0.11
72h	*M. elengi* bark powder	178.63	164.09	484.03	2.04±0.75	2.72	0.51	0.18
	Ethanol extract	51.07	41.37	60.92	1.82±0.46	3.89	0.25	0.20
	Ether extract	103.61	85.76	163.06	1.69±0.59	2.85	0.47	0.07
	Acetone extract	124.42	99.27	247.95	1.69±0.60	2.80	0.48	0.13
	Chloroform extract	119.61	97.27	209.80	1.79±0.60	2.97	0.43	0.12
	Column purified	24.44	14.98	56.30	4.04±0.78	5.19	0.14	0.17
	Saponin	16.57	14.68	19.36	3.35±0.97	3.39	0.33	0.12
96h	*M. elengi* bark powder	108.15	81.31	214.23	1.93±0.73	2.63	0.55	0.18
	Ethanol extract	37.46	27.49	44.71	1.98±0.47	4.17	0.22	0.22
	Ether extract	63.97	44.31	76.72	1.71±0.59	2.89	0.45	0.18
	Acetone extract	84.02	69.92	106.54	1.80±0.59	3.04	0.41	0.13
	Chloroform extract	72.21	51.45	90.62	1.49±0.58	2.55	0.58	0.14
	Column purified	16.27	12.26	39.41	4.91±0.80	6.11	0.10	0.27
	Saponin	12.59	10.32	13.89	4.61±0.98	4.48	0.19	0.22

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *M. elengi* bark powder = *Mimusops elengi* bark powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *M. elengi* bark powder – 11.78+; Chloroform extract –7.32+; Ether extract –14.90+; Acetone extract –15.42+; Ethanol extract – 11.79+; column purified – 13.60+; Saponin –7.23+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-9 Toxicity of *M. elengi* seed powder and different organic solvent extracts against snail the *Indoplanorbis exustus* at different exposure period.

Expos-ure period	Treatments	LC_{50} (mg/l)	Limits LCL	UCL	Slope value	t-ratio	g-value	Hetero-geneity
24h	*M. elengi* seed powder	508.34	363.48	710.20	2.66±0.72	3.17	0.38	0.11
	Ethanol extract	170.58	136.73	280.42	3.14±0.79	3.97	0.24	0.33
	Ether extract	186.39	133.81	572.42	1.89±0.65	2.88	0.46	0.13
	Acetone extract	217.10	145.59	485.08	1.79±0.66	3.27	0.53	0.15
	Chloroform extract	199.92	146.79	476.28	2.48±0.75	3.30	0.35	0.3
48h	*M. elengi* seed powder	462.16	292.48	625.49	4.27±0.98	3.89	0.25	0.13
	Ethanol extract	141.41	107.60	391.90	1.58±0.60	2.61	0.56	0.10
	Ether extract	154.80	121.48	291.01	2.21±0.65	3.39	0.33	0.17
	Acetone extract	164.95	124.31	384.64	1.96±0.64	3.04	0.41	0.16
	Chloroform extract	159.98	157.34	519.29	2.87±0.85	3.36	0.33	0.32
72h	*M. elengi* seed powder	319.30	240.86	564.87	5.40±1.10	4.65	0.17	0.14
	Ethanol extract	81.87	71.12	195.91	2.98±0.78	3.89	0.30	0.18
	Ether extract	115.89	96.13	181.39	1.95±0.60	3.21	0.37	0.13
	Acetone extract	155.00	114.26	526.21	1.57±0.61	2.56	0.58	0.12
	Chloroform extract	124.42	99.27	247.95	1.69±0.60	2.80	0.48	0.13
96h	*M. elengi* seed powder	223.22	144.11	398.31	5.89±1.33	4.49	0.19	0.40
	Ethanol extract	63.24	50.90	122.36	2.38±0.60	3.94	0.24	0.21
	Ether extract	78.43	65.52	93.86	1.98±0.59	3.35	0.34	0.11
	Acetone extract	97.13	81.16	140.26	1.63±0.58	2.93	0.44	0.19
	Chloroform extract	82.36	70.07	99.43	2.04±0.59	3.45	0.32	0.14

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *M. elengi* Seed powder = *Mimusops elengi* Seed powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *M. elengi* Seed powder – 7.76+; Ethanol extract – 7.18+; Ether extract – 32.50+; Acetone extract – 5.74+; Chloroform extract – 46.26+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-10 Toxicity of *Bauhinia variegata* leaf powder and different organic solvent extracts, column purified fraction and quercetin (active component) against snail the *Indoplanorbis exustus* at different exposure period.

Expos-ure period	Tested materials	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	*B. variegata* leaf powder	518.07	380.70	710.60	2.70±0.91	2.94	0.44	0.24
	Ethanol extract.	101.49	96.87	193.69	2.32±0.62	3.70	0.28	0.17
	Ether extract	203.23	133.70	388.67	1.47±0.63	2.34	0.70	0.14
	Acetone extract	171.12	130.16	363.69	2.21±0.67	3.29	0.35	0.6
	Chloroform extract	188.50	130.83	868.87	1.64±0.64	2.59	0.58	0.16
	Column purified	51.20	37.21	106.35	2.16±0.59	4.53	0.19	0.23
	Quercetin	38.99	32.19	65.03	3.83±0.96	3.99	0.24	0.30
48h	*B. variegata* leaf powder	471.47	340.37	715.92	1.98±0.80	2.46	0.63	0.15
	Ethanol extract.	90.62	76.44	133.03	2.13±0.60	3.54	0.30	0.18
	Ether extract	188.76	94.52	251.87	1.56±0.59	2.61	0.56	0.14
	Acetone extract	128.47	99.77	331.55	1.52±0.60	2.53	0.59	0.12
	Chloroform extract	146.39	110.75	403.70	1.63±0.61	2.66	0.53	0.11
	Column purified	38.56	27.79	73.57	1.97±0.47	4.18	0.22	0.14
	Quercetin	34.52	29.13	53.24	3.33±0.83	3.98	0.24	0.09
72h	*B. variegata* leaf powder	318.63	264.09	584.03	2.04±0.75	2.72	0.51	0.18
	Ethanol extract	74.19	62.91	85.49	2.29±0.59	3.83	0.26	0.19
	Ether extract	80.23	68.81	94.55	2.19±0.59	3.68	0.28	0.15
	Acetone extract	71.57	61.31	81.09	2.53±0.60	4.20	0.21	0.23
	Chloroform extract	76.34	61.87	92.30	1.83±0.59	3.11	0.39	0.22
	Column purified	26.20	21.06	61.78	1.85±0.47	1.95	0.25	0.14
	Quercetin	24.61	23.36	34.34	2.94±0.74	3.89	0.25	0.20
96h	*B. variegata* leaf powder	238.17	201.31	314.23	1.93±0.73	2.63	0.55	0.18
	Ethanol extract	46.69	37.58	63.43	3.30±0.64	4.12	0.14	0.22
	Ether extract	62.17	46.86	72.56	2.06±0.59	3.45	0.32	0.18
	Acetone extract	54.90	38.75	64.84	2.15±0.60	3.55	0.30	0.19
	Chloroform extract	55.88	56.80	62.56	3.35±0.65	5.15	0.14	0.35
	Column purified	19.72	12.09	37.49	2.58±0.48	5.04	0.15	0.33
	Quercetin	13.75	12.45	18.61	4.16±0.76	5.05	0.15	0.22

Six batches of ten snails were exposed to different concentrations of the above set of experiment was replicated six times. Abbreviation: *B. variegata* leaf powder = *Bauhinia variegata* leaf powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *B. variegata* leaf powder – 7.23+; Chloroform extract – 7.23+; Ether extract – 4.07+; Acetone extract – 7.20+; Ethanol extract –6.80+; column purified – 10.15+; quercetin – 8.08+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-11 Toxicity of *B. variegata* Bark powder and different organic solvent extracts against snail the *Indoplanorbis exustus* at different exposure period.

Expos-ure period	Treatments	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero-geneity
			LCL	UCL				
24h	*B. variegata* Bark powder	680.50	526.47	824.38	5.80±0.92	3.86	0.46	0.26
	Ethanol extract	168.19	135.02	303.36	3.00±0.88	3.39	0.33	0.21
	Ether extract	258.56	370.60	756.01	0.96±0.65	1.46	0.79	0.14
	Acetone extract	206.46	150.34	505.62	2.53±0.76	3.30	0.35	0.25
	Chloroform extract	242.71	156.21	535.21	1.83±0.69	2.63	0.55	0.16
48h	*B. variegata* Bark powder	452.98	351.34	613.19	4.35±0.84	3.41	0.33	0.22
	Ethanol extract	145.03	118.02	271.07	2.34±0.78	2.98	0.43	0.15
	Ether extract	193.65	155.81	365.08	1.42±0.62	2.28	0.73	0.06
	Acetone extract	171.26	128.43	536.11	1.65±0.64	2.95	0.43	0.21
	Chloroform extract	174.31	127.62	494.19	1.85±0.64	2.88	0.46	0.13
72h	*B. variegata* Bark powder	319.08	190.84	549.21	4.11±0.72	3.19	0.21	0.20
	Ethanol extract	78.41	63.36	97.026	1.74±0.58	2.96	0.43	0.19
	Ether extract	129.77	101.37	305.28	1.59±0.60	2.64	0.54	0.10
	Acetone extract	105.06	86.05	177.44	1.61±0.59	2.72	0.51	0.11
	Chloroform extract	113.35	96.66	172.98	2.08±0.74	2.80	0.48	0.13
96h	*B. variegata* Bark powder	258.13	150.35	330.23	3.85±0.64	2.21	0.19	0.17
	Ethanol extract	54.16	34.86	64.22	1.91±0.60	3.18	0.37	0.14
	Ether extract	86.06	69.97	104.26	1.96±0.73	2.68	0.53	0.16
	Acetone extract	72.51	53.56	89.74	1.58±0.58	2.69	0.53	0.11
	Chloroform extract	85.54	70.62	112.18	1.70±0.58	2.89	0.45	0.14

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *B. variegata* leaf powder = *Bauhinia variegata* leaf powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *B. variegata* bark powder – 16.02++; Chloroform extract – 7.98+; Ether extract – 15.58+; Acetone extract –10.19+; Ethanol extract – 6.73+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-12 Toxicity of *B. variegata* seed powder and different organic solvent extracts against snail the *Indoplanorbis exustus* at different exposure period.

Expos-ure period	Treatments	LC_{50} (mg/l)	Limits		Slope value	t-ratio	g-value	Hetero-geneity
			LCL	UCL				
24h	*B. variegata* seed powder	785.51	696.80	792.10	3.81±0.94	3.78	0.23	0.21
	Ethanol extract	144.04	114.20	266.96	2.07±0.63	3.27	0.35	0.13
	Ether extract	215.42	148.03	791.81	1.99±0.69	2.87	0.46	0.08
	Acetone extract	168.06	119.17	412.37	2.24±0.64	3.50	0.31	0.24
	Chloroform extract	208.91	132.41	590.43	1.90±0.62	3.05	0.41	0.31
48h	*B. variegata* seed powder	638.12	590.10	723.12	4.35±0.99	2.92	0.36	0.23
	Ethanol extract	84.22	74.29	97.64	2.55±0.60	4.22	0.21	0.16
	Ether extract	188.92	113.89	652.47	1.30±0.51	2.53	0.59	0.19
	Acetone extract	152.98	103.90	533.55	1.52±0.52	2.95	0.44	0.13
	Chloroform extract	161.96	118.52	542.51	1.63±0.62	2.62	0.55	0.06
72h	*B. variegata* seed powder	583.21	529.00	669.80	4.12±1.08	2.32	0.42	0.24
	Ethanol extract	56.13	45.17	63.85	2.86±0.62	4.58	0.18	0.22
	Ether extract	113.77	90.40	254.24	1.46±0.59	2.47	0.62	0.06
	Acetone extract	97.74	74.84	203.32	1.43±0.47	2.99	0.42	0.16
	Chloroform extract	110.68	79.45	375.54	1.23±0.47	2.60	0.56	0.20
96h	*B. variegata* seed powder	475.17	413.2	521.80	3.81±0.94	3.78	0.23	0.21
	Ethanol extract	49.27	41.16	55.15	4.13±0.73	5.62	0.12	0.35
	Ether extract	71.08	57.71	82.97	2.05±0.59	3.45	0.32	0.15
	Acetone extract	62.77	49.95	86.88	1.40±0.46	3.04	0.41	0.18
	Chloroform extract	66.46	51.36	106.77	1.22±0.46	2.65	0.54	0.22

Six batches of ten snails were exposed to different concentrations of the above treatments. Mortality was determined at every 24 h up to 96 h. Abbreviation: *B. variegata* leaf powder = *Bauhinia variegata* leaf powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – *B. variegata* seed powder – 8.19+; Chloroform extract – 52.37+; Ether extract – 8.09++; Acetone extract – 6.99+; Ethanol extract – 15.67++; column purified – 20.37+; quercetin – 6.55+.
+: linear regression between x and y; ++: non-linear regression between log x and log y.

TOXICITY OF SYNERGIST:

[A] Toxicity of binary combination (1:1) of *Mimusops elengi and Bauhinia variegata* with other plant derived molluscicide against snails

Section- II [A] deals with study of molluscicidal activity of other plant products of *B. variegata* and *M. elengi* with other plant derived molluscicides viz. *Saraca asoca* and *Thuja orientalis* used in binary combination (1:1) against snail *L. acuminata* and *I. exustus*. The toxicity of all these combinations was determined at single concentration. Mortality was recorded at every 24h up to 96h. The data so obtained were used to calculate at LC values, lower and upper confidence limit (LCL and UCL) and slope values were determined by POLO computer program of Robertson et al., (2007). The toxicity of binary combination (1:1) of leaf powder of *M. elengi* and other plant derived molluscicides *S. asoca* (leaf/bark) and *T. orientalis* (leaf/ fruit) against *L. acuminata* and *I. exustus* was time and concentration dependent. Toxicity of *M. elengi* leaf + *S. asoca* bark powder against *L. acuminata* was (24h LC_{50} - 98.25mg/l and 96h LC_{50} - 40.40 mg/l) and *I. exustus* was (24h LC_{50} - 208.49 mg/l and 96h LC_{50} - 92.65 mg/l), respectively (Table 13 and 18). Toxicity of *M. elengi* leaf + *S. asoca* bark was more effective (Table 13 and 18). There was a significant ($P< 0.05$) negative correlation in between the LC_{50} and exposure period. The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was *M. elengi* leaf + *S. asoca* bark (ML + SB) > *M. elengi* leaf + *T. orientalis* leaf (ML + TL) > *M. elengi* leaf + *S. asoca* leaf (ML + SL) > *M. elengi* leaf + *T. orientalis* fruit (ML + TF) and *I. exustus* was *M. elengi* leaf+ *S. asoca* bark (ML + SB) > *M. elengi* leaf + *T. orientalis* leaf (ML + TL) > *M. elengi* leaf + *S. asoca* leaf (ML + SL) > *M. elengi* leaf + *T. orientalis* fruit (ML + TF).

The toxicity of binary combination (1:1) of bark powder of *Mimusops elengi* and other plant derived molluscicides *S. asoca* and *T. orientalis* against *L. acuminata* and *I. exustus* was time and concentration dependent. Toxicity of *M. elengi* bark + *T. orientalis* fruit powder against *L. acuminata* was (24h LC_{50} - 119.35mg/l and 96h LC_{50} - 48.22 mg/l) and *I. exustus* was (24h LC_{50} - 236.29 mg/l and 96h LC_{50} - 103.16 mg/l), respectively (Table 14 and 19).Toxicity of binary combination (1:1) of *M. elengi* bark + *T. orientalis* fruit was more effective than the *M. elengi* bark + *S. asoca* bark against *L. acuminata* and *I. exustus* (Table 14 and 19). The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was *M. elengi* bark + *T. orientalis* fruit (MB + TF) > *M. elengi* bark + *S. asoca* leaf (MB + SL) > *M. elengi* bark + *T. orientalis* leaf (MB + TL) > *M. elengi* bark + *S. asoca* bark (MB + SB). The order of toxicity against *I. exustus* was *M. elengi* bark + *T. orientalis*

fruit (MB + TF) > *M. elengi* bark + *S. asoca* leaf (MB + SL) > *M. elengi* bark + *T. orientalis* leaf (MB + TL) > *M. elengi* bark+ *S. asoca* bark (MB + SB).

The toxicity of binary combination (1:1) seed powder of *M. elengi* and plant derived molluscicides *S. asoca* and *T. orientalis* against *L. acuminata* and *I. exustus* was time and concentration dependent. Toxicity of *M. elengi* seed + *S. asoca* leaf powder against *L. acuminata* was (24h LC_{50} - 116.92mg/l and 96h LC_{50} - 48.44 mg/l) and *I. exustus* was (24h LC_{50} - 216.95 mg/l and 96h LC_{50} - 98.72 mg/l), respectively (Table 15 and 20). Toxicity of *M. elengi* seed + *S. asoca* leaf was more effective than the *M. elengi* seed + *T. orientalis* leaf against *L. acuminata* and *I. exustu*s (Table 15 and 20). There was a significant ($P<0.05$) negative correlation in between the $LC_{50}$and exposure period. The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was *M. elengi* seed + *S. asoca* leaf (MS + SL) > *M. elengi* seed + *T. orientalis* leaf (MS + TL). The order of toxicity of *I. exustus* *M. elengi* seed + *S. asoca* leaf (MS + SL) > *M. elengi* seed + *T. orientalis* leaf (MS + TL).

The toxicity of binary combination (1:1) leaf powder of *Bauhinia variegata* and plant derived molluscicides *S. asoca* and *T. orientalis* against *L. acuminata* and *I. exustus* was time and concentration dependent. Toxicity of *B. variegata* leaf + *S. asoca* leaf powder against *L. acuminata* (24h LC_{50} - 123.98mg/l and 96h LC_{50} - 57.91 mg/l) and *I. exustus* was (24h LC_{50} - 178.64 mg/l and 96h LC_{50} - 102.72 mg/l), respectively (Table 16 and 21).Toxicity of *B. variegata* leaf + *S. asoca* leaf was more effective than the *B. variegata* leaf + *T. orientalis* leaf against *L. acuminata* and *I. exustu*s (Table 16 and 21). There was a significant ($P<0.05$) negative correlation in between the $LC_{50}$and exposure period. The order of toxicity of these treatments at 24h exposure period against *L. acuminata* was *B. variegata* leaf + *S. asoca* leaf (BL + SL) > *B. variegata* leaf + *T. orientalis* fruit (BL + TF) > *B. variegata* leaf + *T. orientalis* leaf (BL+TL) and *I. exustus* was *B. variegata* leaf + *S. asoca* leaf (BL + SL) > *B. variegata* leaf + *T. orientalis* fruit (BL + TF) > *B. variegata* leaf + *T. orientalis* leaf (BL+TL). The toxicity of binary combination (1:1) seed powder of *B. variegata* and other plant derived molluscicides of *S. asoca* and *T. orientalis* preparations against *L. acuminata* and *I. exustus* was time and concentration dependent. Toxicity of *B. variegata* seed + *S. asoca* leaf powder against *L. acuminata* (24h LC_{50} - 164.51mg/l and 96h LC_{50} - 76.52 mg/l) and *I. exustus* was (24h LC_{50} - 215.15 mg/l and 96h LC_{50} - 131.48 mg/l), respectively (Table 17 and 22). Toxicity of *B. variegata* seed + *S. asoca* leaf was more effective than the *B. variegata* seed + *T. orientalis* leaf against *L. acuminata* and *I. exustu*s (Table 17 and 22). There was a significant ($P<0.05$) negative correlation in between the LC_{50} exposure period. The order of

toxicity of these treatments at 24h exposure period against *L. acuminata* was *B. variegata* seed + *S. asoca* leaf (BS + SL) > *B .variegata* seed + *T. orientalis* leaf (BS + TL). The order of toxicity against *I. exustus was B. variegata* seed + *S. asoca* leaf (BS + SL) > *B .variegata* seed + *T. orientalis* leaf (BS + TL).

[B]Toxicity of binary combinations (1:5) of *Mimusops elengi* and *Bauhinia variegata* and their active components with synergist Piperonyl butoxide or MGK-264 against *Lymnaea acuminata*

Section-II [B] deals with the study of molluscicidal activity of *M. elengi* and *B. variegata* with synergist piperonyl butoxide (PB) or MGK-264 (MGK) against *L. acuminata.* It has been noted that the section–II [A] binary combination (1:1) of leaf, bark and seed powder of *M. elengi* and *B. variegata* with other plants *S. asoca* and *T. orientalis* have sufficient molluscicidal activity against *L. acuminata* and *I. exustus*. Plant *M. elengi* and *B. variegata* were mixed (1:5) with piperonyl butoxide or MGK-264. Thereafter, snails were exposed to the different concentrations of the binary combination. Mortality was recorded at every 24h up to 96h exposure period. The data so obtained were used to calculate at LC values, lower and upper confidence limits (LCL and UCL) and slope values was determined by POLO computer program of Robertson et al., (2007).

Binary combination of *M. elengi* leaf powder with PB or MGK-264 was 38.43 and 22.73 times more toxic against *L. acuminata* than their single treatment at 24h exposure period (Table 23). At 96h exposure period toxicity of *M. elengi* leaf powder with PB or MGK-264 were enhanced to 86.67 or 21.33 times, respectively (Table 23).There was a significant ($P<0.05$) negative correlation between the LC_{50} of different combination of *M. elengi* leaf powder with PB or MGK-264 at different exposure period. The order of toxicity of these treatments at 96h exposure period against *L. acuminata* was *M. elengi* leaf powder + PB >*M. elengi* leaf powder + MGK>*M. elengi* leaf powder.Binary combination of *M. elengi* bark powder with PB or MGK-264 was 46.05 and 40.34 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h exposure period toxicity of *M. elengi* leaf powder with PB or MGK-264 were enhanced to 59.62 or 60.61 times, respectively (Table 24). 24h LC_{50} of binary combination of *M. elengi* bark column purified with PB or MGK-264 was 262.00 or 229.29 times, respectively. Synergistic ratio at 96h exposure period of *M. elengi* bark powder with PB or MGK-264 were enhanced 720 or 360 times, respectively (Table 24). Binary combination of saponin with PB or MGK-264 was only 10.44 or 9.26 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h

exposure period toxicity of saponin with PB or MGK-264 were enhanced as synergistic ratio was 11.81 or 13.00 times, respectively. There was a significant ($P<0.05$) negative correlation between the LC_{50} of different combinations of *M. elengi* bark powder with PB or MGK-264 and different exposure period. The order of toxicity of these treatments at 96h exposure period against *L. acuminata* was column purified + PB > column purified + MGK > Saponin + PB > Saponin + MGK >*M. elengi* bark powder + PB >*M. elengi* bark powder + MGK > Saponin> column purified >*M. elengi* bark powder.

Binary combination (1:5) of *M. elengi* seed powder with PB or MGK-264 was 23.10 and 22.47 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h exposure period toxicity of *M. elengi* seed powder with PB or MGK-264 were enhanced to 41.58 or 53.50 times, respectively (Table 25). There was a significant ($P< 0.05$) negative correlation between the LC_{50} of different combinations of *M. elengi* seed powder with PB or MGK-264 and different exposure period. The order of toxicity of these treatments at 96h exposure period against *L. acuminata* was *M. elengi* seed powder + PB >*M. elengi* seed powder + MGK>*M. elengi* seed powder. Binary combination (1:5) of *B. variegata* leaf powder with PB or MGK-264 was 86.16 or 62.10 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h exposure period toxicity of *B. variegata* leaf powder with PB or MGK-264 were enhanced 175.97 or 194.92 times with respect to single treatment. Binary combination of column purified of *B. variegata* leaf powder with PB or MGK-264 was 253.75 or 184.54 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h exposure period toxicity of column purified of *B. variegata* leaf powder with PB or MGK-264 were enhanced 199.33 or 149.50 times respectively. Binary combination of quercetin with PB or MGK-264 was 7.01 or 7.09 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h exposure period toxicity of quercetin with PB or MGK-264 were enhanced 9.62 or 8.55 times, respectively (Table 26). There was a significant ($P< 0.05$) negative correlation between the LC_{50} of different combinations of *B. variegata* powder with PB or MGK-264 and different exposure period. The order of toxicity of these treatments at 96h exposure period against *L. acuminata* was column purified + PB > column purified + MGK > Quercetin + PB > Quercetin + MGK >*B. variegata* powder + PB >*B. variegata* powder + MGK > Quercetin > column purified > *B. variegata* powder. 24h binary combination of *B. variegata* bark powder with PB or MGK-264 was 31.71 and 25.38 times, more toxic against *L. acuminata* than their single treatment. At 96h exposure period toxicity of *B. variegata* bark powder with PB or MGK-264 was enhanced to 162.88 or 94.16 times,

respectively (Table 27). There was a significant (P< 0.05) negative correlation between the LC_{50} of different combination of *B. variegata* bark powder with PB /MGK-264 and different exposure period. The order of toxicity of these treatments at 96h exposure period against *L. acuminata* was *B. variegata* bark powder + PB >*B. variegata* bark powder + MGK>*B. variegata* bark powder. Binary combination of *B. variegata* seed powder with PB or MGK-264 was 31.29 or 25.86 times more toxic against *L. acuminata* than their single treatment at 24h. At 96h exposure period toxicity of *B. variegata* seed powder with PB or MGK-264 were enhanced to 31.59 or 27.44 times, respectively (Table 28). There was a significant (P< 0.05) negative regression between the LC_{50} of different combination of *B. variegata* seed powder with PB /MGK-264 and different exposure period. The order of toxicity of these treatments at 96h exposure period against *L. acuminata* was *B. variegata* seed powder + PB >*B. variegata* seed powder + MGK>*B. variegata* seed powder.

The slope values were steep and separate estimation of LC based on each six replicates were found within the 95% confidence limits of LC_{50} (Table 23 to 28).The 't' ratio was greater than 1.96 and the heterogeneity factor was less than 1.0, the 'g' value was less than 0.5 at all probability (90, 95, 99) levels.

Table-13 Toxicity of binary combinations (1:1 ratio) of leaf of *Mimusops elengi* crude powder against *Lymnaea acuminata* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heteroge-neity
			LCL	UCL				
24h	ML+TL	123.00	100.39	187.88	2.81±0.64	4.39	0.17	0.50
	ML+SB	98.25	85.19	124.54	2.75±0.71	5.25	0.13	0.41
	ML+TF	164.67	131.27	277.23	3.21±0.81	3.85	0.25	0.26
	ML+SL	132.49	114.90	174.22	5.21±0.94	3.93	0.24	0.31
48h	ML+TL	100.74	84.24	157.96	1.98±0.51	4.07	0.23	0.40
	ML+SB	80.88	70.23	100.75	2.53±0.51	4.94	0.15	0.33
	ML+TF	127.05	105.97	188.95	2.34±0.62	3.72	0.27	0.15
	ML+SL	105.28	97.08	136.00	2.83±0.75	3.73	0.27	0.26
72h	ML+TL	64.07	55.97	75.35	2.31±0.47	4.88	0.16	0.58
	ML+SB	56.86	49.20	66.01	2.29±0.47	4.78	0.16	0.44
	ML+TF	92.88	80.78	115.09	2.24±0.60	3.74	0.27	0.13
	ML+SL	87.19	77.10	98.56	2.81±0.74	3.80	0.26	0.26
96h	ML+TL	36.39	27.94	42.77	2.28±0.47	4.83	0.24	0.98
	ML+SB	40.40	34.11	45.65	2.86±0.49	5.77	0.24	0.47
	ML+TF	68.26	56.73	77.87	2.38±0.59	3.97	0.20	0.13
	ML+SL	69.83	58.84	77.47	3.29±0.75	4.34	0.20	0.45

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: ML- *M. elengi* leaf powder; TL-*T. orientalis* leaf powder; TF- *T. orientalis* fruit powder; SL-*S. asoca* leaf powder; SB- *S. asoca* bark powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – ML+TL – 11.30+; ML+SB – 19.46+;ML+TF – 15.39+; ML+SL – 12.36+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-14 Toxicity of binary combinations (1:1 ratio) of bark of *Mimusops elengi* crude powder against *Lymnaea acuminata* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	MB+TL	125.50	101.07	194.42	2.85±0.63	4.37	0.20	0.37
	MB+TF	119.35	97.60	176.80	3.62±0.83	4.50	0.18	0.36
	MB+SL	122.12	112.22	139.66	4.63±0.93	5.50	0.12	0.35
	MB+SB	131.45	118.10	158.78	3.17±0.68	4.96	0.15	0.28
48h	MB+TL	110.71	87.41	185.74	2.36±0.52	3.84	0.26	0.25
	MB+TF	93.32	78.56	127.06	3.10±0.76	4.52	0.18	0.27
	MB+SL	103.73	95.52	116.52	4.03±0.79	5.11	0.14	0.19
	MB+SB	114.82	102.66	133.31	4.10±0.82	4.98	0.15	0.18
72h	MB+TL	83.00	67.88	124.07	1.71±0.47	3.57	0.30	0.23
	MB+TF	68.90	58.97	86.12	2.03±0.48	4.24	0.21	0.23
	MB+SL	87.20	79.77	95.24	3.77±0.76	4.96	0.15	0.24
	MB+SB	97.41	89.05	109.68	3.52±0.76	4.62	0.18	0.16
96h	MB+TL	52.56	43.03	62.77	1.84±0.46	3.93	0.17	0.20
	MB+TF	48.22	40.22	55.69	2.19±0.47	4.63	0.18	0.18
	MB+SL	73.57	66.31	79.45	4.36±0.78	5.57	0.12	0.48
	MB+SB	78.97	71.65	85.46	4.05±0.76	5.27	0.13	0.34

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: ML- MB *M. elengi* bark powder; TL-*T. orientalis* leaf powder; TF- *T. orientalis* fruit powder; SL- *S. asoca* leaf powder; SB- *S. asoca* bark powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – MB+TL – 9.56+; MB+TF – 14.05+; MB+SL-21.44+; MB+SB-60.98
+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 15 Toxicity of binary combinations (1:1 ratio) of bark of *Mimusops elengi* crude powder against *Lymnaea acuminata* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	MS+TL	128.30	113.41	162.59	3.24±0.61	4.34	0.20	0.16
	MS+SL	116.92	97.30	165.73	2.07±0.50	4.46	0.17	0.34
48h	MS+TL	106.44	95.68	127.10	3.10±0.76	4.06	0.23	0.16
	MS+SL	99.35	81.99	143.55	2.24±0.52	4.29	0.20	0.19
72h	MS+TL	84.87	74.64	95.39	2.83±0.74	3.82	0.26	0.15
	MS+SL	71.07	60.51	90.69	1.98±0.54	4.14	0.16	0.19
96h	MS+TL	68.48	58.07	57.73	3.51±0.76	4.56	0.11	0.39
	MS+SL	48.44	39.94	56.40	2.07±0.47	4.40	0.19	0.24

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: MS- *M. elengi* seed powder; TL-*T. orientalis* leaf powder; SL- *S. asoca* leaf powder; SB- *S. asoca* bark powder; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts-testing significant of the regression coefficient – MS+TL – 21.58+; MS+SL-16.61.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 16 Toxicity of binary combinations (1:1 ratio) of leaf of *Bauhinia variegata* crude powder against *Lymnaea acuminata* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	BL+SL	123.98	106.31	166.45	2.77±0.64	4.27	0.21	0.32
	BL+TF	129.69	112.91	165.96	3.45±0.16	4.86	0.16	0.31
	BL+TL	153.24	128.74	288.40	3.43±0.89	3.84	0.26	0.20
48h	BL+SL	98.07	86.31	119.97	2.54±0.61	4.17	0.22	0.26
	BL+TF	109.62	96.05	137.82	2.77±0.63	4.39	0.19	0.20
	BL+TL	126.80	110.00	172.52	2.94±0.78	3.73	0.27	0.15
72h	BL+SL	75.24	64.8	85.96	2.45±0.59	4.07	0.22	0.29
	BL+TF	86.82	76.62	101.72	2.52±0.60	4.18	0.22	0.16
	BL+TL	101.45	90.15	123.26	2.66±0.74	3.56	0.30	0.11
96h	BL+SL	57.91	46.91	65.75	2.78±0.61	4.49	0.19	0.35
	BL+TF	65.71	55.16	74.16	2.63±0.60	4.32	0.20	0.26
	BL+TL	76.69	68.35	83.60	3.17±0.76	4.86	0.16	0.40

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: BL- *B. variegata* leaf powder; TL- *T. orientalis* leaf powder; TF- *T. orientalis* fruit powder; SL- *S. asoca* leaf; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient –BL+SL – 16.16+; BL+TF – 60.80; BS+TL – 13.38+; BL+TL – 95.15+; BS+SL – 9.90+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 17 Toxicity of binary combinations (1:1 ratio) of seed of *Bauhinia variegata* crude powder against *Lymnaea acuminata* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	BS+TL	175.44	140.25	288.51	3.26±0.80	4.03	0.23	0.46
	BS+SL	164.51	133.05	287.32	3.00±0.87	3.43	0.32	0.11
48h	BS+TL	152.53	121.56	263.86	2.36±0.65	3.61	0.26	0.29
	BS+SL	124.05	107.55	170.07	2.74±0.77	3.59	0.29	0.08
72h	BS+TL	116.80	97.85	172.99	2.11±0.60	3.47	0.13	0.21
	BS+SL	100.02	88.52	122.02	2.55±0.74	3.43	0.32	0.08
96h	BS+TL	79.43	65.77	96.83	1.87±0.59	3.17	0.38	0.18
	BS+SL	76.52	65.34	85.17	2.93±0.74	3.94	0.24	0.12

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: BS- *Bauhinia variegata* seed powder; TL- *T. orientalis* leaf powder; SL- *S. asoca* leaf; LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts-testing significant of the regression coefficient –BS+TL – 13.38+; BS+SL – 9.90+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 18 Toxicity of binary combinations (1:1 ratio) of leaf of *Mimusops elengi* crude powder against *Indoplanorbis exustus* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	ML+TL	246.64	200.39	419.28	2.11±0.49	4.32	0.20	0.22
	ML+SB	208.49	173.75	328.74	2.67±0.52	5.13	0.14	0.35
	ML+TF	466.58	389.65	632.67	2.66±0.51	5.17	0.14	0.33
	ML+SL	339.45	240.06	572.92	1.42±0.41	3.41	0.32	0.31
48h	ML+TL	221.84	179.46	412.51	1.65±0.40	4.08	0.23	0.12
	ML+SB	159.49	139.64	198.26	2.03±0.41	4.91	0.15	0.34
	ML+TF	336.18	285.63	426.57	2.12±0.41	5.19	0.14	0.26
	ML+SL	298.64	202.61	429.33	1.30±0.38	3.42	0.32	0.28
72h	ML+TL	153.31	129.99	202.95	1.45±0.37	3.86	0.25	0.19
	ML+SB	122.58	102.41	140.29	1.62±0.37	4.28	0.28	0.21
	ML+TF	252.40	190.40	366.42	1.15±0.36	3.14	0.38	0.26
	ML+SL	232.00	195.06	277.87	1.90±0.38	4.96	0.15	0.23
96h	ML+TL	111.79	92.30	149.19	1.52±0.37	4.11	0.22	0.43
	ML+SB	92.65	57.51	124.58	1.76±0.33	4.69	0.17	0.32
	ML+TF	158.40	126.79	186.23	2,06±0.38	1.46	0.13	0.28
	ML+SL	150.32	86.81	179.76	1.15±0.36	3.16	0.38	0.28

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: ML- *M. elengi* leaf powder, MB *M. elengi* bark powder, MS- *M. elengi* seed powder, TL-*T. orientalis* leaf powder, TF- *T. orientalis* fruit powder ,SL- *S. asoca* leaf powder ,SB- *S. asoca* bark powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – ML+TL – 8.37+; ML+SB – 12.65+; ML+TF – 14.36+; ML+SL –9.74+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 19 Toxicity of binary combinations (1:1 ratio) of bark of *Mimusops elengi* crude powder against *Indoplanorbis exustus* different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	MB+TL	254.41	204.33	456.58	1.99±0.54	3.66	0.28	0.25
	MB+TF	236.29	238.48	511.21	2.22±0.49	4.51	0.18	0.46
	MB+SL	240.22	152.22	339.66	4.61±0.92	4.30	0.12	0.35
	MB+SB	269.96	224.27	311.84	2.20±0.51	4.31	0.20	0.33
48h	MB+TL	225.96	156.92	475.84	1.64±0.40	4.04	0.23	0.37
	MB+TF	200.79	169.87	295.42	1.22±0.41	2.93	0.44	0.11
	MB+SL	217.43	145.52	316.52	4.03±0.79	3.21	0.14	0.19
	MB+SB	264.83	203.07	357.49	1.33±0.39	3.36	0.34	0.21
72h	MB+TL	137.20	79.77	195.24	3.77±0.76	3.16	0.15	0.24
	MB+TF	149.53	155.16	201.04	1.16±0.37	3.12	0.39	0.19
	MB+SL	157.20	79.77	195.24	3.77±0.76	3.16	0.15	0.24
	MB+SB	179.53	155.16	201.04	1.16±0.37	3.12	0.39	0.19
96h	MB+TL	124.58	87.91	158.04	1.28±0.36	3.95	0.31	0.33
	MB+TF	103.16	87.51	114.58	1.64±0.37	4.41	0.19	0.36
	MB+SL	106.81	90.97	121.95	4.36±0.78	2.97	0.12	0.48
	MB+SB	143.82	125.73	212.79	1.73±0.37	4.63	0.17	0.62

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: ML- *M. elengi* leaf powder, MB *M. elengi* bark powder, MS- *M. elengi* seed powder, TL-*T. orientalis* leaf powder, TF- *T. orientalis* fruit powder, SL- *S. asoca* leaf powder ,SB- *S. asoca* bark powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – MB+TL – 4.79+; MB+TF – 19.98+; MB+SL – 8.37+; MB+SB –4.47+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 20 Toxicity of binary combinations (1:1 ratio) of bark of *Mimusops elengi* crude powder against *Indoplanorbis exustus* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	MS+TL	278.20	163.41	362.59	3.24±0.61	4.24	0.20	0.16
	MS+SL	216.95	127.30	365.73	2.07±0.50	4.42	0.17	0.34
48h	MS+TL	246.44	165.68	327.10	3.12±0.72	4.14	0.21	0.16
	MS+SL	175.36	91.39	243.55	2.24±0.52	4.28	0.20	0.19
72h	MS+TL	164.87	124.64	295.39	2.83±0.74	3.82	0.26	0.15
	MS+SL	126.87	90.51	190.69	1.98±0.54	4.14	0.16	0.19
96h	MS+TL	140.58	117.78	158.04	3.51±0.76	3.56	0.11	0.39
	MS+SL	98.72	59.14	136.40	2.07±0.47	4.03	0.19	0.24

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: ML- *M. elengi* leaf powder, MB *M. elengi* bark powder, MS- *M. elengi* seed powder, TL-*T. orientalis* leaf powder, TF- *T. orientalis* fruit powder ,SL- *S. asoca* leaf powder ,SB- *S. asoca* bark powder LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient – MS+TL – 6.45+; MS+SL – 14.05+.

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table 21 Toxicity of binary combinations (1:1 ratio) of leaf of *Bauhinia variegata* crude powder against *Indoplanorbis exustus* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	BL+SL	178.64	159.35	223.05	3.61±0.87	4.15	0.22	0.21
	BL+TF	201.48	174.52	276.16	3.58±0.91	3.91	0.25	0.20
	BL+TL	203.26	178.90	263.13	4.38±1.01	4.32	0.20	0.30
48h	BL+SL	151.46	136.94	178.29	3.18±0.81	3.92	0.22	0.19
	BL+TF	178.90	154.59	257.09	2.64±0.82	3.22	0.36	0.19
	BL+TL	185.58	161.70	252.78	3.09±0.85	3.64	0.28	0.26
72h	BL+SL	124.78	110.59	138.83	3.06±0.79	3.86	0.25	0.19
	BL+TF	142.65	125.54	174.69	2.45±0.79	3.10	0.39	0.18
	BL+TL	153.31	136.60	189.30	2.76±0.80	3.44	0.32	0.20
96h	BL+SL	102.72	84.37	114.53	3.17±0.80	3.95	0.24	0.22
	BL+TF	110.43	92.45	122.96	2.95±0.79	3.72	0.27	0.44
	BL+TL	124.44	108.83	139.73	2.83±0.79	3.59	0.29	0.25

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: BL- *B. variegata* leaf powder ,BS- *Bauhinia variegate* seed powder, TL- *T. orientalis* leaf powder, TF- *T. orientalis* fruit powder ,SL- *S. asoca* leaf LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient –BL+SL – 16.16+; BL+TF – 60.80;BS+TL – 13.38+; BL+TL – 95.15+; BS+SL – 9.90+.
+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 22 Toxicity of binary combinations (1:1 ratio) of seed of *Bauhinia variegata* crude powder against *Indoplanorbis exustus* at different exposure period.

Exposure Periods	Treatment	LC_{50} (m/l)	Limit		Slope value	t-ratio	g-value	Heterog-eneity
			LCL	UCL				
24h	BS+TL	352.84	234.45	765.39	2.44±0.97	2.32	0.37	0.32
	BS+SL	215.15	186.10	294.78	4.31±1.06	4.07	0.23	0.42
48h	BS+TL	299.64	243.37	439.71	1.83±0.86	2.12	0.45	0.26
	BS+SL	197.85	169.69	285.44	3.10±0.87	3.56	0.30	0.29
72h	BS+TL	217.52	188.89	279.31	1.61±0.80	2.01	0.48	0.20
	BS+SL	164.75	144.99	217.46	2.68±0.81	3.31	0.34	0.26
96h	BS+TL	143.28	128.45	180.96	1.60±0.78	2.05	0.90	0.19
	BS+SL	131.48	114.76	152.59	2.54±0.78	3.23	0.36	0.26

Mortality was determined at every 24 h up to 96 h. Each set of experiment was replicated six times. Abbreviation: BL- *B. variegata* leaf powder ,BS- *Bauhinia variegate* seed powder, TL- *T. orientalis* leaf powder, TF- *T. orientalis* fruit powder ,SL- *S. asoca* leaf LCL = lower confidence limit; UCL = upper confidence limit. Significant negative regression ($P < 0.05$) was observed between exposure time and LC_{50} of treatments. Ts—testing significant of the regression coefficient –BL+TL – 13.38+; BS+SL– 9.90+
+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 23 Toxicity of binary combination (1:5 ratio) of *Mimusops elengi* leaf powder and active component saponin with synergist PB and MGK-264 against *Lymnaea acuminata.*

Exposure period	Treatments	LC_{50} (mg/l)	Synergistic ratio	Limits		Slope value	t-ratio	g-value	Heteroge -neity
				LCL	UCL				
24h	*M. elengi* leaf	196.41	-	145.85	437.75	2.53±0.74	3.41	0.32	0.32
	M. elengi leaf + PB	5.11	38.43	3.87	7.28	1.48±0.28	4.21	0.24	0.17
	M. elengi leaf + MGK	8.64	22.73	7.08	12.92	2.15±0.50	4.31	0.42	0.19
48h	*M. elengi* leaf	167.62	-	123.93	448.39	1.84±0.63	2.89	0.45	0.16
	M. elengi leaf + PB	3.52	47.61	2.49	5.15	1.15±0.26	4.35	0.20	0.41
	M. elengi leaf + MGK	6.82	24.57	4.83	8.66	3.25±0.62	4.43	0.35	0.17
72h	*M. elengi* leaf	101.50	-	92.21	167.99	1.91±0.60	3.17	0.38	0.15
	M. elengi leaf + PB	1.10	92.27	0.48	1.64	1.24±0.27	4.58	0.18	0.42
	M. elengi leaf + MGK	4.64	21.87	3.62	4.67	3.21±0.68	4.72	0.17	0.27
96h	*M. elengi* leaf	68.47	-	58.43	77.09	2.66±0.60	4.39	0.19	0.25
	M. elengi leaf + PB	0.79	86.67	0.30	1.12	1.51±0.30	4.79	0.13	0.44
	M. elengi leaf + MGK	3.21	21.33	2.39	4.83	2.92±0.52	4.92	0.12	0.33

Six batches of ten snails were exposed to different concentration of above combination. Mortality was determined every 24h up to 96h . Concentrations given are the final concentration in the aquarium water. Synergist ratio (LC_{50} of *M. elengi* leaf/ LC_{50} of binary combination of *M. elengi* leaf with synergist MGK- 264 or PB). Significant negative regression ($P<0.05$) was observed between exposure time and LC_{50} of treatments, testing significance of the regression coefficient. *M. elengi* leaf- 11.86+; *M. elengi* leaf + PB-5.30+; *M. elengi* leaf + MGK- 18.50+

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table- 24 Toxicity of binary combination (1:5 ratio) of column purified fraction of *Mimusops elengi* bark powder and active component saponin with synergist PB and MGK-264 against *Lymnaea acuminata*.

Exposure period	Treatments	LC_{50} (mg/l)	Synergistic ratio	Limits		Slope value	t-ratio	g-value	Hetero-geneity
				LCL	UCL				
24h	*M. elengi* bark	91.19	-	75.77	130.60	2.50±0.53	4.72	0.17	0.20
	M. elengi bark + PB	1.98	46.05	1.47	2.72	1.33±0.26	3.87	0.45	0.32
	M. elengi bark + MGK	2.26	40.34	1.77	3.88	1.56±0.27	3.75	0.21	0.40
	M. e. bark CP	18.3	-	10.50	57.75	2.19±0.34	3.49	0.31	0.22
	M. e. bark CP + PB	0.07	262.00	0.05	0.15	1.05±0.27	3.78	0.26	0.15
	M. e. bark CP + MGK	0.08	229.25	0.06	0.16	1.16±0.29	4.00	0.24	0.12
	Saponin	15.57	-	13.68	19.88	4.02±0.78	5.72	0.14	0.26
	Saponin + PB	1.49	10.44	0.86	6.68	0.97±0.29	3.30	0.35	0.26
	Saponin + MGK	1.68	9.26	0.91	9.79	0.94±0.29	3.15	0.38	0.24
48h	*M. elengi* bark	69.65	-	58.04	92.84	2.06±0.48	4.29	0.20	0.25
	M. elengi bark + PB	1.12	62.18	0.78	1.43	1.63±0.28	3.92	0.39	0.26
	M. elengi bark + MGK	1.09	63.89	0.80	1.35	1.39±0.30	3.91	0.19	0.36
	M. e. bark CP	15.71	-	8.07	17.82	1.76±0.28	2.70	0.15	0.16
	M. e. bark CP + PB	0.04	392.75	0.03	0.06	0.95±0.26	3.63	0.29	0.16
	M. e. bark CP + MGK	0.50	31.42	0.03	0.08	1.01±0.26	3.78	0.26	0.10
	Saponin	13.90	-	11.78	17.82	3.20±0.28	3.70	0.18	0.19
	Saponin + PB	0.41	33.90	0.29	0.69	0.87±0.26	3.34	0.39	0.19
	Saponin + MGK	0.89	15.61	0.55	3.30	0.18±0.27	3.00	0.42	0.20
72h	*M. elengi* bark	47.24	-	38.46	55.18	2.44±0.48	5.09	0.14	0.42
	M. elengi bark + PB	0.77	61.35	0.60	0.91	2.43±0.44	4.01	0.32	0.24
	M. elengi bark + MGK	0.73	64.71	0.54	0.88	2.24±0.43	4.22	0.15	0.31
	M. e. bark CP	10.60	-	9.18	12.41	4.76±0.28	5.70	0.11	0.26
	M. e. bark CP + PB	0.02	530.00	0.01	0.05	1.86±0.01	3.96	0.24	0.19
	M. e. bark CP + MGK	0.03	353.33	0.02	0.03	0.94±0.26	3.62	0.29	0.18
	Saponin	4.25	-	2.99	7.06	1.89±0.26	3.41	0.33	0.20
	Saponin + PB	0.20	21.25	0.12	0.27	1.01±0.26	3.90	0.25	0.21
	Saponin + MGK	0.21	20.23	0.13	1.80	0.13±0.29	3.85	0.26	0.25
96h	*M. elengi* bark	36.37	-	28.59	42.43	2.87±0.50	5.66	0.12	0.72
	M. elengi bark + PB	0.61	59.62	0.53	0.68	4.25±0.75	4.11	0.29	0.20
	M. elengi bark + MGK	0.60	60.61	0.52	0.69	3.93±0.74	3.75	0.14	0.25
	M. e. bark CP	7.20	-	5.74	8.15	3.84±0.28	3.70	0.14	0.31
	M. e. bark CP + PB	0.01	720.00	0.005	0.01	0.99±0.26	3.77	0.2	0.23
	M. e. bark CP + MGK	0.02	360.00	0.008	0.02	1.17±0.26	4.42	0.16	0.25
	Saponin	1.30	-	0.27	2.16	0.69±0.25	2.69	0.53	0.19
	Saponin + PB	0.10	11.81	0.06	0.15	1.29±0.27	4.71	0.17	0.59
	Saponin + MGK	0.11	13.00	0.59	0.14	1.40±0.27	5.02	0.15	0.61

Six batches of ten snails were exposed to different concentration of above combination. Mortality was determined every 24h up to 96h. Concentrations given are the final concentration in the aquarium water. Synergist ratio (LC_{50} of *M. elengi* bark/ LC_{50} of binary combination of *M. elengi* bark with synergist MGK- 264 or PB). Significant negative regression ($P<0.05$) was observed between exposure time and LC_{50} of treatments, testing significance of the regression coefficient. Abbreviations: M. e. bark CP- *Mimusops elengi* bark column purified; PB-- piperonyl butoxide; MGK- MGK-264; LCL- Lower confidence limit; Upper confidence limit; MGK-264. *M. elengi* bark CP+PB -6.32+, *M .e.* bark CP- 12.02+, *M. e.* bark CP+MGK- 0.82++, saponin- 4.96+, saponin+ CP- 62.02++, saponin+ MGK-4.82+,. +: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-25 Toxicity of binary combination (1:5 ratio) of *Mimusops elengi* seed powder with synergist PB and MGK-264 against *Lymnaea acuminata*.

Exposure period	Treatments	LC_{50} (mg/l)	Synergistic ratio	Limits		Slope value	t-ratio	g-value	Hetero-geneity
				LCL	UCL				
24h	*M. elengi* seed	221.11	-	201.72	376.37	1.86±0.43	4.25	0.21	0.19
	M. elengi seed + PB	9.57	23.10	7.64	15.49	2.14±0.51	4.18	0.21	0.16
	M. elengi seed + MGK	9.84	22.47	7.70	18.44	1.87±0.49	3.77	0.27	0.14
48h	*M. elengi* seed	151.74	-	133.19	212.83	1.58±0.38	4.82	0.16	0.24
	M. elengi seed + PB	5.30	28.63	4.21	6.08	2.28±0.47	4.71	0.17	0.13
	M. elengi seed + MGK	5.14	29.52	3.40	5.46	3.56±0.71	4.80	0.16	0.16
72h	*M. elengi* seed	121.89	-	146.46	278.64	1.49±0.37	4.03	0.23	0.32
	M. elengi seed + PB	3.44	35.43	2.24	4.24	2.10±0.48	5.19	0.20	0.17
	M. elengi seed + MGK	3.25	37.50	2.31	3.91	2.61±0.50	4.92	0.14	0.24
96h	*M. elengi* seed	72.77	-	93.93	167.45	1.89±0.38	4.93	0.15	0.79
	M. elengi seed + PB	1.75	41.58	1.04	2.38	1.31±0.26	4.91	0.14	0.33
	M. elengi seed + MGK	1.36	53.50	1.42	2.24	2.10±0.28	4.96	0.10	0.37

Six batches of ten snails were exposed to different concentration of above combination. Mortality was determined every 24h up to 96h. Concentrations given are the final concentration in the aquarium water. Synergist ratio (LC_{50} of *M. elengi* leaf/ LC_{50} of binary combination of *M. elengi* leaf with synergist MGK- 264 or PB).Significant negative regression ($P<0.05$) was observed between exposure time and LC_{50} of treatments, testing significance of the regression coefficient. *M. elengi* seed- 9.34+; *M. elengi* seed + PB-5.98++; *M. elengi* seed + MGK- 5.61+

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-26 Toxicity of binary combination (1:5 ratio) of column purified fraction of *Bauhinia variegata* leaf powder and active component saponin with synergist PB and MGK-264 against *Lymnaea acuminata.*

Expos-re period	Treatments	LC_{50} (mg/l)	Synergi st ratio	Limits LCL	Limits UCL	Slope value	t-ratio	g-value	Hetero-geneity
24h	*B. variegata* leaf	244.70	-	216.22	302.00	3.78±0.68	5.51	0.12	0.42
	B. variegata leaf + PB	2.84	86.16	2.24	3.88	1.66±0.27	3.64	0.24	0.23
	B. variegata leaf + MGK	3.94	62.10	2.58	5.01	1.69±0.29	3.76	0.29	0.17
	B. variegata leaf CP	20.30	-	16.99	27.41	2.72±0.48	4.16	0.12	0.28
	B. v. leaf CP + PB	0.08	253.75	0.068	0.11	1.89±0.48	3.90	0.25	0.11
	B. v. leaf CP + MGK	0.11	184.54	0.89	0.16	2.37±0.55	4.31	0.20	0.08
	Quercetin	12.13	-	10.42	24.73	2.19±0.62	3.59	0.32	0.16
	Quercetin + PB	1.73	7.01	1.26	5.26	1.78±0.63	2.81	0.48	0.24
	Quercetin+ MGK	1.71	7.09	1.35	3.04	2.75±0.73	3.75	0.27	0.26
48h	*B. variegata* leaf	203.45	-	179.12	245.20	3.03± 0.60	5.08	0.14	0.37
	B. variegata leaf + PB	1.54	132.11	1.19	1.93	1.72±0.26	3.72	0.21	0.25
	B. variegata leaf + MGK	1.90	107.07	1.35	2.42	1.70±0.27	3.87	0.31	0.22
	B. variegata leaf CP	16.03	-	12.90	22.95	1.79±0.6.	3.16	0.14	0.32
	B. v. leaf CP + PB	0.06	267.16	0.03	0.05	1.79±0.46	3.82	0.26	0.13
	B. v. leaf CP + MGK	0.08	200.00	0.07	0.12	1.94±0.49	3.95	0.24	0.09
	Quercetin	9.86	-	8.45	13.75	2.16±0.60	3.60	0.29	0.13
	Quercetin + PB	1.13	8.72	0.93	1.95	1.74±0.59	2.91	0.45	0.22
	Quercetin+ MGK	1.47	6.70	1.16	2.79	2.08±0.63	3.27	0.35	0.17
72h	*B. variegata* leaf	155.94	-	137.78	174.18	3.52 ±0.58	5.97	0.10	0.40
	B. variegata leaf + PB	0.81	192.51	0.52	1.06	1.77±0.31	3.83	0.19	0.29
	B. variegata leaf + MGK	1.11	140.48	0.76	1.46	1.43±0.25	3.91	0.35	0.24
	B. variegata leaf CP	10.13	-	7.73	17.75	3.82±0.37	3.60	0.14	0.28
	B. v. leaf CP + PB	0.05	202.6	0.05	0.07	1.77±0.46	3.78	0.26	0.11
	B. v. leaf CP + MGK	0.06	168.83	0.05	0.08	1.79±0.47	3.80	0.26	0.10
	Quercetin	6.82	-	4.79	9.93	4.75±0.60	3.39	0.25	0.10
	Quercetin + PB	0.77	8.85	0.61	0.95	1.70±0.58	2.90	0.29	0.15
	Quercetin+ MGK	0.99	13.91	0.85	1.29	2.16±0.60	3.60	0.14	0.11
96h	*B. variegata* leaf	126.70	-	110.93	139.72	4.35±0.63	6.85	0.08	0.57
	B. variegata leaf + PB	0.72	175.97	0.48	0.90	1.81±0.39	3.90	0.16	0.32
	B. variegata leaf + MGK	0.65	194.92	0.39	0.88	1.67±0.29	3.98	0.38	0.29
	B. variegata leaf CP	5.98	-	4.08	9.47	2.42±0.39	5.16	0.13	0.33
	B. v .leaf CP + PB	0.03	199.33	0.02	0.03	2.35±0.49	4.73	0.17	0.37
	B. v. leaf CP + MGK	0.04	149.50	0.03	0.05	1.86±0.01	3.96	0.24	0.19
	Quercetin	5.39	-	4.81	8.41	3.96±0.64	4.55	0.12	0.24
	Quercetin + PB	0.56	9.62	0.43	0.65	2.50±0.61	4.06	0.23	0.52
	Quercetin+ MGK	0.63	8.55	0.55	0.70	3.22±0.62	5.14	0.14	0.50

Six batches of ten snails were exposed to different concentration of above combination. Mortality was determined every 24h. Concentrations given are the final Concentration (mg/l w/v) in the aquarium water. Synergist ratio Lc_{50} of column purified fraction of *B. variegata* leaf powder, Lc_{50} of binary column purified fraction of *B. variegata* leaf powder Significant negative regression ($p<0.05$) was observed between exposure time and MGK of treatments, testing Significance of the regression coefficient. Abbreviations: *B. v.* leaf CP – *Bauhinia variegata* leaf column purified; PB-- piperonyl butoxide; MGK- MGK-264; LCL- Lower confidence limit; UCL- Upper confidence limit. MGK- 264. *B. v.* leaf CP+PB -2.55++, *B. v.* leaf CP-20.37+, *B. v.* leaf CP + MGK-264- 13.27 +, Quercetin- 4.96+ Quercetin+ CP- 10.10++, Quercetin + MGK-11.71,
+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-33 Toxicity of binary combination (1:5 ratio) of *Bauhinia variegata* bark powder with synergist PB and MGK-264 against *Lymnaea acuminata*.

Expos-re period	Treatments	LC_{50} (mg/l)	Syner-gistic ratio	Limits		Slope value	t-ratio	g-value	Hetero-geneity
				LCL	UCL				
24h	*B. variegata* bark	319.06	-	288.39	379.55	4.63±0.91	5.05	0.15	0.19
	B. variegata bark + PB	10.34	31.71	7.10	23.85	1.52±0.34	4.46	0.19	0.26
	B. variegata bark + MGK	12.57	25.38	8.05	28.11	1.43±0.35	4.15	0.22	0.23
48h	*B. variegata* bark	273.58	-	249.38	316.38	3.78±0.79	4.76	0.16	0.21
	B. variegata bark + PB	6.73	40.65	4.56	16.03	1.05±0.28	3.82	0.26	0.19
	B. variegata bark + MGK	9.31	29.38	5.92	20.68	1.07±0.29	3.73	0.28	0.16
72h	*B. variegata* bark	222.04	-	205.54	270.56	4.26±0.77	5.52	0.12	0.26
	B. variegata bark + PB	2.77	80.15	1.70	4.08	1.01±0.26	3.88	0.24	0.17
	B. variegata bark + MGK	4.60	48.26	3.06	9.41	0.92±0.26	3.47	0.32	0.11
96h	*B. variegata* bark	180.80	-	164.61	204.04	4.89±0.80	6.05	0.10	0.69
	B. variegata bark + PB	1.11	162.88	0.49	1.65	1.25±0.27	4.61	0.18	0.20
	B. variegata bark + MGK	1.92	94.16	1.20	2.58	1.33±0.27	4.98	0.16	0.28

Six batches of ten snails were exposed to different concentration of above combination. Mortality was determined every 24h up to 96h. Concentration given are the final concentration in the aquarium water. Synergist ratio (LC_{50} of *B. variegata* bark/ LC_{50} of binary combination of *B. variegata* bark with synergist MGK- 264 or PB). Significant negative regression ($P<0.05$) was observed between exposure time and LC_{50} of treatments, testing significance of the regression coefficient. *B. variegata* bark- 34.87+; *B. variegata* bark + PB-8.77++; *B. variegata* bark + MGK- 14.97+

+: linear regression between x and y; ++: non-linear regression between log x and log y.

Table-34 Toxicity of binary combination (1:5 ratio) of *Bauhinia variegata* seed powder with synergist PB and MGK-264 against *Lymnaea acuminata*.

Exposure period	Treatments	LC_{50} (mg/l)	Synergistic ratio	Limits		Slope value	t-ratio	g-value	Heterogeneity
				LCL	UCL				
24h	*B. variegata* seed	350.21	-	300.52	505.35	4.05±0.92	4.40	0.20	0.43
	B. variegata seed + PB	11.19	31.29	10.01	13.36	4.55±0.82	4.54	0.12	0.32
	B. variegata seed + MGK	13.54	25.86	12.48	26.65	3.17±0.75	4.23	0.21	0.26
48h	*B. variegata* seed	307.62	-	265.47	462.62	2.96±0.79	3.77	0.27	0.32
	B. variegata seed + PB	9.94	30.94	8.76	12.47	3.19±0.69	4.41	0.18	0.20
	B. variegata seed + MGK	12.97	23.71	10.74	20.05	2.76±0.65	3.91	0.22	0.13
72h	*B. variegata* seed	220.92	-	198.50	352.46	3.46±0.75	4.59	0.18	0.19
	B. variegata seed + PB	7.46	29.61	6.67	8.29	3.02±0.67	4.19	0.12	0.30
	B. variegata seed + MGK	8.56	25.80	7.65	7.70	3.41±0.62	4.56	0.14	0.15
96h	*B. variegata* seed	164.92	-	140.32	263.07	4.86±0.82	5.89	0.11	0.29
	B. variegata seed + PB	5.22	31.59	4.49	5.81	2.89±0.71	3.98	0.09	0.25
	B. variegata seed + MGK	6.01	27.44	5.21	6.73	2.91±0.64	4.82	0.10	0.13

Six batches of ten snails were exposed to different concentration of above combination. Mortality was determined every 24h. Concentrations given are the final concentration in the aquarium water. Synergist ratio (LC_{50} of *M. elengi* leaf/ LC_{50} of binary combination of *B. variegata* seed with synergist MGK- 264 or PB).Significant negative regression ($P<0.05$) was observed between exposure time and LC_{50} of treatments, testing significance of the regression coefficient. *B. variegata* seed- 11.27+; *B. variegata* seed + PB-10.85+; *B. variegata* seed + MGK- 5.29+

+: linear regression between x and y; ++: non-linear regression between log x and log y.

ENZYME ACTIVITY:

***In vivo* effect of sublethal treatment of active components viz. saponin, quercetin and column purified fractions on the enzyme activity in the nervous tissue of *Lymnaea acuminata*.**

This section of the result deals with the effect of *in vivo* sublethal treatment (40% and 80% of 96h LC_{50}) of different preparations viz. column purified of *Mimusops elengi* bark, saponin, column purified of *Bauhinia variegata* and quercetin for 24h and 96h on certain key enzymes i.e. acetylcholinesterase (AChE), acid phosphatase (ACP) and alkaline phosphatase (ALP) in the nervous tissue of *L. acuminata*. Sublethal treatments significantly ($P< 0.05$) inhibit the AChE, ACP and ALP activity in the nervous tissue of *L. acuminata.*

Acetylcholinesterase

In control group of snails 24h and 96h exposure period acetylcholinesterase activity in the nervous tissue of *L. acuminata* were 0.92 and 0.90 µ mole 'SH' hydrolyzed min/ mg protein, respectively (Table 29). Sublethal treatment with 40% and 80% of 96h LC_{50} of column purified fraction *B. variegata* leaf and *M. elengi* bark and their active component quercetin and saponin for 24h and 96h exposure period caused significant inhibition ($P< 0.05$) in AChE activity in the nervous tissue of *L. acuminata*. Maximum inhibition (42.39% of control) in acetylcholinesterase activity was observed in the nervous tissue of *L. acuminata* treatment with to 40% of 96h LC_{50} of saponin in 24h exposure period. Maximum inhibition (33.33% of control) was also noted at 96h exposure period (Table 29).Significant inhibition were also noted when snail were exposed to 80% of 96h LC_{50} of column purified fraction of *B. variegata* leaf (72.84% of control), quercetin (46.73% of control), column purified fraction *M. elengi* bark (76.08% of control) and saponin (36.95% of control) in 24h exposure period. Inhibition caused for were column purified fraction of *B. variegata* leaf (64.44% of control), quercetin (42.22% of control) and column purified fraction of *M. elengi* (65.55% of control) and saponin (27.77% of control), in the nervous tissue of *L. acuminata.*

Acid phosphatase

In control group of snails 24h and 96h exposure period acid phosphatase activity in the nervous tissue of *L. acuminata* were 15.95 and 15.90 µmol substrate hydrolyzed/ 30min/ mg protein, respectively (Table 30). *In vivo* sublethal treatment with 40% and 80% of 96h LC_{50} of column purified fraction *B. variegata* leaf and *M. elengi* bark and their active component quercetin and saponin for 24h and 96h exposure period caused significant inhibition ($P< 0.05$) in ACP activity in the nervous tissue of *L. acuminata*. Maximum

inhibition (64.51% of control) in acid phosphatase activity was observed in the nervous tissue of *L. acuminata* with treatment to 40% of 96h LC_{50} of saponin in 24h exposure period .Maximum inhibition (52.51% of control) was noted at 96h exposure period (Table 30). Significant inhibition were also noted when snail were exposed to 80% of 96h LC_{50} of column purified fraction *B. variegata* leaf (70.09% of control), quercetin (52.28% of control), column purified fraction of *M. elengi* bark (47.58% of control) and saponin (44.70% of control) in 24h exposure period. Inhibition caused for were column purified fraction of *B. variegata* leaf (53.33% of control), quercetin (40.56% of control) and column purified fraction of *M. elengi* (39.87% of control) and saponin (36.54 % of control) in the nervous tissue of *L. acuminata.*

Alkaline phosphatase

In control group of snails 24h and 96h exposure period alkaline phosphatase activity in the nervous tissue of *L. acuminata* were 12.92 and 12.02 µ mol substrate hydrolyzed/ 30min/ mg protein (Table 31). *In vivo* sublethal treatment with 40% and 80% of 96h LC_{50} of column purified fraction *B. variegata* leaf and *M. elengi* bark and their active component quercetin and saponin for 24h and 96h exposure period caused significant inhibition ($P< 0.05$) in ALP activity in the nervous tissue of *Lymnaea acuminata*. Maximum inhibition (74.07% of control) in acid phosphatase activity was observed in the nervous tissue of *L. acuminata* treatment with to 40% of 96h LC_{50} of saponin in 24h. Whereas, 96h exposure caused (59.73% of control) in ALP activity (Table 31). Significant inhibition were also noted when snail were exposed to 80% of 96h LC_{50} of column purified fraction *B. variegata* leaf (70.43% of control), quercetin (60.75% of control), column purified fraction of *M. elengi* bark (66.09% of control) and saponin (52.63% of control) in 24h exposure period. Inhibition caused for were column purified fraction of *B. variegata* leaf (64.72% of control), quercetin (49.58% of control) and column purified fraction of *M. elengi* (47.92% of control) and saponin (41.43 % of control) in the nervous tissue of *L. acuminata.* Student's t- test was applied between treated and control group of animals to determine significant ($P<0.05$) variations.

Table-29 *In vivo* effect of 24h and 96h exposure to sublethal concentration (40% and 80% of 96h LC_{50}) of active components and column purified fraction on acetylcholinesterase (AChE) activity in nervous tissue of *L. acuminata.*

Treatment	Concentrations (mg/l) % of 96h LC_{50}	AChE μ mol 'SH' hydrolyzed/min/ mg protein	
		24h exposure period	96h exposure period
Control	-	0.92 ± 0.05 (100)	0.90 ± 0.05 (100)
B. variegata (Leaf-CP)	40% (2.39 mg/l)	0.78±0.004* (84.78)	0.63 ± 0.001* (70.00)
	80% (4.78 mg/l)	0.67±0.004* (72.84)	0.58 ± 0.001* (64.44)
Quercetin	40% (2.88 mg/l)	0.53±0.001* (57.60)	0.50 ± 0.010* (55.55)
	80% (5.76 mg/l)	0.43±0.002* (46.73)	0.38 ± 0.07* (42.22)
M. elengi (Bark-CP)	40% (2.15 mg/l)	0.75±0.006* (81.52)	0.64 ± 0.007* (71.11)
	80% (4.31 mg/l)	0.70 ±0.001 (76.08)	0.59 ± 0.001* (65.55)
Saponin	40% (0.52 mg/l)	0.39±0.004* (42.39)	0.30 ± 0.002* (33.33)
	80% (1.04 mg/l)	0.34±0.001* (36.95)	0.25 ± 0.001* (27.77)

Value are mean ± SE of six replicates. Values in parentheses indicate percent enzyme activity with control taken as 100% Concentrations (w/v) have been expressed as final concentration in aquarium water. (*) significant ($P<0.05$) when Student's 't' test was used for locating differences between experimental and control groups of animals.

Table-30 *In vivo* effect of 24h and 96h exposure to sublethal concentration (40% and 80% of 96h LC_{50}) of active components and column purified fraction on acid phosphatase (ACP) activity in nervous tissue of *L. acuminata.*

Treatment	Concentrations (mg/l) % of 96h LC_{50}	ACP μ mol Substrate hydrolyzed/ 30min/ mg protein	
		At 24h exposure period	At 96h exposure period
Control	-	15.95 ± 0.03 (100)	15.90 ± 0.03 (100)
B. variegata (Leaf-CP)	40% (2.39 mg/l)	13.86±0.07* (86.89)	10.49 ± 0.006* (65.97)
	80% (4.78 mg/l)	11.18±0.003* (70.09)	8.48 ± 0.004* (53.33)
Quercetin	40% (2.88 mg/l)	10.05±0.002* (63.00)	9.05 ± 0.004* (56.91)
	80% (5.76 mg/l)	8.34±0.04* (52.28)	6.45 ± 0.001* (40.56)
M. elengi (Bark-CP)	40% (2.15 mg/l)	12.90±0.07* (80.87)	10.68 ± 0.054* (67.16)
	80% (4.31 mg/l)	7.59±0.01 (47.58)	6.34 ± 0.001* (39.87)
Saponin	40% (0.52 mg/l)	10.29±0.001* (64.51)	8.35 ± 0.004* (52.51)
	80% (1.04 mg/l)	7.13±0.01* (44.70)	5.81 ± 0.007* (36.54)

Value are mean ± SE of six replicates. Values in parentheses indicate percent enzyme activity with control taken as 100% Concentrations (w/v) have been expressed as final concentration in aquarium water. (*) significant ($P<0.05$) when Student's 't' test was used for locating differences between experimental and control groups of animals.

Table-31 *In vivo* effect of 24h and 96h exposure to sublethal concentration (40% and 80% of 96h LC_{50}) of active components and column purified fraction on alkaline phosphatase (ALP) activity in nervous tissue of *L. acuminata.*

Treatment	Concentrations (mg/l) % of 96h LC_{50}	ALP μ mol Substrate hydrolyzed/ 30min/ mg protein	
		At 24h exposure period	At 96h exposure period
Control	-	12.92 ± 0.01 (100)	12.02 ± 0.01 (100)
B. variegata (Leaf-CP)	40% (2.39 mg/l)	11.42±0.01* (88.39)	8.80 ± 0.002* (73.21)
	80% (4.78 mg/l)	9.10±0.01* (70.43)	7.78 ± 0.004* (64.72)
Quercetin	40% (2.88 mg/l)	9.77±0.002* (75.61)	7.06 ± 0.005* (58.73)
	80% (5.76 mg/l)	7.85±0.005* (60.75)	5.96 ± 0.007* (49.58)
M. elengi (Bark-CP)	40% (2.15 mg/l)	10.21±0.07* (79.02)	8.26 ± 0.001* (68.71)
	80% (4.31 mg/l)	8.54±0.007 (66.09)	5.76 ± 0.004* (47.92)
Saponin	40% (0.52 mg/l)	9.57±0.007* (74.07)	7.18 ± 0.004* (59.73)
	80% (1.04 mg/l)	6.80±0.008* (52.63)	4.98 ± 0.008* (41.43)

Value are mean ± SE of six replicates. Values in parentheses indicate percent enzyme activity with control taken as 100% Concentrations (w/v) have been expressed as final concentration in aquarium water. (*) significant ($P<0.05$) when Student's 't' test was used for locating differences between experimental and control groups of animals.