Himhim, *Trichodesma africanum* (Boraginaceae) Ziyeta: *Cleome arabica* (Cleomaceae) and *Origanm syriacm* (Za'ater). All plants were identified through the Department of Flora and Plant Classification Research, Orchard Reasearch Institue, Ministry of Agriculture, Egypt.

Plant extraction: All wholeplants were washed and left for complete dryness. The dried plants were grinded in an electrical grinder. Ethanol was used as a solvent for extracting active ingredients of each dried plant using Soxhlet apparatus. Each extract was dried under vaccum using a rotary evaporator. The resulted crude extracts were stored at 4°C.

Bioassays: Serial dilutions of (1%) crude extract of each plant were prepared, one ml of each concentration was added to 100 ml of water with 10 snails of 8-10 mm diameter for *Biomphalaria alexandria* and 6-8 mm diameter for *Bulinus trancatus*. Small pieces of lettuce were added to each cup for snail nutrition. Each experiment was replicated 4 times. The same conditions were followed without using plant extract as control experiment. All experiments were carried out at 27±2°C and 12: 12 Light and dark periods. Mortality readings were recorded after 24 - 48 hr. Mortailty percentages were corrected using Abbott's formula [14]. LC50 and LC90 values for each plant extract were estimated through calculating the slope function of the regression lines. The results were statistically analysed [15].

Histological preparations: The histopathological changes of mature hermaphrodite snails due to treatment with different plant extracts were studied using the rotein histological preparations. The shell of both normal and treated snails were carefully broken under binocular dissecting microscope and soft body parts were transferred to Bouin's fixative followed by washing, dehydrating clearing in methyl benzoate (6-8hr) then washed in benzene and infiltrated with paraplast - wax material. Paraplast sections at 5-6 μ were prepared for staining with haematoxylin-eosin stains.

Estimation and characterization of body proteins: The total protein body content of both normal and treated snails were estimated using Bio-Rad protein assay kit which based on the method of Lowry *et al.* [16] in which proteins react with folin reagent to give coloured complex. The colour is due to reaction of alkaline copper with proteins and reduction of phosphomlybdate by tyrosine and tryptophane in proteins. Protein profile of normal and treated snails were compared using PAGE technique, following the method of Ibbara and Federichi [17]. Molecular weights of seprarated protein bands were estimated using progel analysis computer program.

RESULTS

Susceptibility of snails to plant extracts: The toxic effect of the six plant extracts against *B. alexandrina* and *B. truncatus* were tabulated in Tables (1-6). Data in all tables proved the toxic effect of all tested plant extracts aginst *B. alexandrina* and *B. truncatus* LC50 values for *B. alexandrina* are 3811.45, 73.68, 346.80, 7.65, 284.93 and 28.87 ppm for Boyceran, Shaka'ah, Hargal, Za'atar, Himhim and Ziyeta extracts respectively. While for *B. truncatus*, LC50 values are 2696.20, 69.78, 321.22, 6.16, 231.56 and 22.88 for the same order of plants.

Table 1: Susceptibiliy of *Biomphalaria alexandrina* and *Bulinus truncatus* to *Artemisia judaicia* L extract (Boyceran)

	B. alexandrina		*B. truncatus*	
Plant Conc. (ppm)	Dead snails (Mean±S.E)	Corrected Mortality %	Dead snails Mean±S.E	Corrected Mortality %
6500	14.7±1.8	73.3	14.7±1.8	73.3
6000	12±1.2	60.0	13.3±0.7	66.7
5000	10±0.0	50.0	12.7±1.3	63.7
4000	8.7±0.7	43.3	10.0±0.0	50.0
3000	6.7±0.7	33.3	8.7±0.7	43.3
Contrc	0.0±0.0		0.0±0.0	
LC50		3811.45		2696.20
LC90		10639.50		13503.05
Slope		2.22		3.49
Chi2		4.12		1.55
P value		<0.0008 (sign)		<0.015 (sign)

Table 2: Susceptibiliy of *Biomphalaria alexandrina* and *Bulinus truncatus* to *Fagonia mollis* del. (Shaka'ah)

	B. alexandrina		*B. truncatus*	
Plant Conc. (ppm)	Dead snails (Mean±S.E)	Corrected Mortality %	Dead snails Mean±S.E	Corrected Mortality %
90	15.3±0.7	76.7	19.3±0.7	96.7
85	13.3±0.7	66.7	18.7±0.7	93.3
80	12±1.2	60.0	17.3±0.6	86.7
75	10.7±0.7	53.3	15.4±0.7	76.7
70	8.7±0.7	43.3	14.7±1.8	73.3
Control	0.0±0.0		0.0±0.0	
LC50		73.68		69.78
LC90		107.70		82.20
Slope		1.34		1.14
Chi^2		0.20		1.60
P value		<0.001 (sign)		<0.002 (sign)

Table 3: Susceptibiliy of *Biomphalaria alexandrina* and *Bulinus truncatus* to *Gomphocarpus sinaicus* Boiss (Hargal)

	B. alexandrina		*B. truncates*	
Plant Conc. (ppm)	Dead snails (Mean±S.E)	Corrected Mortality %	Dead snails Mean±S.E	Corrected Mortality %
400	14.7±0.7	73.3	18.7±0.7	93.3
380	13.3±1.3	66.7	18±0.0	90.0
360	10.7±0.7	53.3	15.3±0.7	76.7
340	9.3±0.7	46.7	14±1.2	70.0
320	7.3±0.7	36.7	13.3±0.7	66.7
Control	0.0±0.0		0.0±0.0	
LC50		346.80		321.22
LC90		455.20		384.33
Slope		1.24		1.15
Chi^2		0.48		1.04
P value		<0.0004(sign)		<0.0013(sign)

Table 4: Susceptibiliy of *Biomphalaria alexandrina* and *Bulinus truncatus* to *Origanum syriacum* extract. (Za'atar)

	B. alexandrina		*B. truncatus*	
Plant Conc. (ppm)	Dead snails Mean±S.E	Corrected Mortality %	Dead snails Mean±S.E	Corrected Mortality %
8.3	17.3±0.7	86.7	16.7±0.7	83.3
7.5	10±0.0	50	13.3±0.7	66.7
6.6	8.7±0.7	43.3	12±1.2	60
5.8	6.7±0.7	33.3	8.7±0.7	43.3
4.2	4.7±0.7	23.3	2.7±1.3	13.3
Control	0.0±0.0		0.0±0.0	
LC50		7.65		6.16
LC90		20.97		9.58
Slope		2.14		1.4
Chi2		0.30		1.10
P value		<0.0001(sign)		<0.0001(sign)

Table 5: Susceptibiliy of *Biomphalaria alexandrina* and *Bulinus truncatus* to *Trichodesma africanum*

	B. alexandrina		*B. truncatus*	
Plant Conc. (ppm)	Dead snails Mean±S.E	Corrected Mortality %	Dead snails Mean±S.E	Corrected Mortality %
500	18.7±0.7	93.3	19.3±0.7	96.7
400	17.3±0.0	86.7	16.7±0.7	83.3
350	13.3±0.7	66.7	15.3±0.7	76.77
300	11.3±0.7	56.7	12.7±1.3	63.3
200	3.3±0.7	16.7	10.7±0.7	53.3
Control	0.0±0.0		0.0±0.0	
LC50		284.93		231.56
LC90		453.22		455.46
Slope		1.44		1.69
Chi^2		1.46		2.88
P value		<0.0001(sign)		<0.0002(sign)

Table 6: Susceptibiliy of *Biomphalaria alexandrina* and *Bulinus truncatus* to *Cleome arabica* L extract

	B. alexandrina		*B. truncatus*	
Plant Conc. (ppm)	Dead snails Mean±S.E	Corrected Mortality %	Dead snails Mean±S.E	Corrected Mortality %
45	17.3±0.7	86.7	19.3±0.7	93.3
38	14.3±1.8	73.3	16.7±0.7	83.3
32	11.3±0.7	56.7	15.3±0.7	76.7
30	9.3±0.7	46.7	13.3±1.3	66.7
25	7.3±0.7	43.3	9.3±0.7	46.7
Control	0.0±0.0		0.0±0.0	
LC50		28.87		22.88
LC90		51.12		42.87
Slope		1.56		1.62
Chi^2		2.49		1.15
P value		<0.0005 (sign)		<0.0005(sign)

Effect of plant extracts on protein profile of the tested snails: Data in Table (7) show that the protein profile of untreated *B. alexandrina* (Lane 9) composed of 11 bands of M.Wt. (228, 158.18, 103.87, 98.20, 70.65, 62.31, 41.22, 33.4, 19.42, 17.28 and 14.5 KD. This profile reduced to 8 bands after treatment of *B. alexandrina* with *Artemisia* extract, with M.Wt. (62.4, 61.76, 57.5, 52.21, 46.11, 25.06, 19.20 and 11.2 KD. Lane 3).

Treatment with *Cleome arabica* (Lane 4) appeared 7 polypeptide fractions of molecular weight (188.73, 89.23, 62.48, 58.98, 49.76, 19.23 and 10.8 KD). Seven bands ranged from 169.82 to 11.4 KD resulted after treatment of *B. alexandrina* with *Origanum syriacum* (Lane 5), while treatment with *Fagonia mollis* yield eight bands of molecular weight ranged from 193.09 to 12.4 KD as shown in (Table 7 - Lane 6). Lane (7) represents protein bands of *Biomphalaria* after treatment with *Gomphocarpus sinacus*, six bands ranged from (198.91 to 12.7 KD) were appeared. Three protein patterns were found to be shared between untreated and *Tricodesma* treated *Biomphalaria* with M.Wt. (62.49, 17.28 and 14.5 KD. The other seven bands are different (Lane 8).

The body protein configuration of treated *Bulinus truncatus* with plant extracts is represented in (Table 8). Untreated Snail (Lane 9) showed eight protein bands weighing 228, 186.81, 63.62, 55.24, 54.24, 37.37, 19.20 and

Table 7: Profile and molecular weight estimates of proteins from *Biomphalaria alexandrina* treated with plant extracts

Lane Rows	Lane1	Lane2	Lane3	Lane4	Lane5	Lane6	Lane7	Lane8	Lane9
1									228
2	212							209.09	
3							198.91		
4		188.27		188.73		193.09			
5					169.82			169.82	
6									158.81
7									
8	116								
9							108.72		
10						100.63			103.87
11	97.4								98.20
12					92.2			98.2	
13				89.23			80.32		
14									70.66
15	66.2					68.42			
16									
17									
18			62.4	62.48	62.50	62.79	62.2	62.49	62.49
19		61.39	61.76						
20		59.53							
21				58.98				58.42	
22	57.5		57.5						
23					54.65				
24			52.21						
25				49.76			50.18		
26			46.11						
27	40					41.22			41.22
28								37	
29					36.4				
30									33.4
31			25.06						
32						22.09			
33	20.4								
34			19.20	19.22	19.21	19.20			19.23
35		18.94							
36	16.9							17.28	17.28
37	14.5							14.5	14.5
38								13.5	
39									
40						12.4	12.7	12.7	
41		11.4	11.2		12.4				
42				10.8					

Lane 1: high molecular weight standard protein. Lane 2: low molecular weight standard protein. Lane 3: Tratment with *Artemisia judiaca* extract. Lane 4: Tratment with *Cleome arabica* extract. Lane 5: Tratment with *Origanum syriacum* extract. Lane 6: Tratment with *Fagnia mollis* extract. Lane 7: Tratment with *Gomphocarpus sinacus* Lane 8: Tratment with *Tricodesma africanum* Lane 9 (Cont): Untrated *Biomphalaria* proteins

Table 8: Profile and molecular weight estimates of proteins from *Bulinus truncatus* treated with plant extracts

Lane Rows	Lane1	Lane2	Lane3	Lane4	Lane5	Lane6	Lane7	Lane8	Lane9
1	212								228
2							182		186.8
3			176	176	176.2	176.2		176.6	
4									
5			161.6	165.2	164	164.6	165	165.6	
6									
7			130.8	130.4	130.6	130.8		130	
8									
9	116						108.72		
10	97.4								
11				83.53					
12	66.2								
13				63.3	62.2	62.3			63.62
14	57.4								
15									55.24
16			54.52	54.24	54.39	54.24	54.3	54.34	54.24
17					44.33				
18	40		40.56				40.56	39.62	
19				37.56	37.37		37	37	37.37
20									
21	31	30.42							
22	20.4	20.23	20.4			20.31			
23				20.05	19.80				
24							19.29	19.12	19.20
25	16.9					16.79	16.71		
26	14.4								
27		14.28	14.29						
28									
29			13.39	13.39	13.39	13.39	13.39	13.39	13.39

Lane 1: high molecular weight standard protein. Lane 2: low molecular weight standard protein. Lane 3: Tratment with *Artemisia judiaca* extract. Lane 4: Tratment with *Cleome arabica* extract. Lane 5: Tratment with *Origanum syriacum* extract. Lane 6: Tratment with *Fagonia mollis* extract. Lane 7: Tratment with *Gomphocarpus sinacus* Lane 8: Tratment with *Tricodesma africanum* Lane 9 (Cont): Untrated *Bulinus* proteins

13.18 KD. Snail treatment with *Cleome arabica*, *Origanum syriacum* and *Gomphocarpus sinacus* increase the number of separated bands to be nine (Table 2 - Lanes 4, 5 & 7). Treat ment with *Gomphocarpus* yield bands rarged from 182 to 13.39 KD (Lane 7) and from 176 to 13.39 KD after trewtment with *Cleome arabica* (Lane 4) while *Origanum* treatment showed protein bands of (176.2, 164, 130.6, 62.2, 54.39, 44.33, 37.37, 19.8 and 13.39 KD (Lane 5). Snail treatment with *Fagonia* produce eight polypeptide chains ranged from 176.2 to 13.39 KD (Lane 6), while treatment with *Tricodesma* (Lane 8) Keep body proteins eight fractions of MWt. 176.6, 167.5, 130, 54.34, 39.62, 37, 19.12 and 13.39 KD.

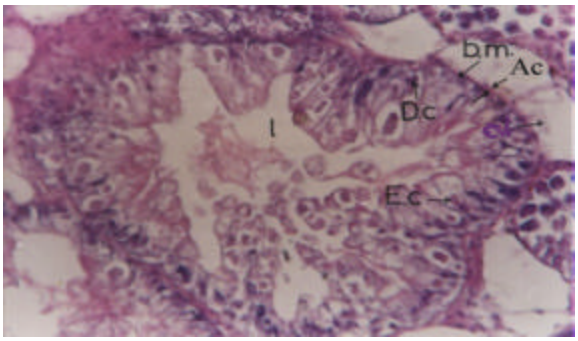


Fig. 1: T.S. in normal *Biomphalaria alexandrina* showing the digestive acini Ec: epithelial cells Ac: Acinus L: lumen bm: basement membrane D.c: secretory cells X = 200

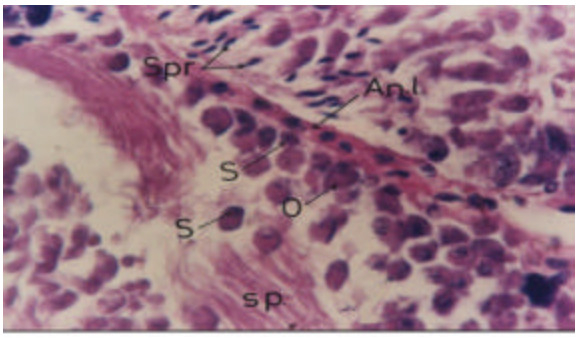


Fig. 5: T.S. in normal *Biophalaria alexandrina* showing the hermaphrodite gland. X=200 Sp=sperms Anl=ancel's layer s=spermatoeytes O=oocyte Spr: heads of sperms. Sp. Tails of sperms

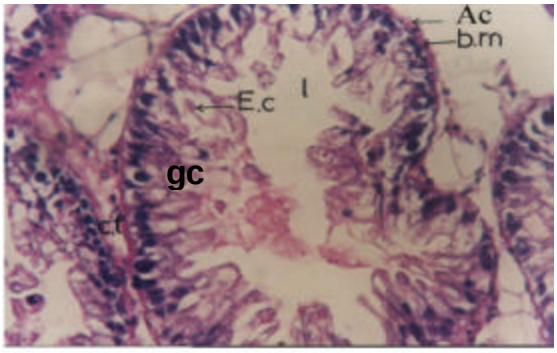


Fig. 2: T.S. in untreated *B. truncatus* (digestive region) Ac: Acinus ct: Connective tissue L: lumen bm: basement membrane X=200 gc : gobled cell

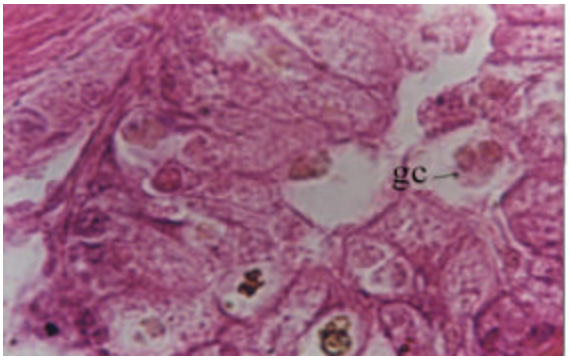
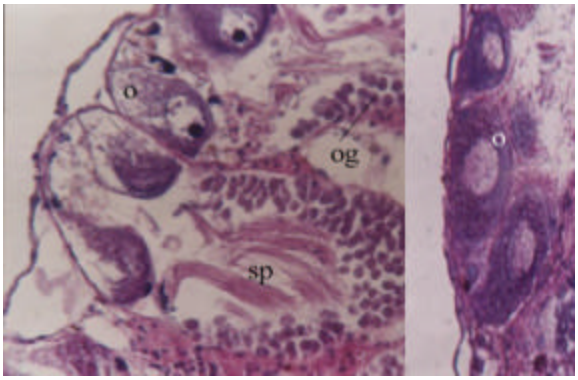


Fig. 6: T.S. in trated *B. alexandrina* with *Origanum* extract showing the epithelial layer. Ec: epithelial cells gc: goblet cell X = 400



Figs. 3&4: T.S. in untreated (normal) *Bulinus truncatus* (hermaphrodite region) O: ovum O.g: oogonia sp: sperms gc: gametocytes X=400

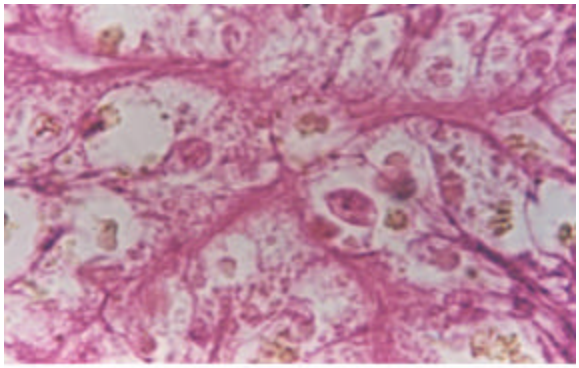


Fig. 7: T.S. in treated *B. truncatus* with *Origanum* extract showing the digestive tract X= 400.

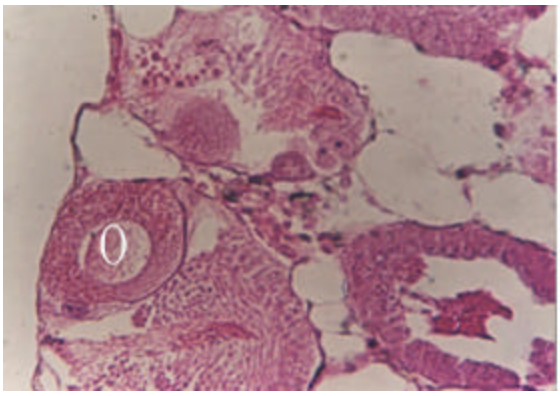


Fig. 8: T.S. in treated *B. truncatus* with *Origanum extract* (Hermaphrodite region). O: ovum X= 400

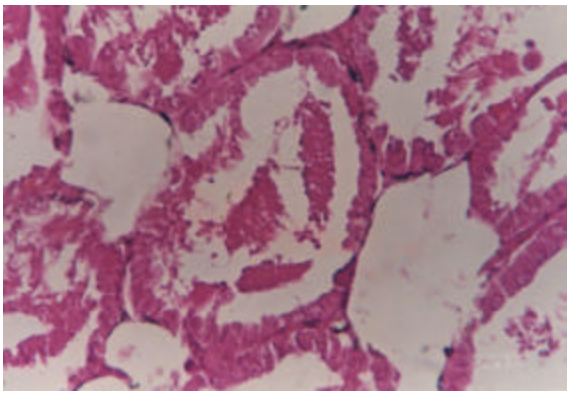


Fig. 11: T.S. in *B. alexandrina* treated with *Cleome* extract (Hermaphrodite gland). X = 200

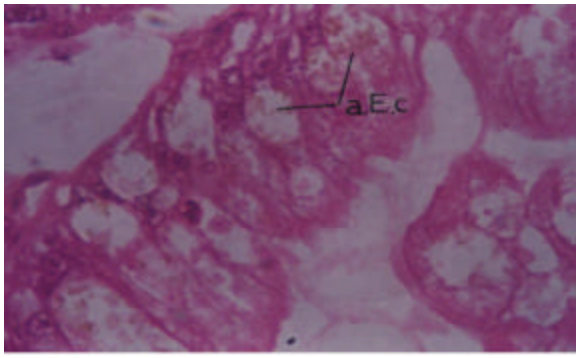


Fig. 9: T.S. in treated *B. alexandrina* with *Cleome* extract showing digestive epithelia. A.E.c: evacuated epithelial cells X = 400

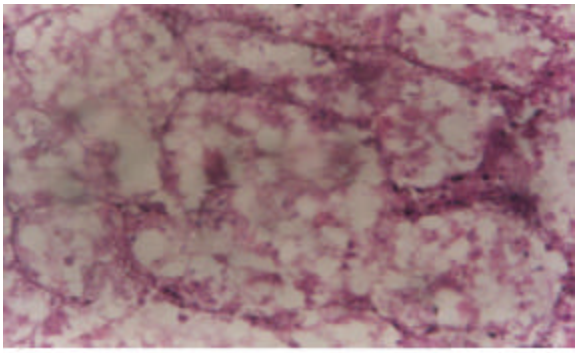


Fig. 12: T.S. in *B. truncatus* treated with *Cleome* extract (digestive gland) X= 400.

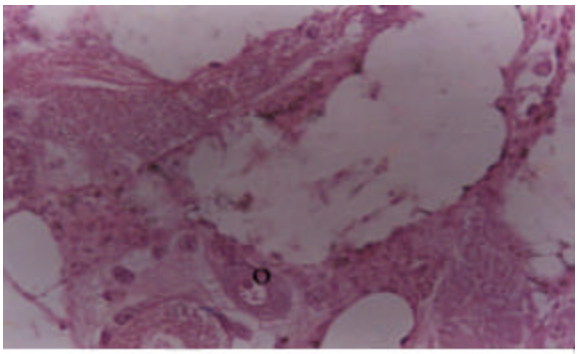


Fig. 10: T.S. in treated *B. truncates* with *Cloeme* extract (Hermaphrodite gland). O: ovum X= 200

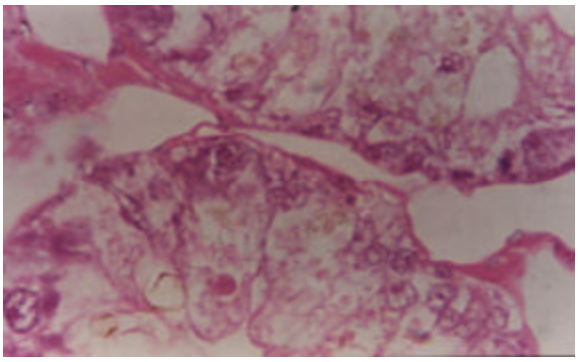


Fig. 13: T.S. in treated *B. alexandrina* with *Fagonia* extact (digestive acini) X = 400

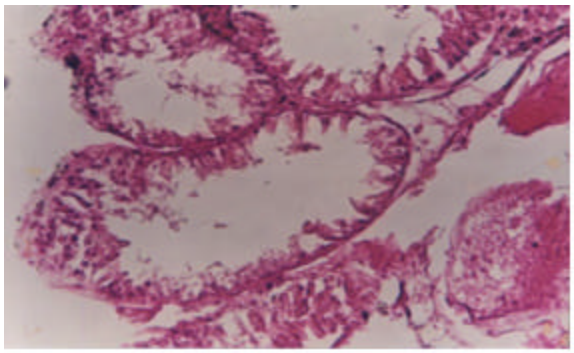


Fig. 14: T.S. in treated *B. truncatus* with *Fagonia* extract (Digestive tract) X = 200

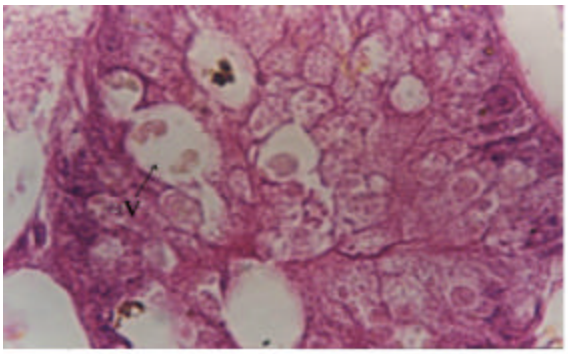


Fig. 17: T.S. in treated *B. truncatus* with *Artemisia* extract (Digestive region). V: vacuoles X=400

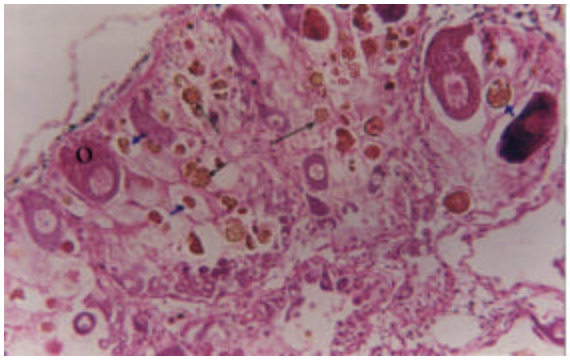


Fig. 15: T.S. in treated *B. alexandrina* with *Fagonia* showing hermaphrodite region. X = 200

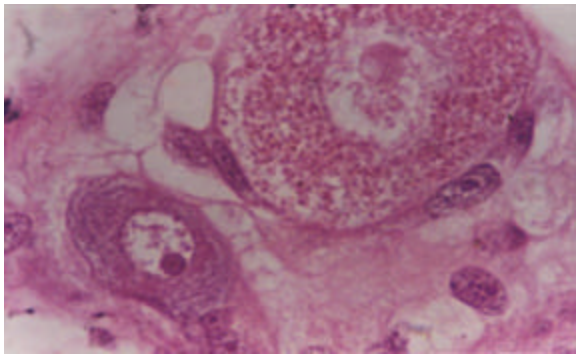


Fig. 18: T.S. in treated *B. truncatus* with *Artemisia* extract at the (Hermaphrodite region). X = 400

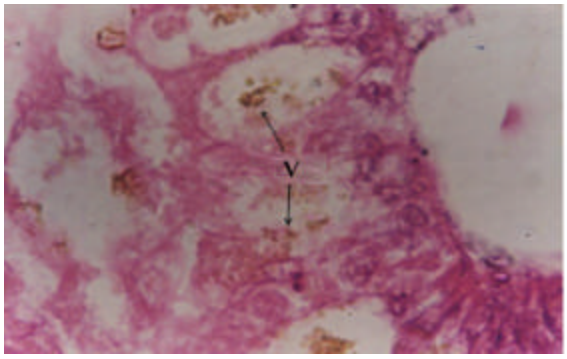


Fig. 16: T.S. in treated *B. truncatus* with *Artemisia* extract (Digestive acini). v: vacuoles X = 400

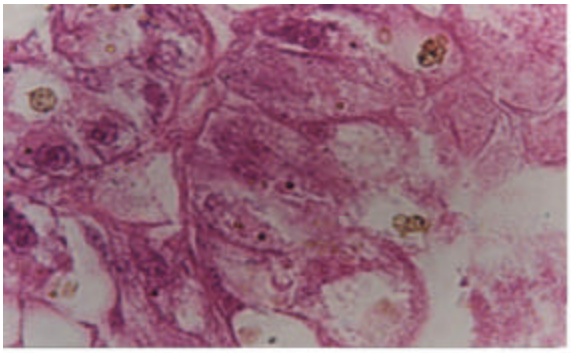


Fig. 19: T.S. in treated *B. truncatus* with *Gomphocarpus* extract showing irregular shape of epithelia. X = 400

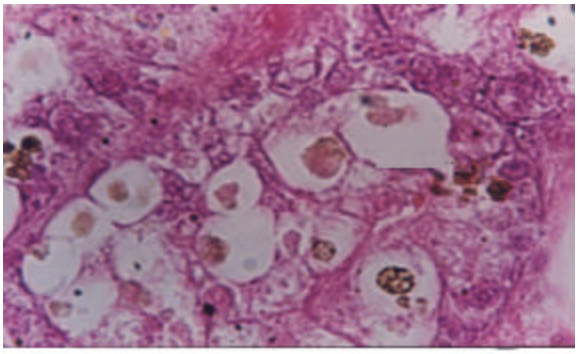


Fig. 20: T.S. in treated *B. alexandrina* with *Gomphocarpus* extract at the digestive acinus region. X = 400

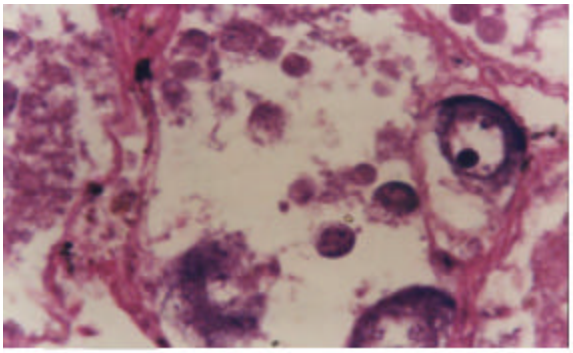


Fig. 23: T.S. in treated *B. truncatus* with *Trichodesma* extract (Hermaphrodite region). X = 400

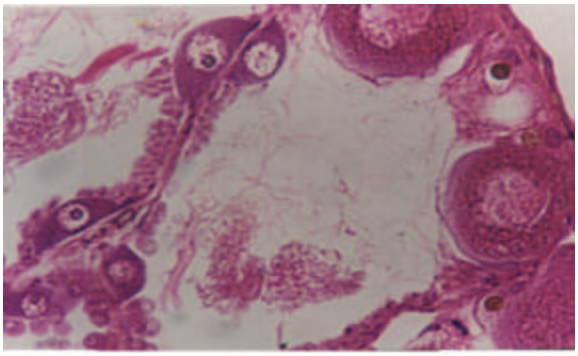


Fig. 21: T.S. in treated *B. alexandrina* with *Gomphocarpus* extract showing inhibition of gametogenesis. X = 400

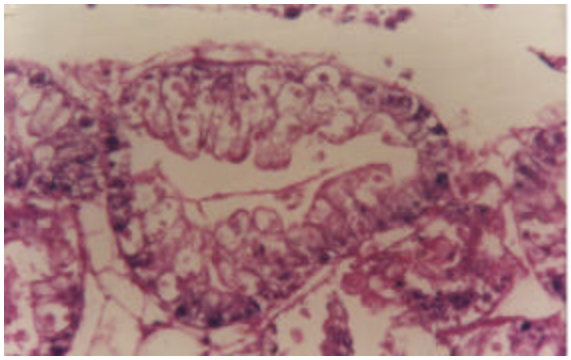


Fig. 24: T.S. in treated *B. alexandrina* with *Trichodesma* extract (digestive gland), X=200.

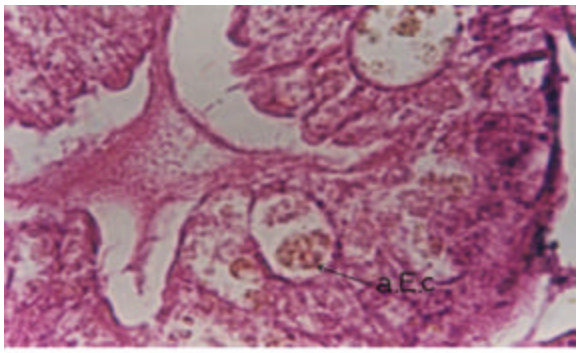


Fig. 22: T.S. in treated *B. truncatus* with *Trichodesma* extract - digestive region. X = 400

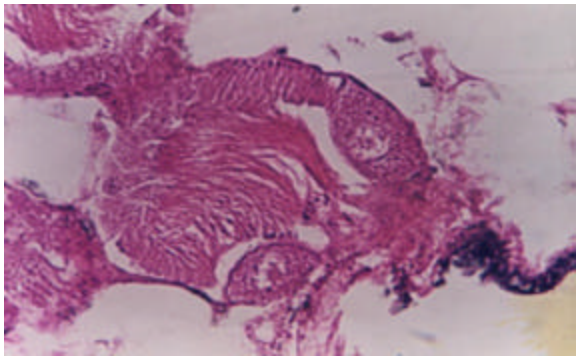


Fig. 25: T.S. in *B. alexandrina* treated with *Trichodesma* extract showing the hermaphrodite follicle, X = 200

Histopathological changes: Normal gut region, (Figs. 1, 2), shows 3 types of cells, normal columnar epithelia (Ec), secretery cells (sc) goblet cells are also appeared. Cells are settled on a basement membrane nuclei are distinct and settled on the basal portion of the cell. The digestive tract composed of bilobed tubulo acinar gland (Ac), acini attached with a cennective tissue (con.t.). The hermaphrodite region (Figs. 3-5) shows mature ova (o), spermatozoa (sp), the ancel's layer (An.l), spermatocytes (spc) and oocytes (oc). Snail treatment with *Origanum syriacum* exract showed great pathological signs to digestive and hermaphrodite gland. Treated *Biomphalaria* with *Origanum* (Fig. 6) showed enlargement of epithelial cells (Ec), cavity of goblet cells is enlarged (gc) and filled with cell debries (cd), severe damage was observed on digestive gland of *Bulinus* after treatment with *Origanum* (Fig. 7), cells lost its regular shape, it appeas empty from cytoplasm, nuclei could not be detected, while some hermaphrodite acini appeared empty from gametocytes (Fig. 8) with destruction of germinal epithelial layer. Inhibition of spermatogenesis is realized but littte mature ova could be detected. Cell abberation and nuclei desentigration appeared as signs of *B. alexandrina* treated with *Cleome* extract. Disappearance of secretory cells from the digestive tubules is realized (Fig. 9), hermaphrodite follicles lost its normal architechture with degeneration of all stages of spermatogenesis (Fig. 10). Treated *Bulinus* with *Cleome* extract showed complete destruction of digestive epithelial cells (Fig. 11) and complete inhibition of gametogenesis can be assured in (Fig. 12). Treatment with *Fagonia* extract have also great effect (Fig. 13-15). Treated *B. alexandrina* showed elongation of epithelial gut cells, its apical margin appeared empty from cytoplasm, margined chromatin of the nuclei appeared (Fig. 13). In treated *B. truncatus* hypertrophy of cells with reduced acini appeared. The lumen was filled with cell debries. Inhibition of spermatogenesis and detachment of germinal epithelial layer of the hermaphrodite gland of treated *B. alexandrina* was detected (Fig. 15).

Artemisia judaica destroyed the normal shape of the epithelial cells of the digestive gland, nuclei disappeared from the columnar cells. Vacuoles filled with abnormal substances appeared within the acini (Figs. 16 & 17). Absence of most developmental immature stages was detected in the hermaphrodite region but mature ovum was almost normal with the appearance of vacuoles in the connective tissue region (Fig. 18).

B. alexandria and *B.truncatus* treated with *Gomphocarpus sinaicus* (Fig. 19 and 20) showed great damage to the epithelia, it lost its shape, appeared empty from cytoplasm with pyknotic nuclei. Accumulation of abnormal substances within large vacuoles appeared, secretory cells were lost, while the hermaphrodite region showed mature ova and sperms with the absence of immature stages of oogenesis and spermatogenesis (Fig. 21).

Trichodesma extract caused vacuoles between epithelial cells of *B.truncatus* which lost its definitive shape (Fig. 22) but great damage appeared within the reproductive region (Fig. 23), destruction of gametogenesis and abnormal ova in shape and number are observed. The opposite was realized after treatment of *B. alexandrina*, where the great damage appeared in the epithelial region, the cells seemed to be empty, secretory cells disappeased, connective tissue between shrinked acini was damaged (Fig. 24) while slight damage was observed within the hermaphrodite region (Fig. 25). In spite of the presence of mature ova and sperms, absence of oocytes on spermatocytes is noticed.

DISCUSSION

Screening the potentcy of plant exctracts as malluscicides is an emerging trend in controlling medically important snail vectors of humam and animal diseases [1-9,12,23]. All tested six plant extracts proved its molluscicidal activity against the medically portent snails, *Biomphalaria alexandrina* and *Bulinus truncatus*. In all bioassay tests, comparing LC50 values (Tables 1-6), *B. truncatus* was more susceptible than. *B. alexandrina* to plant extracts. *Origanum syriacum* (Za'ater) and *Cleome arabica* (Ziyeta) showed the highest toxicity againt both snails. LC50 values are (7.65, 6.16 ppm) for *B. alexandrina*, *B. truncates* after treatment with *Origanum.* LC50 values of *Cleom arabica* extract are (28.87, 22.88 ppm) for *Biomphalaria* and *Bulinus* respectively. These small values of lethal doses explain the severity of the histopathological signs and disconfiguration of snail proteins after treatment with these two plant extracts. *Fagonia* extract also gives satisfactory results. (LC50) values are (73.68, 69.78 ppm) for both snails of the same order.The three plant extracts are known to *Contaim* tannins, trypsin, uscarin calotropin, thymol, coryophllene and calotroxin, which may cause the high molluscicidal activity of these three plants [23, 24]. *Artemisia* is the least potent extract with high LC50 value (Table l). Toxicity of plant extracts against *Biomphalaaria* and Bulinus was previously detected [2, 4, 5, 9, 10, 11, 18, 21, 26, 27 & 28].

Treatment with plant extracts affects snail body proteins in a dramatic way. It is realized that normal *Biomphalaria* proteins of high molecular weight (228KD), disappeared after all treatment (Table 7). It seems to be divided to smaller fractions of 209.09, 198.9, 193.09, 188.73 and 169.82 KD) which are not detected in untreated *Biomphalaria* (Lanes 8, 7, 6, 4, 5). Other normal protein bands are totally disappeared as (103.87, 33.4 KD) as shown in (Lane 9). Common proteins between untreated and treated *Biomphalaria* snails have MWt. (˜62.5 & 19.2 KD). It seems that low molecular weight proteins of *Biomphalaria* are more resistant to treatment than high molecular weight ones.

Protein profile of *Bulinus* is different. Treatment with plant extracts increase numbers of protein bands (Table 8). Disappearance of the highest normal protein of (186.8 KD) could be detected. Detection of smaller fractions appeared in (Lanes 3, 4, 5, 6, 7, & 8 - Table 8) due to plant extract treatments. Two commen bands between untrealed and plant treated snait have the same molecular weights of ˜ 54.4 and 13.39 KD. Protein changes due to snail treatment with plant extractes was previously detected by [7, 11, 19].

It seems that the target tissues for the tested plant extracts were the hermaphrodite gland and the digestive tract. Distruction of the epithelial layer, preciptation of forign, materials within the cytoplasm, vaculation, destruction of secretory cells and *failiur*e to have complete ova are the histoathological signs detected after snails treatments with plant extracts. Similar signs were detected after treatment of snails with otherplant extracts [8, 10, 20, 25].

In general, the use of plant extracts demonstrates a promising molluscicidal activity against *Biomphalaria alexandrina* and *Bulinus truncatus*. The plant species *Origanum syriacum*, *Cleome arabica* and *Fagonia mollis* recorded the least doses required to kill half of the populations of the two snails. Degradation of proteins and the histo-pathological signs after treatment with *Organum* and *Cleome* extracts introduce these plants as candidates to be mollusciscidal agents.

REFERENCES

1. Belot, J., P. Bornarel, M. Diouf and A.M. Polderman, 1991. Ambrosia maritime L: Molluscicidal effects on the local snails *Lymnaea natalensis*, *Bulinus forskalii*, *Bulinus globosus* and *Biomphalaria pfeifferi* from Senegal. Plant Science (Limerik), 74(2): 167-170.
2. Ferrer Lopez, J.R., R. Sanchez Noda, G. Perera de Puga, M.Y. Cong and J. Sanchez Noda, 1993. Laboratory studies of the molluscicidal action of the maguey (*Agave legrelliana*) on *Biomphalaria havanesis*. Rev. Cubana. Med. Trop., 45(2): 118-21.
3. Osuala, F.O.U. and V.N. Okwuosa, 1993. Toxicity of *Azadirachta indica* to freshwater snails and fish, with reference to the physicohemical factor effect on potency. Applied parasitology, 34(1): 63-68.
4. Rawi, S.M., H. El-Gindy and A. Abd El-Kader, 1996. New possible molluscicides from *Calendla micrantha officinal* and egg-laying effects against *Biomphalaria alexandrina* and *Bulinus truncatus*. exotoxical. Environ. Saf., 35(3): 261-7.
5. Zidan, Z.H., A.M. Abdel Hafez, M.I. Abdel-Megeed, M.A. Emam, F.M. Ragab and F.A. El-Deeb, 1998. Susceptibility of *Biomphalaria alexndrina* to the plant *Azolla pinnata* and some aerbicides in relation to infection with *Schistosoma manosoni* miracidia. J. Egypt. Soc. Parasitol., 28(1): 89-100.
6. Alves, T.M., A.F. Silva, M. Brandao, T.S. Grandi, E. Smania, A. Junior and C.L. Zani, 2000. Biological screening of Brazilian medicinal plants. Mem. Inst. Oswaldo Cruz, Rio de Janeriro, 95(3): 367-373.
7. Aly, S.A., H.F. Aly, N. Saba-el-Rigal and E.M. Sammour, 2004. Induced changes in biochemical parameters of the molluscan tissues non-infected using two potent plants molluscicides. J. Egypt Soc. Parasitol., 34(2): 527-42.
8. Rondelaud, D. and G. Dreyfuss, 1996. The development of tissue lesions in the snail *Lymnaea glabra* exposed to a sublethal dose of molluscicide. Vet. Res., 27(1): 79-86.
9. Brackenbury, T.D., 1999. The molluscicidal properties of *Apodytes dimidiate* (Icacinaceae): geographical variation in molluscicidal potency. Ann. Trop. Med. Parasitol., 93(5): 511-8.
10. Brackenbuury, T.D., 1999. Gross histopathological effects of an extract of *Agave attenuata* on the epithelium of the digestive tract of *Bulinus africanus*. Ann Trop. Med. Parasitol., 93(5): 519-526.
11. Rawi, S.M., H.I. El-Gindy and A. Abd-Kader, 1993. The effect of some molluscicides on total protein, albumin, globulin and total lipid of the snail *Biomphalaria alexandrina*. Bull. Fac. Sci., Cair Univ., 61: 87-101.
12. Ahmed, A.H. and M.M. Rifaat, 2004. Molluscicidal and ceercaricidal efficacy of *Acanthus mollis* and its binary and tertiary combinations with *Solanum nigrum* and *Iris pseudacorus* against *Biomphalaria alexandrina*. J. Egypt Soc. Parasitol. Dec., 34(3): 1041-50.

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Comparative Study on the Effect of Some Plant Extracts on the Biology, Body Tissues and Protein Contents of Two Medically Important Snails

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Abstract: Six local plant extracts proved to have molluscicidal activity against the vectors of Schistosomiasis, *Biomphalaria* and *Bulinus* snails. The extract *Origanum syriacum* (Za'atar) showed the highest toxicity against the two test snails, with LC50 values 7.65 and 6.16 ppm for *Biomphalaria* and *Bulinus* respectively. Under the test treatment, *Bulinus truncalus* is more susceptible to the tested plant extracts than *Biomphalaria alexandrina*. Histological studies proved that the site of action of all tested plants was localized in the digestive system and hermaphrodilè gland. Body total proteins of the two test snails are also affected by the treatment, where many proteins were totally inhibited or subdivided to smaller peptides.

Key words: Plant extract · *Biomphalaria* · *Bulinus* · Histopathology · Biochemical changes

INTRODUCTION

One of the new trends in the biological control of vectors of diseases is testing the toxicity of plant extracts as alternatives to chemical pesticides which proved to be environmentally safe and have less residual activity. In the recent years, several extracts of plant origin have been studied against snail-transmitted parasites. Leaves of *Ambrosia maritime* showed molluscicidal effect against indigenous snails, *Lymnea natalensis*, *Bulinus forskalii* and *Bullinus globosus* in Senegal [1]. Molluscicdal action of Agava juice (*Agava Legrelliana*) on *Biomphalria havanensis* was studied by Ferrer Lopez et *al.* [2]. Osuala and Okwuosa [3] recorded 100% mortality when tested stembark neem plant at concentration 100mg L^{-1} of *Azadrirachta indica* against *Biomphalaria pfeifferi*, *Bulinus tuncatus* and *Lymnaea natalensis* after 24hr exposure. Crud extract of *Calendula* plant was more toxic than *Ammi mafus* when tested against two snail vectors of schistosomiasis [4].

The dry powder of the plant *Azolla pinnata* was found to induce toxicity when tested against *Biomphalaria alexandrina* snail [5]. Alves *et al.* [6] screened molluscicidal activity of sixty medicinal plants from Brazilian savanna against *Biomphalria globrata*. Plant extracts can affect the biochemical and histological properties of the medically important snails, it inhibit transaminase activity, change the level of protein content [7]. Necrosis of the epithelial cells of the digestive system of plant extract treated *Lymnea glabra* was detected [8]. Brachenburry [10] examined the effect of crude plant extract of attenuate *Agave* against *Bulinus africanus* as an intermediate host of schistostosomiasis and realized the loss of epithelial cilia of the alimentary canal and disruption of this layer, as signs of molluscicidal effect. Snail's total proteins are also affected through treatment with extracts of different plants [11,12].

This study compares the histopathological and biochemical variations which may occur after treatment of *Biomphalaria alexandrina* and *Bulinus truncatus* with extracts of different local plants.

MATERIALS AND METHODS

Mentainance of snails: Laboratory colonies of *Bulinus truncatus* and *Biomphalaria alexandrina* were raised according to Liang [13]. The blue green algae (*Nostac muscorum*) was used as food for newly hatched young snails [13] and Lettuce leaves for mature ones.

Tested Plants: Six native plants were used during research, *Boyceran*: *Artemisia judaica*, (Compositae), Shaka'ah plant, *Fagonia mollis* (Zygophyllaceae). Haragal, *Gomphocarpus siniacus* (Asclepiadaceae).

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13. Liang, Y.S., 1973. Cultivation of *Bulinus (physopsis) globosus (Morelet)* and *Biomphalaria pfeifferi* pfeifferi (Krauss) snail. Hosts of schistosomiasis. Strekiana, 54: 7-23.
14. Abbott, W.S., 1925. A method of computing the effectiveness of an insecticide. J. Econ. Entomol., 18: 265-267.
15. Finny, D.J., 1971. Probit analysis. Cambridge University Press, 3rd ed. London.
16. Loury, O.H., S.J. Rasenbrough, A.L. Farr and R.J. Rondall, (1951): Protein measurement with the folin phenol reagent. J. Biol. Chem., 193: 265-275.
17. Ibarra, J.E. and B.A. Federici, 1986a. Isolation of a relatively non-toxic 65- kilodalton protein inclusion from the parasporal body of *Bacillus thurirgiensis* subsp. israelensis. J. Bacteriol., 165: 527-533.
18. Al-Mathal E.M. and M.A. Fouad, 2006. Effect of Commiphora molmol on adults, egg masses and egg-deposition of *Biomphalaria arabica* under laboratory conditions. J. Egypt Soc Parasitol., 36(1): 305-14.
19. El-Sayed, K.A., 2006. Effect of the plant *Cupressus macro-carpa* (Cupressacea on some haematolo-gical and Biochemical Parameters of *Biomphalaria alexandrina* snails. J. Egypt Soc Parasitol., 36(3): 911-24.
20. Roses, N., M. Poquet and I. Munoz, 1999. Behavioral and histological effects of atrazine on freshwater mollusces (*Physa acuta* Drap. And *Ancyius fluviatilis* Mull. Gastropoda). J. Appl. Toxicol., 19 (5): 351-6.
21. Schall, V.T., M.C. Vasconcellos, R .S. Rocha, C.P. Souza and N .M. Mendes, 2001. The control of the schistosome-transmitting snail *Biomphalaria glabrata* by the plant molluscicde *Euphorbia splendens* var. *hislopii* (Syn *milli* Des. Moul): a longitudinal field study in an endemic area in Brazil. Acta Tropica., 79: 165-170.
22. Shoeb, H.A., M.M. El-Sayed and A.M. Khalifa, 1990. Some Egyptian plants with molluscicidal activity. Egypt. J. Bith., 12(1-2): 35-43.
23. Souza, C.P.D., N.M. Mendes, L.K. Jannotti-Passos and J.P. Pereira, 1992. The use of cashew nut shell of caju (*Anacadium occidentale*) as alternative molluscicide. Revista Do Instituto De Medicina Tropical De Sao Paulo., 34(5): 459-466.
24. El-Yassaki, M.W. and M.M. El-Sayed, 1996. Botanical extracts exhibt double action against *Culex pipiens* larvae and *Biomphalaria alexandrina* snails. Medical, Feterinary. Edinburgh, Scotland, pp: 171-176.
25. El- Sayed, M.M., M. Abdel-Hadi and H.A. El-Nahas, 1991. Molluscividal activity and clinico-pathological effect of *Agave lophantha*. Arch. Pharm. R., 14(1): 81-6.
26. Diaz Garces, R. and J.R. Ferrer Lopez, 1996. Effect of lethal doses of plants of the Agavaceae family on the cardiac activity and oviposition of *Biomphalaria havanesis* (Mollusca: Planobidae). Rev. Cubana Med. Trop., 48(1): 15-20.
27. Al-Zanbagi, N.A., J. Barrett and A.A. Banaja, 2001. Laboratory evaluation of the molluscicidal properties of some Saudi Arabian euphorbiales against *Biomphalaria pfeifferi.* Acta tropica, 78:23-29.
28. Abdel Hafez, A.M., Z.H. Zidan, M.I. Abdel Megeed, M.A. El-Emam, F.M. Ragab and F.A. El-Deeb, 1997. Effect of the plant *Azollz pinnata* on survival, growth rate, *Fecundity* and hatchability of egg-masses of *Biomphalaria alexandrina* snails. J. Egypt. Soc. Parasitol., 27(3): 825-841.