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# EFFECT OF CASTOR PLANT (*RICINUS COMMUNIS*) EXTRACTS ON THE TERRESTRIAL SNAIL *MONACHA OBSTRUCTA* (FERUSSAC)

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## Abstract

A study on the effect of castor plant *(Ricinus communis)* extracts on the mortality rate of terrestrial snails, *Monacha obstructa* (Ferussac) was carried out. Results indicated that fruit ethanol extract was the most effective, followed by fruit and leave water boiling extracts. The highest toxicity concentrations, of boiling water and cold water extracts, were 5%, 4%, 3%, 2% and 1% gm. The ethanol extract of castor fruit also showed high toxicity, on *Monacha obstructa* (Ferussac), at concentrations of 2%, 1%, 0.5 %, 0.1% and 0.05% gm. Fruit and leave hot water extract treatments showed higher mortality rate of 96% after 72 hrs., 88% after 48 hrs. and 76% after 24 hrs., while the mortality rates of fruit and leave cold water extract treatments were 92% after 72 hrs., 72% after 48hrs. and 32% after 24hrs. Snail treatment with castor fruit powder extracts showed high mortality rate of 84% after 72 hrs., while the treatment of snails with soaked green fruit showed low toxicity and low mortality rate of 40%. When using the juice of green castor fruits it showed high mortality rate 88%.
***Keywords*:** *Ricinus communis* extract, *Monacha obstructa,* toxicity, fruits, leaves, juice.

## Introduction

The repeated use of chemical pesticides, in agriculture pest control programs, led to the development of many serious problems affecting the control success. From these problems are pest resistance to these pesticides and the pollution of the environment. Therefore, there is a growing need to find new natural pesticides, which have a strong effect against pests but safe and friendly to the environment in order to ensure the future safe of agriculture food required for world population without destroying the ecosystems. To reach these goals, researchers began to explore alternative, less expensive and environmentally friendly, pesticides derived from naturally toxic plants.

Land snails are prevalent in many Governorates in Egypt. *Eobania vermiculata* (Müller) and *Monacha obstructa* (Ferussac) caused severe damage to different economic plants (El-Okda, 1979, 1980, 1984 and Azzam, 2006). The controlling of these dangerous pests essentially depend on molluscicidal applications.

Researchers study the effect of several plant extracts on the mortality rate of pest snails. Hilal *et al*. (1989) showed that the ethanolic extract of *Anagallis arvensis* L. spp. *arvensis* and the purified total saponin isolated there had considerable molluscicidal and cercaricidal properties.

Youssef (2006) studied the effect of diluted ethanolic extracts of wormseed (*Artemisia cina*), lemongrass (*Cymbopogon citratus*), senna (*Casia acutifolia*), geranium (*Pelargonium graveolens*) and sweet basil (*Osimum basilicum*), on the mortality of *E. vermiculata, M. obstructa* and *Theba pisana* (Müller).

Abdallah *et al*. (2011), evaluated the molluscicidal effect of leaf extracts from *Calotropis procera* and *Nicotiana tabacum* and from the seeds of *Trigonella foenum* plants against *Bulinus truncatus* snails. He mentioned that these three plant extracts should be used as molluscicidal agents. Aboul. Zahab and El-Ansary (1992), proved molluscicidal effect of methanolic extract of *Lupinus albus* against *Biomphalaria alexandrina*

The present investigation study the effect of *Ricinus communis* extract on the most abundant terrestrial snails *E. vermiculata*.

## Materials and Methods

### Collection of plant samples and snails

Plant specimens (fruits-leaves) were collected and placed in plastic bags on 5/1/2017. Samples of terrestrial snails were hand-picked from infested fields Alfalfa plant located in Shebin Alkomat Menofyia Governorate. Snails were transferred to the laboratory, identified to species. Every species individuals were kept, in a terrarium with a suitable size to their number, and kept, for 30 days under laboratory conditions, for adaptation. Suspected and moribund snails were excluded to ensure the freedom from parasitic or pathogenic organisms. The molluscicidal activity of castor plant extracts were tested with the same technique used by Azzam and Belal (1999 and 2002). Bioassays were carried out according to Azzam and Belal (1999).

### Preparation of plant extracts

### Ethanol Extract

Preparing extracts were conducted by grinding the fruits of castor until getting a fine powder, and then placed it in two flasks 500 gm. each. The powder was soaked in ethanol solvent for 72 hours. The extracted solution was evaporated by rotary evaporator until complete dryness, then weighted and solved in a certain amount of ethanol to prepare the stock solution. This solution was diluted to the desired concentrations (2%, 1%, 0.5 %, 0.1 % and 0.05).

**Preparation of water extracts**

The method of Metspalu *et al*. (2001b) was adopted for the preparation of water extracts from castor plant fruits and leaves. Amount of 100 g of leaves or fruits were placed in a 1000 mL flask glass containing 600 ml cold water. The plant material was mixed with the electric.

Mixer and the solution was covered and left for 72 hrs. The solution was then liquidated and leachate and used to obtain dry raw materials. The same method was followed with the remaining plant extracts but by replacing cold water with boiling water. The raw materials were then tested for the effect of cold water and boiled water extracts on the snail *M. obstructa*.

**Preparation of green fruit juice**

Also juice was the fruit of green castor plant by cutting the fruit into small parts 'then hit in the electric mixer' then filtered take the juice 'made it concentrations and treatment of snails.

**Preparation of socked fruit**

The fruits of castor plants were cut into small pieces and then cast the castor pieces in cold water for 72 hours and then filtered and took the soaking solution for the treatment of snails.

**Biological experiments**

A total of 5 replicates were applied for each of these extracts with 1.5 mL of concentration / replicates each 5 snails for replicate. Results were then taken after 24, 48 and 72 hours and mortality ratio was calculated.

**Statistical analysis**

Analysis of variance was conducted using ANOVA (SAS Institute, 1998). Means separation was conducted using L.S.D from the same program SAS users guide, Statistics, SAS Institute, Cary, NC.

**Fragmentation of castor extracts water**

Qualitative and quantitative profile of curcumin from ethanolic extract of *Curcuma longa*.

LC – MS/MS4000 Qtrap Applied Biosystems citito Nitro – Water – Formic acid.

The extracts were analyzed at the Food and Feed Center of the Agricultural Research Center of the Ministry of Agriculture.

## Results and Discussions

Statistically, Table (1) showed a high correlation between concentration and mortality that is, the higher the concentration, the higher the mortality rate. Also, there is a direct correlation between the ratio of death and time, which increases the mortality rate over time. On the other hand, one of the highest mortality rate extracts is the boiled castor fruits 96% followed by the cold castor fruits 92%. The same trend was shown in Table (2) that is, there is correlation between increased mortality rate with increased concentration and time.

Table (3) shows that the treatment of snails with powdered extract of boiled castor fruits led to an increase in the death rate to 84% Compared to the cold extract of the fruits of the castor plant 80% after 72hrs. The lowest mortality rate was observed when snails were treated with the fruits of the green castor plant 40% after 72hrs.

Effectiveness of the different concentrations of $LC_{50}$ and $LC_{90}$ extracts of boiled and cold water from fruits, leaves, juice, and ethanol extract of castor plant on *Monacha obstructa* was summarized in tables (4-6).

The results showed in Table (4) the high activity of the extract of the castor fruit with boiling water and the various treatments on *M. obstructa*, $LC_{50}$ of the extract of the boiled fruit was recorded 7.755 ppm fiducially limited 95% (5.563 - 10.439), it was for the same extract recorded 35.119 ppm, fiducially limited 95% (22.712 – 75.231).the extract castor fruit with cold water $LC_{50}$ recorded 11.158 ppm, fiducially limited 95% (6.591 – 20.117), Also recorded $LC_{90}$.

163.918 fiducially limited 95% (59.652 – 2963.78). The castor leaves extract with boiled water $LC_{50}$ is recorded 18.066 ppm, fiducially limited 95% (14.368 – 22.564) $LC_{90}$ recorded 53.688 ppm , fiducially limited 95% ( 38.942 – 94.873), castor leaves extract with cold water $LC_{50}$ is recorded 25.653 ppm, fiducially limited 95% (19.981 – 30.441), ) $LC_{90}$ for the same extract 60.530 ppm, fiducially limited 95% (48.821 – 89.307). It was recorded $LC_{50}$ for green fruit juice of castor17.860 ppm fiducially limited 95% (13.182 – 22.669) $LC_{90}$ recorded 63.728 ppm fiducially limited 95% (46.977 – 104.289). The ethanol extract of the castor $LC_{50}$ was recorded 0.215 ppm fiducially limited 95% (0.0654 – 0.4734), $LC_{90}$ recorded for ethanol extract 16 .1279 ppm fiducially limited 95% (3.5150 – 2490.13)

Table (5) showed that the extract with boiled and cold water of the fruits of the castor plant significantly outweighs its effectiveness and the high mortality rate in snails compared to the extract of boiling water and cold leaves of castor plant. This may be due to the fact that the active compounds in the castor plant are alkaline salts that dissolve better in the solvents of the Al-Qudbi including the water, which has good melting properties (Harborne, 1984). The boiling water extract of the castor fruit gave high effect on the snails with high mortality rate.

This may be due to the effect of boiling water on inhibition of the efficiency of the enzymes of active compounds such as Esterase, Phenolase and Hydrolase, which was not affected by cold water extract (Harborne, 1984). It has been reported that the water extracts of leaves of castor plant have a deadly effect on the larvae of the second phase and fourth stage of *C. pipenis* (Aouinty *et al*., 2006). Study is to detect the effects of leave and bark extracts of *R. communis* on the snail vector of Schistosomiasis in order to control the bilharzia disease (Mohammed *et al*., 2015). The best concentrations that gave a significant effect were 5% and then 4%, 3%, 2%, 1% In other words, the concentration is directly proportional to the mortality rate in the snails. The greater the concentration, the greater the mortality rate in the *E. vermiculata.* And that the best time to have a high impact on the snails is after 72 hours and then 48 hr and then24 hr, that the higher the exposure period of the extract increases the death rate on the snails. The same conclusion was reported also by Abdel-Megeed *et al.* (2000) on the Bactospine and florbac against *B. alexandrina* .It was also clear that effect of extract increased with the increase of exposure period. Similar conclusion was observed by Shoeb *et al.* (1988), on *B. alexandrina* treated with *Buddleja madagascariensis* extract Bakry (2009), methanolic extracts

of *Euphorbia* recorded significant reduction of *B. alexandrina* survival.

Table (6) indicates that the treatment of snails with the water extract of the castor bean boiled and cold showed a high significant effect and an increase in the mortality rate of snails by causing drought in the shell body by withdrawing water from it .Also, the mortality rate in the snails increases with the period of exposure to the extract, the highest effect after 72 hrs. When snails are exposed to water soak the castor showed a low effect compared to the rest of the treatments and also increased the proportion of death after passing72 hrs.

On the other hand, when the snails were fed on lettuce leaves treated with different extracts from the castor, there was a refusal to eat that these extracts had a repellent effect on the snails; this is shown in Fig (2). Chevalier *et al.* (2000) found that *Helix aspersa* snails reject feeding on *Lupinus albus* and rejection of the chemotype with high alkaloid content of associated with an increase in the amount of alkaloids.(Azzam et al 2014) Concerning the effect of lupine extract on terrestrial snails no mortality occurred with the concentrations used with aquatic snails , when increasing the concentration to 3,5,7 and 9% anti feeder effect was observed with the snail *Eobania vermiculata* .

Fig. (3, 4, 5, and 6) indicates the most important active substances in the water extract of castor fruits. Reicin is highly toxic for its ability to penetrate the cells of the body and prevent the production of the protein necessary for its vital functions, thus destroying cells in all organs of the body, leading to death. resulting from the analysis of a device LC – MS/MS4000 Qtrap Applied Biosystems citito Nitro – Water – Formic acid. LC – MS/MS4000 Qtrap Applied Biosystems citito Nitro – Water – Formic acid.

## Conclusion

In general, there are two types of physiological effects that are caused by toxic compounds of the pest tissue (Sukumer *et al*., 1991; Kuusik *et al*., 2001) which are the indirect effects of the toxin, the malfunction of the neural secretion system, or the direct effect of the action of toxic compounds on specific tissues called target tissues or because of toxic compounds that inhibit the effectiveness Digestive Enzymes of protein. The substance is very toxic to its ability to penetrate the cells of the body and prevent the production of protein necessary for its biological functions, and thus the destruction of cells in all organs of the body, leading to death. This is the substance found in the plant castor and derivatives, which appeared in the analysis of castor extract samples. The boiling water extract showed a high effect compared to the rest of the treatments due to the effect of the inhibition of boiling water of the enzymes of the active compounds which were not affected by the cold water extract.

## Recommendations

In this study, we recommend using the castor plant extract for its high effectiveness in the control of snails, in view of the fact that a widespread plant and an economic plant. And that the water extract of the castor plant does not need expensive solvents because it was extracted by water and this is available to anyone who wants to use it for control, but after it is applied field.

**Table 1 :** Cumulative percentage mortalities of *Monacha obstructa* exposed to different concentrations of castor plant extract at 28± 2 ºC .

| **Concentrations (%)** | | | | | | | | | | | | | | | | | | **Treatments** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mortality(%) after 72 hrs** | | | | | | **Mortality(%) after 48 hrs** | | | | | | **Mortality(%) after 24 hrs** | | | | | | |
| 5 | 4 | 3 | 2 | 1 | Cont | 5 | 4 | 3 | 2 | 1 | Cont | 5 | 4 | 3 | 2 | 1 | Cont | |
| 96 | 92 | 84 | 80 | 44 | 0 | 88 | 84 | 68 | 64 | 36 | 0 | 76 | 64 | 56 | 44 | 32 | 0 | Hot fruit extract |
| 92 | 80 | 72 | 56 | 40 | 0 | 72 | 64 | 48 | 44 | 32 | 0 | 32 | 28 | 32 | 20 | 12 | 0 | Cold fruit extract |
| 88 | 80 | 72 | 40 | 36 | 0 | 60 | 50 | 40 | 32 | 16 | 0 | 48 | 32 | 20 | 20 | 12 | 0 | Hot leaf extract |
| 88 | 68 | 56 | 48 | 4 | 0 | 50 | 48 | 32 | 12 | 0 | 0 | 52 | 32 | 12 | 12 | 0 | 0 | Cold leaf extract |
| 88 | 80 | 68 | 48 | 32 | 0 | 76 | 64 | 56 | 40 | 24 | 0 | 64 | 48 | 44 | 32 | 16 | 0 | Green fruit juice |

**Table 2 :** Cumulative percentage mortalities of *Monacha obstructa* exposed to different concentrations of ethanolic fruits castor plant extract at 28± 2 ºC

| **Mortality after 72hrs** | **Mortality after 48 hrs** | **Mortality after 24 hrs** | **Concentrations** |
|---|---|---|---|
| 36 | 24 | 8 | 0.05 |
| 44 | 36 | 24 | 0.1 |
| 48 | 40 | 28 | 0.5 |
| 64 | 44 | 36 | 1 |
| 84 | 72 | 48 | 2 |
| 0 | 0 | 0 | Control |

**Table 3 :** Cumulative percentage mortalities of *Monacha obstructa* exposed to different concentrations of castor plant extract tracking and soaked fruits at 28± 2 ºC .

| Treatments | Mortality after 24 hrs | Mortality after 48hrs | Mortality after 72 hrs |
|---|---|---|---|
| Hot fruit extract (tracking) | 16 | 44 | 84 |
| Cold fruit extract (tracking) | 36 | 60 | 80 |
| Soaked green fruit | 30 | 40 | 40 |
| Control | 0 | 0 | 0 |

**Table 4 :** Values of $LC_{50}$ and $LC_{90}$ against *Monacha obstructa* treated with. Ricinus *communis* extract.

| Treatments | $LC_{50}$ | Fiducially limits 95% | | $LC_{90}$ | Fiducially limits 95% | |
|---|---|---|---|---|---|---|
| | | lower | Upper | | Lower | Upper |
| Cold fruit extract | 11.158 | 6.591 | 20.117 | 163.918 | 59.652 | 2963.78 |
| boiled fruit extract | 7.755 | 5.563 | 10.439 | 35.119 | 22.712 | 75.231 |
| Cold leaf extract | 25.653 | 19.981 | 30.441 | 60.530 | 48.821 | 89.307 |
| boiled leaf extract | 18.066 | 14.386 | 22.564 | 53.688 | 38.942 | 94.873 |
| Green fruit juice | 17.860 | 13.182 | 22.669 | 63.728 | 46.977 | 104.289 |
| Ethanol extract | 0.215 | 0.0654 | 0.473 | 16.128 | 3.515 | 2490.13 |

**Table 5 :** Effect of different factors of castor extract on *Monacha obstructa* under laboratory conditions.

| Factors | Levels | Means ± SD |
|---|---|---|
| Treatments | Cold fruit extract | 2.4400 ± 1.318 **b** |
| | Hot fruit extract | 3.3467 ± 1.236 **a** |
| | Cold leaf extract | 1.7333 ± 1.446 **c** |
| | Hot leaf extract | 1.6267 ± 1.412 **c** |
| | Green fruit juice | 2.6000 ± 1.197 **c** |
| | P | 0.0001 |
| | L.S.D | 0.2144 |
| Concentrations (%) | 5 | 3.5200 ± 1.131**a** |
| | 4 | 3.0267 ± 1.273 **b** |
| | 3 | 2.1867 ±1.343**c** |
| | 2 | 2.1867 ±1.037**c** |
| | 1 | 0.9067 ± 00932**d** |
| | P | 0.0001 |
| | L.S.D | 0.2144 |
| Times | 24 hrs | 1.6160 ± 1.156 **c** |
| | 48 hrs | 2.3200 ± 1.342 **b** |
| | 72 hrs | 3.1120 ± 1.471 **a** |
| | P | 0.0001 |
| | L.S.D | 0.166 |

**Table 6 :** Effect of tracking power and soaking of castor plant on *Monacha obstructa* under laboratory conditions

| Factor | Level | Mean ± SD |
|---|---|---|
| Treatments (Tracking) | Hot fruit extract | 2.400 ± 1.549 a |
| | Cold fruit extract | 2.933 ± 1.387 a |
| | P | 0.0001 |
| | L.S.D | 0.6788 |
| Time | 24hrs | 1.300 ± 1.159 c |
| | 48hrs | 2.600 ± 0.843 b |
| | 72hrs | 4.100 ± 0.737 a |
| | P | 0.0001 |
| | L.S.D | 0.8314 |
| Treatments (Soaking) | 24hrs | 1.000 ± 0.577 a |
| | 48hrs | 1.333 ± 0.577 a |
| | 72hrs | 0.666 ± 0.577 a |
| | P | 0.5787 |
| | L.S.D | 1.4891 |

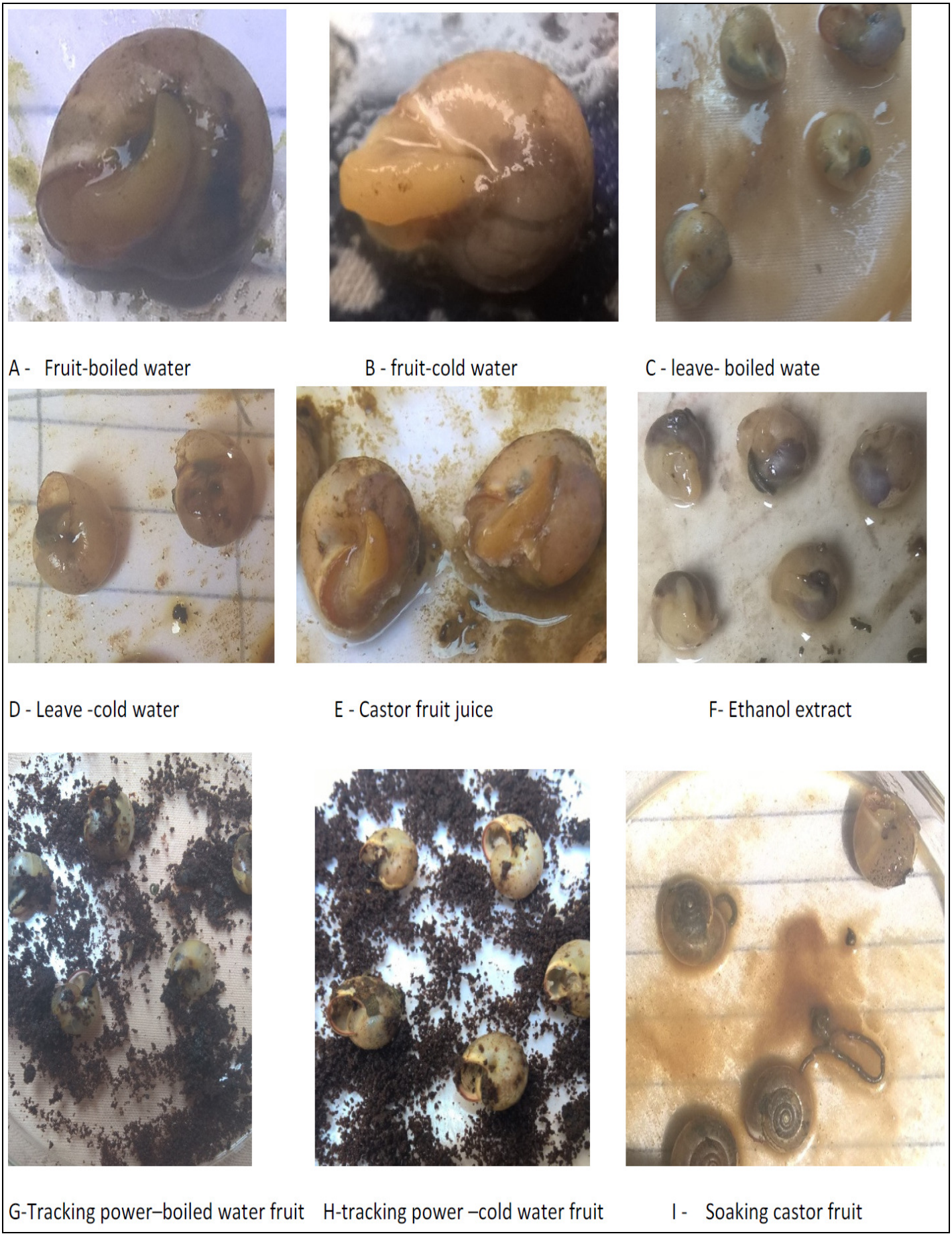
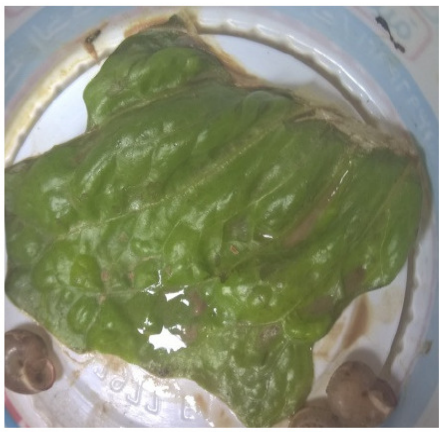



Fig (1): effect of Different treatment of castor extracts on *Monacha obstructa*

A - Fruit-boiled water



B - Fruit-cold water

C- leave-boiled water

D - Leave-cold water

E - Castor fruit juice

F - ethanol extract

G -Tracking power –boiled water fruit

H - Tracking power–cold water fruit

I - Soaking castor

**Fig. 2 :** Residue of 50x50 $ml^2$ of lettuce leaves treated with Castor extracts and eating by *Monacha obstructa in* one day.

**Rinisine m/z 165**

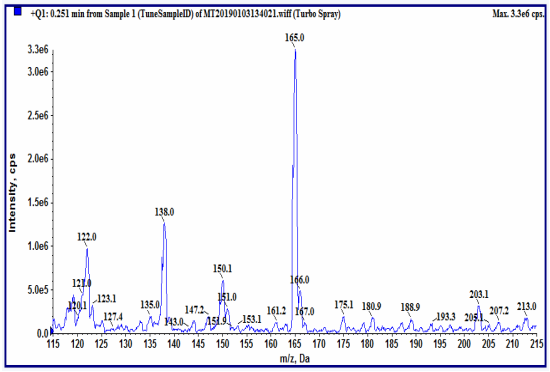



**Fig. 3 :** Fruit-boiled water

**Ricinoleic acid m/z 297**

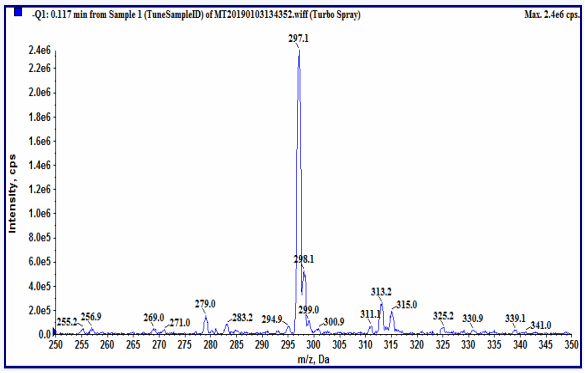



**Fig. 4 :** Fruit-boiled water

**Linoleic acid m/z 281**

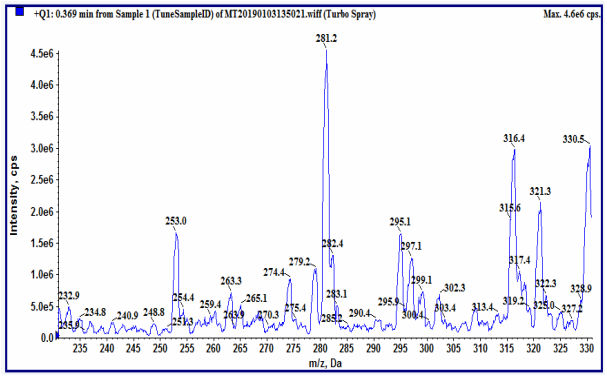



**Fig. 5 :** Fruit-boiled water

**Quinic acid m/z 191**

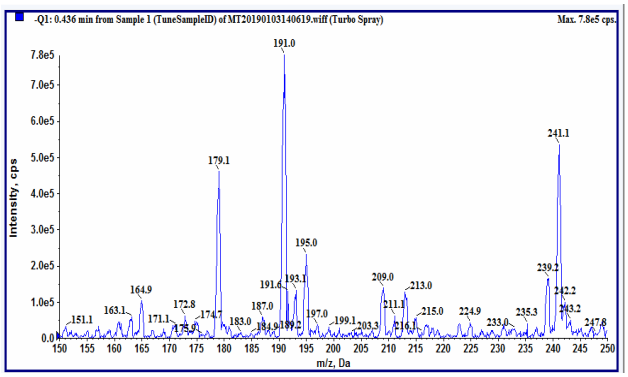



**Fig. 6 :** Fruit-boiled water

Fig (3,4,5,6) indicate the most important active substances in the water extract of castor fruits Reicin is highly toxic for its ability to penetrate the cells of the body and prevent the production of the protein necessary for its vital functions, thus destroying cells in all organs of the body, leading to death.

**Risine m/z 165**

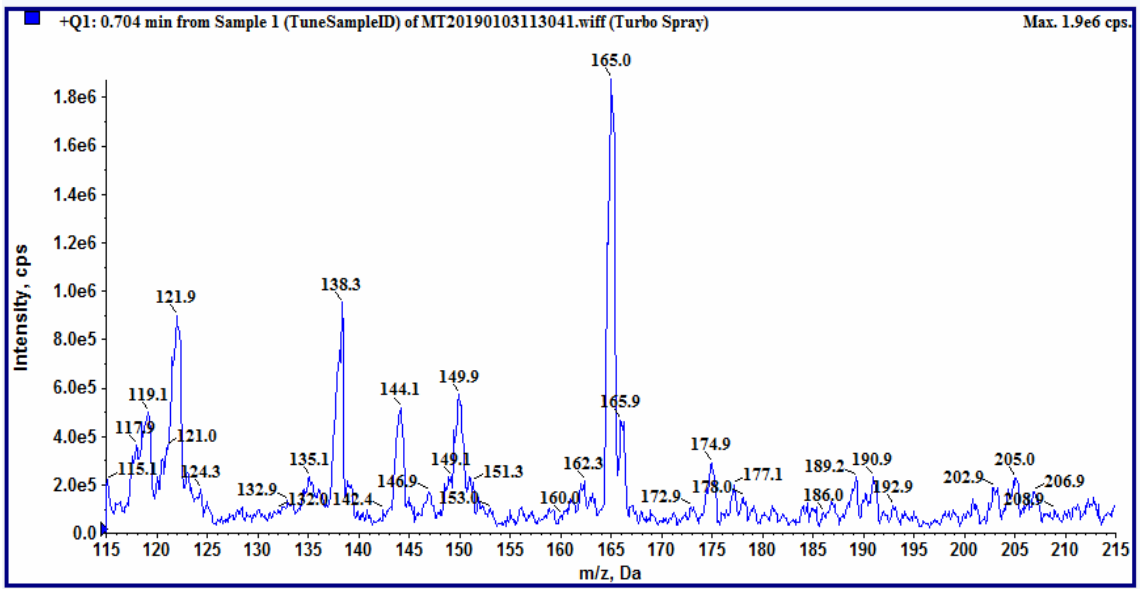



**Fig. 7 :** Leave-boiled water

**Rutin m/z 609**

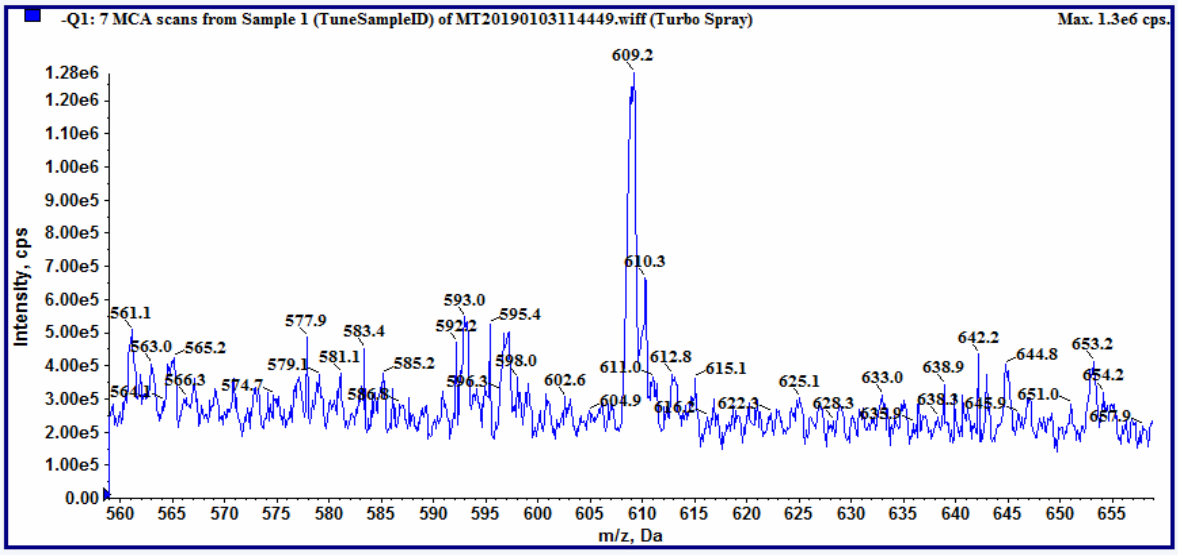



**Fig. 8 :** Leave-boiled water

Fig (7 and 8): indicate the most important active substances in the water extract of castor leave Resulting from the analysis of a device LC – MS/MS4000 Qtrap Applied Biosystems citito Nitro – Water – Formaic acid.

**Risinine m/z 165**

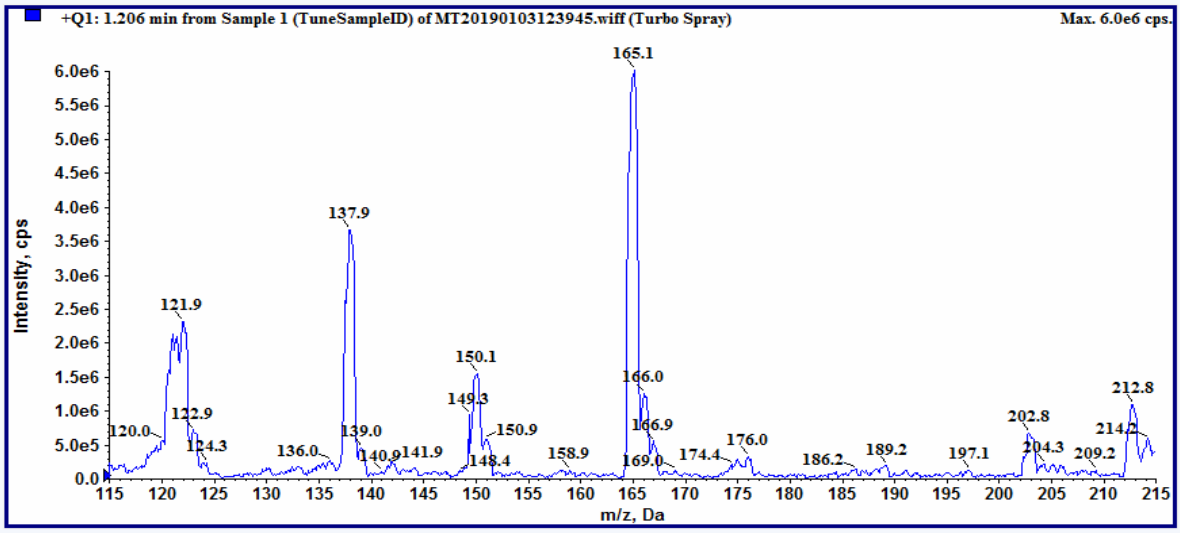



**Fig. 9 :** Castor fruit juice

**Ricinoleic acid m/z 297**

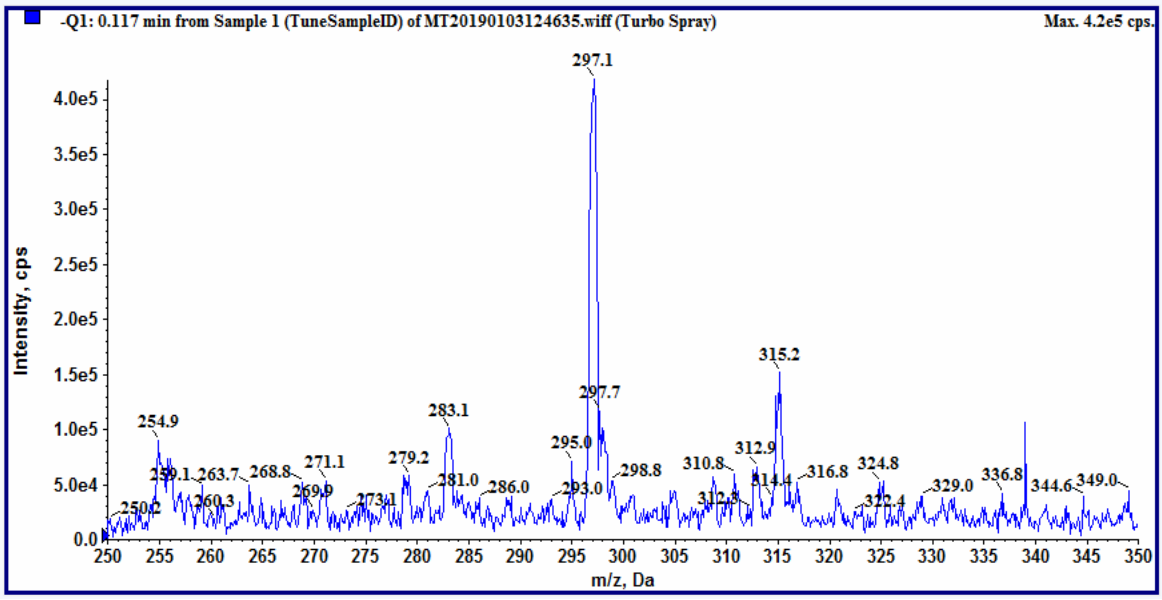



**Fig. 10 :** Castor fruit juice

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