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# Harmful and Beneficial Effects of the Land Snail *Monacha sp.*

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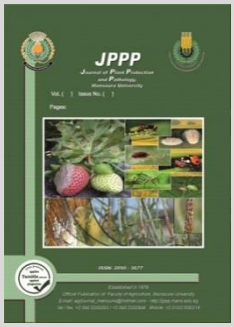


## ABSTRACT

The harmful and beneficial effects of the land snail *Monacha sp*. were studied in Sharkiah Governorate.Harmful effects were brightly observed in microbiological examination of gastropod and mucus in laboratory, and evaluating its damage on cabbage plant in laboratory and field. Microbial examination revealed that the gastropod was contaminated with (*Klepcella*) a harmful bacteria of man and animals and *(Burkhelderia ceptacia*) a non-useful bacteria in mucus. Few data were dealing with contamination of *Monacha* land snail in Egypt so, this study aims to highlight in this respect for taking into a sustainable infection when contact and thoroughly washing vegetables and fruits that are favorable food for *Monacha* land snails.Our results showed noticeable damage of cabbage leaves by *Monacha* snails in laboratory (26. 93%) and field (39. 23%) as a general mean value of cabbage consumption. Beneficial effects were revealed through biochemical analysis of both gastropod and shell components. Analysis revealed that *Monacha sp*.rich in protean (17.9%) and minerals such as calcium, phosphorus, magnesium and potassium. Calcium determined the highest (Ca, 13%), followed by phosphorus (Ph., 0.60%), magnesium (Mg, 0.12%) and potassium (K, 0.094%) so, the second aim of our study is the revealing of the economic feature of *Monacha* land snails as an addition to the fodder of farm animals and in traditional medicine.

***Keywords:*** biochemical analysis, microbial examination, mucus, gastropod, shell, damage, Cabbage, *Monacha sp*.

## INTRODUCTION

Land snails *Monacha species* consider important agricultural pest. Their damage involving considerable financial loss is inflicted on different agricultural crops in different localities of Egypt (Wafaa *et al*., 2018).They cause considerable damage in cabbage plants which be considered a vegetable crop. Economic damage caused by snails is due to not only feeding but also to contamination with their bodies, feces or slime leading to deterioration of the product quality (Heiba *et al*., 2018) and might transmit diseases, or might serve as intermediate hosts for parasites of man and animals. In spite of their previous harmful effects, *Monacha* snails have shining side due to their richness in proteins and minerals especially calcium.They promise to be as an addition in traditional medicine, as addition to herbal remedies for measles, cough and gonorrhea, or to treatwounds, since calcium improves blood clotting, to store medicinal concoctions, as material to produce tooth powder, or as a component of feed for farm animals, particularly layer hens(Houndonougbo *et al.* 2012, Amubode & Fafunwa 2014,Ademolu *et al.* 2015). They are a fundamental ring in the food chain where other animals and birds used snails as a food rich in proteins and minerals (Godan 1983).The present work aimed to throw light on negative and positive aspects of *Monacha* snails for treating negatives and take advantages of positives.

## MATERIALS AND METHODS

**Collection of *Monacha sp.*:**

Mature snails *Monacha sp.* were collected from untreated infested fields at Awlad Sakr district, Sharkia Governorate during the winter of 2020 and were transported into muslin bags to the laboratory (Wafaa *et.al*., 2018). In the laboratory, snails were put in acontainer (1m× 50 cm × 50 cm.) and fed daily for a week on fresh cabbage leaves for acclimatization under laboratory conditions.

**A- Laboratory Experiments:**

**1-Microbiological and biochemical analysis:**

**Sample collection (mucus, gastropod and shell's powder)**

Mucus (5 ml) was collected from roughly 100 individuals by stimulating the surface of alive healthy mature *Monacha* snails by small plastic syringe (5 ml) (Sallam *et al.* 2009). The samples were stored at -20°C in a deep freezer until microbiological examination. Other 100 individuals were washed carefully with tap water, the flesh (gastropod) as a whale mount is removed and kept in sterilized glass container and stored at -20°C in a deep freezer until biochemical analysis of the total protein and microbial examination. The shells are not discarded but allow drying at room temperature and crushed carefully as powder and kept also in sterilized glass container covered carefully until biochemical analysis of mineral salts (Ca, Ph, Mg and K).

**Biochemical analysis and isolation of bacteria in mucus and gastropod:**

Microbiological and biochemical analysis were made in (AHRI) Animal Health Research Institute, Agricultural research center, Egypt.

Isolation of harmful bacteria (*Klepcella*) in the gastropod and non-useful one (*Burkhelderia ceptacia*) in

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mucus of mature snails *Monacha sp.* made in *microbiology Dept.* by Vitek2 device according to Pincus D.H. 2006.

Total Calcium, total Phosphorus and Magnesium in the shell powder and total protean in the gastropod were determined according to AOAC 968.31.201.2016 in biochemistry Dept., but total Potassiumin the shell powderwas determined by (Atomic Absorption Spectrometer) SENS A A TOXICOLOGY UNIT.

**2- Estimation damage of cabbage leaves caused by *Monacha* snails under laboratory conditions:**

This experiment was planned to estimate damage values of cabbage leaves caused by *Monacha* snails under laboratory conditions of Sharkia Governorate during the winter of 2020.Twenty acclimatized healthy individuals were selected for treatment then divided into ten replicates each of which has two snails. A known area (2.5X2.5cm²) of cabbage leaves were offered to snails every 3 days in each replicate in round plastic boxes 12 cm in diameter containing moistened soil.This experiment was conducted for nine successive days from January2$^{nd}$ to 10$^{rd}$.The damaged surface areas of cabbage leaves were detected every 3 days by using the graph.The offered cabbage leaf area was replenished every time (Wafaa *et al*., 2018 ) **.**

**3-Estimation damage of cabbage plants caused by *Monacha* snails under field conditions:**

A field trial was carried out to estimate damage of cabbage leaves caused by *Monacha* snails at Sharkia Governorate under field conditions. Three samples were chosen randomly to conduct the experiment that took three weeks starting from 11 to 31 January 2020.Each sample was artificially infested with labeled 50 healthy mature individuals of *Monacha* snails and caged carefully with pored plastic cage to prevent escaping of snails. Both of the whole leaf surface area in addition to the damaged surface areas was estimated by using the graph at initial and final of the experiment. The percentage of damaged cabbage leaf surface area was calculated according to the equation adopted by El-Deeb *et al*. (1985).

$$\% \text{ damage} = \frac{\text{Area of damaged leaf surface}}{\text{Whole area of leaf}} \times 100$$

## RESULTS AND DISCUSSION

In Table (1), microbial examination showed presence of harmful bacteria (*Klepcella*) in the gastropod and non-useful bacteria (*Burkhelderia ceptacia*) in mucus of *Monacha sp*. Our results agreed with Godan (1983) who showed that molluscs might transmit disease to man and animals. The sources of infection may adhere to the slime on the body of the snail which crawls around, they may be deposited on vegetables, lettuces and strawberries therefore human health is at risk when these commodities are consumed without being thoroughly washed.

**Table 1. Some chemical and biological compositions of the gastropod, mucus and shell of *Monacha sp*.**

| composition | Component | | |
|---|---|---|---|
| | Shell | Mucus | Gastropod |
| Biochemical composition | 13% Ca<br>0.60% Ph<br>0.12% Mg<br>0.094% K | | 17.9% Total protean |
| Microbiological composition | | Burkhelderia ceptacia (non useful bacteria) | Klepcella beneomonia (harmful bacteria) |

The proximate percentages of minerals (calcium, phosphorus, Magnesium and potassium) in the shell of *Monacha snails* are represented in Table 1. According to the results of our study, Calcium was determined the highest in *Monacha* land snails (Ca13%) followed by phosphorus (Ph 0.60%), Magnesium (Mg 0.12%) and potassium (K 0.094%).This current data agree with Ademolu *et al*. (2015) and Kehinde *et al.* (2016). They found that calcium was the most abundant element in the shell. They said that the snail shells are primarily built of calcium carbonate which contributes to the shell's mechanical resistance (Ademolu *et al*., 2015). The high calcium content is the reason for adding snail shells to the fodder of farm animals, particularly layer hens (Houndonougbo *et al*., 2012).The mineral content is known to change by location, biological cycles, season and feeding habits (Özoğul *et al*., 2005)..As rich in minerals, our study shows that *Monacha* snails are also rich in protean (17.9 %) (Table1). The previous studies reported that value of protean for other land snails was, 12.87% for garden snails (*Helix aspersa)* Çağıltay *et al.* (2011), was 16.35 % for wild snail (*Helix pomatia*) Özoğul *et al*.(2005) and was 10.22 % in another study (Olgunoğlu & Olgunoğlu 2009). It has been noted in many studies that nutritional composition may change between species. Factors like collection method location, season and sexual condition are important factors for the nutritional compositions (Ludorff & Meyer, 1973). Data presented in Table (2) revealed cumulative damage, general mean and percentages of cabbage leaf surface area (cm²) consumed by a mature individual of *Monacha* snails during 9 days under laboratory conditions.

**Table 2. Cumulative damage, general mean and percentage of damage in cabbage leaves caused by a mature individual of *Monacha* snails during 9 days under laboratory conditions.**

| Replicate number | Cumulative area (cm²) of cabbage leaves consumed Feeding period (days) | | | Total leaf surface area (cm²) offered | % Damage (after 9 days) |
|---|---|---|---|---|---|
| | (3 days) | (6 days ) | (9 days ) | | |
| 1 | 4.74 | 5.24 | 6.12 | 18.75 | 32.64 |
| 2 | 2.50 | 3.17 | 3.97 | 18.75 | 21.17 |
| 3 | 4.50 | 5.02 | 6.03 | 18.75 | 32.16 |
| 4 | 3.38 | 3.38 | 3.65 | 18.75 | 19.47 |
| 5 | 4.18 | 4.36 | 4.36 | 18.75 | 23.25 |
| 6 | 3.49 | 3.93 | 6.81 | 18.75 | 36.32 |
| 7 | 4.22 | 4.68 | 4.75 | 18.75 | 25.33 |
| 8 | 3.38 | 4.09 | 4.84 | 18.75 | 25.81 |
| 9 | 3.13 | 4.26 | 5.32 | 18.75 | 28.37 |
| 10 | 2.63 | 3.16 | 4.13 | 18.75 | 22.03 |
| General mean | 3.61 | 4.13 | 4.99 | 18.75 | 26.66 |

It is obvious that damage increased with increasing time. Cumulative damage in replicate number 1,2,3,4 ,5,6,7,8,9 and 10 was (4.74, 5.24and 6.12cm²); was (2.50,3.17 and 3.97cm²); was (4.50, 5.02 and 6.03cm²); was (3.38, 3.38 and 3.65cm²) **;** was (4.18,4.36 and 4.36cm²)**;** was (3.49, 3.93 and 6.81cm²); was (4.22,4.68 and 4.75 cm²); was (3.38, 4.09 and 4.84cm²); (3.13,4.26 and 5.32 cm²) and was (2.63, 3.16 and 4.13cm²)after 3, 6 and 9 days respectively**.** The corresponding percentages of damage were (32.64, 21.17, 32.16, 19.47, 23.25, 36.32, 25.33, 25.81, 28.37 and 22.03) respectively. The general mean of damage after 3 , 6 and 9 days was 3.61, 4.13 and 4.99 cm² respectively. The general mean of damage percentage was 26.66.

It can be seen that damage caused by 50 individuals of *Monacha* snails in cabbage plants after 21 days of infection under field conditions was 785.83, 730.49 and 811.97 cm² in replicate number 1, 2, 3 respectively, with general mean 776.1. The corresponding damage percentage was 39.9, 37.09 and 40.7) respectively, with general mean 39.23 % (Table 3).

**Table 3. Damage values and damage percentages caused by *Monacha* snails in cabbage plants after 21 days of artificial infection under field conditions.**

| Sample number | Total leaves area (cm²) | | Damage (cm²) | Damage (%) |
|---|---|---|---|---|
| | before infection | after infection | | |
| 1 | 1171 | 1971 | 785.83 | 39.9 |
| 2 | 1157 | 1969.5 | 730.49 | 37.09 |
| 3 | 1160 | 1995 | 811.97 | 40.7 |
| General mean | 1162.7 | 1978.5 | 776.1 | 39.23 |

Table (4) showed comparison between damage in cabbage leaves under laboratory and field conditions caused by a mature individual *Monacha* snails after 9 days of feeding. Damage % of cabbage leaves in field was higher (35.48) than that in laboratory (25.40) as a general mean. .Abd El-Hak (1997) showed that fresh leaves of lettuce were more preferred for *Monacha sp.* and *Eabania sp*. followed by peas and cabbage while garden rocket leaves were the lowest .Mahrous *et al* . (2002) reported that cabbage and lettuce harbored the highest numbers of *M. cartusiana* snails, while, pepper, pea and tomato attracted lower numbers.These results agree also with Hermann (1971) mentioned that the slug *Deroceras reticulatus* consumed in one night a leaf of 2 cm² (young rape plant).

He also found that the land snail *Helix pomatia* consumed in one night 50-70 cm² of *Datura starmonium* leaves and up to 5.2 g of lettuce. Godan (1983) mentioned that damage caused by terrestrial gastropods was dependent not only their activity and population density but also on their feeding habit which differ from species to species. Zedan *et al.* (2005) reported that land snails caused high injury in lettuce leaves. Also, he mentioned that *M. cartusiana* snails were responsible for damage in lettuce leaves of 17.25% at Mansoura district, Dakahlia Governorate. Wafaa *et al*. (2018) reported that fresh leaves of lettuce were most preferred by *M. cantiana* followed by onion, whereas parsley and pepper were less preferable than the two previous vegetables, while garlic leaves were the lowest preferred by snails.Wafaa *et al*. (2018) reported that the injuries affected by land snail species varied greatly from place to place depending on the abundance of the animals, the nature and extent of their food supply and weather conditions.

**Table 4. Comparison between damage in cabbage leaves under laboratory and field conditions caused by a mature individual of *Monacha* snails after 9 days of feeding.**

| Sample umber | Damage in laboratory (cm²) | % Damage in laboratory | Damage in field (cm²) | % Damage in field |
|---|---|---|---|---|
| 1 | 4.84 | 25.81 | 6.74 | 35.95 |
| 2 | 5.32 | 28.37 | 6.26 | 33.39 |
| 3 | 4.13 | 22.03 | 6.96 | 37.12 |
| General mean | 4.76 | 25.40 | 6.65 | 35.48 |

## REFERENCES


Abd El-Hak, A.I.A. (1997). Studies on some land molluscs at Sharkia Governorate. M.Sc. Thesis, Fac. Agric.,Al-Azhar Univ., 137 pp.

Ademolu K.O, Akintola M. Y., Olanloye A.O., Adelabu B. A. 2015. Traditional utilization and biochemical composition of six mollusc shells in Nigeria. Rev. Biol. Trop. 63: 459–464.

Amubode A. A., Fafunwa F.2014. Snail farming and hospitality industries. In: Abiona J. A., Osunsina I. O. (eds). Proceedings of the 3rd International Conference on Giant African Land Snails (NeTGALS). Federal College of Education, Abeokuta, Nigeria, pp. 31–36.

AOAC 968.31.201.2016., Association of Official Analytical Chemists 2016. Official Method of Analysis (OMA) - 2016. Method Submission Deadlines.

El-Deeb, H.I.H; A.A. Asran and G. Kuehert (1985). Damage and losses caused by rodents to mandarin and certain varieties of orange. J. Agric. Mansoura Univ., 10(2): 564-566.

Çağıltay, F ; Erkan, N.; Tosun, D. and Selçuk A. (2011). Amino acid, fatty acid, vitamin and mineral contents of the edible garden snail (Helix aspersa). J. FisheriesSciences.com, 5(4): 354-363.

Godan, D.(1983).pest slugs and snails (Biology and control). Springer Verlag, Berlin,Meidelberg, New York, 1 – 991.

Heiba, Fadia, N.; M.M. Mortada; S.N. Geassa; A.I. tlam and Sahar I. Abd El-Wahed (2018). Terrestrial gastropds: Survey and relationships between land snail assemblage and soil properties. J. Plant Prot. and Path., Mansoura Univ., 9(3): 219-224.

Hermann, G. (1971). Bekampfung von landschuecken mit methio carb. Meded. Facult Landb. Wetensch. Rijksuniv. Gent., 36: 179-206.

Houndonougbo M. F., Chrysotome C. A., Odoulami R.C. Codjia J.T. 2012. Snail shell as efficient mineral feedstuff for layer hens: effects and optimum rate. Livestock Res. Rural Dev. 24: 1–7.

Kehinde Ademolu, Olaniyi Precious, ,Ime Ebenso, , Idowu Babatunde (2016) Morphometrics and mineral composition of shell whorls in three species of giant African snails from Abeokuta, Nigeria. Folia Malacol. 24 (2): 81-84

Ludorff, W., Meyer, V., (1973). *Fische und Fischerzeugnisse*. Paul Parey Verlag. Hamburg. Berlin

Mahrous, M.H.; M.H. Ibrahim and E.M. Abd El-Aal (2002). Occurrence, population density and importance value of land snails infesting different crops at Sharkia Governorate. Zagazig J. Agric. Res., 29(2): 613-629.

Olgunoğlu, I.A., Olgunoğlu, M.P., (2009).Dondurulmuş Tereyağlı Salyangoz (Helix lucorum Linnaeus, 1758) Etinin Hazırlanmasıve Besin Etiketi Analizleri, *Biyoloji Bilimleri Araştırma Dergisi*, 2(1): 39-43.

Özoğul, Y., Özoğul, F., Olgunoğlu, I.A.,(2005).Fatty acid profile and mineral content of the wild snail (Helix pomatia) from the region of the South of the Turkey, European Food Research and Technology, 221:547-549.

Pincus T, Vogel S, Sandos R, Breen A, Foster N and Underwood M.,(2006). The attitudes to back pain scale in musculoskeletal practitioners (ABS-mp).Clin J. pain.vol.22 NO. 4,

Sallam, A. A. A. ; EL-Massry, S. A and Nasr I. N (2009). Chemical analysis of mucus from certain land snails under Egyptian conditions. Archives of Phytopathology and Plant Protection September. 42(9): 874–881.

Wafaa A. Shahawy ; Nadia M. Mostafa and Hend S. El-Tahawe (2018). Population Density, Food Consumption and Damage Caused by the Land Snail *Monacha cantiana* to Some Vegetable Crops at Kafr El-Sheikh Governorate. J. Plant Prot. and Path., Mansoura Univ., Vol.9 (9): 601- 604

Zedan, H.A.; M.M. Mortada and M.H. Awad (2005).Survey, damage and losses caused by land snails on certain crops at Dakahlia, Sharkia and Damietta Governorates. Egypt J. Agric., 83(2): 669-677.

## التأثيرات الضارة و المفيدة للقوقع الأرضى من نوع المونـاكا

**آمال حلمي السيد عبد الرحمن ، سالم عبد الفتاح احمد المصري، يونس احمد عيسي و إيمان كامل خضر**

**معهد بحوث وقاية النباتات – مركز البحوث الزراعية - الدقي – الجيزة – مصر**

أوضحت هذه الدراسة التى أجريت بمحافظة الشرقية التأثيرات السلبية والتأثيرات الإيجابية للقوقع الآرضى نوع المونـاكا. فقد أوضحت الفحوصات الميكروبية تلوث بطنقدم القوقع ببكتيريا *كلبسللا* الضارة بكل من الانسان و الحيوان كما أوضحت تلك الفحوصات تواجد نوع أخر من البكتيريا غير الضارة فى مخاط القوقع و تعرف بإسم *بركلديريا سيبتاسيا*. كما أوضحت التجارب المعملية و الحقلية التى أجريت على محصول نبات الكرنب مدى الخسائر التى يسببها القوقع حيث بلغت نسبتها 93و26% معمليا و 23و39% حقليا كمتوسط عام استهلاك لأوراق الكرنب المستهلكة. ومن ناحية أخرى فقد أوضحت التحاليل البيوكيميائية التى أجريت على مكونات كلٌ من البطنقدم و الصدفة التأثيرات الإيجابية للقوقع من حيث غناه بالبروتين والذى وصلت نسبته الى 9و17% فى البطنقدم أما الصدفة فكانت غنية بالعناصر الغذائية الهامة مثل الكالسيوم والفوسفور والماغنيسيوم والبوتاسيوم و التى بلغت نسبتها على التوالى 13% ، 60و0% ، 12و0% ، 094و0%.لذا فإن هدف البحث توضيح الجوانب السلبية للقوقع لإتخاذ التدابير اللازمة لمنع حدوث عدوى مرضية عند التعامل مع القوقع و كذلك من خلال غسل الخضراوات و الفاكهة التى تعتبر غذاء مفضلا للمونـاكا.ومن ناحية أخرى أوضحت الدراسة الأهمية الاقتصادية للقوقع و جوانب الإستفادة من مكوناته الغنية بالبروتين على مستوى البطنقدم و غناه بالمعادن الهامة على مستوى الصدفة خاصة الكالسيوم وإمكانية استخدام تلك المكونات كإضافة إلى أعلاف حيوانات المزارع خاصة الدواجن و كذلك فى الطب التقليدى.