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Evaluation of the Effect of Quicklime on Some Organisms from Different Ecosystems in Egypt: Morphological Perspective

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Abstract Quicklime needs wise management decisions before using either in the terrestrial or aquatic environment, especially in fish farms against benthic organisms infected with pathogenic parasites. It has been found that its reaction with water led to water heating, and other disturbances appear to occur. Many health problems have been observed on fish due to lime water. Lime kills snails when it is in a dry state or hydrate, also at high concentrations in addition dangerous to fish. On the other hand, in agriculture, lime water may not be recommended because of its '*in vitro*' negative effect on the green material of the plant as well. Therefore, it seems better to be away or needs a lot of precautions before applying it specifically as a disinfectant in dense fish farms. It is clear that biological control looks better, perhaps by grazing certain predators. Moreover, to protect the health of workers from invaders, special clothing should be taken seriously during irrigation or fishing as an important preventive measure.

Keywords Biology, Habitats, Water, Land, Plant, Snail, Fish, Parasite, Quicklime, CaO, Control

1. Introduction

Generally, snails are a nutritional component of many organisms in different environments [1], [2] particularly in aquatic ecosystem (Figs. 1, 2). They may be intermediate host of various parasites for many living organisms such as: fish, birds and humans. Therefore, the wise management is an essential element to eliminate dangerous snails especially with pathogens on a large scale in fish farms. Brown and Gratzek [3], Dupree and Huner [4] stated that "the ponds must expose to sun-rays about half month, especially after draining, weeds must be removed, then spray formalin about 60 to 100 Cm^3/m^2 this in such of alkaline ponds, but in that of acidic ones calcium oxide (quicklime) is a suitable agent, it is usually added to the bottom and sides of the ponds, at the rate of about 5 Ib to 100 Ft^2".

Land gastropod as an example of snails may be the intermediate host for unknown parasites and seems dangerous to plants as well. Therefore, in the current study, the use of quicklime is re- evaluated. In addition to specific biological observations on the present wild mollusk and dryness tool to eliminate such critical gastropods of either land or aquatic snails.

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2. Materials and Methods

In September 2018, about 59 samples of the wild snail and on October 4, 2018, many similar snails were collected from a small-scale garden near a navigation canal of agricultural land. They were found under some herbs and around the roots of some fruit trees with the other attached to a leaf of the tree in the village of Nawasa El-Gheit, Aga, Daqahlia Governorate. Also, in November 2018, about 69 similar snails were collected including two different shells possibly aquatic snails. Some snails have been photographed (Figs. 3, 4, 7-18). Until a certain period, some live snails were placed in a clean transparent jar with a perforated lid. Sixteen samples of the current land snail were measured length 0.9-1.4 cm (mean 1.225) and 0.8-1.2 cm in width (mean 1). For experiments, a reaction of 20-25 g of quicklime (CaO) with different amounts of de- chlorinated water led to slaked lime and then lime water 'supernatant' which was practically used. In October, November 2018, underwent experiments with investigations, especially to show the effect of dry quicklime and lime water on the vitality of the land snail, catfish, and '*in vitro'* parts of the ficus tree. In addition, on July 8, 2019 from a market in Marioutia, Haram, Giza Governorate, different sample of a land gastropod 'length of about 0.9 cm and 0.7 cm in width' was observed on one of the grape fruit (Figs. 5, 6).

Figure 1. The Nile River at the city of Qanater, Qalioubia Governorate (March 24, 2019)

Figure 2. Freshwater fish in a rearing pond at the farm of El-Qanater El-Khairia Research Station, 2018

Figure 3,4. Photographs at different magnification show samples of snails of the land gastropod collected from the soil beside a fruit tree 'Fig. 3' at a small garden irrigated with freshwater from El-Mansouria canal in the village of Nawasa El-Gheit. The gastropod reached and fix itself at the bottom surface of the tree leaf, it seems as an external parasite 'Fig. 4'

Figure 5,6. Photographs show a sample of land snail 'dorsal and ventral view' from a market in Marioutia, Giza Governorate (July 8, 2019). The gastropod stabilized by a dried sticky substance in the outer surface of the Grape fruit. Particularly at the site of attachment, it seems as an ectoparasite, which may cause serious damage to fruit tissue and probably secondary infection with other pathogens, x10

Figure 7,8. Snails of the land snail, under unsuitable circumstances. *In situ*, note empty shells 'Fig. 7' and the gastropod in the latent state 'Fig. 8'. Obviously this mollusk can't tolerate drought for a long period

Figure 9-12. Photographs show some collected dormant and active samples snails of the land mollusk, x10. The land gastropod in the dorsal and ventral view, are clearly discernible 'Fig. 10'. Under favorable conditions, some body organelles extruded out its shell and reached to the outer edge 'Fig. 11'. On a closed jar with a perforated lid, the gastropod moved upside, fixed itself and in dormant state is clearly noticed 'Fig. 12'

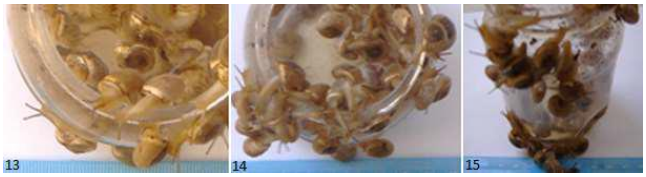

Figure 13-15. For short time in a little amount of de-chlorinated water, the land gastropod flourished and escaped out

Figure 16,17. The land gastropod is a mollusk breathes air, x10

Figure 18. Others probably belong to aquatic mollusks that may be loaded with water during irrigation, x10

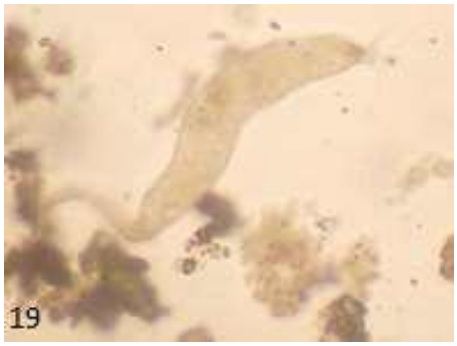

Figure 19. Photomicrograph of an aquatic organism noticed free movable in droplets of water contained live samples of the land snail, possibly a stage of an unknown parasite (September 19, 2018)

3. Results

3.1. The Effect of Calcium Oxide on a Land Gastropod (Figs. 20-25)

Snails died after 3-5 days when placed with some de-chlorinated water in a jar. Also, they all died after about 5 days of exposure to some calcium oxide and lime water. Severe degeneration was observed especially after snails were exposed to a quantity of quicklime.

3.2. The Effect of Calcium Oxide on the Catfish *Clarias gariepinus*

Experimentally, the catfish was exposed twice to different doses '100-150 g and 20-25 g' of quicklime at room temperature in autumn 2018.

The catfish appeared with severe irritation, jumped out of the treated water and lost its ability to live, after about two hours of placing in 100-150 g of dry quicklime mixed with 5-7 Liter of tap water. Significant skin erosion and 100% mortality were observed. At this dosage, hydrated lime seems to be caused sudden choking of the fish.

In October 2018, the catfish was exposed to 20-25 g of quicklime dissolved in about 21 liter of tap water. Lesions such as: skin damage, inflammation, necrosis, erosion, ulceration and degeneration were observed; after about 12 hours the severe irritated fish jumped out of the treated water and all fish were died. Post death, samples were placed with some water contained quicklime. After about 24 hours, the corpse was stiff with parts of the skin free of epithelium.

Probably, a huge amount of oxygen has been reduced during the reaction of quicklime with water causing severe macroscopic lesions and deaths under inappropriate conditions (Figs. 26, 27).

3.3. The Effect of Calcium Oxide on Some Parts of the Ficus Tree (Figs. 28-31)

On September 27, 2018, all green leaf samples from the ficus tree '*in vitro*' were dried after about 5 days. At the same time, the drought also occurred to some of the tree parts (leaf, twig and branch) which were treated with a quantity of calcium oxide. This means that quicklime does not affect plant safety.

On November 18, 2018, some ficus leaves embedded in dry quicklime, while others placed in water lime 'calcium oxide mixed with de-chlorinated water'. As a control, some other leaves immersed only in some de-chlorinated water. After about 2 weeks, the leaves of lime mixed with water lost its greenish color 'chlorophyll' that completely disappeared but they were still soft 'watery'. However, control leaves were still normal but other leaves treated only with dry quicklime looked completely dried similar to the control leaves. This means that after at least about two weeks, only when calcium oxide mixed with water affected particularly on the green material of the plant 'color remover'.

On December 10, 2018, some leaves with its branch were placed in de-chlorinated water. *In vitro* after about one month, they completely lost the green color but still soft. This means that lime water accelerates the loss of the green matter of the plant, while flexibility remains for both.

Figure 20. The land gastropod in dorsal 'top' and ventral view 'below'. Valid samples as a control 'the first four snails from right'. For several days 'about 5 days', mollusk exposed to some dry quicklime and lime water respectively 'Other snails'

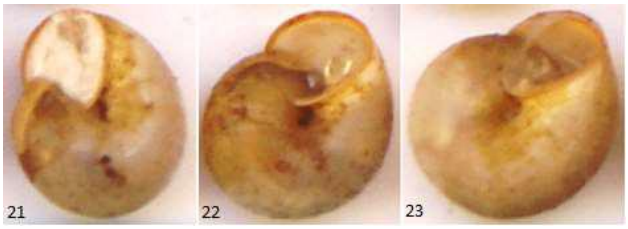

Figure 21-23. The viable gastropod characterized by a shell opening that is closed in stress conditions to be in dormant state 'control'. Note the dry white material that closed the aperture of the shell 'Fig. 21'. Snail after a short period with water, the transparency occurred for the gate 'Fig. 22'. The gastropod that appeared dead, was exposed to dry quicklime. Note the disappearance of the gate 'white matter' 'Fig. 23'

Figure 24,25. In favorable circumstances 'after more time in the moisture with a small amount of water', the mollusk flourished 'control' and extruded from the shell 'Fig. 24'. After about 5 days, the gastropod significantly deteriorated due to quicklime. Note the complete destruction of the gate at the opening of the shell 'Fig. 25'

Figure 26,27. Photographs show samples of the catfish *Clarias gariepinus* from fish market in El-Qanater El-Khairia. Live fish samples as a control 'Fig 26'. At room temperature, catfish exposed to 20-25 g quicklime dissolved in about 21 liter of tap water (October 2018). After about 12 hours, 'severe skin damage-inflammation, necrosis, erosion and ulceration', the irritated fish jumped out the treated water and lost the ability to survive. In some treated water, after about 24 hours of death the corpse seemed stiff with parts of the skin free of epithelium 'Fig. 27'

Figure 28. Photographs show leaves taken from a ficus tree in the Marioutia region, x10. a. A control leaf cut from the tree and placed in open air about two weeks, dryness is clearly visible 'a'. A treated leaf out of the tree after about 2 weeks with some dry quicklime, still similar to control 'b'. A leaf after about 2 weeks with some de-chlorinated water, still fresh 'c'. After about 2 weeks of cutting a leaf from the tree and submerge it in an amount of quicklime mixed with some water. It looks dark and lost its greenish color 'd'

Figure 29-31. Photographs show leaves and parts of the twig taken from the ficus tree, x10. Normal leaf and twig cut from the tree and put in some de-chlorinated water. After about 2 weeks, they seemed fresh with normal green color 'a, c'. After about 2 weeks in lime water, green color disappeared 'b, d'. Leaves with a part of the twig immersed in some water. After nearly a month, the green color also completely lost 'Fig. 29'

Figure 32,33. During the irrigation of a field in the village of Nawasa El-Gheit, pictures appear the bird that called farmer friend (October 4, 2018)

Figure 34,35. Photographs show empty shells of the land snail 'dorsal and ventral view', x10. After gastropod death, samples were collected from a small garden in the village of Nawasa El-Gheit (June 12, 2019). Notice, most shells seem dry with a color change to white 'probably due to prolonged exposure to the heat of the sun' compared to snails living in suitable conditions 'e.g. Figs. 9-12'

4. Discussion

Here, it may be worth to mention that, in August 2018 about 47 live samples of the land snail were collected, 22 of them were placed in 20-25 g calcium carbonate dissolved by about 250 ml water. The rest snails were used as control. All snails died in both calcium carbonate and control after about three days. Mortality may be caused by stress due to its presence outside the natural environment. So, calcium carbonate did not affect the vitality of the land snail, it may be a component of the hard shell. On the other hand, Al Ghaban et al. [5] stated that "incorporation of micro $CaCO_3$ and micro SiO_2 particles lead to increase the packing and enhance the mechanical properties and durability of concrete".

Apparently, quicklime needs a lot of precautions before using. The reaction of CaO with H_2O may cause water heating. Fomina et al. [6] stated that "it is found highly exothermic reactions occur at temperatures up to 190 ℃ when slaking of highly active lime with water-solid ratio close to the theoretical value. When increasing of water amounts the slaking temperature is reduced".

Figure 36-39. Photographs show aquatic snails in a dorsal and ventral view, x10. After the death of the gastropod 'possibly because of severe drought', some empty shells were collected from the shore of the fish pond at the Qanater Research Station. They 'Figs. 36, 37' looked dry with dark color (May 13, 2019). After more than a month', other samples 'Figs. 38, 39' appeared very dry with light color (June 26, 2019)

In the current study, quicklime kills snails when it is in a dry state or hydrate and also risky to fish. Serious health problems and death of catfish due to lime water were observed. Therefore, care must be taken before using it as an antiseptic after drainage to eliminate infected snails. Before supplying the next water and fish, all quicklime should be completely removed from the pond by some water several times.

In agriculture, although Tugbobo et al. [7] stated that "arsenic-induced lipid peroxidation is a potential threat and could possibly be salvaged by lime in growing rice plants". Lime water may not be recommended because of its '*in vitro*' negative effect on the plant's green matter as well. Thus, lime water seems better to be away or needs a scientific management decision before applying it especially in fish farms.

Obviously, the biological control seems to be a favorite. Perhaps by some predators such as: catfish and certain birds

for an example: a friend of the farmer (Figs. 32, 33). Also, grazing may be more better by certain others, especially of those have many benefits in particular during irrigation and/ or before planting.

Moreover, drought due to the impact of sun's heat on gastropod life either in aquatic or on ground habitats appear to be also a useful way of eradicating disease-causing snails (Figs. 34-39). Particularly, in fish farms, after draining the pond water, exposure to sun rays for about two weeks or for a long time may extend to a month to get rid of live snails, especially those infected with pathogenic parasites.

Furthermore, to protect the health of workers from invaders such as: parasitic stages viable in water, special clothing during irrigation or fishing as an important preventive measure should be taken seriously.

On the other hand, [8] stated that "at different times during the evolution of snails (Gastropoda), some members of otherwise marine snail groups independently adapted to life on land. This sometimes take place passing freshwater habitats, for an instance: rivers and lakes, and sometimes the direct way passing the coastal habitats that share characters of sea and land. One group of terrestrial snails has remained in this early state of evolution until today - the Ellobiidae. Those ancient snails still live in transient habitats near the sea". While [9] stated that "Ellobiidae is a family of small air-breathing land snails, terrestrial pulmonate gastropod mollusks in the clade Eupulmonata [10]". The taxon Ellobioidea comprises a group of morphologically and ecologically highly diverse snails, known to have successfully invaded the marine, brackish water and terrestrial habitats [11]". However, another vision has been presented in conclusions section.

Regarding the land snail *Drobacia banatica*, not a complete agreement with Domokos et al. [12] whom stated that "however, as a large, conspicuous, "pretty" snail species, which is a relict in the Carpathian Mountains, indicates natural habitats of high quality and belongs to a monotypic genus, should be protected by the law in all countries where it occurs, in order to avoid future reductions of the number of living populations". In this study, most snails were found in many locations around the soil of the agricultural field under some herbs or up to foliage and fruit or near to the irrigated canals in August, September and November 2018. It may be worth noting that Shalaby and El-Rashedi [13] recorded 71 species of gastropods from four chosen sites; Red Sea for a year. Also they stated that "distribution of gastropods revealed a seasonal variation. Gastropods were more abundant during winter, decrease through spring, reached their minimum numbers during summer and their existence gradually increased during autumn".

5. Conclusions

It seems here that snails and catfish have died with quicklime and lime water. The interaction of quicklime with water may led to water heating with other stresses that negatively affected both. Thus, calcium oxide causes serious injuries, may be also because it covers their airways. Obviously, hypoxia in particular when using a high dose of quicklime causes severe damage and loss of life. Also, lime water has a negative effect not only on the health of snails and fish but also led to death may be due to suffocation.

Microscopically, a small amount of water with live samples of wild snail was free of parasites. Only three specimens of unknown parasitic stage (Fig. 19) were noticed alive in water droplets, possibly released from the terrestrial snail. In addition, infectious stages of aquatic parasites, such as schistosomiasis may be transmitted to humans during irrigation. In shaa Allah, further study of snails and/ or water parasites, especially in the absence of appropriate precautions has recommended.

Overall, herein the land gastropod has its own awareness. In favorable conditions it appears active and has a sense against the abnormal factors through rapid entry into the shell. In addition, land snail cannot tolerate its presence in the water for a long time, often escaped to breathe air. Then again, compare with the shell of land and aquatic snails. With extreme fatigue, the animal may die leaving empty shell with some color change, probably after prolonged exposure to sun's heat (Figs. 34, 35). Similar observations emerged on aquatic snails that removed from the water 'natural environment' (Figs. 36-39). Substantially, after the death of the gastropod 'with unfavorable conditions especially drought due to high temperature', shells of land and aquatic snails appeared non-vital.

It is clear that mollusks have unique properties suitable for living on land or in water. Distinctly, wild snails have a respiratory system that is only suitable for breathing air on the ground. Finally, the land snail that was created by Allah (God) is a wild creature from the beginning, and Allah knows best.

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REFERENCES

[1] https://www.snail-world.com/snail-predators

[2] https://www.hookedoncatfish.com/will-catfish-eat-snails-and-shrimp/

[3] Brown, E.E. and Gratzek, J.B. (1980). Fish farming hand book, food bait, tropical and gold fish. The A.V.I. publication company, Inc. Westport, Connecticut.

[4] Dupree, H.K. and Huner, J.V. (1984). The status of worm water fish farming and progress in fish farming research. Third report to the fish farms. Published by U.S. fish and wild life service, Washington, D.C.

[5] Al Ghaban A., Al Zubaidi, A.B. and Jawad, Z.F. (2018). Study the effect of micro CaCO3 and SiO2 and their mixture on properties of high strength concrete. Engineering and Technology Journal, Vol. 36, Part A, No. 10, pp. 1027-1033.

[6] Fomina, E.V., Strokova, V.V. and Kozhukhova, M.I. (2013). Effect of previously slaked lime on properties of autoclave composite binders. World Applied Sciences Journal, 24 (11): 1519- 1524.

[7] Tugbobo, O.S., Abegunde, S.M. and Idowu, K.S. (2018). Inhibitory effect of lime on arsenic- induced lipid peroxidation in growing rice plants. J. Adv. Res. Med. Sci. Tech., 5(1): 1-5.

[8] http://molluscs.at/gastropoda/terrestrial.html.

[9] https://en.wikipedia.org/wiki/Ellobiidae#cite_ref-Weigand_2013_1-0.

[10] Bouchet, P. (2012). Ellobiidae. Accessed through: World Register of Marine Species at http://www.marinespecies.org/aphia.php?p=taxdetails&id=198 on 2012-08-19.

[11] Weigand, A.M., Jochum, A., Slapnik, R., Schnitzler, J., Zarza, E., Klussmann-Kolb, A. (2013). Evolution of microgastropods (Ellobioidea, Carychiidae): integrating taxonomic, phylogenetic and evolutionary hypotheses. BMC Evolutionary Biology 13:18. doi:10.1186/1471-2148-13-18.

[12] Domokos, T., Deli, T., Varga, A., Flaviu-Crişan, H., Balashov, I., Gheoca, V., Biatov, A., Szappanos, B., Pál-Gergely, B. (2018). Distribution of *Drobacia banatica* (Rossmässler, 1838) over time and space (Gastropoda: Stylommatophora: Helicidae). Brukenthal. Acta Musei, 13(3): 459-484.

[13] Shalaby, I.M.I. and El-Rashedi, M.E.M. (1994). Ecological studies on the marine gastropod molluscs in Sharm El-Sheikh, southern Sinai, Egypt. J. Egypt. Ger. Soc. Zool. Vol. 13 (D), Invertebrate Zoology & Parasitology, 397-428.