A. Ü. Vet. Fak. Derg.
33 (2): 225-231, 1986

FEEDING ABILITY OF THE SNAIL MARISA CORNUARIETIS (L.) ON RICE PLANT ORYZA SATIVA UNDER SEMI-FIELD CONDITIONS IN EGYPT.

Erian G. Kamel[1]

Mısır'da yarı saha şartlarında Marisa cornuarietis (L.) adlı sümüklünün, pirinç (Oryza sativa) bitkisiyle beslenme yeteneği

Özet: *Bu çalışma ile Güney Amerika ampullariid sümüklüsü olan* Marisa cornuarietis *(L) in Schistosoma nakleden bazı sümüklü türlerinin biyolojik kontrolünde kesin olanaklar sağladığı anlaşılmıştır.*

Araştırmamızda bu sümüklünün, gelişmesi esnasında uzun bir süre su altında kalması gereken ve ekonomik önem taşıyan bir ürün olan pirinç (Oryza sativa) bitkisiyle beslenme olanağı bulunup bulunmadığı konusunda yarı saha şartları altında deneyler yapılmıştır.

Yukardaki şartlar altında yapılan gözlemler sonunda M. cornuarietis*'in pirinç tanelerine, bunların yeni filizlerine ve bu bitkinin olgunlarına yapışmadığı saptanmıştır. Bu gözlemler tek çenetli (monocot) bir kara bitkisi olan pirincin* (Oryza sativa) M. cornuarietis *adlı sümüklü tarafından yenilmediğini doğrulamıştır. Hatta bu sümüklüler bu bitkinin su içinde kalan bölümlerini emniyetli ve uygun bularak buraya yumurta kümelerini bırakmaktadırlar.*

Burada bildirilen gözlemler, bu sümüklünün Mısır'da pirinç ürününe ciddi ve tahrip edici bir etki göstermediğini vurgulamaktadır.

Bu sonuçlar, Mısır'da schistosomiasisin aracıları olan sümüklülere karşı biyolojik bir kontrol aracı olan M. cornuarietis*'in kullanılışının Birleşik Arap Cumhuriyetinde çok bulunan ve yerli bir kara bitkisi olan pirinç ürününe ciddi bir tehlike oluşturmadığının ümit ve cesaret verici belirtileri olmaktadır.*

Summary: *The South American ampullariid snail* Marisa cornuarietis *(L.) has shown definite possibilities in the biological control of*

1 Associate Professor, Ain Shams University, Women College For Arts, Science and Education, Cairo, Egypt.

some schistosome-transmitting snails. In the present study, a semi-field test was made on the ability of this snail to feed on rice plant, Oryza sativa, *as one of the most economically important crop plant needs to be submerged in fresh water for many days during its growth.*

The present semi-field observations indicated that the snail M. cornuarietis *did not attack rice grains, new germinations and the mature plant cultivated by transplanting. The observations confirm that the terrestrial monocot plant* Oryza sativa *is non-edible to the snail* M. cornuarietis. *The snail even find the submerged parts of this plant safe enough to lay its egg-masses upon.*

The observations presented here may suggest that this snail not constitute a serious threat to the rice crop in Egypt. The results provide encouraging indications of the possible utility of M. cornuarietis *as a biological control agent against the snail hosts of schistosomiasis in Egypt without serious threat to rice crop plant as one of the most common local terrestrial plant in U.A.R.*

Introduction

Previous laboratory and field observations made on the fresh water ampullariid snail *Marisa cornuarietis* included several remarks on its value in the biological snail control, as a means of limiting the transmission of schistosomiasis (Chernin et al (1), Ferguson et al (8), Radke et al (10), Demian and Lutfy (4, 5, 6), Kamel (9), Demian and Kamel (3)).

M. cornuarietis has been also known for its outstanding feeding capacity as a macrophagous herbivore (Chernin et al. (1), Radke et al. (10)). In laboratory Demian and Ibrahim (2) proved that *M. cornuarietis* have a fairly wide range of acceptable plant food. It readily fed on almost all Egyptian local aquatic plants, as well as on several terrestrial herbaceous dicots when made available to it in water. Other terrestrial herbaceous dicots were not accepted by the snail as food, and some others were repellent to it. The majority of local Egyptian monocot plants, whether terrestrial or semi-aquatic, proved to be non-edible to the snail.

M. cornuarietis might be harmful to some economically important crop plants in the field. The most important among these plants is probably the rice, *Oryza sativa*, which needs to be submerged in fresh water for many days during its growth. The laboratory observa-

tions made by Demian and Ibrahim (2) suggested that *M. cornuarietis* might not constitute a serious threat to the rice crop.

The purpose of the present semi-field study was to test the ability of the snail *M. cornuarietis* to feed on rice under semi-field conditions as the rice might be expected to serve as potential food source for this snail in the natural habitat in Egypt. Also the study aimed to evaluate the benefits gained or dangers imposed by the introduction of *M. cornuarietis* in U.A.R.

Material and Methods

An experimental semi-field area 8.0 x 3.25 meters, was specially designed for this study and was established in the botanical garden of the Faculty of Science, Ain Shams University, Cairo, Egypt. Four parallel ditches were prepared in the area, 20 cm apart. Each ditch was 3.25 m long, 1.85 m wide and 15 cm deep. Two channels were established in the area at right angle to the four ditches, one served as a common feeding channel and the other as a common drain. The ditches were supplied with piped, non-purified, slit-bearing Nile water which is used for irrigating the garden of Ain Shams University. The water flowed first in the common feeding channel, from which it pourd through a series of 4 leveled opening into the 4 ditches at equal rate. All ditches were fully exposed to sunshine. Tadpoles, mosquito larvae and pupae as well as various aquatic insects made their appearance in the ditches soon after their establishment.

Snails used in the present observations were based on laboratory reared and naturally-bred *M. cornuarietis* of Puerto Rican origin. The specimens were selected at random from a large stock colony that has been raised in laboratory as well as those which has been kept in earth-lined artificial ditches filled with slow-flowing non-purified Nile water (9).

Rice seeds, *Oryza sativa*, type EL-NAHDDA were obtained from the Ministry of Agriculture, Cairo, Egypt. Seeds were carefully examined for any foreign grains. All seeds were nearly of same size and shape.

The first experiment was run on April 15, 1984 for about one month to observe the effect of the snail *M. cornuarietis* on rice grains as well as new germinations. The four ditches were prepared for cultivation. Two ditches (1 and 3) were served as control whilst the

other two (2 and 4) were experimental ditches. An amount of 500 grams of rice grains were scattered (sowed) in each ditch. The amount of seeds were calculated according to the quantity used to cultivate an acre. A cohort of 30 mature snail, comprising 20 female and 10 male of 26–28 mm in shell diameter was added to ditch (2). On the other hand fifty mature specimens (25 males and 25 females) of 32–34 mm in shell diameter were placed in ditch 4. In addition to the four ditches and for closed observations, 10 pots of 40 cm in diameter were kept deeply in the main drainning channel. Equal amount of grains were sowed in each pot. Five were served as control and the others were experimental with different numbers of *Marisa* snail. Pots with *Marisa* were guarded by wire nets to prevent escape of the snails. A continuous flow of water was maintained in all pots and ditches.

In the second experiment, rice was cultivated in the experimental area by transplantation. On May 25, 1984. Sixty bands of rice were transplanted to each ditch approximatly 30 cm apart from one another. Ditch 1 and 3 were served as control while 2 and 4 were experimental ditches with same number and size of the snail *Marisa cornuarietis* as in experiment 1. The ditches were closely observed for the appearance of any destructive damage to the rice plant. Experimental ditches were regularly watched for the appearance of egg–masses and newly hatched *Marisa*. The ditches were continuously submerged with water during the experimental duration which lasting 4 months.

Results

The feeding activity or reaction of the snail *M. cournuarietis* towards rice seeds or plant was closely watched and observed. In the first experiment rice seeds were made available to *Marisa* in water at the two experimental ditches (2 and 4) to find out if rice grains may serve as acceptable food. The experiment was run during the period April–May, the winter or period of reduced activity of the snail was largely avoided. Closed observations of the control and experimental ditches as well as the pots, clearly indicated that *Marisa* has no effect on rice grains. The rice seeds were considered non–edible or non–acceptable food as they were not attacked by the snails.

New germinations started to appear a week after cultivation with the same density in all four ditches.

The rice plants in the two experimental ditches were not attacked by the snails. The plant have more or less stiffen narrow leaves and tough stems. It seems to be more non-edible than non-acceptable food plant for *M. cornuarietis*. Snails in the experimental ditches finds the submerged parts of rice plant safe enough to lay its egg-masses upon.

In the second experiment, with transplanted rice *Marisa* readily used the stems and leaves of the growing rice plant as favorite egg-laying sites. It seems probable that the snail *Marisa* would not attack such terrestrial crop plant in the field area.

It was of some interest to note that the rice plant grew normally, in both control and experimental ditches, at the semi-field area. The observations revealed no significant differences in the density or the height of the rice plant between control and experimental ditches. The average height of the rice plant in control ditches was 35, 70, 95 and 125 cm compared with 37, 71, 93 and 130 cm in experimental ditches during the period May-August respectively.

Egg-masses of *Marisa cornuarietis* were mainly deposited on the stiff and tough stem of the rice plant which seems normally non-edible to the snails. This observation may indicate that a hard surface of the submerged object which is found near the water surface and is not liable to be eaten by the snail or to be rotten quickly is a prime requisite for egg laying of *Marisa*. Newly hatched snails were first observed in the experimental ditches by mid-June 1984. The snail populations thus build up gradually in the experimental ditches during the duration of the experiment. Young, middle aged and old snails were almost evenly represented in the experimental ditches. Snails were occasionally noticed nipping at the edges of the somewhat softened and partly decaying leaves of rice plant. At the same time the snails readily deposit their egg-masses on the stem and leaves of the rice plant. The snails did not attack the plant in the experimental ditches and avoided to approach the growing plant.

Discussion and Conclusion

It was noted in the laboratory by Chernin et al. (1) that *Marisa cornuarietis* feed actively on water cress, cabomba, elodea, cabbage, lettuce, tomato, synthetic alginate food and even on paper towelling.

According to Ferguson and Butler (7), the snail was also successfully fed in the laboratory on banana leaves, various algal mats, floating ferm, water hyacinth, water lettuce and water lily. In nature, in Puerto Rico, it was observed to attack more commonly to submerged aquatic vegetation than to semi-aquatic or emergent vegetation below the water level. It seemed to prefer feeding on surface and submerged aquatic plants and to reject tough grasses which grow on stream banks.

Demian and Ibrahim (2) confirmed that *M. cornuarietis* in laboratory has a wide range of acceptable plant food. The snail readily consumes almost all species of hydrophytes commonly found in nature in the United Arab Republic. The more interesting observation made by Demian and Ibrahim (2) was that the majority of local monocot plants, whether terrestrial or semi-aquatic, are non edible to *M. cornuarietis*. The snails even find the submerged parts of these plant safe enough to lay its egg-masses upon. The rice plant is the most important among these plants which needs to be submerged in fresh water for many days during its growth.

The present observations under semi-field conditions confirmed that the snail *M. cornuarietis* not constitute a serious threat to the rice crop in Egypt both sowed and transplanted. The growth of rice was normal and the population density of the snail *M. cornuarietis* was also normal.

The observations presented here support the suggestion that *Marisa* not attack the rice crop in the field. The semi-field investigations provide encouraging indications of the possible utility of *M. cornuarietis* as a biological control agent against schistosome-transmitting snails in Egypt without constitution of any destructive effect to rice crop plant which considered as one of the most important local terrestrial crop plant in Egypt.

Acknowledgment

The author is highly indebted to Professor Nevzat Güralp, Director of Diseases and Clinical Sections, Faculte of Veterinary Medicine, Ankara University, Turkey, for writing the Turkish summary and for his valuable advice.

References

1. **Chernin, E., Michelson, E.H. and Augustine, D.L.** (1956). *Studies on the biological control* of schistosome-bearing snails. I. The control of *Australorbis glabratus* populations by the snail, *Marisa cornuarietis*, under laboratory conditions. Am. J. trop. Med. Hyg., 5: 297 - 307.

2. **Demian, E.S. and Ibrahim, A.M.** (1969). Feeding activities of the snail *Marisa cornuarietis* (L.) under laboratory conditions. Proc. Sixth Arab Science Congress, Damascus, 1969, Part I. 145 - 165.

3. **Demian, E.S. and Kamel, E.G.** (1978). Displacement of *Bulinus truncatus* by *Marisa cornuarietis* under semi-field conditions in Egypt. Internat. Congr. Bilharziasis, October, 1975, Cairo. Published in 1978, 731 - 739.

4. **Demian, E.S. and Lutfy, R.G.** (1964). Prospects of the use of *Marisa cornuarietis* in the biological control of *Limnaea caillaudi* in the U.A.R. Proc. Egypt. Acad. Sci., 18: 46 - 50.

5. **Demian, E.S. and Lutfy, R.G.** (1965 a.) Predatory activity of *Marisa cornuarietis* against *Bulinus (Bulinus) truncatus*, the transmitter of urinary schistosomiasis. Ann. trop. Med. Parasit., 59: 331 - 336.

6. **Demian, E.S. and Lutfy, R.G.** (1965 b.) Predatory activity of *Marisa cornuarietis* against *Biomphalaria alexandrina* under laboratory conditions. Ibid., 59: 337 - 339.

7. **Ferguson, F.F. and Butler, J.M.** (1966). Ecology of *Marisa* and its potential as an agent for the elimination of aquatic weeds in Puerto Rico. Proc. Southern Weed Conf., 19: 468 - 476.

8. **Ferguson, F.F., Oliver - Gonzalez, J. and Palmer, J.R.** (1958). Potential for biological control of *Australorbis glabratus*, the intermediate host of Puerto Ricon schistosomiasis. Am. J. trop. Med. Hyg., 7: 491 - 493.

9. **Kamel, E.G.** (1973). Studies on the biology and biological control of schistosome-carrying snails in Egypt. M. Sc. Thesis, Ain Shams University, Cairo, Egypt,

10. **Radke, M.G., Ritchie, L.S. and Ferguson, F.F.** (1961). Demonstrated control of *Australorbis glabratus* by *Marisa cornuarietis* under field conditions in Puerto Rico. Am J. trop. Med. Hyg., 10: 370 - 373.