

WATER HYACINTH (*EICHHORNIA CRASSIPES*) AS A NATURAL RODENTICIDE

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ABSTRACT

The mature plants of water hyacinth were taken to evaluate their effects against rodents as a natural rodenticide. Water hyacinth plant was baited with crushed maize in different ratios. Free-and no- choice feeding test proved that water hyacinth baiting systems were effective against males and females of white norway rats (*Rattus norvegicus* var. *albus*) to be palatable and causing lethal symptoms and completely death after 8-12 days of feeding. It was found also that, the blood contents (haemoglobin, haematocrit, RBC'S and WBC'S) as well as sGPT and sGOT enzymes were highly affected in both male and female rats which were fed on water hyacinth baits leading to death.

INTRODUCTION

The economic importance of water hyacinth (*Eichhornia crassipes*) has been investigated all over the world by several investigators. It is considered an acutal or a potential major aquatic weed in tropical and subtropical areas and a lot of money has been spent for controlling it. The mature plants of water hyacinth lose about three time as much water through evapotranspiration as it is lost from evaporation of an equivalent area of open water (Benton *et al.*, 1978; Brezny and Sharman,

1973 and Obeid, 1975). Obeid (1975) reported that the specific harmful effects of water hyacinth are the problems of blocking the suction lines of irrigation pumps, obstruct the transportation, prevents fishing as well as providing a suitable breeding and nursing habitat for mosquitoes. On the other hand, the utilization of water hyacinth was suggested as manure (Finlow and Mclean, 1917); as fuel (Umschau, 1977); as fodder (Chatterjee and Hye, 1938) as well as raw materials in industries of paper and plastic (Nolan and Kirmse, 1974 and Zerrudo *et al.*, 1978).

These different aspects provided an impetus to utilize water hyacinth as fresh or dry powdered baiting with crushed maize to be evaluated as natural rodenticide against rats.

MATERIALS AND METHODS

I- Tested Plant :

Water hyacinth (*Eichhornia crassipes*) was obtained from Agricultural Research station at Abbis, Faculty of Agriculture, University of Alexandria. The plant was used as chopped water hyacinth baited with crushed maize or it was sun-dried and then baited as powdered dry plant with crushed maize at different ratios.

II- Tested Animals :

Tested white Norway rats (*Rattus norvegicus* var. *albus*) were taken from a colony raised in the rodent house of Pesticide Chemistry Department, Faculty of Agriculture, Alexandria University.

III- Methods of Testing :

A. No- and Free-Choice Tests :

The white Norway rats (*Rattus norvegicus* var. *albus*) were caged individually with adequate water supply. Rats were preconditioned to the non-poison diet which was the crushed maize, until starting the test. Fresh bait and clean food pots were provided daily (E.P.P.O, 1975).

One cup contains poison bait (No-choice test) whereas two cups (Free choice test) were placed inside each cage, one containing the non-

poison bait (20 gm crushed maize) and the other cup containing the poison bait (20 gm of mixed plant and crushed maize bait). Daily fresh baits was supplied and the position of the two cups were interchanged. Untreated rats were concurrently caged in separate cages with non-poison bait (crushed maize). Ten to twenty- five rats were used for each treatment. The results were recorded daily as bait consumption (poison and non-poison baits). The total consumption of non-poison and poison baits/rat/day were reported. The average amount of consumed poison bait in gm/Kg body weight/day and gm poison bait /Kg body weight until death were calculated. The mean percentage of palatability was determined by the following equation (Mukatha *et al.*, 1978):

$$\% \text{ Palatability} = \frac{\text{Mean consumption of choice poison bait/24 hrs}}{\text{Mean consumption of choice non-poison bait/24 hrs}} \times 100$$

Mean percentages of mortality and time to death were reported. The data express as mean $\pm$ standard deviation (S.D).

B. Biochemical Measurements :

Hemoglobin determination as gm haemoglobin per 100 ml of the blood (Hb%) was conducted according to Wintrobe's (1965) method, using Boehringer Mannheim Gm bH Diagnostic Kit. Haematocrit value (Hc%) was measured by special centrifuge and the centrifuged blood was read by a special measurements of haematocrit. White blood cells (WBC'S) and Red blood cells (RBC'S) of prepared blood samples were counted by using the haemocytometer (Dacie and Lewis, 1991). *In vivo* determination of glutamic- pyruvic transaminase (GPT) and glutamic - oxaloacetic transaminase (GOT) activities were based on the methods described by Reitman and Frankle (1957) using Boehringer Mannheim Gm bH Diagnostic Kits. Untreated males and females (fed only on the normal non-poison bait) were also concurrently examined under the same conditions. Generally, the results are measured as reduction or elevation percent of blood content or enzyme activity according to the following equation : $\% \text{ Reduction or elevation} = 100 - (\text{Treatment/Control}) \times 100$

RESULTS AND DISCUSSION

A. Free and No-Choice Test :

The results of free-choice effect of crushed maize combined with different ratio of powdered leaves of water hyacinth (*Eichhornia crassipes*) against white norway rats (*Rattus norvegicus* var. *albus*) were recorded in Table (1), from which it could be observed that males which were fed on bait with ratio 1:1, were susceptible with 27.6 gm poison bait/rat and 99% palatability leading to 100% death within 12 days .

Table (1): Free choice test of crushed maize: dry powdered leaves of water hyacinth(*Eichhornia Crassipes*) with different ratios against white norway rats (*Rattus norvegicus* var. *albus*).

Bait system	Sex	Average Body Weight (gm)	Average non-poison bait consumed /rat (gm)	Average poison Bait consumed /rat (gm)	Palatability (%)	Mortality (%)	Time to death (days)	
							Range	Average
Crushed maize : Dry powdered leaves	Male	275±18.2	31.0±1.4	27.6±0.3	89.0	100	10 - 14	12±1.60
	Female	200±15.2	28.5±0.5	21.5±0.4	75.4	100	6 - 10	8.0±1.58
2 : 1	Male	227.5±10.6	43.7±2.4	34.2±1.6	78.3	100	7 - 12	9.5±2.20
1 : 2	Male	323±22.5	62.4±2.3	21.6±1.1	34.6	100	10 - 15	12±2.35
	Female	194±15.7	19.2±0.8	18.4±1.2	95.8	100	5 - 10	8±2.10

Females were more affected with 21.5 gm/rat and palatability equal to 75% which caused complete death during 8.0 days. The ratio 2:1 (crushed maize : dry powdered leaves) was found to be palatable to males

with 78.3% by consuming 34.2 gm /rat to cause 100% death in 9.5 days . Concerning the highest ratio of baiting system, 1:2 (crushed maize : dry powdered leaves), it was found that, males were less palatable with 34.6% by consuming 21.6 gm/rat during 12 days for complete death, whereas females were more palatable for the poison bait system (1:2) with 95.8% by consuming 18.4 gm/ rat within 8.0 days for 100% death.

Generally, the observed symptoms on rats fed baits of water hyacinth were dropping of hair after three days of feeding , haemorrhage from the mouth and legs which was increased with increasing time and amount of the water hyacinth baits consumption.

Bleeding from eyes resulted in the abnormal eyelid of rats become narrow and finally closed which lead to blinded rats with some swelling of face. The fed rats died after different periods depending on the amount consumed, sex and palatability.

No-choice effects of chopped green water hyacinth shoots mixed with crushed maize with the highest ratio of bait system (1 crushed maize : 2 chopped green leaves) against females of white norway rats (*Rattus norvegicus* var *albus*) are shown in Table (2). Females were completely affected by consuming 60.9gm/rat which caused 100% death during 8.7 ± 2.8 days, and the symptoms were recorded as haemorrhage from the legs, mouth and tail, bleeding from the reproductive system, the rats setteled lazy, some tumor appearance and finally the rats died.

Table (2): No-choice Test of crushed maize: Chopped green leaves of water hyacinth (*Eichhornia crassipes*) with different ratios against white norway rats (*Rattus norvegicus* var.*albus*).

Bait system Crushed maize : Chopped Green leaves	Sex	Average Body Weight (gm)	Average poison bait consumed /rat (gm)	Mortality (%)	Time to death (days)	
					Range	Average
1 : 2	Female	151.3 $\pm$ 15.7	60.9 $\pm$ 5.3	100	3 - 14	8.7 $\pm$ 2.8

- No death occurred in control treatments.

B. Biochemical Effects :

In vivo effects of water hyacinth baits on blood contents and enzymes activity of white norway rats (*R. norvegicus* var. *albus*) are recorded in Table (3). The dry powdered leaves of water hyacinth mixed with crushed maize with 1:1 ratio caused an elevation of haemoglobin (Hb), haematocrit (Hc) and red blood cells (RBC'S) counts with 16.8; 13.9 and 56.9%, respectively, in comparison with control; whereas white blood cells(WBC'S) counts; GPT and GOT activities were reduced with 67.5 ; 54.3 and 24.5% , respectively, in the treated females.

Table (3): *In vivo* effects of water hyacinth on blood contents and enzymes activity of white norway rats (*Rattus norvegicus* var. *albus*) fed on different bait systems of powdered leaves; shown as Reduction % (- value) or Elevation % (+ value).

Bait system	Sex	Reduction % (- value) or Elevation % (+ value)					
		Hb	HC	RBC's	WBC's	GPT	GOT
Crushed maize							
Dry leaves							
1 : 1	Female	+16.8	+13.9	+56.9	-67.5	-54.3	-24.5
2 : 1	Male	-39.0	-44.4	-43.6	-57.8	-23.4	+24.5
1 : 2	Female	+11.2	+12.6	-76.3	-64.3	+70.2	+18.9

Males fed on bait of crushed maize: dry powdered leaves (2:1) showed reduction in hemoglobin , haematocrit, RBC'S , WBC'S and GPT with 39.0, 44.4; 43.6, 57.8 and 23.4%, respectivel , whersas GOT activity was elevated with 24.5% in this respect.

GPT , GOT activities , haematocrit and hemoglobin content were elevated with 70.2 , 18.9 , 12.6 and 11.2%, respectively in females fed on bait system of ratio (1:2) whereas RBC'S and WBC;S were highly reduced with 76.3 and 64.3%, respectively.

However, these effects on blood contents may be due to the entry of the products of the digested water hyacinth and its metabolites into the circulation of blood and of protein fluid as a result of the fall in capillary filtration pressure produced by arteriolar constriction or the interaction with hemoglobin function which is the transport of oxygen from lungs to

the tissues (Bell *et al.*, 1976). The elevation of s-GPT and s-GOT activities may cause extensive hepatic necrosis, liver injuries or diffuse and focal chronic liver diseases such as chronic active hepatitis, cirrhosis and hepatic metastases (Dacie and Lewis, 1991). However, further studies are needed to apply baits of water hyacinth as a new biological and natural rodenticide in a commercial product under field conditions

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الملخص العربي

ورد النيل (*Eichhorina crassipes*) كمبيد قوارض طبيعي

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تم تقييم فاعلية النباتات الناضجة من ورد النيل كمبيد قوارض طبيعي. تم عمل طعوم من مسحوق الأوراق الجافة ومهروس الأوراق الخضراء مع جريش الذرة بنسب مختلفة وتم اختبار كفاءة هذه الطعوم بطريقتي التغذية الاختيارية والتغذية الغير اختيارية على إناث وذكور الفأر النرويجي الأبيض *Rattus norvegicus* var. *albus*. أثبتت الطعوم المختلفة لنبات ورد النيل بطريقتي الاختبار أنها مقبولة وجذابة للفأر النرويجي الأبيض وسببت أعراض مميتة ثم الموت الكامل خلال 8-12 يوم من التغذية. وقد تأثرت بشده مكونات الدم (الهيموجلوبين، الهيماتوكريت، كرات الدم الحمراء، كرات الدم البيضاء) بالإضافة إلى نشاط انزيمي جلوتاميك بيروفيك ترانس أمينيز وجلوتاميك أوكسالواسيتيك ترانس أمينيز في كل من ذكور وإناث الفأر النرويجي الأبيض التي تغذت على طعوم ورد النيل.