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RODENTICIDAL EFFECT OF DATURA PLANT LEAVES UNDER LABORATORY AND FIELD CONDITIONS

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ABSTRACT

The rodenticidal effect of datura plant leaves was studied under laboratory and field conditions. In both free choice and non-choice feeding tests, the chopped green leaves and dry powdered leaves baited with crushed maize, in different ratios, were tested for their rodenticidal activity. The results indicated that the dry powdered baits were more effective than the chopped green baits. Males of albino rats, *Rattus norvegicus* albinus, were more susceptible than females and pregnant females for all tested cases. In addition, data illustrated that, less amounts of different bait ratios were consumed by females followed by pregnant females and males. With increasing the amount of treated bait rather than crushed maize, the mortality percentages increased and the time to death decreased. This means that the rodenticidal effect of the datura plant leaves considerably differed according to leave condition (green or dry) and bait ratios. The field results were in harmony with the laboratory results as (1 crushed maize : 2 dry powdered leaves) was the most effective against the Shaw jird, *Meriones shawi* (population reduction, 62.07%).

INTRODUCTION

The large scale use of broad spectrum synthetic pesticides enhance the contamination of biosphere and increase the resistant problem to most of agricultural pests. The massive application of pesticides has created serious problems such as the build-up of pest resistance, the upsetting of natural balance, and the acute and chronic hazards to man and animals. It is therefore necessary to complement our reliance on synthetic pesticides with less hazardous, safe and biodegradable substitutes (Bali *et al.,* 1985).

The environmental pollution by synthetic chemicals has been providing us an impetus to get active materials as rodenticides from natural sources. Recently, several bioactive compounds which proved satisfactory in pest control were evaluated by researchers, i.e. Satpathy (1983), Morallo-Rajessus (1984), Saleh *et al.* (1986), Qureshi *et al.* (1991), Afifi *et al.* (1992) and Oji *et al.* (1994).

The aim of this work is to evaluate the toxicity of datura plant leaves as a naturally active product on the albino rat, *Rattus norvegicus* albinus and Shaw jird, *Meriones shawi,* under laboratory and field conditions.

MATERIALS AND METHODS

Tested plant:

The datura plant leaves, *Datura stramonium* (Fam. : Solanaceae) used in this study were collected from Helwan Governorate. The plants were identified by the Department of Timber-trees Research, Horticultural Research Institute, Agricultural Research Center.

Plant preparation:

Leaves were collected and cleaned from the dust and debris. Leaves of datura were dried under room temperature of 28±1°Cfor at least one week. The dry leaves were ground in a grinder to a coarse powder. The plant leaves were baited as chopped green or dry powdered mixed with crushed maize in different ratios.

Tested animals:

The adult male, female and pregnant albino rats, *Rattus norvegicus* (170-200 grams body weight) were used for laboratory experiments. Animals were caged individually and offered standard diet (65% crushed maize + 25% ground wheat + 5% sugar + 5% corn oil) and allowed free access to water. The unhealthy animals were excluded. The field experiments were conducted on the Shaw jird, *Meriones shawi* which was the dominant species infesting in El-Kefel farm at Nubaria area in Alexandria Governorate.

Laboratory experiments:

Free choice feeding test:

Free choice feeding test is important to determine the acceptability of datura plant leaves by comparing datura consumption with that of challenge diet according to Palmateer (1974).

Ten albino rats were used for each treatment. Rats were given a free choice between two food dishes in each cage, one containing untreated bait and the other containing the treated bait (macerated green leaves or dry powdered leaves mixed with crushed maize at 1:1, 1:2 and 2:1 ratios). One of each treatment and standard challenge diet were offered to each rat in small separate dishes (25 g of each). Their position was daily altered to avoid location preference. The consumed amount of bait and diet was recorded daily for 14 successive days. The treated baits were removed and survived animals were fed for 28 additional days on challenge diet. A parallel control test was conducted using standard diet. Bait acceptance was recorded and calculated according to Buckle and Smith (1994) equation as follow:

$$\textbf{Acceptance \%} = \frac{\text{Consumed amount of treated bait}}{\text{Consumed amount of treated bait + challenge diet}} \times 100$$

Non choice feeding test:

Rats were divided into 4 groups (each of 10 rats), three treatment groups and one as a control. Each rat was caged individually and offered one dish containing 25 g of treated baits (dry powdered leaves mixed with crushed maize 1:1, 1:2 and 2:1 ratios) for 14 successive days. The treated baits were removed and the survivor animals were fed on the standard diet and observed for 28 days. The consumed amount of bait was daily calculated. The mortality percentages, time to death (range and mean) and weight of consumed bait were recorded.

Field test:

The dry powdered baits of datura leaves were evaluated under field conditions in El-Kefel farm at Nubaria area in Alexandria Governorate. The trials were conducted during June and July after winter crops in an area infested with the Shaw jird, *Meriones shawi*. The test area was divided into 4 plots (each of one feddan) representing the three of treatments and another

plot was left without treatment as a control. The population density of rodents was estimated pre and post treatment according to Dubock (1982). Two Kg of each treatment were divided into plastic sacks (100 g of each) and distributed in every plot and exposed to rats using plastic bait stations. The consumed quantity of the treated baits were replaced every week until the stop of consumption. Bait consumption was recorded for every plot ever week. The percentage of population reduction was calculated using the following equation:

$$\text{\% Population reduction} = \frac{\text{Pre-treatment census - post treatment census}}{\text{Pre- treatment census}} \times 100$$

RESULTS AND DISCUSSION

Laboratory studies:

Free choice feeding test:

The results recorded in Tables 1 and 2 showed that the Bait ratio (2:1, 1:1 and 1:2 crushed maize : dry powdered leaves) were effective to cause 40, 40 and 60% mortality for the tested male rats with average treated bait consumed 85.71, 71.02 and 103.56 g followed by 20, 30 and 50% and 10, 20 and 40% mortality with average treated bait consumed 88.55, 59.13 g and 90.22 and 63.82, 55.71 and 77.79 g for pregnant and female rats, respectively. On the other hand, all ratios of chopped green leaves of datura exhibited less effects against rats showing 10, 20 and 30% and 10, 10 and 20% and 10, 10 and 20% mortality on male, female and pregnant rats, respectively.

The acceptance of baits treated with dry powdered leaves were 47.87, 48.44 and 54.60% and 43.54, 45.32 and 49.45% and 50.40, 39.50 and 46.82% compared with baits treated with chopped green leaves were 33.96, 23.55 and 22.02% and 27.95, 21.32 and 13.29% and 26.97, 19.97 and 16.27% on male, female and pregnant rats, respectively.

Table (1): Toxicity effect of dry powdered leaves of datura against albino rat, *Rattus norvegicus* by using free-choice feeding test.

Bait ratio	Sex	Average untreated bait consumed (g)	Average treated bait consumed (g)	Acceptance %	Mortality %	Time to death (day)	
Crushed maize : dry powdered leaves						Range	Mean±SE
2:1	Male	93.32	85.71	47.87	40	10-15	11.55± 0.1
	Female	82.76	63.82	43.54	10	-	16.0± 1.0
	Pregnant	87.15	88.55	50.40	20	10-17	13.5± 0.5
1:1	Male	75.60	71.02	48.44	40	5-11	9.00± 1.5
	Female	67.22	55.71	45.32	20	7-14	10.50± 0.5
	Pregnant	90.56	59.13	39.50	30	6-12	9.67± 0.1
1:2	Male	86.10	103.56	54.60	60	5-10	8.00± 1.5
	Female	79.53	77.79	49.45	40	6-12	9.50± 0.5
	Pregnant	102.48	90.22	46.82	50	6-10	8.50± 0.5
L.S.D. at 0.05	-	-	-	-	14.01	-	-

Table (2): Toxicity effect of chopped green leaves of datura against albino rat, *Rattus norvegicus* using free-choice feeding test.

Bait ratio	Sex	Average untreated bait consumed (g)	Average treated bait consumed (g)	Acceptance %	Mortality %	Time to death (day)	
Crushed maize : chopped green leaves						Range	Mean± SE
2:1	Male	116.25	59.77	33.96	10	-	24±1.0
	Female	99.70	38.67	27.95	10	-	25±0.5
	Pregnant	120.56	44.52	26.97	10	-	23±1.0
1:1	Male	133.81	41.22	23.55	20	18-22	20±0.1
	Female	110.22	29.87	21.32	10	-	23±1.0
	Pregnant	122.88	30.67	19.97	10	-	22±0.1
1:2	Male	128.33	36.25	22.02	30	15-20	17.0± 0.5
	Female	121.76	18.67	13.29	20	20-22	21.0±0.5
	Pregnant	130.89	25.44	16.27	20	19-21	20.0±1.0
L.S.D. at 0.05	-	-	-	-	9.42	-	-

The mean time required to death, for the three treatment ratios (2:1, 1:1 and 1:2 crushed maize : dry powdered leaves of datura) were 11.55, 9.0 and 8.0 days for adult males, and 16.0, 10.5 and 9.5 days and 13.5, 9.67 and 8.5 days for adult and pregnant females, respectively. On the other hand, a wide variation was observed for bait palatability of dry powdered leaves and chopped green leaves.

The compiled data revealed that, all ratios of baits treated with dry powdered leaves exhibited noticeable rodenticidal effects against albino rats compared with chopped green leaves baits.

Non choice feeding test:

Data in Table 3 show the rodenticidal potential of different ratio of baits treated with dry powdered leaves of datura. The compiled data was in parallel with these obtained from free choice test. The results indicated that the bait of crushed maize and dry powdered leaves of the tested plant at all ratios (2:1, 1:1 and 1:2) were very effective against males of albino rats followed by pregnant females and adult females, respectively. The highest mortality percentage was 70% in case of (1 crushed maize : 2 dry powdered leaves) against males with a considerable amount of bait consumption (75.66 g), with mean time to death of 7.57 days. A considerable variation in time to death was observed, whereas it ranged between 7.57 to 13.5 days. Less amounts of bait were consumed by females followed by pregnant females and males, with increasing the amount of treated bait rather than crushed maize the mortality percentages increased and the time to death was decreased.

This means that the rodenticidal effect of the datura plant leaves considerably differed according to leaves condition (green or dry) and bait ratios.

Datura plant contains toxic Tropane alkaloids, which have caused poisoning and death in humans and animals (Cheeke and Shull, 1985). All parts of datura plants contain dangerous levels of poison and may be fatal if ingested by humans or animals. The active ingredient are the Tropane alkaloids atropine, hyoscyamine and scopolamine which are classified as

deliriants or anticholinergies (Preissel and Hans-Georg, 2002 and Tannis *et al.,* 2008).

Table (3):Toxicity effect of dry powdered leaves of datura against albino rat, *Rattus norvegicus* by using non-choice feeding test.

Bait ratio	Sex	Average bait consumed (g)	Mortality %	Time to death (day)	
Crushed maize : dry powdered leaves				Range	Mean ± SE
2:1	Male	65.46	40	8-14	10.75± 1.0
	Female	46.13	20	12-15	13.50± 0.5
	Pregnant	60.67	20	10-15	12.50± 0.5
1:1	Male	59.70	50	5-12	9.0± 0.1
	Female	32.11	30	8-14	10.67± 0.1
	Pregnant	41.33	40	7-13	10.0±
1:2	Male	75.66	70	5-9	7.57± 1.0
	Female	50.20	50	6-11	8.20± 0.5
	Pregnant	59.88	60	6-10	8.00± 0.5
L.S.D. at 0.05	-	-	21.05	-	-

No death occurred in control treatments.

These findings are in agree with those obtained by Mahmoud *et al.* (1979), found that administration of the latex of oshar by all routes and the fresh leaves, by feeding, caused death in animals. Pahwa and Chatterjee (1988), reported that the latex of oshar against the black rat, *Rattus rattus* was led up to mortality and a maximum of 10 days through bait prepared from wheat flour, ground nut oil and sugar. Pahwa and Chatterjee (1990), found that crushed ground seed of yellow oleander were fed with bait caused mortality to the roof rat, *Rattus rattus* for maximum 10 days. Patel *et al.* (1993), found that datura plant gave higher mortality within 24 hrs against logicorn. Barri *et al.* (1998), found that dry shoots of *Crotataria saltiana* were fed to mice, it produced toxicity and death after 7 to 29 days. El-Deeb *et al.* (2008), reported that there are other compounds and natural products such as plant extracts were used as rodenticides.

Field studies:

The efficiency of the same three bait treatment ratios of dry powdered Leaves were tested against the Shaw jird, *Meriones shawi* under field conditions at Nubaria area in Alexandria Governorate. Results in Table 4 indicated that treatment (1 crushed maize : 2 dry powdered leaves) was the most effective one causing 62.07% reduction in rat population. This was followed by 40.83% and 18.92% for treatments (1:1 and 2:1 crushed maize : dry powdered leaves), respectively. The amount of dry powdered leaves of datura required for mortality differed according to bait ratios. The highest consumed amount per feddan was (1350 g) in case of (2 crushed maize : 1 dry powdered leaves).

Discussing the aforementioned data, it could be noticed that the field performance was in harmony and confirmed the laboratory results. Similar observations in field were recorded by El-Deeb *et al.* (2008).

Table (4): Field performance of dry powdered leaves of datura against Shaw jird, *Meriones shawi* at Nubaria area.

Bait ratio	Consumption (g)/feddan			%population reduction
Crushed maize : dry powdered leaves	Pre-treatment	Poison bait	Post-treatment	
2:1	1480	1350	1200	18.92
1:1	1200	1120	710	40.83
1:2	1450	1200	550	62.07
L.S.D. at 0.05	-	-	-	27.31

REFERENCES

Afifi, F. A.; A. A. Gomaa; Z. H. Zidan; E. Z. Fam and M. S. Salwa Ahmed (1992): Preliminary evaluation of chemical constituents in certain bioactive plant extracts. Arab Univ. J. Agric. Sci., Ain-Shams Univ., Cairo, 1(1): 97-111.

Bali, H. S.S.; S. Pati and S. Sawai (1985): Preliminary screening of some plant for moluscicidal activity against two snail species. Indian J. Anima. Sci., 55 (5): 338-340.

Barri, S. E.; I. Adam and O. H. Omar (1998): Toxic effects of *Crotalaria saltiana* in mice. Hum. Toxicol, 30 (5): 429-430.

Buckle, A. P. and R. H. Smith (1994): Rodent pests and their control,. Cab. International, UK, Pp. 161-181.

Cheeke, P. R. and Shull, L. R. (1985): Natural toxicants in feeds and poisonous plants. AVI Publishing Company, Inc., Westport, Conn., USA 429 pp.

Dubock, A. C. (1982): Pulsed baiting-a new technique for high potency slow acting rodenticides. Proc. Conf. The Organization and Practice of Vertebra. Pest Control UK: 105-143.

El-Deeb, H. I.; M. R. Abd-El Kader; W. M. Gabr and H. A. Ahmed (2008): Rodenticidal efficiency of certain compounds against *Rattus norvegicus* and *Rattus rattus alexandrines*. Egypt. J. Agric. Res., 86 (2): 459-469.

Mahmoud, O. M.; S. E. I. Adam and G. Tartour (1979): The effect of *Calotropis procera* on small ruminants. I. Effects of feeding sheep with the plant. J. of Comp. Path., 89 (2): 241-250.

Morallo-Rajessus, B. (1984): Status and prospects of botanical pesticides in Philippines. II SERCA Conf. Chair Lecture 29 Agu. 1984 Univ. of Phillipp. At Los Bamos, College of Laguna, Philippines. P 19.

Oji, O.; F. N. Madubuik; P. C. Ojimelukwa and C. M. Ibeh (1994): Rodenticide potential of *Thevetia peruviana.* J. Hebs, species and Medical plants, 2: 3, 3-10; 9 ref., 1 p1.

Pahwa, R. and V. C. Chatterjee (1988): The toxicity of Indian *Calotropis procera* RBr latex in the black rat, *Rattus rattus* Linn. Vet. Hum. Toxicol., 30 (4): 305-308.

Pahwa, R. and V. C. Chatterjee (1990): The toxicity of yellow oleander seed kernels to rats. Vet. Hum. Toxicol., 32 (6): 561-565.

Palmateer, S. D. (1974): Laboratory testing of albino rats with anticoagulant rodenticides. Proc. 6th Vert. Pest Conf., Anaheim Calif. March, 5-7: 63-72.

Patel, J. R.; D. B. Jyani; C. C. Patel and P. K. Broad (1993): Insecticidal property of some plant and their available formulations against *Amsacta moori* bulter. Bot. Pes. In Integrated Pest Management.

Preissel, U. and Hans-Georg P. (2002): Brugmansia and Datura Angel's Trumpets and Thorn Apples. Buffalo, New York. Firefly Books. PP 124-125.

Qureshi, M. A.; N. M. Qureshi; R. Arshad and R. Begum (1991): A study on the antisperm activity in extracts from different parts of *Calotropis procera.* Pakistan J. Zoology, 23 (2): 161-166.

Saleh, M. A.; N. A. Ibrahim; M. M. El-Bolok and E. A. Abdel-Salam (1986): Insecticidal activity of selected Egyptian wild plants. Bull. Fac. Agric., Cairo Univ., 37 (1): 517-525.

Satpathy, J. M. (1983): Plant species reportedly possessing pest control properties. An EWC/UH DATA BASE, Hawaii Univ., Pp. 249.

Tannis, H. W.; Eric, S. S. and Laurence, Y. K. (2008): Angel's Trumpet (*Datura stramonium*) poisoning and delirium in adolescents in Winnipeg, Manitoba: Summer 2006. Paediatr Child Health, 13 (3): 193-196.

التأثير الإبادي لأوراق نبات الداتورة علي الفئران تحت الظروف المعملية والحقلية

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تم دراسة تأثير أوراق نبات الداتورة كمبيد قوارض تحت الظروف المعملية والحقلية. ولقد أجري معملياً في كل من إختباري التغذية الإختيارية واللاختيارية طعوم من مهروس الأوراق الخضراء وكذلك مسحوق الأوراق الجافة مع جريش الذرة بنسب مختلفة وإختبار تأثيرها الإبادي علي الفئران البيضاء.

أوضحت النتائج أن طعوم مسحوق الأوراق الجافة كانت أكثر فاعلية من طعوم مهروس الأوراق الخضراء في جميع الحالات والنسب المختبرة. كما أكدت النتائج أن ذكور الفئران البيضاء أكثر حساسية من الإناث والإناث الحوامل في جميع الحالات المختبرة وكذلك لوحظ أن الإناث كانت أقل إستهلاكاً للطعوم بنسبها المختلفة تليها الإناث الحوامل ثم الذكور، كما أن زيادة كمية الطعوم السامة من أوراق نبات الداتورة سواء كانت خضراء أو جافة عن جريش الذرة في جميع الحالات المختبرة يزيد من نسب الموت مع إنخفاض زمن الموت. وبذلك أظهرت النتائج المتحصل عليها أن التأثير الإبادي لأوراق نبات الداتورة يختلف بإختلاف نوع الأوراق (خضراء أو جافة) بالإضافة الي كميتها.

أما بالنسبة للنتائج الحقلية فقد كانت متوافقة مع النتائج المعملية حيث أعطي طعم جريش الذرة مع مسحوق الأوراق الجافة بنسبة (2:1) أعلي نسبة خفض في تعداد الجيرد الشاوا 62,07%.

قام بتحكيم البحث

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