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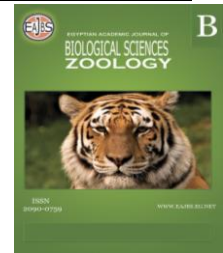


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Evaluation of The Toxicity of Scorpion Venom and Digoxin on Human Cardiovascular System and in Decomposition Arthropods Succession Using Rat Carrions

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ABSTRACT

Background and Objective: Arthropods discovered at a forensic scene are thought to provide vital evidence regarding the time and place of death, the victim's possible antemortem or postmortem treatment, drugs, toxins, Scorpion envenomation, digoxin and so on. Although digoxin is used for treating a variety of heart problems, digoxin toxicity is clinically important as it can lead to mortal cardiac arrhythmias. Scorpion (*Leiurus quinquestratus*) is one of the maximum risky scorpions in the world, which also causes cardiotoxic effects. The aim of this investigation is to evaluate the toxic effect of scorpion venom and digoxin on the human cardiovascular system and a comparative study between the death and decomposition of rat carrions in a natural way, scorpion stings and the toxicity of digoxin. **Materials& Methods:** The present study consisted of two parts; the first part; describe ECG findings of the toxic effect of scorpion venom and digoxin on human and the second part; decomposition arthropods succession using rat carrions. **Results:** A total of 100cases attended the emergency department of Internal Medicine Assiut University Hospital during the period from March 2020 to August 2021 (50 normal, 26 scorpion envenomation and 24 digoxin toxicity. 71% (18) of patients diagnosed by digitalis Toxicity presented by scoping of T wae; 29 % (6) presented by heart block. 65% (17) patients diagnosed by scorpion bite presented by myocarditis and 35%(9) patients presents by a variable degree of AV and intraventricular block.

The venom apparatus of the Scorpion(*Leiurus quinquestratus*) has morphological and histological desecrations. The current results revealed that the forensically important arthropods, represented by fourteen taxa, belong to the phylum Arthropoda and 11 families.

Conclusion: The present investigation considered a step forwarded and a basis for further works dealing with arthropods colonization and decomposition of carrions.further studies would be directed toward investigating try to trace the digoxin or scorpion venom (in the form of nanoparticles) inside the tissue of arthropod larvae.

INTRODUCTION

Digitalis purpurea, a type of foxglove, is the source of digoxin. It belongs to the digitalis class and is a cardiotonic glycoside. Digoxin's chemical formula is $C_{41}H_{64}O_{14}$. Cardiac glycosides, such as digitalis and digoxin, have been used in clinical practice for a long time. This medicine was approved by the FDA in 1954 and is used to treat a variety of cardiac conditions including atrial flutter, atrial fibrillation, and heart failure with accompanying symptoms (Grubb & Mentz 2020).

In clinical practice, digoxin overdose is significant because it can cause fatal cardiac arrhythmias. It is estimated that between 0.8 and 4% of people on long-term digoxin medication will develop this condition. Toxicity is more likely when serum digoxin concentrations exceed 2.0 ng/ml. Toxicity can occur at lower dosages, especially when additional risk factors such as low body weight, elderly age, and dehydration are present and deteriorating health (Fu *et al.*, 2020).

Scorpion (*Leiurus quinquestriatus*) is one of the most dangerous scorpion species in the world, and it is found in Egypt, particularly in Upper Egypt and Sinai (El-Hennawy, 2014). According to Abdelaziz *et al.* (2019), it is more toxic than *Androctonus crassicauda* in Egypt, posing a health risk.

Scorpion venom is a water-soluble antigenic mixture antigenic of neurotoxic, cardiotoxin, nephrotoxin, hemolysins, phosphodiesterases, phospholipase, hyaluronidases, histamine, and other substances. Voltage-dependent ion channels are the main target of scorpion venom (Bawaskar & Bawaskar, 1998).

Both local and systemic reactions are triggered by the venom. Itching, edema, and ecchymosis with burning pain are common local reactions. Giddiness, bradycardia, a drop in body temperature, restlessness and tachycardia, and lastly pulmonary edema are the cardiovascular symptoms (Wallace, 1994). The venom can cause cardiac injury by a variety of pathogenetic pathways, the most common of which is myocardial ischemia which is caused by coronary spasm, the release of peptides and amine components that are vasoactive, inflammatory, and thrombogenic (histamine, serotonin, bradykinin, leukotrienes, thromboxane) (Yang *et al.*, 2009). The venom has a cardiotoxic impact, causing toxic myocarditis via reduction of Na-K-ATPase and adrenergic myocarditis (Rahav & Weiss, 1990). Anaphylactic shock is caused by the release of allergenic proteins, which produces hypotension, vasodilation, and a decrease in intravascular volume, as well as impaired cardiac perfusion. (Bahloul *et al.*, 2005).

Forensic arthropodology is a science which deals with arthropods and insects that are successive to the carrions in order to succession and helps to determine the post-mortem period (Joseph *et al.*, 2011). Entomology is defined as the study of insects and other arthropods that are connected to them (crustaceans, spiders and so on). It is the name given to this study when it is utilized to assist in legal investigations (Benecke, Lessig, 2001). Arthropods are the most varied and largest invertebrate animal phylum (Abdelaziz, 2018). The first step to solve the criminal case is knowing the exact time and cause of death through the correct number and types of arthropods and their identification as well as other crucial details about the victim's death, such as the season of death, the scene of death, and the movement of the victim's remains after death (Campobasso & Introna, 2001) and (Sharma *et al.*, 2015). Where insects and arthropods use carrion for food and as a medium for mating and laying eggs on it (Rivers & Dahlem, 2014). There are many reasons that affect the success of arthropods on carrions: the climatic region, the type of soil, the season, the types of arthropods present in the region, as well as their seasonal availability and vegetation cover (Anderson, 2000) (Anderson *et al.*, 2010). Many authors have admitted that there is a lack of forensic arthropods. For

example Mabika et al. (2014) and Padonou *et al.* (2017).

The present study entailed two parts; the first part; describes the ECG findings of the toxic effect of scorpion venom and digoxin on humans and the second part; decomposition of arthropods succession using rat carrions.

MATERIALS AND METHODS

1.The First Part of This Study(human part):

A hospital-based retrospective study that includes analysis of ECG of 100 cases (50 normal, 26 scorpion envenomation and 24 digoxin toxicity) attending the emergency department of Internal Medicine Assiut University Hospital during the period of March 2020 to August 2021.

2.The Second Part of This Study(experimental part):

This work was carried out in Assiut University, Faculty of Science, during the Summer of 2021. The experiment included fifteen male albino rats weighted (200- 300 grams) purchased from the Animal House, Faculty of Science, Assiut University. Each rat was identified by branding with dilute picric acid. Before the start of the experiment, tested animals were acclimatized for one week to normal laboratory conditions (temperature: $28\pm 20^{\circ}\text{C}$, relative humidity: $50\pm 5\%$ with 12 hours of the light-dark cycle). They were maintained at the same conditions throughout the study period according to the guidelines on Care and Use of Laboratory animals (Essiet *et al.*, 2017). The studied rats were divided into three groups (five rats in each group). Group 1; Control, Group 2; rats were kept in a cage with 20 scorpions(*Leiurus quinquestriatus*)for half an hour and Group 3; Rats received oral digoxin by a dosage of (60 mg/kg) which represent twice LD50(Digoxin tablets were obtained from pharmaceuticals and dissolved in distilled water). The studied rat models were used to simulate human cadaver decomposition. Outdoor, each rat was placed on the sandy substrate. Through the first month after death, the carrions were visited daily. During each visit, arthropod specimens were collected from the groups and transported to the Laboratory of the Zoology Department, Faculty of Science, AssiutUniversity. For identification of the collecting arthropods, for permanent preservation arthropods were placed in 72% ethanol or 10% neutral formalin (Fig. 1).

❖ Histological Investigations:

According to Carleton *et al.* (1980) tissue sections ($5\mu\text{m}$) from the Scorpion, apparatus were mounted on slides and dried overnight at 37°C , de-waxed in xylene and hydrated in a graded series of alcohols and stained with hematoxylin and eosin.

❖ Statistical Analysis:

SPSS version 22 was used to analyse the data (SPSS, Inc., Chicago, IL). Quantitative data were expressed as mean SD, whereas qualitative data were expressed as frequency and percent. The chi-square test was used to compare qualitative data, whereas the t-test was used to compare quantitative data. Statistical significance was defined as a P value of less than 0.05.

❖ Ethical Consideration:

The ethical committee of Assiut University's faculty of medicine approved the study protocol.

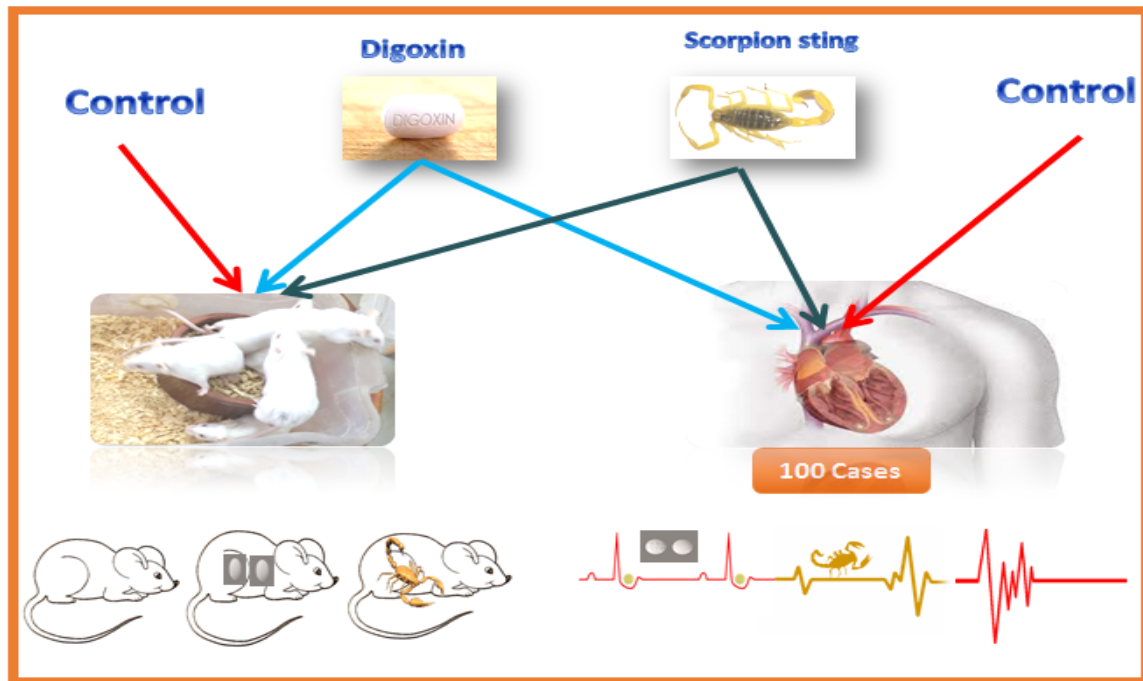


Fig. 1: Diagram showing the study design.

RESULTS

1. The First Part of This Study (human part):

The Cardiovascular Toxicity Of Scorpion Venom And Digoxin In Humans (ECG findings of scorpion venom and digoxin toxicity)

In our 100 patients finding (50 normal, 26 scorpion envenomation and 24 digoxin toxicity). Normal electrocardiography (ECG) (Fig.2,A) ,Patient take therapeutic digoxin in context of AF (Fig.2,B) 71% (18) of patients diagnosed by digitalis. Toxicity (i.e. toxic level of serum digoxin) presented by scooping of T wave;29 %(6) presented by heart block (Fig.2,C), 65% (17) patients diagnosed by scorpion bite presented by myocarditis (Fig.2,D), Myocarditis with wide QRS and secondary T wave changes in scorpion bite (Fig.2,E) and 35% (9) patients present by a variable degree of AV and intraventricular block (Fig. 2, F) and (Fig.3).

2.The Second Part Of This Study (experimental part):

i. Observation of the studied rats;

Rats of group 2died within half an hour. They showed multiple stings at different sites of their bodies, While rats of group 3 died within an hour of oral administration of digoxin.

ii. Morphological Structures (examination) of Venom Apparatus of the Scorpion (*Leiurus quinquestriatus*):

Adult scorpion length ranged from 80 to 110 mm. Color ranges from yellow to orangish-yellow. Dark colouring is often limited to the posterior 2/3 of the metasomal segment. The amount and intensity of black colouring differ from specimen to specimen. Older specimens may have a darker overall colour, with the metasomal segment dark coloration faded, diminished, or obscure. metasomal segment faded, reduced or indistinct. Pectinaltooth in male(31–36) and in female (26–29) (Fig.4,A,B&C).The venom apparatus consists of a bulbus vesicle and a stinger. The vesicle is yellowish and globosely while the brownish aculeus is longer than the vesicle, sharply pointed and shallowly curved (Fig.4,D).

iii. Histological structures(examination) of venom apparatus of the Scorpion (*Leiurus quinquestriatus*):

Histological examination of the venom apparatus revealed that In the vesicle of the telson, two totally distinct bilateral venom glands are discovered, one on each side of the midline(Fig.5,A). The telson is covered by a thick cuticle; which consists of two layers: an outer exocuticle and an inner endocuticle (Fig.5,B,C&D).

iv. The Collecting Arthropods (isolation and identification):

In the present investigation, fourteen taxa were recorded. These taxa belong to phylum Arthropoda and eleven families (Fig.6).

v. Stages of Decomposition From Fresh to Dry Stages:

There are five stages of decomposition in this work (Fig.7) (Fig.8,F).

a) Fresh Stage (0-12h):

This stage lasted from the moment of death till bloating. There were no foul odours in any of the three groups. Calliphoridae, Muscidae, and Sarcophagidae families were discovered hovering around carrions (Fig.8,A) and(Table 1).

b) Bloat Stage (12h-3 days):

All of the carrions in this study were totally bloated, had a strong putrid odor, with decomposition fluids pouring beneath the corpse. The odour of the decaying corpse attracts these arthropods. Within minutes, the calliphorids arrive, and the egg hatches into the first instar. It moults to become the third instar, which then moves on to the wandering stage. The initial colonizers were *Chrysomya albiceps*, *Musca domestica*, *Sarcophaga* sp., *Wohlfahrti amagnifica* and *Parasarco phagaorgyro stama*. Under the carrions, there were numerous isopods, spiders, *Apissp.*, and beetles in groups(1&3), digoxin (group 3) was found to increase the growth rate of larvae, and altered the post mortem interval by 18 h and 48 h when estimated from larvae and puparia respectively, while group (2)the presence of scorpion venom was observed to reduce the rate of growth of fly larvae. The larvae feeding on poisoned tissues were smaller, and it was claimed that larvae taken from poisoned muscle and liver tissues would change the post mortem interval calculation by 36 hours and 28 hours, respectively (Fig.8,B) and (Table 1).

c) Active Decay Stage(4-6 days):

In group 1 (Control) the skin fur separation, all body surface intact and larval infestation, group 2 (Scorpion envenomation) purification, open abdomen and mild larval but infestation in development of flies was observed in tissues containing scorpion venom and group 3 (digoxin toxicity) sever putrefaction, severely liquefied tissues, intestine out the abdomen and ruptured intestine pelvis, severe infestation, heavy larval infestation and tissue severely putrefied(Fig.8,C). Maggots stop eating as soon as they reach their maximum length, according to daily observations of their feeding behaviour by arthropods. The anterior intestine is usually empty during the course of its future development. According to reports, the post mortem period in blowfly maggots can be determined by analysing the intestinal contents after 14 days (Table 1).

d) Advanced Decay Stage (7-29 days):

In groups (1&3) odors were less. Carrions were completely dehydrated with a loss of weight. Dry skin was starting to separate from the bodies. Numerous insects, isopods, beetles were found. Except for group (2) dry body liquefied tissues in dryness form arborization, mild larval(Fig.8,D) and (Table 2).

e) Dry (remains) Stage (30-70 days):

The soft tissue vanished in all three groups, and the carrion odour began to dissipate. Dry skin and bone made up the rats. Calliphoridae, Muscidae, and Sarcophagidae had fewer specimens collected (Fig.8,E) and (Table 2).

Table 1: Comparison between the studied groups in Arthropods of Forensic during the period from 0- 7days.

Variables		Group (1)		Group (2)		Group (3)		P- value*
		No.	%	No.	%	No.	%	
(0-1) Day	Eggs	8	57	2	13	6	26	0.368
	Larva 1	2	14	3	20	1	4	0.809
	Larva 2	0	0	3	20	1	4	0.377
	Larva 3	0	0	3	20	0	0	NA
	Pupae	0	0	2	13	0	0	NA
	Adult	4	29	2	13	15	65	0.050
	Total	14		15		23		-
	P- value**	0.001		0.028		0.00		-
(2-4) Days	Eggs	25	11	8	18	12	6	0.286
	Larva 1	50	23	11	25	37	17	0.262
	Larva 2	35	16	13	30	74	35	0.039
	Larva 3	43	20	7	16	45	21	0.428
	Pupae	0	0	0	0	0	0	NA
	Adult	67	30	5	11	46	21	0.098
	Total	220		44		214		-
	P- value**	0.350		0.172		0.049		-
(5-7) Days	Eggs	27		27		40		0.782
	Larva 1	80		52		166		0.096
	Larva 2	37		96		241		0.038
	Larva 3	31		31		138		0.066
	Pupae	57		47		95		0.718
	Adult	79		9		27		0.000
	Total	311		262		707		-
	P- value**	0.432		0.199		0.030		-

*P-value** represents a significant difference between groups.

*P-value*** represents a significant difference within each group.

Table 2: Comparison between the studied groups in Arthropods of Forensic during the period from 8- 30days.

Variables		Group (1)		Group (2)		Group (3)		P- value
		No.	%	No.	%	No.	%	
(8-9) Days	Eggs	33	11	33	15	28	6	0.962
	Larva 1	70	23	76	34	117	23	0.850
	Larva 2	31	10	45	20	154	31	0.050
	Larva 3	17	6	14	6	43	9	0.303
	Pupae	28	9	28	13	28	6	1.000
	Adult	124	41	28	13	131	26	0.080
	Total	303		224		501		-
	P- value**	0.062		0.199		0.030		-
(10-30) Days	Eggs	23	5	21	11	107	16	0.125
	Larva 1	106	24	51	28	159	23	0.190
	Larva 2	31	7	21	11	177	26	0.124
	Larva 3	95	22	40	22	135	20	0.385
	Pupae	64	15	43	23	84	12	0.746
	Adult	121	28	9	5	28	4	0.002
	Total	440		185		690		-
	P- value**	0.282		0.493		0.520		-

*P-value** represents a significant difference between groups.

*P-value*** represents a significant difference within each group

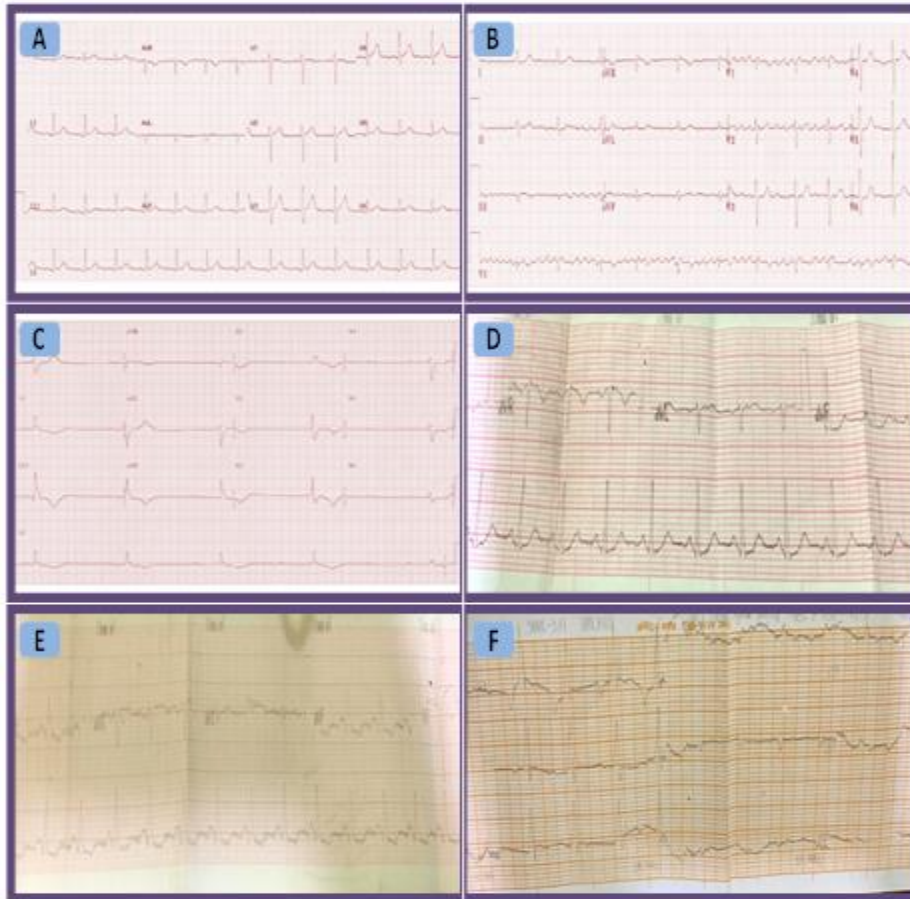


Fig. 2: A: Normal ECG ,B: Patient take therapeutic digoxin in context of AF ,C: Picture of digitalis toxicity ,Scoping of T wave; complete heart block, D:Sinus tachycardia in scorpion bite , E: Myocarditis with wide QRS and secondary T wave changes in scorpion bite and F:Variable degree of AV intra-ventricular block in scorpion bite.

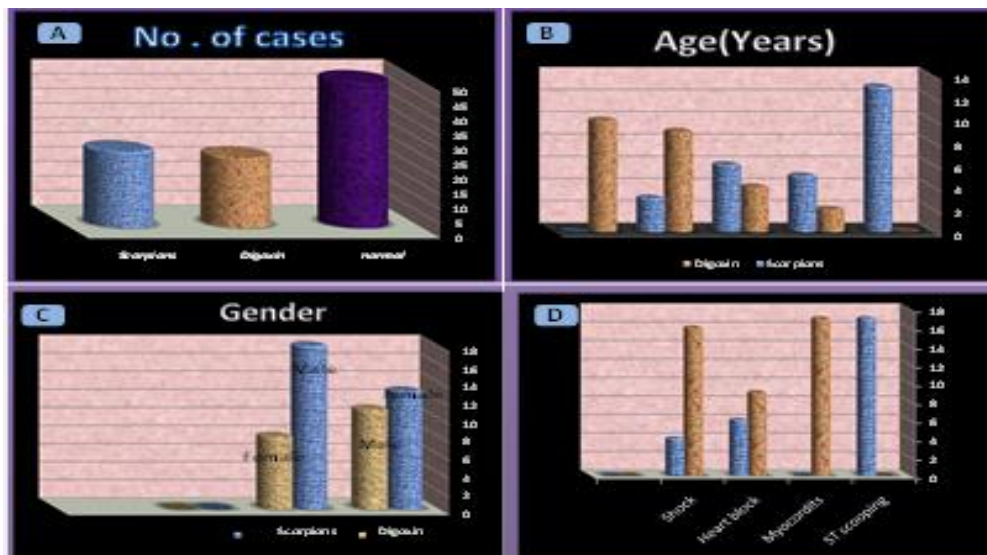


Fig. 3:Epidemiological criteria of scorpion sting and digoxin cases: A: Number of patients (100 cases),B:Age (years) of cases, C: Gender (Number of males and females) and D:patients Clinical diagnosed .



Fig. 4: Photograph showing: A Scorpions (*Leiurus quinquestriatus*), B: Dorsal view of scorpion (*L. quinquestriatus*), C: ventral view of scorpion (*L. quinquestriatus*) and D: venom apparatus of scorpion (*L. quinquestriatus*).

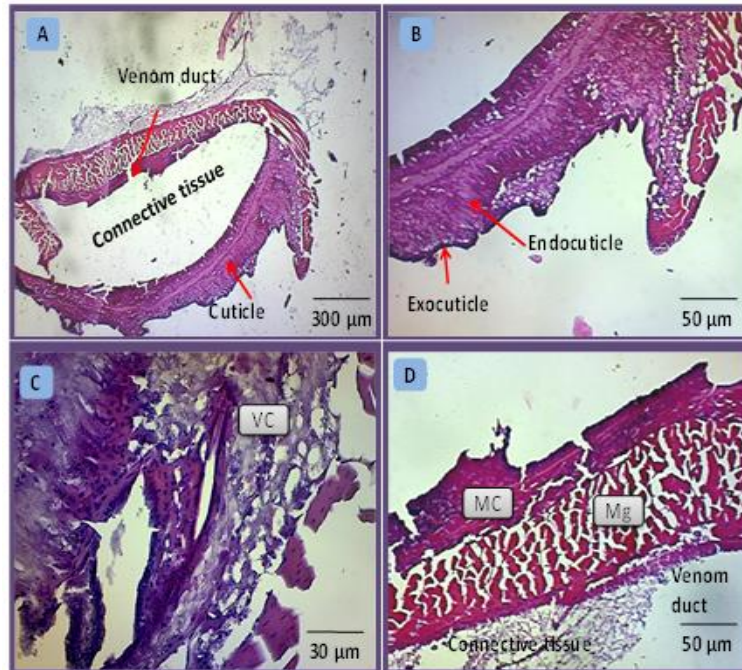


Fig. 5 : Light micrographs of venom glands of *L. quinquestriatus* showing their histological structures (Stained H&E). A: A section of the venom gland of scorpion (*L. quinquestriatus*) showing thin trabecula of connective tissue upon which the glandular epithelia are located. Note the presence of skeletal muscle fibers at the periphery together with the glandular capsule., B: A section of the venom gland showing two-layered cuticle, C: A section of the of venom gland showing venom-producing cells with different types of granules and D: A section of the of venom gland showing mucous cells and mucous granules. **Note** also the density stained within the secretory cells. (MC: mucous cells, Mg: mucous granules, VC: venom-producing cells).

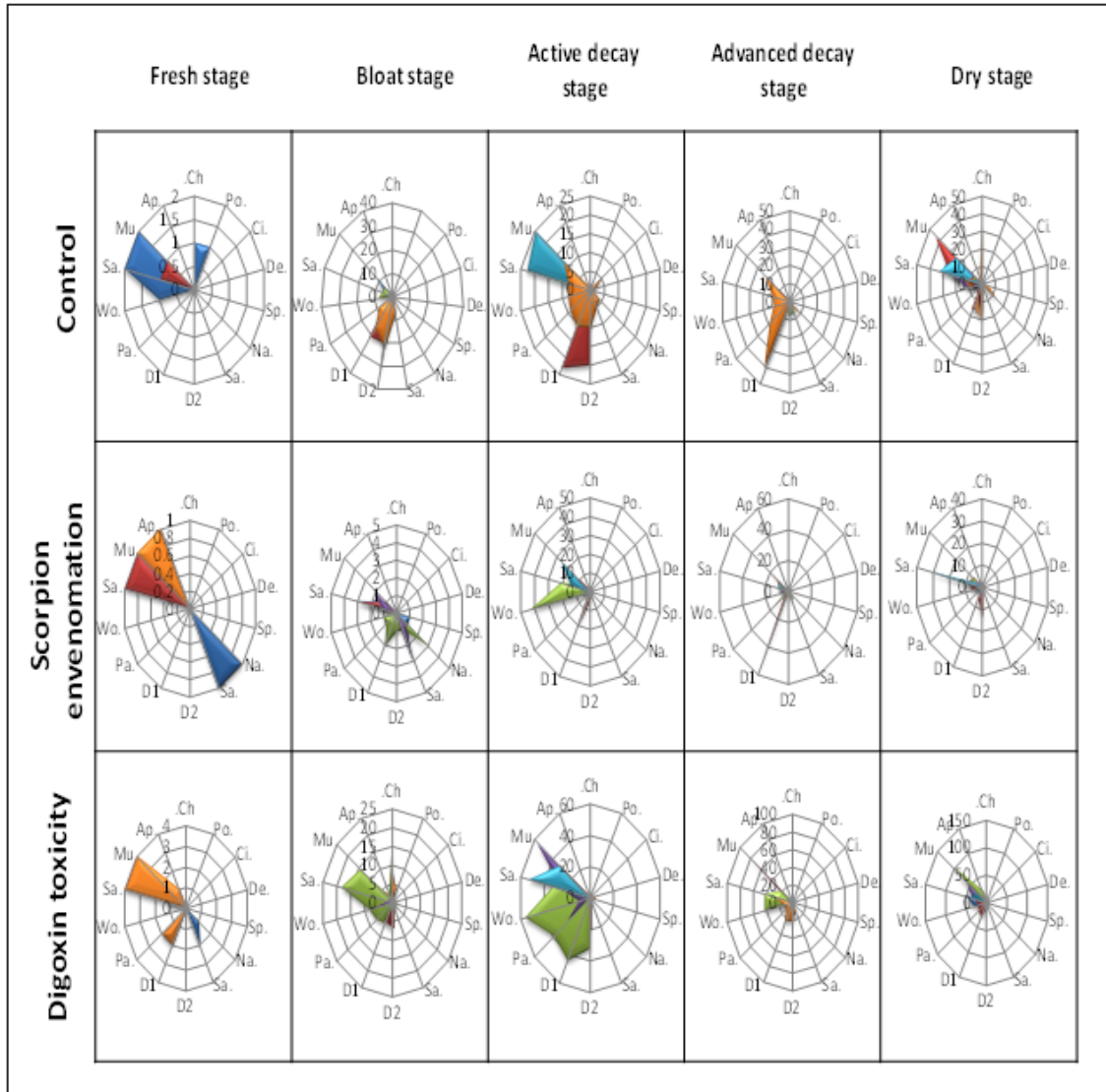


Fig. 6: Number of arthropods collected from from rat carrions in all three in stages of decomposition. (Ch. :*Chrysomya albiceps* , Ap. :*Apis* sp., Mu. :*Musca domestica* , Sa. :*Sarcophaga* sp., Wo. :*Wohlfahrtia magnifica*, Pa.: *Parasarcophaga* , D1 :*Dermestes maculates*, D2 ;*Dermestes frischi* ,Sa. :*Saprinus* sp. , Na.: *Nasonia* sp. ,Sp :*Spider*, De.:*Dermatophagoides* sp. , Ci.: *Cimex lectularis*, Po. : *Porcellio laevis*).

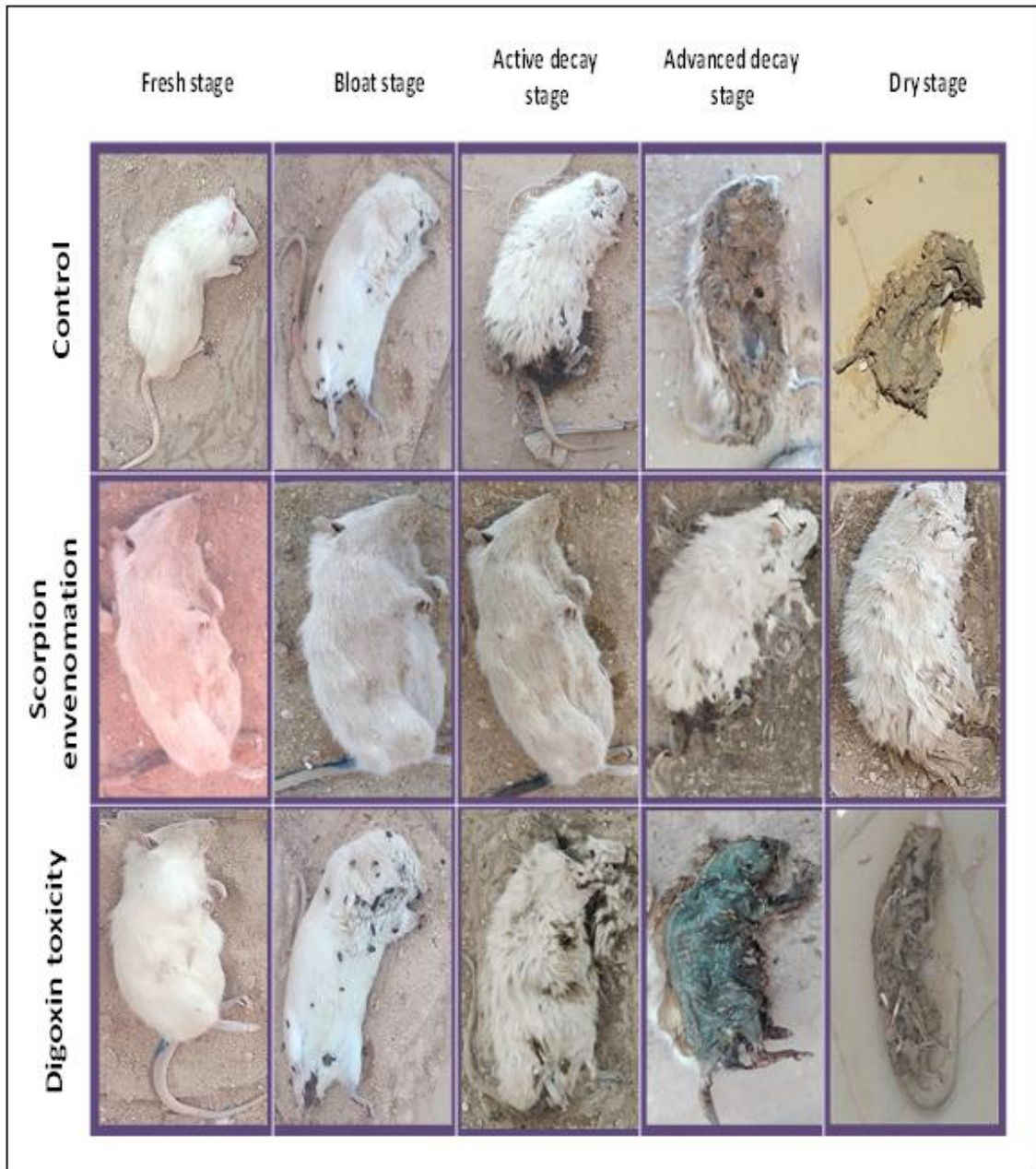


Fig. 7: Overview showing the decomposition stages of rats, Group (1); Control, Group (2); Scorpion envenomation and Group (3); Digoxin toxicity.

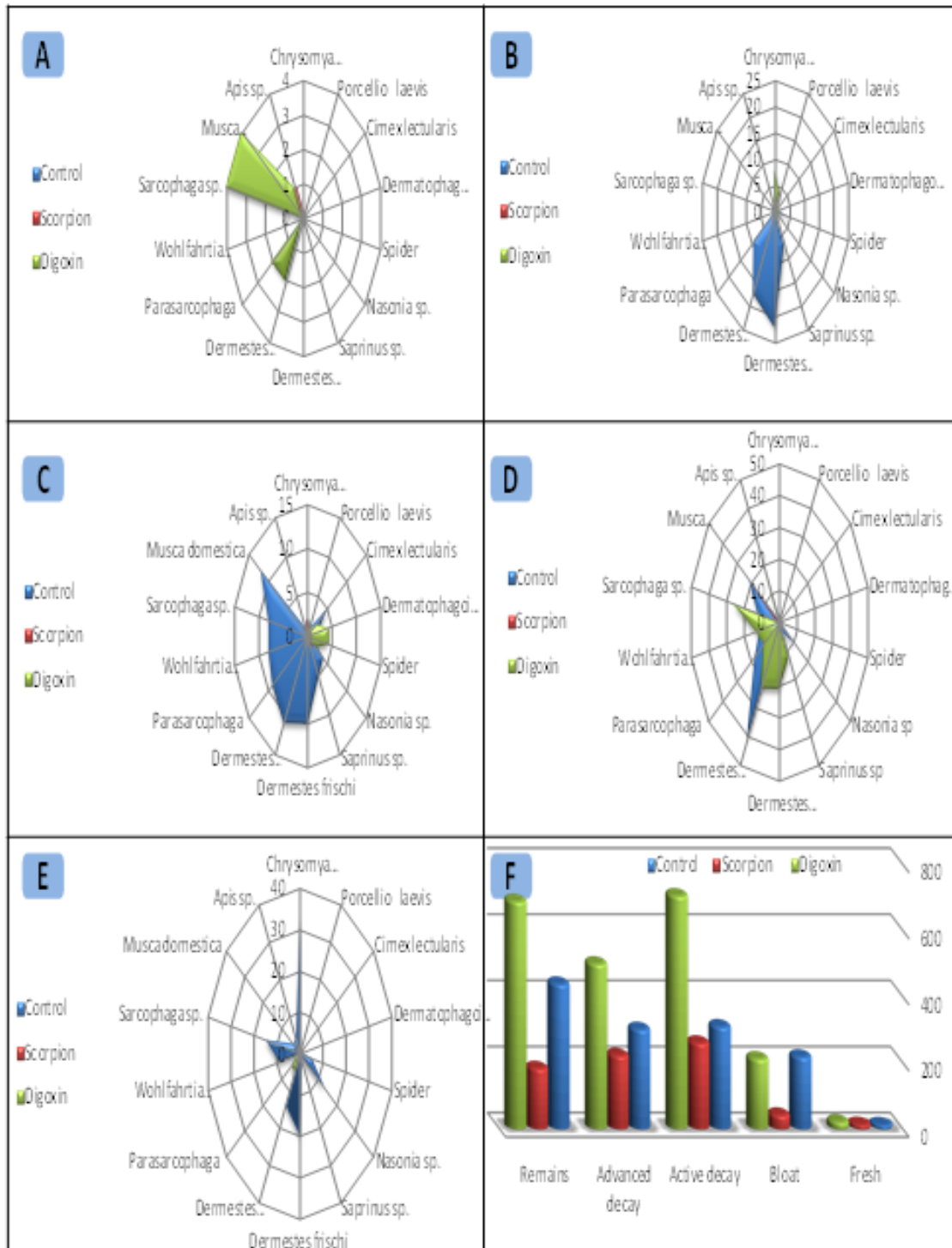


Fig. 8: Stages of decomposition, A: Fresh stage ,B: Bloat stage ,C: Active decay stage, D: Advanced decay stage , E: Dry (remains) stage and F: Stages of decomposition from fresh to dry stages in three groups.

DISCUSSION

It is well known that digoxin is considered as a treatment option to control heart rate in patients with atrial fibrillation also, digoxin is important to avoid hospital admissions in patients with heart failure (Shrier *et al.*, 2007). Arrhythmias may occur in digitalis toxicity even if the patient is asymptomatic because they usually necessitate intact

conduction in the atrioventricular node. Characteristic arrhythmias are those in, sinus bradycardia, atrioventricular block and ventricular ectopy are more common. With severe poisoning, ventricular tachycardia (which may be bidirectional) and ventricular fibrillation can occur. 'Reverse tick' T-wave inversion (scooping) is not an indicator of toxicity (Williamson *et al.*, 1998).levels over the usual therapeutic of digoxin range appear to indicate heightened levels before death, and pose a deadly threat. Because digoxin's poisonous symptoms include a cause of persistent congestive heart failure and the emergence of life-threatening diseases arrhythmias (Chung, 1969&Fisch, 1971).In the present study, digoxin increased the growth rate of larvae while scorpion venom decrease the growth rate of larvae. It is worthy to mention that Lieu recorded the presence of harmful compounds has been observed to accelerate or reduce the pace of larval growth.

The findings in our patients were consistent with acute myocarditis most likely as a result of toxic myocarditis and/or coronary spasm. After an arthropod envenomation, acute myocardial infarction is quite rare.

Valdivia *et al.* (1992) described a group of 32 youngsters, they were suffered cardiac issues after being bitten by a scorpion.50 percent of these people had myocarditis, 12.5 percent had a subclinical illness, and 63 percent had ECG abnormalities.

Although insects, especially flies, are considered a source of nuisance and transmission of diseases, they are of great importance in forensic science because they are an important indicator in knowing the post-mortem period (Anderson, 2000). Forensic entomologists are often based on magnopotti samples collected and preserved and preserved using a variety of techniques from police medical examiners. The type of solution in which worms are killed or preserved has significant effects on their length(El-Kady, 1999). Arthropods are the various first and greater crucial invertebrates to reach and colonize a cadaver whether or not animal or human (Nuorteva 1977), (Smith, 1975) and (Erzincllioğlu, 1983). Dead frame progresses via a diagnosed series of decomposing stages, from fresh to skeletal, over a length of time. The arthropods arise in predictable series depending on the degree of decay (Turchetto *et al.*, 2004). This present result is according withMorettiet *al.* (2008) and Abdelaziz & El Shehaby (2019)class of decomposition in specific conditions varies relying on the sort of carcass and the period of the levels. Approximately 5 levels of decomposition have been diagnosed in rat and mouse carcasses.

The current findings revealed that the forensically important arthropod species are represented by 14 taxa belonging to the phylum Arthropoda and 11 families. Similar observations were also reported by Abd Abdelaziz & El Shehaby (2019)whoidentified13 taxa belonging to the phylum Arthropoda and 10 families and Valdes-Perezgasga *et al.* (2010) revealed on Pig in Mexico that19 species of Arthropods. Another vital contribution that arthropods can make in figuring out the motive of demise is withinside the location of toxicology (entomotoxicology), i.e. in which the frame has decomposed to the factor in which it's far withinside the dry stage, containing the simplest skin and bones or has grown to be skeletonized with simplest bones remaining, it's far nevertheless feasible to decide if the sufferer died as a result of a drug overdose or poisoning (Klotzbach *et al.*, 2004). As a result, arthropoda species and decomposition times varied depending on the type of carrion, habitat, sit and way of death (normal or digoxin or venom).

The present investigation confirmed that the venom apparatus of *L. quinquestriatus* consists of a pointed stinger and a paired venom gland located inside the vesicle, this result is in accordance withJiao& Zhu (2010), who indicated that scorpions are distinguished by the presence of a venom apparatus at the end of their telsons. Its survival is dependent on the secretion of extremely potent neurotoxic venom, which is

primarily employed to kill its prey. Numerous researchers looked into the overall histology, histochemistry, and fine structure of the venom glands of several scorpion species (Soliman et al., 2013). The results of this investigation revealed that the histological structure of *L. quinquestriatus* venom glands is identical to that reported by (Halse et al., 1980). Each gland is encased in a basement membrane, which is followed by a layer of connective tissue extending between a single layer of glandular secretory epithelium.

Conclusion:

The number one goal of this take a look at is to accumulate baseline data and to stimulate similarly take a look at of the forensically important arthropods in forensic, mainly the species which have established because the number one signs of time in view that death. The investigation presented here can light on the importance of arthropods as post mortem interval indicators. This study will make the criminal investigation team aware of forensic anthropology, a step that may initiate future studies and interest in the application of insect evidence in legal investigations. The tale of digitalis toxicity keeps into the existing and physicians need to be vigilant concerning the drug's capability for poisoning that may end result from prescribing digitalis with lack of knowledge of right dosage, pharmacodynamics or drug interactions, in addition to from unintended overdose and use with self-adverse or homicidal intent. Scorpion envenomation is a prevalent medical condition that causes significant morbidity and mortality in many places. The annual number of scorpion stings exceeds 1.2 million, most of the lethal species are in the family Buthidae including (*Leiurus quinquestriatus*). It is important for forensic entomologists to know the time between bite and death, types of scorpion and symptoms of envenomation to facilitate their post mortem investigations.

REFERENCES

- Abdelaziz & El Shehaby, D. M. (2019): Effect of Arthropods on the Decomposition of Rat Carrions in an Aerated Environment in Spring Season in Assiut, Egypt. *Egyptian Academic Journal of Biological Sciences, B. Zoology*, 11(1): 1-12.
- Abdelaziz, A., F (2018): Morphological Characterization of Arthropod Ectoparasites by Scanning Electron Microscopy. *Egyptian Academic Journal of Biological Sciences, B. Zoology*, 10(1): 93-104.
- Abdelaziz, A., F, El Shehaby, D. M., Elghazally, S. A. & Hetta, H. F. (2019): Toxicological and epidemiological studies of scorpion sting cases and morphological characterization of scorpions (*Leiurus quinquestriatus* and *Androctonus crassicauda*) in Luxor, Egypt. *Toxicology reports*, 6: 329-335.
- Anderson, Gail S & Byrd, J. (2010): Factors that influence insect succession on carrion. *Forensic entomology: the utility of arthropods in legal investigations*, 2: 201-250.
- Anderson, G. S. (2000): Minimum and maximum development rates of some forensically important Calliphoridae (Diptera). *Journal of Forensic Sciences*, 45(4): 824-832.
- Bahloul, M., Kallel, H., Rekik, N., Chelly, H. & Bouaziz, M. J. P. M. (2005): Cardiovascular dysfunction following severe scorpion envenomation. *Mechanisms and physiopathology*, 34(2 Pt 1): 115-120.
- Bawaskar, H. & Bawaskar, P. (1998): Scorpion sting. *The Journal of the Association of Physicians of India*, 46(4): 388-392.
- Campobasso, C. P. & Introna, F. (2001): The forensic entomologist in the context of the forensic pathologist's role. *Forensic Science International*, 120(1-2): 132-139.
- Carleton, H. M., Drury, R. a. B. & Wallington, E. A. 1980. *Carleton's histological technique*, Oxford University Press, USA.

- El-Hennawy, H. 2014. Updated list of scorpions of Egypt. Serket.
- El-Kady, E. J. P. J. O. B. S. (1999): Problems facing application of forensic entomology. *Pakistan Journal of Biological Sciences*, Volume 2 (2): 280-289.
- Erzinclioğlu, Y. (1983): The application of entomology to forensic medicine. *J Medicine, Science the Law* 23(1): 57-63.
- Essiet, G., Essien, A. & Akuodor, G. J. I.-J. (2017): Embryotoxic and teratogenic potentials of *Salacia lehmbachii* in rats. *Journal of Pharmacy and Biological Sciences*, 12(2):43-48
- Fu, J. L., Yu, Q., Li, M. D., Hu, C. M. & Shi, G. (2020): Deleterious cardiovascular effect of exosome in digitalis-treated decompensated congestive heart failure. *Journal of biochemical molecular toxicology* 34(5): e22462.
- Grubb, A. & Mentz, R. (2020): Pharmacological management of atrial fibrillation in patients with heart failure with reduced ejection fraction: review of current knowledge and future directions. *Expert review of cardiovascular therapy*, 18(2): 85-101.
- Halse, S., Prideaux, P., Cockson, A. & Zwicky, K. J. a. J. O. Z. (1980): Observations on the Morphology and Histochemistry of the Venom Glands of a Scorpion, *Urodacus Novaehollandiae* Peters (Scorpionidae). *Australian Journal of Zoology*, 28(2): 185-194.
- Jiao, G. B. & Zhu, M. (2010): Courtship and mating of *Scorpiops luridus* Zhu Lourenço & Qi, 2005 (Scorpiones: Euscorpidae) from Xizang province, China. *Journal of Venomous Animals Toxins including Tropical Diseases*, 16: 155-165.
- Joseph, I., Mathew, D. G., Sathyan, P. & Vargheese, G. (2011): The use of insects in forensic investigations: An overview on the scope of forensic entomology. *Journal of forensic dental sciences*, 3(2): 89.
- Klotzbach, H., Schroeder, H., Augustin, C. & Puschel, K. (2004): Information is Everything-A case report demonstrating the necessity of Entomological knowledge at the crime scene. *Internet Journal of Forensic Medicine Toxicology*, 5(1): 19-21.
- Liu, X., Shi, Y., Wang, H. & Zhang, R. (2009): Determination of malathion levels and its effect on the development of *Chrysomya megacephala* (Fabricius) in South China. *Forensic science international*, 192(1-3): 14-18.
- Mabika, N., Masendu, R. & Mawera, G. (2014): An initial study of insect succession on decomposing rabbit carrions in Harare, Zimbabwe. *Asian Pacific Journal of Tropical Biomedicine*, 4(7): 561-565.
- Moretti, T. D. C., Ribeiro, O. B., Thyssen, P. J. & Solis, D. R. (2008): Insects on decomposing carcasses of small rodents in a secondary forest in Southeastern Brazil. *European Journal of Entomology*, 105(4): 691-696.
- Nuorteva, P. (1977): Sarcosaprophagous insects as forensic indicators. *Forensic medicine: a study in trauma environmental hazards*, 1072-1095.
- Padonou, G. G., Gnanguenon, V., Ossè, R., Oussou, O., Odjo, E., Akinro, B. & Akogbeton, M. (2017): First evidence of forensic entomology revealed the presence of arthropods on rabbit carrion in Cotonou, Benin (West Africa). *Int J Entomol Res*, 2(6): 94-98.
- Rahav, G. & Weiss, A. T. (1990): Scorpion sting-induced pulmonary edema: scintigraphic evidence of cardiac dysfunction. *Chest*, 97(6): 1478-1480.
- Rivers, D. B. & Dahlem, G. A. 2014. *The science of forensic entomology*, John Wiley & Sons.
- Sharma, R., Garg, R. K. & Gaur, J. (2015): Various methods for the estimation of the post mortem interval from Calliphoridae: A review. *Egyptian Journal of Forensic Sciences*, 5(1): 1-12.

- Shrier, I., Boivin, J.-F., Steele, R. J., Platt, R. W., Furlan, A., Kakuma, R., Brophy, J. & Rossignol, M. J. a. J. O. E. (2007): Should meta-analyses of interventions include observational studies in addition to randomized controlled trials? *A critical examination of underlying principles*. 166(10): 1203-1209.
- Smith, K. G. (1975): The faunal succession of insects and other invertebrates on a dead fox. *Entomological Gazette*, 26: 277.
- Soliman, B. A., Shoukry, N. M., Mohallal, M. E. & Fetaih, H. A. (2013): Fine structure of the stinger, histology and histochemistry of the venom gland in the scorpion *Androctonus amoreuxi* (Buthidae). *The Journal of Basic Applied Zoology*, 66(2): 41-46.
- Turchetto, M., Vanin, S. & Toxicology (2004): Forensic evaluations on a crime case with monospecific necrophagous fly population infected by two parasitoid species. *Anil Aggrawal's internet journal of forensic medicine*, 5(1): 12-18.
- Valdes-Perezgasga, M. T., Sanchez-Ramos, F. J., Garcia-Martinez, O. & Anderson, G. S. (2010): Arthropods of forensic importance on pig carrion in the Coahuilan semidesert, Mexico. *Journal of Forensic Sciences*, 55(4): 1098-1101.
- Valdivia, H. H., Kirby, M. S., Lederer, W. J. & Coronado, R. (1992): Scorpion toxins targeted against the sarcoplasmic reticulum Ca (2+)-release channel of skeletal and cardiac muscle. *Proceedings of the National Academy of Sciences*, 89(24): 12185-12189.
- Wallace JF (1994). Disorders caused by venoms, bites and stings. In: Isselbacher KJ, Martin JB, Braunwald E, editors. *Harrison's Principle of Internal Medicine*. New York: McGraw Hill Inc; 2467-73.
- Williamson, K. M., Thrasher, K. A., Fulton, K. B., Lapointe, N. M. A., Dunham, G. D., Cooper, A. A., Barrett, P. S. & Patterson, J. H. J. a. O. I. M. (1998): Digoxin toxicity: an evaluation in current clinical practice. *archives of internal medicine*;158(22):2444-9. doi:10.1001/archinte.158.22.2444.
- Yang, H.-P., Chen, F.-C., Chen, C.-C., Shen, T.-Y., Wu, S.-P. & Tseng, Y.-Z. J. a. C. S. (2009): Manifestations mimicking acute myocardial infarction after honeybee sting. *Acta Cardiol Sin*, 25(1): 31-35.

ARABIC SUMMARY

تقييم سمية سم العقرب والديجوكسين على الجهاز القلبي الوعائي للإنسان وفي تعاقب مفصليات الأرجل المتحللة باستخدام جيف الفئران

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1- قسم الحيوان والحشرات, كلية العلوم جامعة أسيوط

2- قسم الباطنه كلية الطب جامعة أسيوط

3- قسم الطب الشرعي والسموم الاكلينيكيهكلية الطب جامعة أسيوط

الخلفية والهدف: يُعتقد أن الحيوانات المفصلية في الطب الشرعي التي تستعمر الجيف وتوفر أدلة حيوية فيما يتعلق بوقت ومكان الوفاة ، وعلاج الضحية المحتمل قبل الوفاة أو بعد الوفاة ، والعقاقير ، والسموم ، وسم العقرب وما إلى ذلك. بالرغم من أن استخدام الديجوكسين لعلاج مجموعة متنوعة من مشاكل القلب ، إلا أن سمية الديجوكسين مهمة لتقييم الحالات للمظاهر السريرية، لأنها قد تؤدي إلى عدم انتظام ضربات القلب المميتة. العقرب الأصفر (*Leiurus quinquestriatus*) يعتبر واحد من أكثر العقارب خطورة داخل العالم ، والذي يسبب أيضاً تأثيرات سامة للقلب. الهدف من هذا البحث هو تقييم التأثير السام لسم العقرب والديجوكسين على الجهاز القلبي الوعائي للإنسان ودراسة مقارنة بين موت وتحلل جيف الفئران بطريقة طبيعية مقارنة بموتها بلسعات العقارب وسمية الديجوكسين. **المواد والطرق:** تكونت الدراسة الحالية من جزأين؛ **الجزء الأول** ؛ وصف نتائج مخطط كهربية القلب للتأثير السام لسم العقرب والديجوكسين على الإنسان. **الجزء الثاني** ؛ مفصليات الأرجل المتعاقب باستخدام جيف الفئران. **النتائج:** الجزء الأول منا لدراسة يشمل جميع حالات من قسم الطوارئ بالطب الباطني بمستشفى أسيوط الجامعي خلال الفترة من مارس 2020 إلى أغسطس 2021 تم استعراض مجموعه 100 حالات (50 حالة طبيعية ، 26 حالات لسعات العقارب و 24 سمية ديغوكسين). 71% (18) من المرضى من خلال الفحص تم تشخيصهم سمية الديجيتال. من T wae ؛ 29% (6) تم تشخيصهم عن طريق إحصار القلب. 65% (17) مريض تم تشخيصه عن طريق لدغة العقرب نتيجة التهاب عضلة القلب و 35% (9) مريض تم تشخيصه بدرجات متفاوتة من AV وإحصار داخل البطيني