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RESEARCH ARTICLE

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LIZARD COMMUNITY AND THE GENETIC VARIABILITY FOR TWO LACERTID SPECIES IN DAMIETTA, NORTH EGYPT

ABSTRACT:

The structure of the lizard community in Damietta was analyzed in the present study. Five locations were selected as a study area, each represents different habitat of Damietta Governorate. Seven lizard species were recorded which are related to four families and five genera. They were *Chamaeleo africanus, Hemidactylus turcicus, Chalcides ocellatus, Mabuya quinquetaeniata, Mabuya vittata, Acanthodactylus boskianus* and *Acanthodactylus scutellatus*. The lacertid lizards *Acanthodactylus boskianus* and *Acanthodactylus scutellatus* were the most common species in the community. Therefore, the study was extended to reveal the genetic variability for the population of these two species in Damietta. Four arbitrary chosen enzymes were analyzed electrophoretically. These enzymes were Glucose-6-phosphate dehydrogenase (G6PDH), esterase (EST), lactate dehydrogenase (LDH) and acid phosphatase (ACP). Eleven presumed gene loci have been recorded. *A. scutellatus* showed higher genetic variability with a polymorphism of 90% of its population compared to 82% for the samples of *A. boskianus.*

KEY WORDS:
Lizard community, ecology, taxonomy, Lacertidae, isoenzymes.

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INTRODUCTION:

Damietta Governorate is situated at the north east of Nile Delta of Egypt on the Mediterranean basin with an area of 1.029 km^2 (Fig. 1). It is divided into marine and coastal habitat, wetland habitat, cultivated habitat and urban landscape (SEAM, 2004). Recently, the herpetofauna of this area have received some taxonomical and ecological studies (Baha El Din, 1996; Saleh, 1997; Ibrahim, 1999, 2000, 2002; SEAM, 2004). SEAM (2004) reported 14 reptilian species; 6 of them were lizards. These lizard taxa were *Chamaeleo africanus, Hemidactylus turcicus, Chalcides ocellatus, Mabuya quinquetaeniata, Acanthodactylus boskianus* and *Acanthodactylus scutellatus*. The present studies revised this record with an observation of the lizard community of Damietta throughout a year and have recorded one more scincid taxon.

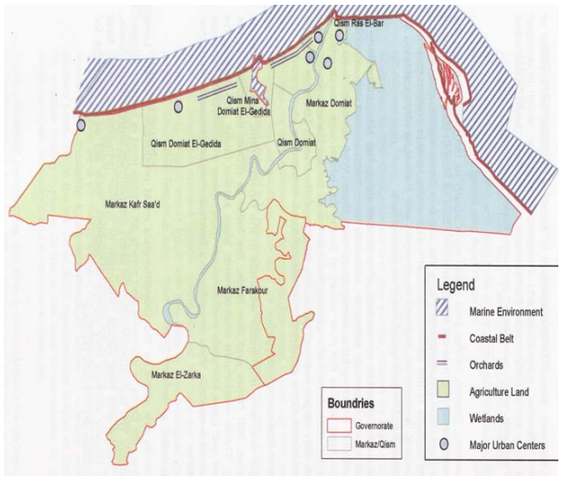

Fig. 1 Main habitats that have been found in Damietta Governorate (SEAM 2004).

The most diversified taxa in Damietta were the sand-dwelling lacertid lizards *Acanthodactylus boskianus* and *Acanthodactylus scutellatus*. They constitute an important part of the vertebrate fauna in the arid and desert of North African ecosystems

(Nouïra and Blanc, 1994). As such, they have been the subject of many ecological (Aljohany and Spellerberg, 1989; Mellado and Olmedo, 1991; Belliure and Carrascal, 1996; Crochet et al., 2003), behavioural (Day et al., 1999; Sword et al., 2000) and taxonomic studies (Arnold, 1983; Blanc and Carious, 1987; Baha El Din, 1994; Harris and Arnold, 2000; Amer and Sallam, 2006; Baha El-Din, 2007).

The present study therefore was extended to analyze four arbitrary chosen enzymes electrophoretically for *Acanthodactylus boskianus* and *A. scutellatus* and the resultant data was used to reveal the genetic variability for these two lacertids.

MATERIAL AND METHODS:

A- Study area:

In the present study, five locations were selected, each represents different habitat of Damietta Governorate. They were:

1. North Coast of New Damietta City (Marine and Coastal Habitat).
2. El-Debba (Marine and Coastal Habitat).
3. Manzala Lake (Wetland Habitat).
4. El-Sinania Village (Cultivated Habitat).
5. El-Asr (Urban Land Scape).

B- Sampling and identification:

All locations of the study area were visited monthly from April 2005 to March 2006. The specimens were caught by the aid of the sticky traps or picked up by voluntaries. The samples were then labelled and preserved in 10% formalin. The specimens were identified according to the reviews of Hussein and Darwish (2001).

C- Isoenzymes:

Ten samples of *A. boskianus* and *A. scutellatus* were collected from the sandy dunes of the Mediterranean coastal zone. Animals were dissected and livers were taken and immediately stored at -20°C. 0.5 g of the stored tissues was thawed, homogenized in 1 ml cold bidistilled water and centrifuged (3000 rpm, 4°C for 5 min). 50 µl of the clear supernatant were mixed with 20 µl of protein dye (1% Naphthalene Black-P) and 20 µl of 2% sucrose and then were applied in polyacrylamide gel.

Four arbitrary chosen enzymes were investigated. Glucose-6-phosphate dehydrogenase (G6PDH), esterase (EST) and lactate dehydrogenase (LDH) were electerophoretically assayed according to the method of Shaw and Prasad (1970) while acid phosphatase (ACP) was assayed according to Michlson and DuBois (1981).

D- Statistics:

The electerophoretic bands of enzyme activity were designated using the system of nomenclature suggested by Allendorf and Utter (1978). An abbreviation which corresponds to the name of the enzyme designated each locus. When multiple loci were involved, the fasted anodal protein band was designated as locus one, the next as locus two and so on.

Allelic variants were identified by their relative mobility. The allele producing the fastest anodally band was designated as a, the next as b and so.

The allelic frequencies were calculated according to the formula given by Ferguson (1980): 2H0+He/2N. H0: Number of homozygotes for that allele, He: Number of heterozygotes for that allele, N: Number of individuals examined.

The genetic variability between the two species was measured by four parameters (Nei, 1975): A, P, he and H where A= mean number of alleles per locus, P= number of polymorphic loci, he= expected frequency of heterozygotes per locus. he was calculated according to the formula: $he=1-\Sigma Xi^2$ where Xi = frequency of i-th allele at X-locus. H: Mean heterozygosity and it is calculated according to the following formula: $H=\Sigma$ he /r where r is the number of all loci studied.

RESULTS:

Survey of Lizards at Damietta:

Seven species that are related to four families and five genera were recorded in the present study. The recorded species are listed (see Saleh, 1997 and SEAM, 2004 for their synonymy) using common English, scientific and arabic names, respectively (Table 1).

Table 1. List of lizard species collected from Damietta at spring, summer, and autumn 2005

English name	Scientific name	Arabic name	Family
African *Chamaeleon*	***Chamaeleo africanus***	حرباء خضراء	Chamaeleontidae
Warty gecko	***Hemidactylus turcicus***	برص منزلي	Gekkonidae
Ocellated skink	*Chalcides ocellatus*	سحلية دفانة	Scincidae
Bean skink	*Mabuya quinquetaeniata*	سحلية جرابة	
Banded skink	*Mabuya vittata*	سحلية جرابة مخططة	
Bosc's lizard	*Acanthodactylus boskianus*	سقنقور خشن	Lacertidae
Nidua lizard	*Acanthodactylus scutellatus*	سقنقور الرمل الكبير	

These lizards occupy a wide range of habitats (Table 2) from the extremely arid desert to the cultivated fields of the Nile Delta and even human habitations in large cities (urban habitats). All the samples were collected during 2005.

Table 2. Distribution of lizard species that have been recorded in Damietta at different study area

Species	*Environment*			
	Coastal	Wetland	Cultivated	Urban
African chamaeleon	x	-	xxx	x
Warty gecko	-	-	-	xxx
Ocellated skink	xx	-	xx	xxx
Bean skink	-	-	xx	xxx
Banded skink	xx	-	-	-
Bosc's lizard	xxx	-	-	-
Nidua lizard	xxx	-	-	-

(-) No species was found, (X) low distribution, (XX) relatively high distribution, (XXX) extremely wide distribution.

Family Chamaeleontidae:

One species was surveyed.

African Chamaeleon: *Chamaeleo africanus,* African *Chamaeleon*, Basilisk *Chamaeleon*, حرباء خضراء

Habitats:

Chamaeleon was recorded in all the studied habitats of Damietta, but it seems to be highly frequented in cultivated areas. Mostly this species was noticed inhabiting trees or shrubs in cultivated areas. In coastal habitat, it was rarely recorded in vegetation area. In countryside of the urban area, it was recorded on roads. It was collected from North Coast of New Damietta at May, from El-Sinania at June and from El-Asr at May.

Family Gekkonidae:

One species was surveyed at the different studied locations.

Warty gecko: *Hemidactylus turcicus*, Turkish gecko, Warty gecko, برص منزلي

Habitats:

Mostly this species associated with human dwelling. It rarely inhabits agriculture or wetland environment. It was collected from El-Asr at April, June and October.

Family Scincidae:

Three species were surveyed from different studied locations that are belonging to two genera, *Chalcides* and *Mabuya*.

Ocellated skink: *Chalcides ocellatus*, Eyed skink, ocellated skink, سحلية دفانة

Habitats:

Eyed skink was noticed living under sand or dead vegetation. It was observed in sandy desert and banks of irrigation canals in the cultivated area. It was collected from El-Asr at August, from North Coast of New Damietta at May and from El-Sinania at May and September.

Bean skink: *Mabuya quinquetaeniata*, Bean skink, Blue tailed skink, سحلية جراية

Habitats:

Bean skink was observed in gardens and other green areas within towns and villages. This species is frequently noticed in the wild agricultural land, scrub land, houses and around human occupation. It was collected from El-Asr at May and from El-Sinania at June.

Banded skink: *Mabuya vittata***,** Bridled skink, Banded skink**,** سحلية جراية مخططة

Habitats:

Banded skink was found throughout the costal area. It rarely inhabits vegetated desert areas and margins of cultivation. It was collected from North Coast of New Damietta at June.

Family Lacertidae

Two species were surveyed at different studied areas.

Bosc's lizard: *Acanthodactylus boskianus,* Bosc's lizard سقنقور خشن

Habitats:

Bosc's lizard was recorded only in coastal and urban habitats. It seemed to be highly distributed in costal sandy area with sparse vegetations being abundant at sand dunes between sparse vegetation. A lot of individuals were collected from coastal habitat at north coast of New Damietta and El-Debba. Some individuals showed either forked tail or wounds of limbs at the beginning of autumn. Abundance of juveniles was observed at the end of August and during September.

Nidua lizard: *Acanthodactylus scutellatus,* Nidua lizard, سقنقور الرمل الكبير

Habitats:

Nidua lizard was found only in sand dunes at coastal habitat. It is usually inhabiting the disperse vegetation in sand dunes. Individuals were collected from North Coast of New Damietta and El-Debba at June, May, August, September and October. It was found sympatrically with Bosc's lizards.

Isoenzymes:

The electrophoretic behaviour of the four studied isoenzymes is shown in figure 2. The allelic frequencies for the selected isoenzymes were listed in table 3. These frequencies were calculated according to the number of alleles recognized per each locus. The four isoenzymes studied have recorded thirteenisozymic forms that are controlled by eleven presumed loci (where LDH is controlled only by two subunits). They showed thirty two alleles. The data indicated that LDH_1, LDH_4, EST_4 and ACP_2 were recorded only in *A. boskianus.* EST_2 and EST_3 were recorded only in the samples of *A. scutellatus*.

All the other forms were recorded in both species with different allelic frequencies.

Table 3. Allele frequencies at thirteen isozymic forms in the two Acanthodactylus species. Number of samples at each allele is indicated between brackets. h_e is the frequency of heterozygotes per locus

Allele	*A. boskianus*	*A. scutellatus*
$G6PDH_1^a$	0.6 (3)	0.4 (2)
$G6PDH_1^b$	0.4 (2)	0.6 (3)
h_e	0.48	0.48
$G6PDH_2^a$	-	0.8 (4)
$G6PDH_2^b$	0.6 (3)	0.2 (1)
$G6PDH_2^c$	0.4 (2)	-
h_e	0.48	0.32
$G6PDH_3^a$	0.2 (1)	0.4 (2)
$G6PDH_3^b$	0.8 (4)	0.6 (3)
h_e	0.32	0.48
EST_1^a	0.6 (3)	0.2(1)
EST_1^b	0.4 (2)	0. 8(4)
h_e	0.48	0.32
EST_2^a	-	1.0 (5)
EST_2^b	0.4 (2)	-
EST_2^c	0.6 (3)	-
h_e	0.48	-
EST_3^a	0.4 (2)	1.0 (5)
EST_3^b	0.6 (3)	-
h_e	0.48	-
EST_4^a	-	0.4 (2)
EST_4^b	1.0 (5)	0.6 (3)
h_e	-	0.48
LDH_1^a	-	0.8 (4)
LDH_1^b	1.0 (5)	0.2 (1)
h_e	-	0.32
LDH_2^a	-	0.2 (1)
LDH_2^b	0.2 (1)	0.2 (1)
LDH_2^c	0.8 (4)	0.6 (3)
h_e	0.32	0.56
LDH_3^a	-	0.2 (1)
LDH_3^b	0.8 (4)	0.6 (3)
LDH_3^c	0.2 (1)	-
LDH_3^d	-	0.2 (1)
h_e	0.32	0.56
LDH_4^a	-	0.6 (3)
LDH_4^b	-	0.2 (1)
LDH_4^c	1.0 (5)	0.2 (1)
h_e	-	0.56
ACP_1^a	0.2 (1)	0.6 (3)
ACP_1^b	0.8 (4)	0.4 (2)
h_e	0.32	0.48
ACP_2^a	-	0.2 (1)
ACP_2^b	-	0.8 (4)
ACP_2^c	1.0 (5)	-
h_e	-	0.32

A. scutellatus showed higher genetic variability with a polymorphism of 90% and mean number of alleles per locus A = 1.63 (Table 4). *A. boskianus* showed lower genetic variability and the polymorphism was 82% with mean number of alleles per locus A = 1.63.

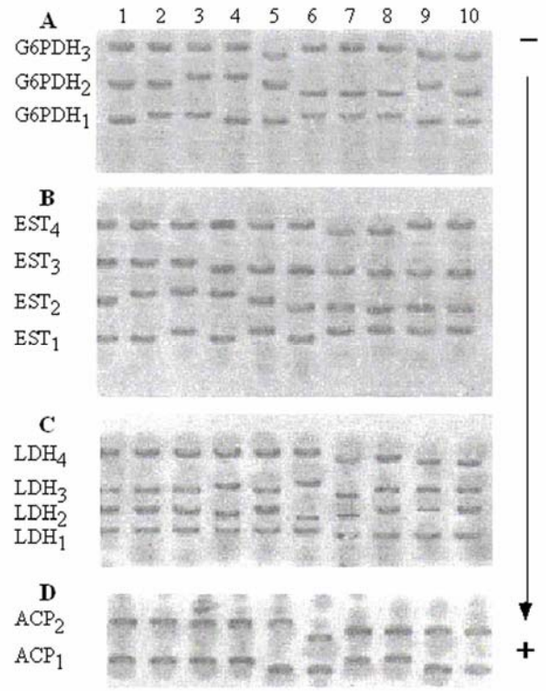

Fig. 2 Electrophoretic behaviours of glucose-6-phosphate dehydrogenase (A), esterase (B), lactate dehydrogenase (C) and acid phosphatase (D) isoenzymes in *Acanthodactylus boskianus* (1-5) and *A. scutellatus* (6-10) from the cosal zone of Damietta governorate

The estimated heterozygosity (H) for the species studied was calculated (Table 4). The higher value (H = 0.44) was recorded for *A. scutellatus*. This value indicates that 44% of the specimens examined were heterozygotes. *A. boskianus* showed lower heterozygosity (H=0.33) and 33% of the specimens examined were heterozygotes.

Table 4. Estimates of degree of genetic variation based on the electrophoretic analysis for the samples studies

Species	P	A	H
A. boskianus	9	1.63	0.33
A. scutellatus	10	1.63	0.44

DISCUSSION:

Lizard Community in Damietta:

In a recent study (SEAM, 2004) 14 species of reptiles have been reported in Damiettta Governorate. Six of them were lizards, viz, *Chamaeleo africanus*, *Hemidactylus turcicus*, *Chalcides ocellatus, Mabuya quinquetaeniata*, *Acanthodactylus boskianus* and *Acanthodactylus scutellatus*. The present study has collected, besides these six species, one scincid lizard *Mabuya vittata* which was not recorded by SEAM (2004). This species was observed in the coastal habitat near the western border of the

Governorate. This study showed that *Acathodactylus boskianus* and *Acathodactylus scutellatus* were the most abundant species in the coastal area. Similarly, Ibrahim (1990) and Ibrahim *et al*. (2000) reported the abundance of both species in the coastal sand dunes of north Egypt extending east to Sinai. The authors attributed this abundance to the extreme locomotion of these taxa in the coastal sand dunes. In agreement to our observation, the activity of *A. boskianus* and *A. scutellatus* seemed to depend considerably on time of sunrise and sunset (Ibrahim *et al.*, 2000). The current study observed that *A. boskianus* and *A. scutellatus* were active in sunny days throughout the year being highest in summer and lowest in winter. The same findings were recorded by Ghobashi *et al*. (1990).

Extensive field observations for the foraging activity of *A. boskianus* and *A. scutellatus* revealed that these species would spend most time motionless waiting to ambush the prey. Pianka (1966) considered *A. boskianus* and *A. scutellatus* a sit-and-wait predator.

Similar to Saleh (1997), the present study has recorded that the Turkish *Hemidactylus turcicus* is abundant in different urban stations. According to Ibrahim (2000), *Hemidactylus turcicus* is widely distributed and is observed on the walls of all buildings nocturnally. It is active immediately after sunset until the first light of the following day. Some individuals were observed frequently around electric lamps waiting a relatively long time for feeding up on moving insects. Vaclav and Zbysek (1985) reported that despite the nocturnal life of the gecko, it also appears at the entrance to its hiding-place during the daytime, to bask for a short time in the sun.

Ocellated skink, *Chalcides ocellatus* was abundant in cultivated and urban areas. Saleh (1997) reported that this species is widely distributed throughout the Mediterranean coastal desert areas of Egypt to Sinai, as well as the Nile Valley and Delta. In the present study, this diurnal species was mainly observed in the morning before it becomes hot, being generally basking in the sun patches under bushes.

African *Chamaeleon* was rarely surveyed and collected from only cultivated and urban stations. The present observation agrees with Saleh (1997) who reported that this species is distributed only throughout cultivated areas of Nile Valley and Delta in Egypt. On the other hand, Ibrahim (2002) stated that although *Chamaeleon* is uncommon, it was observed in most stations. Despite their arboreality, some individuals were observed walking on the ground, even during midday in June and July. At night, they were observed sleeping on bushes.

In the present work, Although Bean skink, *Mabuya quinquetaeniata* was highly distributed in cultivated and urban stations, a single record of Banded skink, *Mabuya vitatta* was conducted in the western margins of Damietta. The present observation agrees with Saleh (1997) who reported that Bean skink is widely distributed throughout the Nile Valley and Delta and adjacent reclaimed cultivated land, while banded skink is limited to vegetated desert areas and margins of cultivation at the northern fringes of the Delta.

Isoenzymes:

Isoenzymatic and morphological tools are still up to date applicable for lizard systematics (Buth and Murphy, 1999; Pinho *et al*., 2003; Busack and Lawson, 2006; Arnold *et al*., 2007). In this study, the genetic variability in the samples of *A. boskianus* indicated that 33% of the specimens were heterozygotes. *A. scutellatus* showed higher heterozygosity and indicated that 44% of the examined specimens were heterozygotes. This heterozygosity was shown to be comparable to that observed for other lizards studied like agamids (Amer, 2000), scincids (Abdel-Megeid, 1991) and lacertids (Blanc and Carious, 1987). However, the genetic variability for the Egyptian *Acanthodactylus* was slightly higher than that calculated by Blanc and Carious (1987) for Tunisian *Acanthodactylus* (their mean heterozygosity was ranked from 14% to 28%). These results may indicate high adaptation (Soulé, 1976) for the genus to the sandy dunes habitat of Damietta region and that *A. scutellatus* seemed to be the most variable, the most adapted lizard and with the largest population size.

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عشائر السحالي والتنوع الجيني لنوعين من جنس السقنقور في محافظة دمياط بشمال مصر

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لعمل مسح لعشائر السحالي في محافظة دمياط وذلك في خمس مناطق تمثل البيئات المختلفة في المحافظة. سجلت هذه الدراسة سبعة أنواع من السحالي تنتمي إلى أربع عائلات وخمسة أجناس وهي كالتالي: الحرباء الخضراء الأفريقية و البرص المنزلي وسحلية الدفان الكبير و السحلية الجراية و السحلية الجراية المخططة و السقنقور الخشن وسقنقور الرمل الكبير. لوحظ أن نوعي السقنقور كانا الأوسع انتشارا بين هذه الأنواع السبعة. وقد امتدت هذه الدراسة لتشمل معرفة العلاقة الوراثية والتنوع الجيني لهذين النوعين. تم عمل فصل كهربي لأربعة انزيمات اختيرت عشوائيا واستخدمت نتائجها في معرفة التنوع الجيني لنوعي السقنقور. هذه الإنزيمات هي الجلوكوز-6-فوسفات ديهيدروجينيز و الإستيريز و لاكتيت ديهيدروجينيز والفوسفاتيز الحامضي. سجلت عملية الفصل الكهربي لهذه الإنزيمات الأربعة إحدى عشر موقعا جينيا افتراضيا. كان سقنقور الرمل الكبير الأكثر تنوعا جينيا حيث أظهر تباينا في 90 % من عيناته بينما سجل السقنقور الخشن تنوعا جينيا في 82 % من عيناته.

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