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Surveying on the Biologic Behaviors of Hemiscorpius Lepturus Peters 1861, Scorpion in Laboratory (Khuzestan, Iran) (Scorpions: Hemiscorpiidae)

[1]Rouhullah Dehghani, [2]Tahereh Khamehchian and [1]Mohammad Bagher Miranzadeh
[1]Department of Environmental Health,
[2]Department of Pathology, Kashan University of Medical Sciences, Iran

Abstract: This descriptive research was conducted so as to find and distinguish the sex of *H. lepturus* based on 107 dead specimens in the 70% ethyl alcohol and exact decision on their species using a criterion considering all morphological parameters and by the use of stereo microscope. Their biologic behaviors, 50 *H. lepturus* specimens which were fed and kept alive in capped bottles were studies while their way of shedding and number of newly-born young were also investigated under laboratory conditions in the process. The research revealed that in 107 *H. lepturus* specimens, 27 specimens (23%) were male and 80 ones (77%) were female. The results gained from 50 scorpions kept in the laboratory showed that only 10 cases (20%) had shed. Duration of emergence varies in each young from 10-20 min and delivery lasts approximately for 4-6 h. The average number of the young born was 24.3 in each delivery. It was concluded that the time of delivery and shedding in *H. lepturus* is definitely fixed during the year and the number of pectine denticles and length of the tail can be used to differentiate male and female *H. lepturus*.

Key words: Scorpion, *Hemiscorpius lepturus*, laboratory, biologic behavior

INTRODUCTION

The country of Iran due to its miscellaneous climate is very rich in arachnids such as scorpions in particular. According to Kovarik (1997) report, there exit about 32 species of scorpions in Iran. Scorpion stung cases are reported annually from all over Iran and based upon the reports, 40000-50000 cases of scorpion stings and various cases led to deaths have occurred annually in our country (Dehghani and Valaie, 2005). *H. lepturus*, *Androctonus crassicauda* and *Mesobuthus eupeus* are thought of as the main factors and agents in scorpion stings, while *Buthotus saulcy*, *Odontobuthus doriae*, *Buthotus schach*, *Olivierus caucasicas* and *Apistobuthus petrygosercus* are considered as the agents of secondary and minor importance in this respect in Iran which have been reported sporadically (Dehghani *et al*., 1998; Radmanesh, 1990a, 1998). *H. lepturus* has a yellow/yellow brown color and a dark stripe on the mesosoma. The length of the male can reach up to 8.5 cm, while the female only reach 5 cm in length. Males have a significantly longer cauda than females. It was described by Peters in 1861. *H. lepturus*, a scorpion reported by Vashon to occur in Iran and Iraq and a member of Genus with three other species found in the Mid East, was named by Pringle in 1960 as a cause of both local and systemic effects of envenomation in Iraq (Keegan, 1980). *H. lepturus* among the notable medical species is exceptional in terms of its dangerous and clinical symptoms. These symptoms appear both topically and systemically. Radmanesh (1990b) in a survey on scorpion stings, especially those of *H. lepturus* species in Khouzestan, has mentioned a 10-15% share attributed to the above -mentioned scorpion in the province of Khouzestan (Radmanesh, 1990b). This species of scorpion had been responsible for stinging a great number of people annually in the southern humid and tropical provinces such as Khouzestan (Dehghani, 2006). Since scorpion sting mortality in Iran is mostly due to *H. lepturus* in Khouzestan, thus it can be stated that this creature is the most dangerous scorpion of Iran, living in Khouzestan province especially on the east (Dehghani and Valaie, 2004). Which its sting leads to fatal and serious clinical indispositions such as fatal and acute Hemolysis chronic failure of the kidney, deep and Necrotic wounds, ankylosis of the joints, permanent and temporary Psycosis and regular deaths (Radmanesh, 1990b). Apart from therapeutic matters and provision of antivenin serum which had root in the domain of medicine, surveying other aspects of scorpions, life such as biology, ecology and toxicologic studies in different disciplines have been much time-consuming. Therefore, all the studies conducted should reviewed into the line to find and solve the problem caused by scorpion sting indisposition (Dehghani, 2006). Because the

Corresponding Author: Rouhullah Dehghani, Department of Environmental Health, Kashan University of Medical Sciences, Iran

behavioral aspects of biology have been less documented and most studies have been anecdotal in nature, or just have included brief descriptions of biology for different species (Franke and Jones, 1982; Rein, 2003). One exception is study on birth behavior and life history of Diplocentrus spitzeri Stanhnke (Franke, 1981). So, in this study, following the above guidelines, present studies might lead to the recognition of strong and weak points concerning scorpions in terms of ecology, biology and other aspect, which ultimately facilitate our ways of control or prevention from their threat and nuisance. In this study, three fundamental issues, that is, survey of delivery behaviors, shedding and decision on the sex of this species of scorpion under laboratory conditions have been discussed. Study of different biological and behavioral aspects of scorpions in the nature introduces specific applications, because these creatures comparing other arachnids are less active outside the barrows and sheltered retreats. On the other hand, the first step in each region of the country in order to avoid scorpion sting, in addition to the understanding and familiarity with this arachnids ecology, is doing studies on the biological behaviors like shedding, delivery and morphological differences of each species separately. Familiarity with different facets and aspect of this creature, uncovers their ways of reproduction and their ability in this regard (Dehghani and Valaie, 2004). With regard to this fact that *H. lepturus* is the most dangerous scorpion of Iran and is a native of the countries of Iran, Iraq and Yemen, then various biological and ecological aspects of this scorpion must be studied and covered in these countries. Considering the above cases and the importance of studying the scorpions biological behaviors and existence of some imperfections in this regard and also due to the attempts targeted at solving the local problems of Iran, this research was carried out to survey the biological behaviors of this species in the laboratory during 2001-2002.

In this study, the different behavioral components involved in the delivery, shedding and sex ratio were identified and observed and then discussed. The purpose of this study is to present a quantitative analysis of the behavior components involved in biology in *H. lepturus* (Peters, 1861) from East-west of Iran. in turn, this aids understanding of many other poorly known aspects of scorpion biology.

MATERIALS AND METHODS

This descriptive research was conducted so as to find and distinguish the sex of *H. lepturus* based on 107 specimens gathered and collected from different towns and counties of Khouzestan province during six expeditions across rural and urbane regions such as Baghmalek, Izeh, Radmermaz, Shush, Ahvaz, Hamidieh in August, October, November, February, March and April of years 2001-2002. The collected specimens were all sent to the laboratory to distinguish the species precisely and after putting them dead in the 70% ethyl alcohol and exact decision on their species using a criterion considering all morphological parameters and by the use of stereo microscope, their abdominal pectine denticles were counted. To peruse the biological behaviors, 50 *H. lepturus* specimens which were fed and kept in capped bottles were studies while their way of shedding and number of newly-born young were also investigated under laboratory conditions in the process. Collected data from the biological behaviors such as shedding and delivery along with the information about the count of abdominal pectine denticles were all recorded and presented through statistical and descriptive tables.

RESULTS

Results obtained from sex ratio in *H. lepturus*: The research revealed that in 107 *H. lepturus* specimens, 27 specimens (23%) were male and 80 ones (77%) were female. Distinguishing between the male and the female was made by counting the number of abdominal pectine denticles which were 9-12 and 14-16 in females and males, respectively. By exerting the bisexual method in 107 specimens of *H. lepturus*, 21 cases were long-tailed (19.5%), that is, male and the rest 86 cases (80.5%) were female (Table 1 and Fig. 1).

Table 1: Total No. and percentage of female and male *H. lepturus* based on method of distinguishing

	Method of distinguishing	
Sex	Count of abdominal pectine denticles	Shape of the tail (%)
Male	27 (23)	21 (19.5)
Female	80 (77)	86 (80.5)
Total	107 (100)	107 (100)

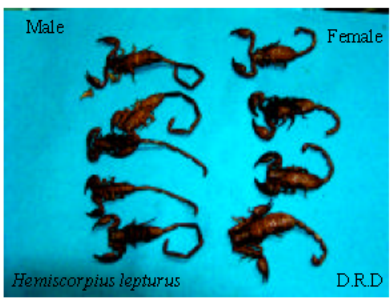

Fig. 1: Bisexuality in male and female *H. lepturus*

Fig. 2: *H. lepturus* coming out of the old cuticule

Fig. 3: 5 old-shed *H. lepturus* in full

Results acquired from *H. lepturus* shedding: At the beginning of shedding, the cuticule is broken apart at the joining point of carapace and the sides and then the chelicerae are driven out of the old cuticule. As the pedipalps come out of the old cuticule, carapace is driven upwards following the contraction made in the scorpion's body. With the continuation of the contractions, pedipalps, legs and the tail come gradually out of the cuticule. the body at this moment gets so soft and jellied (Fig. 2).

Duration of shedding for the specimens under survey lasted for about 4-6 h (Fig. 3). The newly-shed *H. lepturus* appears dark only in the lateral and median eyes and at the end of the tail, while other parts of the body such as a abdomen, legs, chelicerae, pedipalps, tail and interior surface of the pedipalps remain colorless.

The body in this way is entirely soft and the scorpion's motions is too slow. Because of the softness of the claws and legs, the scorpion moves so slow, nevertheless it reacts to the finger motion of human begin and the object, but does not drive its telson to sting. Melanization is also relative slow under laboratory conditions in *H. lepturus* and takes a 10-30 day period so that the color of the newly-born scorpion goes like the other scorpions. Softness of the body of the newly-born scorpion is clearly distinguishable after 2-3 days. The new cuticule is brownish yellow and in the pedipalps it is dark born.

Table 2: Observation on the *H. lepturus* shedding based on time (month, day, night)

No. of scorpion	Month of shedding	Date	Time of shedding
1	August	29 July, 2002	Night
2	August	1 August, 2002	Night
3	August	1 August, 2002	Night
4	August	4 August, 2002	Day
5	August	5 August, 2002	Night
6	August	6 August, 2002	Day
7	August	25 August, 2002	Night
8	August	27 August, 2002	Day
9	August	29 August, 2002	Night
10	August	29 August, 2002	Night

The results gained from 50 scorpions kept in the laboratory showed that only 10 cases (20%) had shed. Among these cases one cases was male. in the other cases, they were all female or not reached maturity yet. 6 cases of the sheddings (60%) and the rest four (40%) had occurred in August and September respectively (Table 2).

Results obtained from *H. lepturus* delivery: Gestation period for *H. lepturus* is not evidently known. But scorpions in a certain season manifest their mating manifestations. In the body of a pregnant *H. lepturus*, the young are seen perfectly arranged side by side especially by the sides. Abdominal segment have been totally parted from one another from the back and the sides so that the view of the young's whiteness in the back, has given a distinct appearance to the scorpion. In this condition, the Tergites (dorsal segments) have born white and brown spots on them. Delivery is not successfully done in all cases and on some occasions, although the young has half come out of the genital opening, the mother has not been successful to undergo and terminate its delivery and has died in the process (Fig. 4).

While delivering, the space between carapace and the abdomen is partly contracted so that the genital opening and the pectines are distinctively pressurized to keep the pectines in an angular position with the abdomen. At the time of delivery, the tail comes out of the genital opening first. After the appearance, the tail moves incessantly to and fro. Sometimes two tails related to two young come out the genital opening simultaneously that only one succeeds to emerge and the other, comes out immediately. The last parts coming out of the mother's body are the pedipalps (Fig. 5).

Delivery is facilitated by the young's motion sideways and the mothers contraction. Duration of emergence varies in each young from 10-20 min and delivery lasts approximately for 4-6 h. The young are piled

Fig. 4: A gestated *H. lepturus*

Fig. 5: Emergence of a *H. lepturus* young

Fig. 6: *H. lepturus* with young on her back

up between mother's folded legs, called as birth basket and the chelicerae from the very beginning, but then mother stimulates them by her pedipalps to direct them from different parts of the body (pedipalps, legs, abdomen and tail) to her back. this process continues until the last young is climbed to the mothers back (Fig. 6).

The results of the study demonstrated that out of 50 *H. lepturus*, 42 cases were female. Among their number, 16 cases were with young which 14 case of them had successful birth, while two case of them had died prior to or at the very beginning of the delivery due to some indefinite reasons. Their abdomens were entirely swollen and the young within were thoroughly distinguishable (Table 3).

Table 3: Total No. and percentage of female *H. lepturus* based on delivery process

	State of delivery		
Status of gestation	Delivered	No delivered	Total
	(%)		
Pregnant	14 (87/5)	2 (12/5)	16 (100)
Not Pregnant			26
Total female			42

Values in parentheses shows percentage

Table 4: Observation on the distribution of delivery process in *H. lepturus* based on time

No. of scorpion	Month of delivery	Date of delivery	No. of young	Time of delivery
1	August	15 August, 2001	23	Day
2	August	16 August, 2001	34	Night
3	August	16 August, 2001	18	Night
4	August	16 August, 2001	27	Night
5	August	16 August, 2001	29	Day
6	August	17 August, 2001	25	Night
7	August	23 August, 2001	15	Night
8	August	24 August, 2001	31	Night
9	August	25 August, 2001	26	Night
10	August	26 August, 2001	19	Day
11	August	26 August, 2001	21	Day
12	August	26 August, 2001	30	Night
13	September	12 September, 2001	31	Night
14	September	25 September, 2001	21	Night

It was concluded that the time of delivery in *H. lepturus* is definitely fixed during the year which lasted from 15 August to 25 September, that is about one month and a half in the studied cases. in the rest month of the year, despite the sameness of temperature in the laboratory, no other delivery was observed. Out of the fourteen deliveries already mentioned, 4 cases (28-5%) and the rest (71.5%) had taken place in daytime and nighttime, respectively (Table 4). Duration of delivery varied 4-6 h approximately. the average number of the young born was 24.3 in each delivery.

DISCUSSION

The results revealed that the average number of young born in each delivery in *H. lepturus* had been 24.3. Farzanpey (1987), regarding the number of the scorpion's young points out that the number is variable in each species ranging from 6 to 90 young (Farzanpey, 1987). Kamali (1984) has reported a 20-60 range of number in each species which has sometimes been more (Kamali, 1984). Franke (1981) has reported the number of the young in *Centruoides gracilies* from 22 to 91 ones in different countries (Franke, 1981). Vazirianzade (1990) has given a distinctive count of 35 and 38 in the number of *H. lepturus*' young differently (Vazirianzadeh, 1990). The differences observed in the number of young born in each delivery in *H. lepturus* are most likely species related because the environmental conditions used for this study

were similar to the environmental conditions used in other studies. All the above studies were conducted laboratory.

The survey showed that out of 107 cases of *H. lepturus*, 27 (23%) were male and 80 (77%) were female. Counting the number of pectine denticles was managed as a parameter, varying in both sexes of *H. lepturus* for distinguishing between the male and the female totaling 9-12 and 14-16 in them, respectively. Farzanpey (1987) has declared the number of the pectine denticles in the above-mentioned scorpion as 12-16 in the male and 8-11 in the female (Farzanpey, 1987). Vazirianzadeh (1990) has reported the number of the pectine denticles in the *H. lepturus* as 8-11 and 12-16 in female and male, respectively which in accordance with the results achieved in this study (Vazirianzadeh, 1990). Levi and Amitai (1980) believed that the number of pectine denticles in the males are more than the females (Levy *et al*., 1980). A vast variety of different species have been studies in view of their number of pectine denticles. Another way of distinction has been applied on the basis of the exterior shape and bisexuality which is only applicable after full maturation. In this way, long tails of the males are clearly distinguishable from those of the females. By applying the bisexual method, out of 107 specimens of *H. lepturus*, 21 (19.5%) were long-tailed, that is male and the rest 86 specimens (80.5%) were totally female. Levy and Amitai (1980) reported that the body males are more slender that the female (Levy *et al*., 1980). It can be inferred that the difference in the number of both methods, is something related to the immature male scorpions still under going their formal development.

In this way, the scorpions sex can be distinguished easily without touching it. In sum, the results obtained demonstrate that due to the unavailability of urgent anatomy of the scorpion, probing the genital pores in the males and studying the other morphological traits applicable in distinguishing between the sexes, counting the abdominal pectine denticles is a relatively convenient and reliable way to the final distinction of the sexes in this scorpion before maturation without causing serious harm to it.

Vazirianzadeh (1990) has reported one case of shedding in the *H. lepturus* species in which the scorpion behaves so placidly for ten days as from the shedding and does not react to the mechanical stimulus (Vazirianzadeh, 1990). This is in accordance with our findings. Eating her own young is one of the outstanding characteristics attributed to *H. lepturus* which is proved by a 50% report of eating the young by their mother under laboratory conditions. Among those, without tendency to eat their young, the first shedding of the young occurred ten days after their birth. It seem that *H. lepturus* comparing other specie is more prone to eat her young which laboratory conditions may be the most contributory factor in this respect.

The results of present study demonstrate that *H. lepturus* can be reared successfully in the laboratory. Knowledge of the laboratory biology of this species will enable future studies to be conducted. Additional studies should be attempted to understand how other temperature, humidity and photoperiod regimens could effect the developmental cycle of *H. lepturus* and how these parameters could affect the Biologic behaviors.

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