

1-1-2007

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SEZEK, FATİH and ÖZKAN, MUHLİS (2007) "The Morphological Features of the Development Stages of *Pselaphochernes scorpioides* (Hermann, 1804) (Arachnida, Pseudoscorpionida)," *Turkish Journal of Zoology*. Vol. 31: No. 1, Article 4. Available at: <https://journals.tubitak.gov.tr/zoology/vol31/iss1/4>

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The Morphological Features of the Development Stages of *Pselaphochernes scorpioides* (Hermann, 1804) (Arachnida, Pseudoscorpionida)*

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Received: 25.10.2005

Abstract: The morphological features of the developmental stages of *Pselaphochernes scorpioides* Hermann, 1804 are given.

Key Words: Pseudoscorpionida, *Pselaphochernes*, Developmental stages, Turkey

Pselaphochernes scorpioides (Hermann, 1804) (Arachnida, Pseudoscorpionida)'in Gelişim Safhalarının Morfolojik Özellikleri

Özet: *Pselaphochernes scorpioides* Hermann, 1804'ün gelişim safhalarının morfolojik özellikleri verilmiştir.

Anahtar Sözcükler: Pseudoscorpionida, *Pselaphochernes*, Gelişim safhaları, Türkiye

Introduction

The genus *Pselaphochernes* Beier (1932) comprises 17 species (Harvey, 1990). To date, 3 species have been reported in Turkey (Beier, 1932, 1967; Harvey, 1990). Most pseudoscorpion species are known to have 3 nymphal stages: protonymph, deutonymph, and tritonymph (Chamberlin, 1931; Harvey 1985, 1987; Sakayori, 1989). However, previously collected samples of *P. scorpioides* from Turkey have been poorly categorised in terms of development stages (Chamberlin, 1931; Beier, 1932; Mahnert, 1974; Schawaller, 1983).

The aim of this study was to contribute to the knowledge of the developmental stages of *P. scorpioides*. Herein, we present redescrptions of the eggs, egg package, and nymphal stages of Turkish samples of this species.

Materials and Methods

Specimens of *Pselaphochernes scorpioides* (Herman, 1804) were collected from the decayed litter of fruit trees and *Salix* stumps. They were extracted through Tullgren funnels and preserved in 70%-80% ethanol, dissected, cleared in 50% lactic acid for 1 h, and then mounted on microscope slides for detailed examination. The measurements were performed according to Chamberlin (1931) and are given in millimetres. Figures in front of parentheses are length:breadth ratio, the first number in parentheses is length and second is breadth. Figures 1A-D, 2A-F, 3A-F, 4A-E, 5A-F, 6A-D, and 7A-D were drawn with the aid of a Nikon type 104 microscope. These preparations will be deposited in the senior author's collection.

* Some part of this study printed as summary in XVII National Biology Congress.

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Results

Pselaphochernes scorpoides (Hermann, 1804)

(Figures 1-7)

Body

Female: Length of body 2.349 (n = 4), reddish-brown. Carapace 1 (0.584:0.537). Anterior margin of carapace is plate. Eyes absent. Carapacial chaetotaxy 4-4-4-4-2-5-4-2-4-2-2-6-2-9. Genital area with 22 setae. Male: Body 1.764 long (n = 4). Carapace 1.25 (0.574:0.458). Carapacial chaetotaxy 4-4-4-2-2-3-2-4-2-6-4-4-9. Genital area with 31-33 setae. Tritonymph: Body 1.648 long (n = 4). Carapace 1.2 (0.522:0.427). Carapacial chaetotaxy 4-4-2-4-2-4-2-4-6-7-8. Genital area with 5 setae. Deutonymph: Body 1.464 long (n = 1). Carapace 1.2 (0.479:0.400). Carapacial chaetotaxy 4-4-4-2-4-4-6-7-8-10. Genital area with 4 or 5 setae. Protonymph: Length of body 1.033 (n = 4). Carapace 1 (0.335:0.333). Carapacial chaetotaxy 4-2-2-2-2-4-2-2-2-6. Genital area without seta (Figures 1,2).

Chelicera

Female: Cheliceral galea distally branched, and exterior serrula with 17 setae. Fixed finger of chelicera

1.6 (0.180:0.110), movable finger 0.180 long. Flagellum of chelicera composed of 3 setae. Male: Fixed finger of chelicera 1.44 (0.155:0.108), movable finger 0.165 long. Tritonymph: Serrula exterior of chelicera with 15 or 16 setae. Fixed finger of chelicera 1.54 (0.143:0.093) and movable finger 0.148 long. Deutonymph: Serrula exterior of chelicera with 14 or 15 setae. Fixed finger chelicera 1.33 (0.125:0.094) and movable finger 0.135 long. Protonymph: Serrula exterior of chelicera with 11 setae. Chelicera 1.3 (0.103:0.078), movable finger 0.103 long (Figure 3).

Eggs

Egg packages 0.74 (0.658:0.886). Each package contains 20 eggs, each 0.136-0.232 in diameter (Figure 4E).

Palp

Female: Fixed finger of palp with 41 or 42 teeth, 6 or 7 accessory teeth. Movable finger with 41 or 42 teeth, 5 or 6 accessory teeth. Palpal digits: trochanter 1.8 (0.310:0.172); femur 2.6 (0.500:0.193); tibia 2.2 (0.485:0.218); chela (excluding pedicel) 3 (0.822:0.279); depth of chela 0.288; hand 1.5

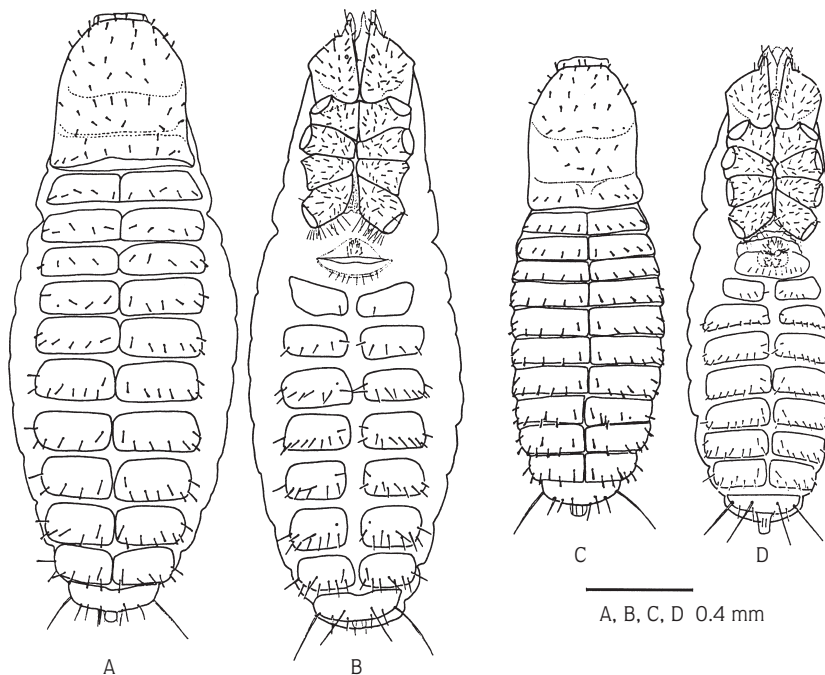


Figure 1. *Pselaphochernes scorpoides* (Hermann, 1804). Female: A) dorsal view; B) ventral view. Male: C) dorsal view; D) ventral view.

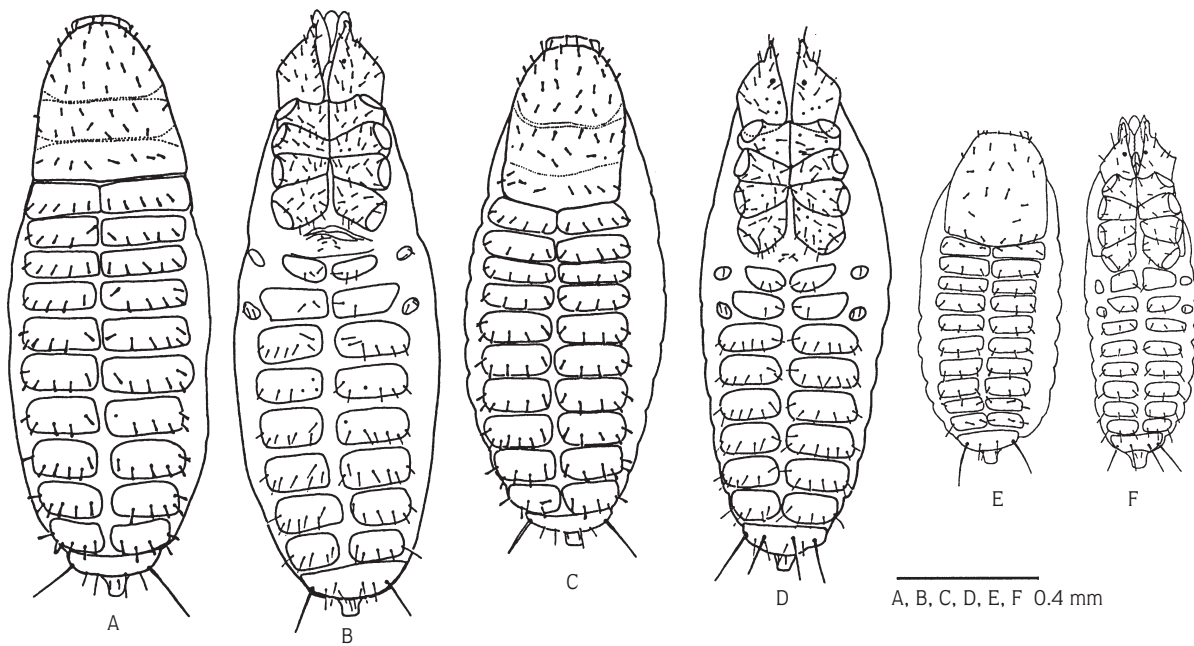


Figure 2. *Pselaphochernes scorpioides* (Hermann, 1804). Tritonymph: A) dorsal view; B) ventral view. Deutonymph: C) dorsal view; D) ventral view. Protonymph: E) dorsal view; F) ventral view.

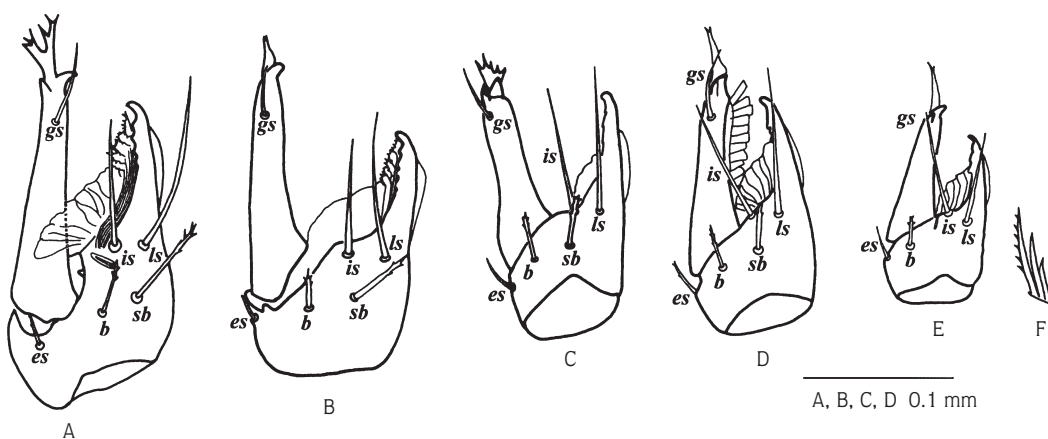


Figure 3. *Pselaphochernes scorpioides* (Hermann, 1804). Chelicera: A) female; B) male; C) tritonymph; D) deutonymph; E) protonymph; F) flagellum. Abbreviations: (es) exterior seta; (b) basal seta; (sb) subbasal seta; (is) interior seta; (ls) laminal seta; (gs) galeal seta.

(0.437:0.288); movable finger 0.441. Male: Fixed finger of palp with 36-39 teeth, 6 or 7 accessory teeth. Movable finger with 36-39 teeth, 5 accessory teeth. Palpal digits: trochanter 1.75 (0.293:0.167); femur 2.5 (0.445:0.178); tibia 2.23 (0.453:0.203); chela (excluding pedicel) 3 (0.748:0.245); depth of palp 0.250; hand 1.5 (0.379:0.250); movable finger 0.398

long. Tritonymph: Fixed finger of palp with 27-31 teeth and 5 or 6 accessory teeth. Movable finger with 28-35 teeth and 3 or 4 accessory teeth. Palpal digits: trochanter 1.63 (0.225:0.138); femur 2.2 (0.318:0.145); tibia 2 (0.333:0.165); chela (excluding pedicel) 3 (0.611:0.206); depth of palp 0.211; hand 1.56 (0.322:0.206); movable finger 0.313 long.

Deutonymph: Fixed finger of palp with 25 or 26 teeth and 5 or 6 accessory teeth. Movable finger with 28-31 teeth and 4 or 5 accessory teeth. Palpal digits: trochanter 1.6 (0.205:0.128); femur 2.13 (0.300:0.141); tibia 1.82 (0.272:0.149); chela (excluding pedicel) 2.55 (0.493:0.193); depth of palp 0.200; hand 1.49 (0.294:0.198); movable finger 0.265 long. Protonymph: Fixed finger of palp with 21-23 teeth and movable finger with 23-25 teeth. Fingers do not have accessory teeth. Palpal digits: trochanter 1.56 (0.145:0.093); femur 1.88 (0.160:0.085); tibia 1.8 (0.180:0.100); chela (excluding pedicel) 3 (0.360:0.120); depth of palp 0.130; hand 1.54 (0.185:0.120); movable finger 0.195 long (Figures 4 and 5).

Legs

Female: Leg I: trochanter 1.45 (0.128:0.088); basifemur 1.35 (0.135:0.100); telofemur 2.9 (0.243:0.083); tibia 3.7 (0.248:0.068); tarsus 5.42 (0.260:0.048). Leg IV: trochanter 1.9 (0.225:0.120); basifemur 1.8 (0.178:0.100); telofemur 2.8 (0.340:0.123); tibia 4 (0.355:0.088); tarsus 5 (0.298:0.060). Male: Leg I: trochanter 1.42 (0.118:0.083); basifemur 1.2 (0.123:0.103); telofemur

2.44 (0.215:0.088); tibia 3.5 (0.223:0.063); tarsus 5.3 (0.238:0.045). Leg IV: trochanter 1.8 (0.178:0.100); basifemur 1.5 (0.150:0.098); telofemur 2.7 (0.313:0.113); tibia 4 (0.318:0.078); tarsus 5 (0.265:0.053). Tritonymph: Leg I: trochanter 1.34 (0.098:0.073); basifemur 1 (0.095:0.090); telofemur 2.1 (0.168:0.080); tibia 2.8 (0.160:0.058); tarsus 4 (0.190:0.048). Leg IV: trochanter 1.45 (0.145:0.100); basifemur 1.5 (0.140:0.095); telofemur 2.6 (0.240:0.093); tibia 3.6 (0.245:0.068); tarsus 4 (0.225:0.055). Deutonymph: Leg I: trochanter 1.04 (0.073:0.070); basifemur 1.14 (0.083:0.073); telofemur 2.05 (0.133:0.065); tibia 2.51 (0.133:0.053); tarsus 3.45 (0.145:0.042). Leg IV: trochanter 1.45 (0.133:0.092); basifemur 1.45 (0.123:0.085); telofemur 2.14 (0.193:0.090); tibia 2.4 (0.188:0.078); tarsus 3.3 (0.175:0.053). Protonymph: Leg I: trochanter 1.22 (0.065:0.053); basifemur 0.9 (0.050:0.055); telofemur 1.9 (0.095:0.050); tibia 2.16 (0.093:0.043); tarsus 3.3 (0.125:0.038). Leg IV: trochanter 1.4 (0.085:0.060); basifemur 1.42 (0.085:0.060); telofemur 2.1 (0.123:0.058); tibia 2.56 (0.128:0.050); tarsus 3.3 (0.133:0.040) (Figures 6 and 7).

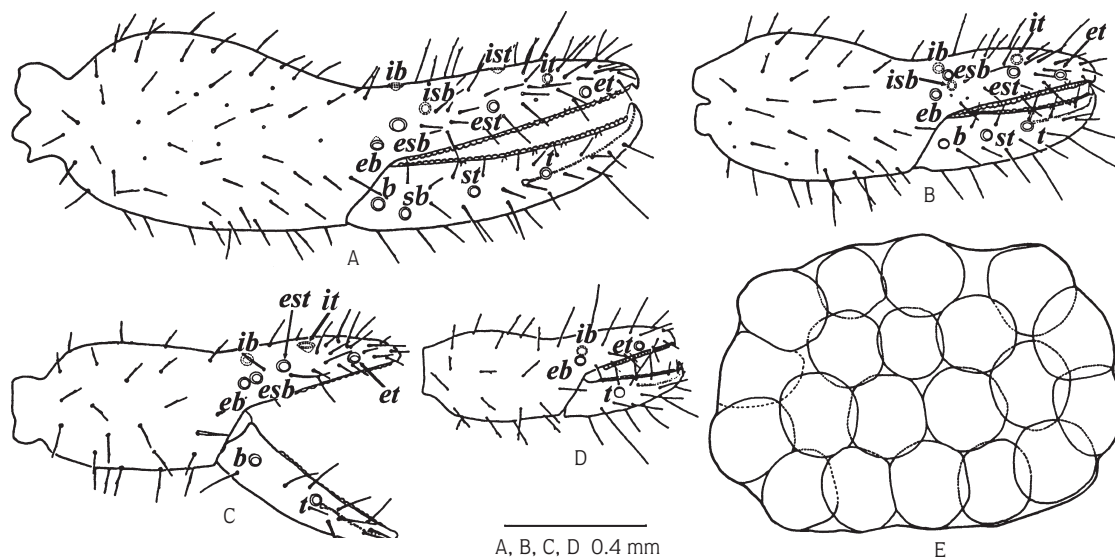


Figure 4. *Pselaphochernes scorpioides* (Hermann, 1804). Lateral view of palpal chela: A) female; B) tritonymph; C) deutonymph; D) protonymph; E) egg package. Tactile setae on movable finger: (b) basal; (sb) subbasal; (st) subterminal; (t) terminal. Tactile setae on fixed finger: (eb) exterior basal; (esb) exterior subbasal; (est) exterior subterminal; (et) exterior terminal; (ib) interior basal; (isb) interior subbasal; (ist) interior subterminal; (it) interior terminal.

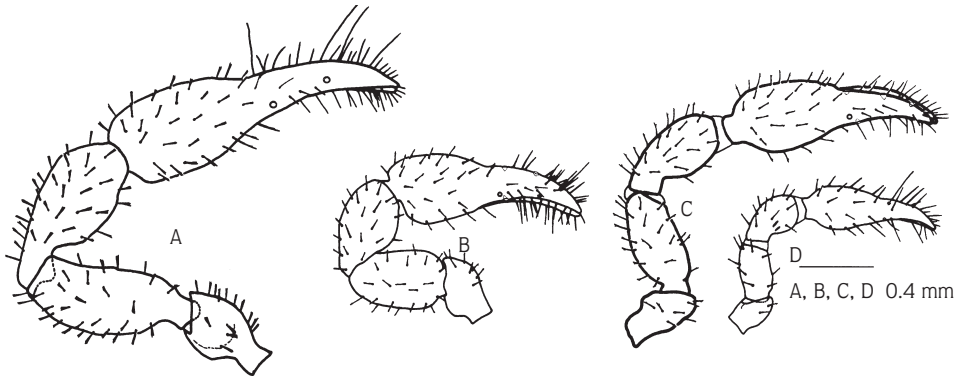


Figure 5. *Pselaphochernes scorpioides* (Hermann, 1804). Dorsal view of palp: A) female; B) tritonymph; C) deutonymph; D) protonymph.

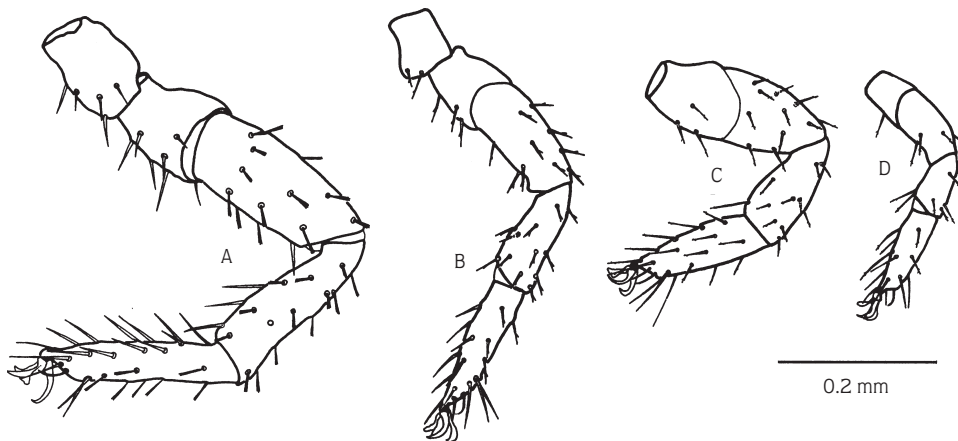


Figure 6. *Pselaphochernes scorpioides* (Hermann, 1804). Legs-I: A) male; B) tritonymph; C) deutonymph; D) protonymph.

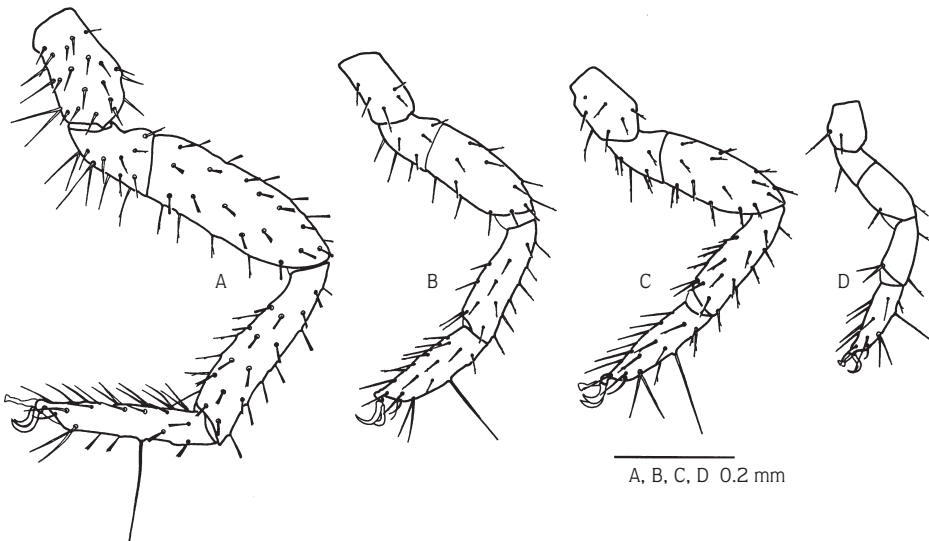


Figure 7. *Pselaphochernes scorpioides* (Hermann, 1804) Leg-IV: A) female; B) tritonymph; C) deutonymph; D) protonymph.

Examined samples and habitats: The shore of Tortum Lake in Erzurum province, litter of fruit trees, 15 June 2001, 3♀♀, 4♂♂, 4 tritonymphs, 1 deutonymph, 4 protonymphs. Köprüküy, near Söylemez village, decayed shavings from *Salix* stump, 23 June 2000, 2♀♀, 3♂♂, 1 tritonymph.

Distribution: Algeria, Armenia, Austria, Azerbaijan, Azores, Balearic Islands, Belgium, Bulgaria, Greece, Germany, Hungary, Iran, Ireland, Israel, Italy, Latvia, Lebanon, Morocco, the Netherlands, Norway, Poland, Romania, R.S.S.F., Sardinia, Sicily, Spain, Sweden, Switzerland, Syria, Turkey (Ankara, Antalya, Elazığ, Malatya, Muğla), U.S.A. (Connecticut, Indiana, Kentucky, Massachusetts, New York), Ukraine, Uzbekistan, and Yugoslavia (Beier, 1932, 1966, 1967; Gardini, 2000; Harvey, 1990; Mahnert, 1974; Pieper, 1981; Schawaller, 1981, 1983, 1989).

Discussion

This species, which is known to be quite widespread, has been reported from Ankara, Antalya, Elazığ, Malatya,

and Muğla in Turkey (Harvey, 1990; Beier, 1967). Our adult samples closely resembled all features previously published (Beier, 1932; Mahnert, 1974; Schawaller, 1983), except they had a longer body, and a tibia and tarsus of leg IV that were more slender.

The most apparent differences between the successive post-embryonic stages are the increase in the number of setae (especially of the chelicera and chela), and the development of genitalia. The acquisition of genitalia (or, at least, the sclerotised portions) is apparently limited to the final moult and does not possess a sequential pattern. Adults of many pseudoscorpion genera have 12 chelal trichobothria: 8 on fixed fingers and 4 on movable fingers (Chamberlin, 1931; Harvey, 1985; Sakayori, 1989). The present study on the post-embryonic development revealed that the stages of protonymph, deutonymph, and tritonymph of this species are precisely identical to those of the corresponding stages of other pseudoscorpion species reported in the literature. Differences among these stages are given in summary (Table). In addition, eggs and egg packages are described.

Table. Properties of the developmental stages of *P. scorpioides*.

Body area	Adult		Tritonymph	Deutonymph	Protonymph	
Palpal chela	Trichobothria on fixed finger		ib, isb, ist, it, eb, esb, est, et,	ib, isb, it, eb, esb, est, et,	ib, it, eb, esb, est, et,	ib, eb, et
	Trichobothria on movable finger		b, sb, st, t	b, st, t	b, t	t
	Accessory teeth on fixed finger		6-7	5-6	5-6	—
	Accessory teeth on movable finger		5-6	4-5	3-4	—
Chelicera	Setae of hand		gs, es, b, sb, is, ls	gs, es, b, sb, is, ls	gs, es, b, sb, is, ls	es, b, is, ls
	Serrula exterior		17	15-16	14-15	11
Palpal digits		Female	Male			
	Trochanter	1.8 (0.310:0.172)	1.75 (0.293:0.167)	1.63 (0.225:0.138)	1.6 (0.205:0.128)	1.56 (0.145:0.093)
	Femur	2.6 (0.500:0.193)	2.5 (0.445:0.178)	2.2 (0.318:0.145)	2.13 (0.30:0.141)	1.88 (0.160:0.085)
	Tibia	2.2 (0.485:0.218)	2.23(0.453:0.203)	2 (0.333:0.165)	1.82 (0.272/0.149)	1.8 (0.180:0.100)
	Chela (without pedicel)	3 (0.822:0.279)	3 (0.748:0.245)	3 (0.611:0.206)	2.55 (0.493/0.193)	3 (0.360:0.120)
	Depth of chela	0.288	0.250	0.211	0.200	0.130
	Movable finger	0.441	0.398	0.313	0.265	0.195
Hand	1.5 (0.437:0.288)	1.5 (0.379:0.250)	1.56 (0.322:0.206)	1.49 (0.294/0.198)	1.54 (0.185:0.120)	
Body	Body length	2.349	1.764	1.648	1.464	1.033
	Genital area	present		absent	absent	absent
	Spermateca	present (female)		absent	absent	absent
	Chitinisation	plenty		medium	medium	little

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