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DISTRIBUTION OF THREE SCORPION SPECIES (SCORPIONES: ARACHNIDA) IN JAFFNA PENINSULA

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ABSTRACT

The Jaffna Peninsula is located at the northernmost region of the Island of Sri Lanka, with area of about 1,025.6km^2. The topography of the region is almost flat and of low elevation except in the central part of the western sector, where the elevation rises, just to 10.5 m above sea level. Recent taxonomic studies revealed the presence of three species of scorpions in Jaffna Peninsula. They belong to two families, three genera and three species: the Buthids *Hottentottatamulus* and the Scorpionid *Heterometrusswammerdami and Isomertusmaculatus*. The flat Jaffna peninsula is made of limestone unlike most other parts of Sri Lanka, which is the main feature of Jaffna Peninsula's geography. The soils are derived from limestone. It is not fertile; the grey loam and red soil which lack organic matter and which can hardly retain moisture particularly during the dry season. Good soil in the Peninsula is certainly man-made. Somehow, these scorpion species successfully adapted to this soil environment.

INTRODUCTION

The Jaffna Peninsula (9°40'0"N 80°0'0"E) is located at the northernmost region of the Island of Sri Lanka, with area of about 1,025.6km^2. It is in close proximity to the sub-continent of India and separated from it by the Palk Strait and the Bay of Bengal. The peninsula is actually almost an island, much of it covered by shallow lagoons, and has a number of interesting islands dotted offshore. Most of the area is dry and sandy. Elephant Pass,a narrow causeway, connects Jaffna with the rest of Sri Lanka. Jaffna features a tropical rainforest climate with no true dry season month. The average annual temperature is 27.190°C. The average rainfall is 1,811.8 mm (Statistical Hand Book, 2012). The topography of the region is almost flat and of low elevation except in the central part of the western sector in the area around Tellippalai where the elevation rises to 10.5 m above sea level. The flat Jaffna peninsula is made of limestone unlike most other parts of Sri Lanka, which is the main feature of Jaffna Peninsula'sgeography (Cooray, 1984).

National Red List 2012 of Sri Lanka considered some selected group of animals such as dung beetles, corals, echinoderms, centipedes, bivalves and gastropods as lesser known faunal groups. Furthermore other invertebrate group of Arachnida that includes especially spiders and scorpions. The Red List contains 501 spider species (including 257 endemics). Also, it was reported that the scorpion fauna is largely neglected in taxonomic records in Jaffna Peninsula as well as Sri Lanka. (IUCN, 2012).

Distribution of the scorpion fauna in the northern part of Sri Lanka remained under pressure of severe habitat degradation at frequent rate during war time and even after the resettlement. Conservation of biodiversity depends on the identification and maintenance of the taxonomic records of biotic components (Sureshan, 2007). This area is poorly known for invertebrate fauna, and extensive field surveys are needed to obtain preliminary data of the scorpion diversity of these area.

According to Pocock (1900) 11 species of scorpions under 3 families, namely Scorpionidae, Charilidae and Buthidae occur in SriLanka. Vachon (1982) made inventories of the scorpions of Sri Lanka (studies on the scorpions deposited in the collection of the Natural History Museum Geneva III) comprising of 11 species: 3Scorpionidae, 7Buthidae and Chaerillidae along with a key to their identification of these species and a

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map of their distribution. Additionally, four species have been recorded from SriLanka during the last decade by several researchers (Lourenço 2002; Lourenço& Huber, 2002; Lourenço, 1997; Lou-renco& Huber, 1999; Kovařík, 2003; Kovařík, 2004). These members of scorpions were reported only from Yala national park, Willpattu National Park, Kandy, Anurathdhapura, Trincomalee, Mannar and Mullaittivu (Vachon, 1982). Ranawanaet *et al.* (2013), have reviewed the current list of scorpions, including the total count up to 16 species found in SriLanka.

When compared to other parts of the country, the scorpion fauna of Jaffna Peninsula is poorly documented. Recently, Ranawana *et al.,* (2013) discovered a medically important new species *Hottentotatamulus* within the family Buthidae recorded in Jaffna Peninsula.

This article provides a detailed systematic account of scorpion fauna of Jaffna, mainly from Northern Province of SriLanka. This includes 3 species belonging to 2 families.Veronika *et al.,* (2013) have reported very recently about the existence of *Heterometrusswammerdami* (Simon, 1872) and *Isomertusmaculatus* (DeGeer, 1778). Ranwana *et al.,* (2013) did not include this species in their work and no further specimens were reported from Jaffna Peninsula by other authors as well. The aim of this article was to establish the composition of scorpion fauna with identification key to scorpions of Jaffna Peninsula, and to contribute further knowledge of scorpion fauna in Sri Lanka.

COLLECTION OF SCORPION

Field survey was carried out during the period from September 2010 to August 2012. Random search method was done during the survey and scorpions were searched under rocks, within soil and leaf litter, under bark, and within vegetation.In particular, we surveyed from Jaffna town (9°40'0"N 80°0'0"E) to Vadamaradchi area (9° 48' 21. 97" N 80° 12' 16. 77"E) (Fig. 1). Scorpions in the field were collected with the help of forceps, transferred to the plastic jar and preserved in 70% ethyl alcohol. Most of the scorpions were collected by "rock rolling" (Williams, 1968). Furthermore, we did nocturnal observations in above localities. The temperature of air and substrate was taken at the collection sites. The air temperature ranged between 26 °C and 33 °C, whereas the soil values ranged between 27 °C and 32 °C. All the collected specimens were deposited, after identification, in the faunal holding of Museum of Dept of Zoology, University of Jaffna.

Identification of scorpion

Photographs of live specimens were taken with a digital camera, while photos for morphological characters of preserved material were taken with the same camera mounted on the eye piece of Olympus microscope. Digital images were slightly processed with Adobe Photoshop7.0, only to optimize brightness and contrast. Measurements (in mm) follow Sissom(1990) and descriptive terminology mostly follows Hjelle (1990). Morphological investigation and counts of pectinal teeth were carried out under dissecting microscope (kyowa, ×20, ×40).

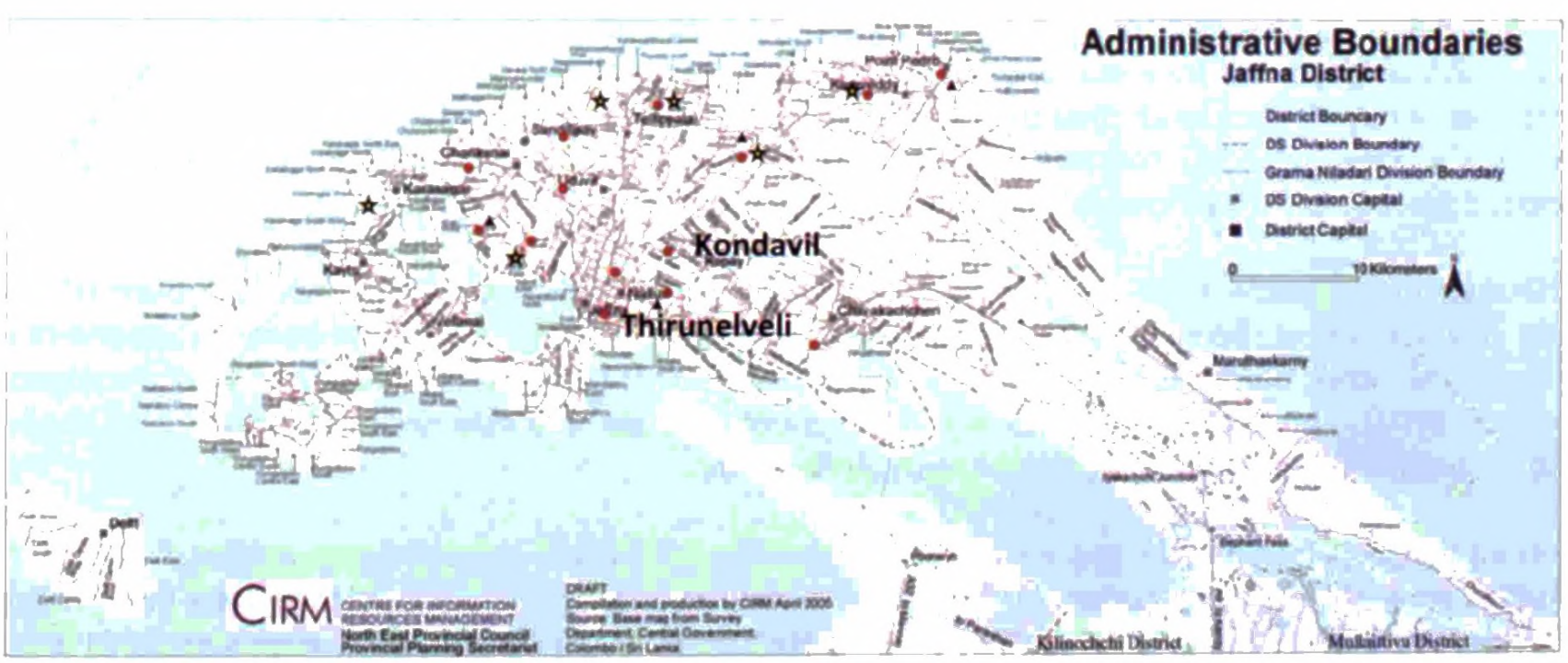

Figure 1: Map of Jaffna Penninsula, showing the localities of scorpion species (circle, *Heterometrusswammerdami*; *Isomertusmaculatus*and star, *Hottentottatamulus* Triangle).

SYSTEMATICS

Order Scorpiones C. L. Koch, 1850

Family Scorpionidae Latreille, 1802

Subfamily Scorpioninae Latreille, 1802

Heterometrusswammerdami (Simon, 1872) (Figure2; Table1)

Habitat: This is a common species. They are found in the gap of soil, leaf litter and under the stones.

Distribution. India, Sri Lanka: Puttalam, Anuradhapura, Kandy, Jaffna (Veronika *et al.*2013).

Family **Buthidae** C. L. Koch, 1837

Sub family: **Buthinae** C. L. Koch, 1837

Hottentottatamulus(Fabricius, 1798) (Figure3, Table 1)

Habitat: It was observedunder rocks and in crevices.

Distribution: India, Pakistan, Sri Lanka: (The occurrence of this species in Jaffna, Palali, Karainagar, Achchuveli is mentioned by Ranawana *et al.*, 2013, and in Karaveddy and Iddaikadu is mentioned by Veronika *et al.*. 2013).

Isometrus (Isometrus) maculatus(DeGeer, 1778) (Figure 4; Table 1)

Habitat: Endemic species in Sri Lanka (Lourenco and Huber, 2002). It is found in wild conditions inland in Sri Lanka (Lourenco and Huber, 2002). It was collected close to human dwelling and under barks of large trees.

Distribution: Cosmopolitan (Fet& Lowe, 2000), Sri Lanka: Matala, Mannar, Anuradhapura, Jaffna (Veronika et al, 2013).

Figure 2: *Heterometrusswammerdami*, left - Dorsal and right-ventral views

Figure 3:. *Hottentotta tamulus*, left - Dorsal and right-ventral views

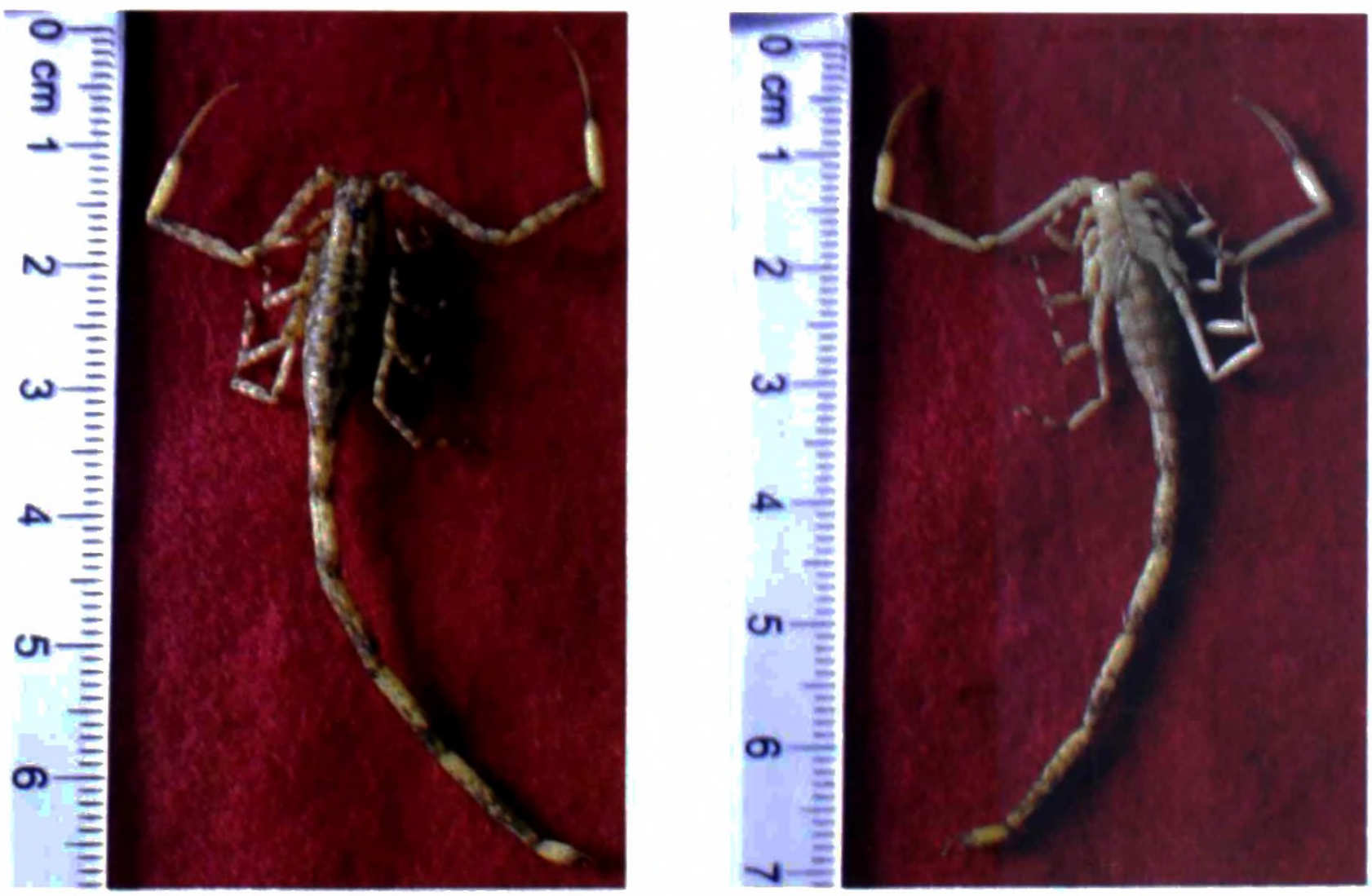

Figure 4: *Isometrusmaculatus*, Dorsal and right - ventral views

DISCUSSION

Preliminary records revealed the occurrence of three species of scorpions belonging to two families, namely, Buthidae and Scorpionidae from the northern part of Sri Lanka. Among the species reported here, *Heterometrusswammerdami* appears to be widely distributed in the leaf litter and gap of soil in Jaffna Peninsula. Palmyrah palms are found in abundance in the Peninsula. In some places they grow wild, having a life span of one hundred years; they shape the landscape in many parts of the Peninsula region. These scorpion species predominantly spend their day time within the parts of the Palmyrah tree. Two species *Isometrus (Isometrus) maculatus* and *Heterometrusswammerdami* are reported for the first time from Jaffna (Veronika *et al.*, 2013). The species *Heterometrusswammerdami*is is the most common species to Sri Lanka (Kovařík, 2004) distributed over the whole area of Jaffna Peninsula, represented by a fairy good number of specimens. *Isometrus (Isometrus) maculates* (DeGeer, 1778) was recorded as an endemic species to Sri Lanka (Lourenco and Huber, 2002) whereas, this species is widely distributed as cosmopolitan (Fet& Lowe, 2000) though this species was reported here as rare species from Jaffna district. Therefore, their occurrence in this area needs conformation by further collection of specimens. The recent discovery of a medically important alien species *Hottentottatamulus*from in the Jaffna Peninsula (Ranawana *et al.*, 2013) indicate the possible occurrence of further venomous taxa in this area. This *H.tamulus* spends mostly under stones and crevices. Here, we presented the records on the diversity and distribution of scorpion fauna while the key will be intended for a wide range of conservation managers to easily identify the scorpions from Jaffna Peninsula.

Table1: Measurements (in millimeters), Specimens of *Heterometrusswammerdami*, *Hottentotta tumulus* and *Isometrusmaculates* from Jaffna Peninsula deposited at the Department of Zoology, Faculty of Science, University of Jaffna, Sri Lanka.

	Heterometrusswammerdami	*Hottentottatamulus*	*Isometrusmaculatus*
Carapace, length	19	9	6
Carapace, anterior width	18	5	
Carapace, posterior width	19	10	
Mesosoma, length	39	24	9
Metasomal segment I			
Length	10	4	4
Width	7	5	
Metasomal segment II			
Length	11	5	5
Width	6	5	
Metasomal segment III			
Length	13	5	7
Width	6	5	-
Metasomal segment IV			
Length	15	6	7
Width	6	5	-
Metasomal segment V			
Length	17	9	10
Width	5	4	-
Metasomal length	65	29	33
Telson length	17	8	5
Aculeus length	10	3	-
Pedipalp, femur Length	13	6	8
Width	6	2	-
Pedipalp, patella Length	15	8	8
Width	19	3	-
Pedipalp, chela Length	31	3	10
Width	22	2	-
Movable finger, Length	19	10	6
Total body length	140	70	53
Pectinal teeth count			
Left/Right	18/18	30/30	19/18

Key to the species of scorpions occurring in Jaffna Peninsula

Abdomen very long, consisting of twelve distinct somites, of which the posterior five are narrowed and compressed to form with the post anal sclerite or vesicle, a distinct tail; post anal sclerite with two poison-glands; a posterior of comb like abdominal appendages.....**SCORPIONE.**

1. -Pedipalps and metasoma short and robust. Colouration basically brown, densely spotted with black, so the scorpion looks uniformly dark to blackish to unaided eye. Trichobothrial pattern C: femur with only three tricho-bothria, patella with three ventral trichobothria. Sternum type 2: Widely hexagonal, with a posterior emargination and convex lateral lobes. Leg tarsomere II ventrally with two parallel rows of stout spiniform seta.....**SCORPIONIDAE——(3)**

-Pedipalps and metasoma long and slender. Colouration basically yellow, sparsely spotted with light to dark brown, so the scorpion looks pale and striped to unaided eye. Trichobothrial pattern A: femur with 10 trichobothria, patella without ventral trichobothria. Ster-num type 1: narrowly pentagonal, with a posterior depression that does not bisect the posterior edge. Leg tarsomere II ventrally with dense and irregular cover of thin setae.....**BUTHIDAE——(2)**

2. -Pedipalp fingers dark brown to black, conspicuously darker than hand. Trichobothrium*db*on chela of pedipalp situated between trichobothria*dt* and *et*Manus of pedipalp very thin, width of male manus equals width of patella and femur. Pattern on mesosomal segments light coloured. First basal middle lamella of female pectin quadrangular. Telson with subaculear tubercle very large, sharp and triangular.....'.....***Isometrus(Isometrus)maculatus***(DeGeer, 1778).

-Color uniformly yellow to reddish, mesosoma dark. Chela of pedipalp of same colour as femur of pedipalp, not darker . Male has markedly broader manus than female. Metasoma only sparsely hirsute. Total length 50 –90 mm. Pectinal teeth number 30–39 in males, 27–34 in females.....***Hottentottatamulus*** (Fabricius, 1798).

3. -Dorsal surface of chela covered by pointed or rounded granules. Fifth segment of metasoma longer than femur of pedipalp, fourth segment of metasoma about as long as femur of pedipalps. Chela of pedipalp of adults coloured similarly to body.....***Heterometrus swammerdami*** (Simon, 1872).

REFERENCES

Cooray, P.G. 1984. An Introduction to the Geology of SriLanka (Ceylon).*2nd revised ed.* National Museums Sri Lanka. Colombo. 126- 269.

Fet, V. & G. Lowe. 2000. Family Buthidae C.L. Koch, 1837. Pp. 54–286 in: Fet, V, W.D. Sissom, G. Lowe & M.E. Braunwalder (eds). Catalog of the Scorpions of the World (1758–1998). New York: The New York Entomological Society.

Hjelle, J. T. 1990. Anatomy and morphology. Pp. 9–63 in: Polis, G.A. (ed.). The Biology of Scorpions. Stanford: Stanford University Press.

IUCN, 2012.*in*: *The National Red List 2012 of Sri Lanka;Conservation Status of the Fauna and Flora.* Weerakoon, D.K. & S. Wijesundara (eds.). Ministry of Environment, Colombo, Sri Lanka. xviii-xix pp.

Kovařík, F. 2003. A review of the genus IsometrusEhrenberg, 1828 (Scorpiones: Buthidae) with descriptions of four new species from Asia and Australia. *Euscorpius*, 10: 1–19.

Kovařík, F. 2004. A review of the genus HeterometrusEhrenberg, 1828, with descriptions of seven new species (Scorpiones, Scorpionidae).*Euscorpius*, 15: 1–60.

Kovařík, F. 2007. A revision of the genus HottentottaBirula, 1908, with descriptions of four new species (Scorpiones, Buthidae).*Euscorpius*,58: 1–107.

Lourenço, W. R. 1997. A new species of *Lychas*Koch, 1845 (Chelicerata, Scorpiones, Buthidae) from Sri Lanka.*Revue suisse de Zoologie*, 104(4): 831-836.

Lourenço, W. R. 2002. Further taxonomic considerations about the genus *Charmus*Karsch, 1879 (Scorpiones, Buthidae), with the description of a new species from Sri Lanka with the description of a new species from Sri Lanka.*EntomologischeMitteilungenausdemZoologischen Museum Hamburg*, 14(165): 17-25.

Lourenço, W. R. & D. Huber. 1999. One more new species of *Lychas*Koch, 1845 (Chelicerata, Scorpiones, Buthidae) from Sri Lanka. *EntomologischeMitteilungenausdemZoologischen Museum Hamburg*, 13(159): 23-27.

Pocock, R. I. 1900. Arachnida.*The fauna of British India, including Ceylon and Burma*.Published under the authority of the Secretary of State for India in Council. London: W. T. Blandford, xii, 279 pp.

Ranawana, k. B., N. P. Dinamithra, S. Sivansuthan,I. Nagasena, F. Kovařík& S. A. M. Kularatne. 2013. First Report on *Hottentottatamulus* (Scorpiones: Buthidae) from Sri Lanka, and its Medical Importance. *Euscorpius*, 155: 1–10.

Sureshan, P. M., D. B. Bastawade, & C. Radhakrishnan. 2007. Taxonomic studies on a collection of scorpions (Scorpiones: Arachnida) from western ghats in Kerala, India with two new distribution records. *Zoos' print Journal*, 22 (12): 2903-2908.

Sissom, W. D. 1990.Systematics, biogeography and paleontology. Pp. 64–160 *in*: Polis, G. A. (ed.). *The Biology of Scorpions*. Stanford: Stanford University Press.

Statistical Hand Book, 2012.*in*: *Statistical Information 2012*. Wijialudchumi, R (eds.). Provincial Planning Secretariat, Northern Province, Jaffna. 3-4 pp.

VACHON, M. 1982. Les scorpions de Sri Lanka (Recherchessur les scorpions appartenantoudéposés au Muséumd'Histoirenaturelle de Genéve III.).*Revue Suisse De Zoologie*,89: 77-114.

Veronika K,'Akilan K, Murugananthan A and Eswaramohan T. 2013. Diversity and identification key to the species of scorpions (Scorpiones: Arachnida) from Jaffna Peninsula, Sri Lanka. *Journal of Entomology and Zoology studies, 1 (5):70-77.*

Williams, S. C. 1968. Methods of sampling scorpion populations.*Proceedings of the California Academy of Sciences*, (4) 36: 221–230.

Veronika K, Akilan K, Murugananthan A and Eswaramohan T. 2013. Diversity and identification key to the species of scorpions (Scorpiones: Arachnida) from Jaffna Peninsula, Sri Lanka.*Journal of Entomology and Zoology studies, 1 (5):70-77.*