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A first report on *Lychas srilankensis* (*Lourenco*, 1997) (Scorpiones: Buthidae) in Jaffna Peninsula, Northern part of Sri Lanka

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Abstract
A first report on the endemic scorpion *Lychas srilankensis* (*Lourenco*, 1997) in Jaffna Peninsula, Northern part of Sri Lanka *Lychas srilankensis* is one of the endemic scorpion belongs to the family Buthidae out of ten endemic scorpions. The present study was conducted to record the available scorpion species from Jaffna Peninsula. Diurnal random sampling was implemented during weekends from the first week of April 2014 to last week February 2015 in Jaffna peninsula. Altogether 3 scorpions were collected and reared in the Animal House of Department of Zoology with the occasional feeding of cockroach nymphs and thrips with *adlibitum* water. The tanks that housed the samples resembled their natural habitat with dark covers around it. This scorpion is characterized with 23 pectinal combs; darken colouration at fourth and fifth segments of metasoma and light brown to reddish coloration with the average total length of 50.00± 2.00mm. The scorpions were identified as *Lychas srilankensis* using standard keys. It will be valuable to determine the toxic nature by venom characterization in future.

Keywords: *Lychas srilankensis*, Pectinal comb, Buthidae, Sri Lanka, Scorpion

Introduction
Scorpions are usually believed as a generalized predator, due to its vision and sometimes audition help them to capture its prey in their locality [1-3]. There are three units, which make the scorpion body, namely carapace, abdomen (mesosoma and metasoma) and telson from front to back large number of venomous animals are existing all over the world, in which a few scorpion species are reported to be lethal to man out of about 1750 known species [4].
Sri Lanka is considered as one of the top biodiversity hotspot covering 65 610 km^2 area with diverse fauna and flora. Sri Lanka is the pearl of the Indian ocean where Jaffna peninsula is a smaller portion occurring in the northern part of the island with the area of 1025.6 km^2 with the annual average temperature of 27.190 ºC & the average rain fall of 1,811.8mm [5] and it is divided into four administrative zones, vitz. Vadamarachchi, Thenmarachchi, Valikamam and the Island zone. Chavakachcheri and Vadamarachchi areas have the significant variation of physical environments. Chavakachcheri is characterised with sandy soil with less stones whereas Vadamarachchi is characterised with stones with sandy soil with salted air from the sea of Indian Ocean.
As far as faunal research studies are concerned, insects were occupied in the top priority list among all the arthropods. The scorpions of Sri Lanka are less blessed with scientific researches, as there are few reports regarding their diversity from Sri Lanka. But, interestingly Pocock [6] listed 11 scorpion species from Sri Lanka under three families, namely Buthidae, Chaerilidae and Scorpoinidae out of six scorpion families [7, 8]. After his report, no articles report the availability of the scorpion species from Sri Lanka other than the reported scorpion families. Therefore, the present study was started with the aim to make a profile of available scorpion species from northern part of Sri Lanka, Jaffna.

Materials and Methods
The scorpion specimens were collected during the day times in Thamparsity (9º 49'42.9" N, 80º 13'28.6" E) and Chavakachcheri (9º39'07.1" N, 80º05'38.8" E) areas in the Jaffna Peninsula (Fig: 01), during the survey the latitudes and the longitudes were recorded. In Thamparsity area, this scorpion was collected from the small stones since July 2014.

Tongs were used to collect the specimens once they were spotted at their habitat. In Chavakachcheri area, the scorpions were collected from the husk shells.

Random sampling was implemented during weekends. Collected scorpion samples were kept in the Animal House of the Department of Zoology in the University of Jaffna and were occasionally fed with nymphs of cockroaches and thrips and adlibitum of water with petti disc was provided daily. The tanks that housed the sample resembled their natural habitat with native soil/sand, rocks from the same vicinity in which the scorpions were caught, and dark covers were placed around the tanks. The room was also kept dark with heavy curtains to mimic the underground conditions of their burrowing habitats. The present study was ethically approved by the Department of Zoology, University of Jaffna.

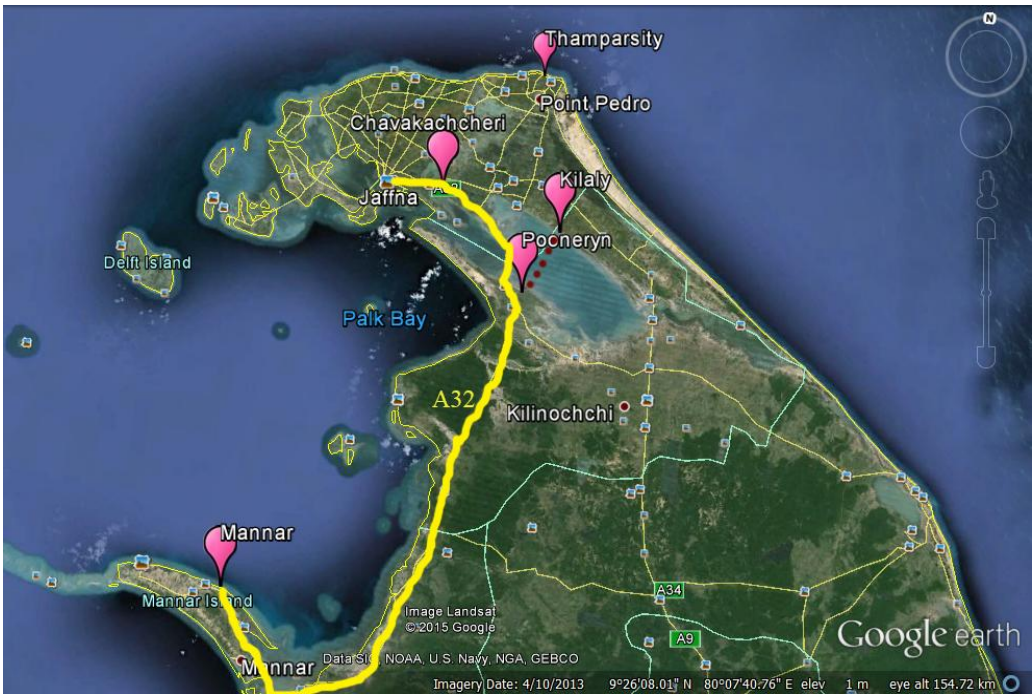

Fig 1: Location of the Northern part of Sri Lanka with the illustration of our sampling areas.

This map indicates our sampling locations in Jaffna Peninsula, the sampling areas were Chavakacheri and Thamparsity. The migratory routes of scorpion through the possible way is also illustrated in the map.

The relevant measurements of length were taken from the dead samples by using (Vernier caliper 150 x 0.02mm, 6x 0.001inches), the photographs were taken by using camera (FUJIFILM FINE PIX HS50 EXR). The minute structures are observed under the microscope (Binoculor microscope model SE-L). They were identified using several keys [4].

Discussion

Preliminary morphological observations of the scorpion *Lychas srilankensis* along with standard taxonomic keys revealed some interesting facts as the scorpion has a unique and different colouration pattern in the dorsal as well as in the ventral part. The colouration pattern of this scorpion is our first result to keep this scorpion under different genus.

Colouration

Entire body is spotted with yellow and brown, the fingers and manus of the pedipalp of same colour (Fig: 02, 03, 04, 05, 06 and 07) which is off light and spotted in the pedipalp region. Sometimes the finger may be darker in colour than that of the manus region. The fifth metasomal segment is darker in colour than that of other segments (Fig: 04).

Prosoma

Prosoma region is spotted; entire prosoma region is evenly granulated. The granules are round. There are few number of tricobothria found in the anterior edge of the prosoma region (Fig: 07).

Mesosoma

It is also spotted and granulated with round granules.

Telson

Telson is distinct subacular in shape with reddish and black in colour. In addition to these features, there are some tricobothrias present in the telson region (Fig: 08).

Cheliceral region

Fixed finger of Cheliceral region is characterised with a single fixed distal and sub distal tooth and a basal tooth. The movable finger is with ventral distal tooth, distal tooth, sub distal tooth and medial tooth (Fig: 09).

Third & fourth legs are with tibial spurs (Fig: 05). The movable fingers present in the pedipalp region are with diagonal rows of granules (Fig: 10). The tricobothrias in the dorsal region of the femur are arranged in a beta configuration.

Pedipalp

Movable fingers of pedipalp have rows of granules (Fig: 10). There are about six rows of granules present in which the sixth row of pedipalp is without external granules.

Pectinal teeth

The pectinal teeth number of this scorpion is 23. The pectin is longer than width and it is 5 times longer than the width (Fig: 11 and 12).

Measurements

The morphological identification of the scorpion mainly deals with their specific length: width ratio of key identification

characters. Such measurements of the scorpion have been tabulated in the Table: 01

Table 1: The morphological measurements of *L. srilankensis*

Characters	Male	Female
Prosoma length	06.00mm	05.00mm
Prosoma anterior width	03.40mm	03.34mm
Prosoma posterior width	05.60mm	05.00mm
Mesosoma length	11.20mm	15.30mm
Mesosoma anterior width	05.60mm	05.30mm
Mesosoma posterior width	03.00mm	03.30mm
Metasomal segment –I		
Length	05.00mm	03.60mm
Width	03.30mm	03.20mm
Depth	02.50mm	02.70mm
Metasomal segment –II		
Length	05.60mm	04.22mm
Width	03.30mm	03.10mm
Depth	02.60mm	02.70mm
Metasomal segment –III		
Length	05.90mm	04.50mm
Width	03.34mm	03.10mm
Depth	02.50mm	02.80mm
Metasomal segment –IV		
Length	06.40mm	05.10mm
Width	03.14mm	03.00mm
Depth	02.40mm	02.56mm
Metasomal segment –V		
Length	07.40mm	06.00mm
Width	03.10mm	02.90mm
Depth	02.30mm	02.50mm
Metasoma length	23.20mm	22.80mm
Telson length	06.00mm	05.00mm
Aculeus length	04.00mm	03.00mm
Pedipalp length	21.70mm	21.40mm
Femur Length (maximum/minimum) Width (maximum/minimum) Depth	05.30mm/03.60mm 02.00mm/01.40mm 01.20mm	04.32mm/02.40mm 01.18mm/01.00mm 01.10mm
Patella Length (maximum/minimum) Width (maximum/minimum) Depth	05.70mm/04.00mm 01.58mm/01.00mm 02.00mm	05.00mm/03.00mm 01.50mm/01.30mm 01.22mm
Length of manus	09.00mm	06.70mm
Length of tarsus	05.00mm	04.20mm
Length of tarsus of chelicerae	01.78mm	02.00
Length of tibia of chelicerae	00.80mm	
Total body length	52.00mm	48.00
Number of basal teeth	01	01
Number of pectinal comb	23	23

Fig 2: Dorsal view of Scorpion with scale.

Fig 3: The ventral view of Scorpion with scale.

Fig 4: The metasoma and telson

Fig 5: The third and fourth leg of scorpion.

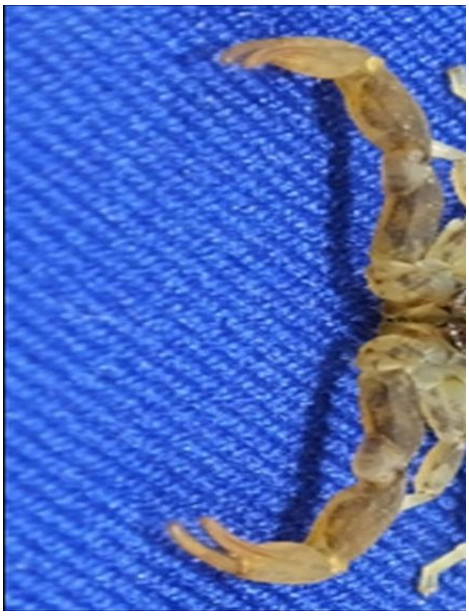

Fig 6: The pedipalp region.

Fig 7: The prosoma region

Fig 8: The sub aculus telson.x20

Fig 9: The cheliceral region.

Fig 10: Rows of granules in the movable finger of pedipalp

Fig 11: The sternum region x20x2

Fig 12: The pectinal teeth x 40

So far our team have come across with three species of scorpions, namely *H. tamulus*, *I. maculatus* and *H. swammerdammi*. These three scorpions are belonging to the family Buthidae and scorpionidae respectively. Number of Pectinal combs and the shape of the sternum are the peculiar characters in the scorpion identification.

It was so surprising to see this specimen as it is entirely different from the previous collections such as *Heterometrus swammerdammi* and *Hottentotta tamulus*. But, it shares some features with already reported species *Isometrus maculates*. Sub aculus telson with dark coloration and dark and light alternative colouration pattern in the entire body were the similarities with *I. macultus*. The pectinal comb number of genus *Isometrus* is ranging from 11-19 [4]. The pectinal comb number of this species is 23 and it has the peculiar darken colouration in its fourth and fifth segments of metasoma region.

Systematics

Order: Scorpiones C. L. Koch, 1837.
Family: Buthidae. C. L. Koch, 1837.
Geneus: *Lychas.* C. L. Koch, 1845.
Species: *Lychas srilankensis.* Lourenco, 1997.

Diagnosis of the genus *Lychas*

Total length about 40 mm. Metasoma approximately the same length in both sexes. Sixth row of granules on both movable and fixed fingers of pedipalp without external and internal granules. First through third metasomal segments may bear 10 carinae, fourth bear 8 carinae. Intermediate carinae of second and third metasomal segments may be incomplete. Fingers and manus of pedipalp identically coloured, light and spotted. Manus of pedipalp smooth, without granules. Pectinal teeth number 22-25.

Diagnosis of the species *Lychas srilankensis*

Total length 21.8-90 mm, dorsal tricobothria of femur arranged in beta – configuration. Cheliceral fixed finger with a single ventral denticle. Third and fourth legs with tibial spurs. Pectines with conspicuous or inconspicuous fulcra. Pectinal teeth number 8 – 26. Movable fingers of pedipalps with six rows of granules and external and internal granules and apical row represented by 3 or 4 accessory granules. Total number of terminal granules is 6 or 7. Carapace in lateral view with entire dorsal surface horizontal or nearly so. Telson with a distinct subaculear tooth. Fifth metasomal segment with carinae [4].

As many reports suggested male and female differentiation of scorpions has determined by the measurements got from some of the regions such as carapace, sternite, metasoma, pedipalp and pectinal combs [1, 2, 9-14]. The width of the body of female *Lychas srilankensis* is wider than male scorpion.

This is a first report of *Lychas srilankensis* from Jaffna Peninsula. It is an endemic species to Sri Lanka. But, it was reported earlier in Sri Lanka only from Mannar district, Occapu Kallu and Wilpattu, not in other parts of the Island so far [4]. There is no report to date regarding its molecular phylogeny and the nature of its venom.

Mannar district is the considerably nearest place to Jaffna peninsula when compared to other part of Sri Lanka with the distance of nearly 100km. Mannar is one of the driest place in Sri Lanka. Jaffna Peninsula has the connection with Mannar District by land route by means of A32 and A14 routes. During the war period in Sri Lanka nearly 30 years since 1983, there was no land route connection between Jaffna and Mannar directly. Before year 2013, there was only the A14 route functioned through Vavuniya District. During that period, people from Jaffna used to move in and out through Killaly lagoon area. Only alternative for the transport was the domestic traditional boat services. Most places adjacent to the coastal area in the Mannar and Pooneryn were No-man places. Most of the human dwellings were become abundant places with the wild bushes. These bushes almost spread all over the areas of those ruined houses. This must have created a new environmental condition for the scorpion migration along with other animal groups without any human interventions. This can be a cause for the presence of *Lychas srilankensis* in Jaffna Peninsula.

Conclusion

Sorpion species was concluded as *Lychas srilankensis* from the morphological observations with the standard adapted keys for the identification of scorpion.

The scorpion species *Lychas srilankensis* were only collected from Chavakachcheri and Thamparsity areas and those are located closed to the coastal region away from the main city. This fact indicates, that the scorpion *Lychas srilankensis* is not migrated towards the town yet. Therefore, it can be concluded that they have established their population in those coastal areas with the available climatic and environmental parameters and also available in the undisturbed areas such as coastal belt, small scale forests with dark environmental conditions.

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The authors declare that they have no competing interests.

Authors Contributions

Dr. T. Eswaramohan designed the study, carried out the experiments, analysed data and revised the manuscript. Mr.S. Arthiyan and Ms. R. Jeyasutha collected samples and draft the manuscript. Dr. A. Murugananthan helped designing the study and critically revised the manuscript. All authors read and approved final manuscript.

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