Tiger beetles (Coleoptera: Cicindelidae) of ancient reservoir ecosystems of Sri Lanka

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Abstract: The reservoir ecosystems of Sri Lanka are ancient man-made riparian habitats. Adequate food supply and suitable climatic and soil parameters make these habitats ideal for tiger beetles. Twenty-six reservoirs were investigated for the presence of tiger beetles, and four species were recorded: *Calomera angulata* (Fabricius, 1798), *Myriochila* (*Monelica*) *fastidiosa* (Dejean, 1825), *Cylindera (Oligoma) lacunosa* (Putzeys, 1875) and *Lophyra (Lophyra) catena* (Fabricius, 1775). *Calomera angulata* is the most common species, occurring in the majority of reservoir habitats. Key environmental factors of climate and soil were examined and linked to habitat preferences of tiger beetle species.

Keywords: Coleoptera, Cicindelidae, habitat preferences, reservoirs, tiger beetles.

Sinhala Abstract: වැව්, ශ්‍රී ලංකාවේ දක්නට ලැබෙන ඉපැරණි පරිසර පද්ධතියකි. මිනිසා විසින් තනන ලද මෙම වැව් ජලාශ්‍රිත ජීවීන් සඳහා කදිම වාසස්ථානයකි. ප්‍රමාණවත් ආහාර සැපයුම නිසාත්, යෝග්‍ය වූ කාලගුණික හා පාංශු තත්ව නිසාත්, මෙම වාසස්ථාන ටයිගර් කුරුමිණියන්ගේ වාසය සඳහා ඉතා සුදුසු වේ. මෙම අධ්‍යයනයේ දී වැව් විසි හයක් විමර්ශනය කරන ලද අතර එහිදී ටයිගර් කුරුමිණියන් විශේෂ 4 ක් අනාවරනය විය: *Calomera angulata* Fabricius 1798, *Myriochila* (*Monelica*) *fastidiosa* Dejean 1825, *Cylindera (Oligoma) lacunosa* Putzeys 1875, *Lophyra (Lophyra) catena* Fabricius 1775. මෙම විශේෂ අතුරින් වැව් බහුතරයක දක්නට ලැබුනු විශේෂය වූයේ *Calomera angulata* යි. වැව් පරිසර පද්ධති වල ප්‍රධාන කාලගුණික හා පාංශු ලක්ෂණ පරීක්ෂා කරන ලද අතර, එම ලක්ෂණ ටයිගර් කුරුමිණි විශේෂයන්ගේ වාසස්ථාන රුචිකත්වය හා සම්බන්ධ කෙරිණි.

INTRODUCTION

Tiger beetles (Coleoptera: Cicindelidae) have been recorded from Sri Lanka since the 1860s. Identified species, their distributions and habitats are given by Tennent (1860), Horn (1904), Fowler (1912), Wiesner (1975), Naviaux (1984) and Acciavatti & Pearson (1989). These records together show 59 tiger beetle species from Sri Lanka, of which 39 are endemic.

The majority of tiger beetles in Sri Lanka are terrestrial and diurnal, and are included in the genera *Cicindela*, *Calochroa*, *Calomera*, *Lophyra*, *Jansenia*, *Cylindera*, *Myriochila*, *Hypaetha* and *Callytron*. These species occupy a variety of habitats on the island such as riverine sandy areas, beaches and coastal areas, lagoons by the ocean, forests, forest openings, wet rocks along water courses, grasslands, fallow fields and road cuts (Wiesner 1975; Naviaux 1984; Acciavatti & Pearson 1989). However, the habitats of many species are unrecorded, and current localities of occurrence are unknown.

Tiger beetles are highly habitat-specific (Knisley & Hill 1992; Adis et al. 1998; Morgan et al. 2000; Cardoso & Vogler 2005; Satoh et al. 2006; Pearson & Cassola 2007). Human activities in Sri Lanka have caused habitat loss, fragmentation and degradation, increasing the risk of extinction for many species including endemics (IUCN 2006). Therefore, it is highly likely that insect species with narrow habitat requirements, such as the tiger beetles, will be threatened with extinction in the near future given the pressures of development in the country. Therefore, it is imperative that the current occurrence and status of tiger beetles be investigated.

The ancient man-made reservoir (tank) systems are a unique habitat in Sri Lanka, dating back to about 2500 years when the country had a hydraulic civilization. They were built by the kings for irrigation purposes, domestic and municipality needs, and flourish today in the ancient kingdoms of Anuradhapura, Polonnaruwa and Sigiriya in the North-Central Province of the country (Bandaragoda 2006). Over 30,000 reservoirs have been built in Sri Lanka, and some are still found covered by thick jungle dotting the landscape all over the country, especially in the dry zone (De Silva 1988). A noteworthy, modern day feature of this unique system for water storage is that it performs important roles in conservation of Sri Lankan biodiversity apart from the original roles for which they were constructed. Although the reservoirs are man-made they very often blend seamlessly with the natural environment and it is nearly impossible to separate the man-made, reservoir-based agricultural environment from the natural environment.

We report here the first recorded occurrence of tiger beetle species from the ancient reservoir ecosystems of Sri Lanka. The study reports the occurrence of four tiger beetle species that have been previously found in other habitat types in Sri Lanka and other countries, associated with reservoir habitats for the first time. Further, we reveal the habitat preferences of the tiger beetle species associated with the reservoir habitats of Sri Lanka.

METHODS AND MATERIALS

Study area

Twenty six reservoirs were surveyed for the occurrence of tiger beetle species from December, 2003 to November 2005. Most of the reservoirs were located in the North-Central Province of the country, while the other reservoirs were located in the North-Western, Southern, Central and Western provinces of the island (Fig. 1, Table 1).

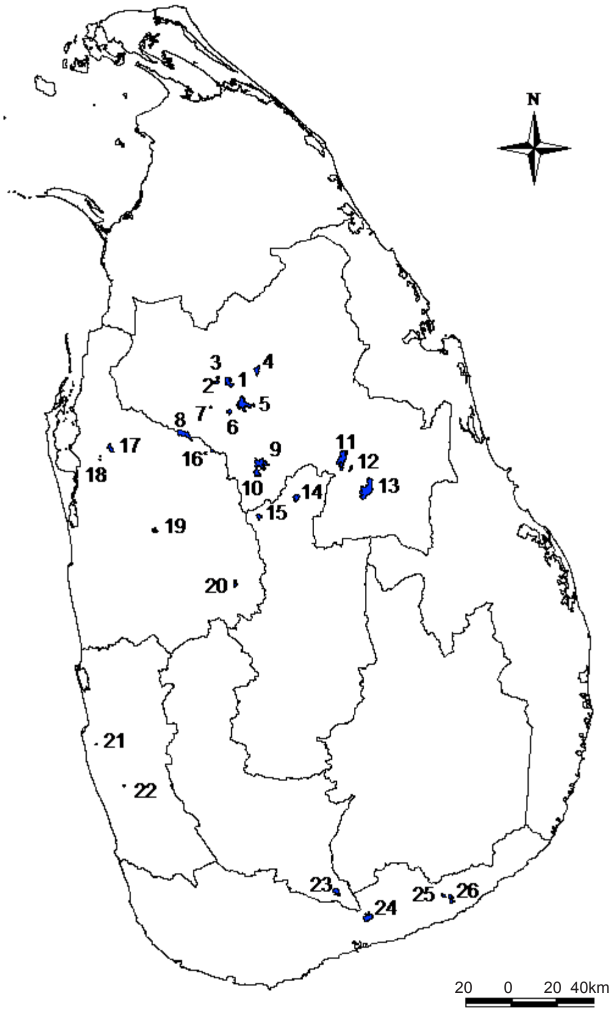

Figure 1. Reservoirs of Sri Lanka surveyed for the occurrence of tiger beetles

Measuring habitat variables of the reservoirs

The habitat variables of the climate and soil of the reservoirs in which tiger beetles occurred were measured as follows:

(i) Climate variables: The ambient temperature, degree of solar radiation, relative humidity and wind speed of the habitat were recorded using a portable integrated weather station with optional sensors (Health EnviroMonitor, Davis Instrument Corp., Hayward, CA, USA).

(ii) Soil variables: These included the soil type/texture, using the sedimentation technique "soil textural triangle" (Bierman 2007); soil colour, measured by comparison with a Munsell soil colour chart; soil temperature, determined by using an Insert soil thermometer (SG 680-10) ranging from -10 to 110 ^{0}C; soil pH, determined by using a portable soil

Table 1. The reservoirs of Sri Lanka surveyed for tiger beetles

	Reservoir	Location	Date surveyed
1	Nuwara Wewa	Anuradhapura District, North-Central Province 8^{0}20’88”N & 80^{0}25’97”E, 80.69m	December 2003, July 2004
2	Thisa Wewa	Anuradhapura District, North-Central Province 8^{0}20’53”N & 80^{0}23’06”E, 79.86m	December 2003
3	Abhaya Wewa	Anuradhapura District, North-Central Province 8^{0}16’33”N & 80^{0}20’08”E, 86.15m	December 2003
4	Mahakanadarawa Wewa	Anuradhapura District, North-Central Province 8^{0}23’25”N & 80^{0}31’98”E, 85.04m	July 2004
5	Nachchaduwa Wewa	Anuradhapura District, North-Central Province 8^{0}15’85”N & 80^{0}28’67”E, 96.01m	July 2004
6	Turuwila Wewa	Anuradhapura District, North-Central Province 8^{0}13’56”N & 80^{0}26’15”E, 120.5m	April 2005
7	Talawa Wewa	Anuradhapura District, North-Central Province 8^{0}16’08”N & 80^{0}20’19”E, 105.69m	April 2005
8	Rajangana reservoir	Tambuttegama, Anuradhapura District, North-Central Province 8^{0}13’06”N & 80^{0}25’49”E, 79.75m	April 2005
9	Kala Wewa	Anuradhapura District, North-Central Province 8^{0}02’01”N & 80^{0}32’16”E, 125.88m	July 2004
10	Balalu Wewa	Anuradhapura District, North-Central Province 8^{0}02’01”N & 80^{0}32’18”E, 125.64m	July 2004
11	Minneriya Wewa	Polonnaruwa District, North-Central Province 8^{0}02’33”N & 80^{0}02’36”E, 96.25m	December 2003
12	Giritale Wewa	Polonnaruwa District, North-Central Province 7^{0}56’32”N & 81^{0}01’09”E, 131.45m	December 2003
13	Parakrama Samudra	Polonnaruwa District, North-Central Province 7057’01”N & 80^{0}59’98”E, 56.69m	December 2003
14	Kandalama Wewa	Dambulla, Matale District, Central Province 7^{0}52’51”N & 80^{0}41’51”E, 176.52m	December 2003, December 2005
15	Devahuwa Wewa	Dambulla, Matale District, Central Province 7^{0}48’41”N & 80^{0}33’20”E, 181.66m	December 2003
16	Kurundankulama Wewa	Anuradhapura District, North-Central Province 8^{0}35’01”N & 80^{0}43’18”E, 105.5m	April 2005
17	Tabbowa Wewa	KaruwalagasWewa, Puttalam District, North-Western Province 8^{0}04’32”N & 79^{0}56’69”E, 20.42m	June 2004
18	Billu Wewa	Puttalam District, North-Western Province 7^{0}08’54”N & 79^{0}51’20”E 20.15m	June 2004
19	Magalla Wewa	Nikawaratiya, Kurunegala District, North-Western Province 7^{0}44’31”N & 80^{0}07’47”E, 54.62m	April 2005
20	Batalagoda Wewa	Ibbagamuwa, Kurunegala District, North-Western Province 7^{0}32’12”N & 80^{0}02’04”E, 131.98m	December 2003
21	Kimbulwila Wewa	Malwana, Gampaha District, Western Province 6^{0}56’57”N & 80^{0}00’55”E, 23.37m	August 2003
22	Gammanpila Wewa	Bandaragama, Kalutara District, Western Province 6^{0}31’48”N & 79^{0}58’08”E, 5.25m	June 2004
23	Chandrika Wewa	Embilipitiya, Hambantota District, Southern Province 6^{0}19’03”N & 80^{0}51’19”E, 9.76m	November 2004
24	Ridiyagama Wewa	Ambalantota, Hambantota District, Southern Province 6^{0}20’89”N & 80^{0}98’56”E, 2.74m	November 2004
25	Tissa Wewa	Tissamaharama, Hambantota District, Southern Province 6^{0}17’12”N & 81^{0}16’91”E, 16.16m	November 2005
26	Yoda Wewa	Kirinda, Hambantota District, Southern Province 6^{0}15’60”N & 81^{0}18’61”E, 13.11m	November 2005

pH meter (Westminster, No. 259); soil moisture, determined by selecting five random spots of a locality and collecting samples down to a depth of 10cm and estimating the difference in weight before and after oven drying to 107–120 ^{0}C in the laboratory; and soil salinity, determined by a YSI model 30 hand-held salinity meter.

Collection of beetles

Tiger beetle species were surveyed between 1000 –1500 hr at all localities. Adult tiger beetles were searched in specific habitats including the bank of the reservoir, surrounding shrub area near the reservoir, and off-road trails. Beetles were collected using a standard insect net. Specimens were preserved in 96% ethanol and stored at -20^{0}C after examining for morphological characters and recording morphometric measurements. Permission to enter various areas for tiger beetle collection and for collecting specimens was obtained from the Department of Wildlife Conservation of Sri Lanka.

Identification of tiger beetles

Taxonomic keys of the *Cicindela* of the Indian subcontinent by Acciavatti & Pearson (1989), descriptions of Horn (1904) and Fowler (1912) were used to identify the species and confirmation of identification was done through comparisons with specimens available at the National Museum of Colombo and Natural History Museum (NHM), London. Taxonomic names of species, with the present nomenclatural changes, are based on Wiesner 1992, except for the use of *Calomera* instead of *Lophyridia,* which is based on Lorenz (1998).

The beetles were observed under a photomicrographic attachment which was also used in photographing each specimen (Nikon AFX-DX, Tokyo, Japan).

RESULTS

Tiger beetle species were recorded from the sandy banks of eleven reservoirs of Sri Lanka. Most of the reservoirs were located in the North-Central and North-Western provinces while a few were located in the Central and Southern provinces (Image 1, Table 2).

Image 1. Kandalama Reservoir, Matale District, Central Province of Sri Lanka with the sandy bank on which tiger beetles were found

Table 2. Reservoirs ecosystems of Sri Lanka and associated tiger beetles

Reservoir	Species Recorded
Nuwara Wewa	*Myriochila* (*Monelica*) *fastidiosa*
Thisa Wewa	*Calomera angulata*
Mahakanadarawa Wewa	*Calomera angulata*
Nachchaduwa Wewa	*Calomera angulata* *Myriochila* (*Monelica*) *fastidiosa*
Kala Wewa	*Calomera angulata*
Parakrama Samudra	*Calomera angulata*
Kandalama Wewa	*Calomera angulata* *Myriochila* (*Monelica*) *fastidiosa*
Devahuwa Wewa	*Calomera angulata* *Cylindera* (*Oligoma*) *lacunosa* *Lophyra* (*Lophyra*) *catena*
Tabbowa Wewa	*Calomera angulata* *Myriochila* (*Monelica*) *fastidiosa*
Batalagoda wewa	*Calomera angulata*
Ridiyagama Wewa	*Lophyra* (*Lophyra*) *catena*

Habitat variables of the reservoirs

Habitat sampling from December 2003 to November 2005 revealed that tiger beetles occur on sandy soils of reservoirs in areas of sparse vegetation. The beetles exhibited a significant preference for sun-lit areas with high solar radiation where climatic and soil temperatures were only slightly different. A soil moisture of 4.25±0.67 % prevailed in the soils of the reservoirs which were more or less neutral with a salinity of zero value. The climatic and soil conditions of the reservoir habitats are given in Table 3.

Tiger beetle species recorded from the reservoirs of Sri Lanka

Four species of tiger beetles, *Calomera angulata* (Fabricius, 1798), *Myriochila* (*Monelica*) *fastidiosa* (Dejean, 1825), *Cylindera* (*Oligoma*) *lacunosa* (Putzeys, 1875) and *Lophyra* (*Lophyra*) *catena* (Fabricius, 1775) were recorded from the reservoir habitats of Sri Lanka (Table 2).

Calomera angulata (Fabricius, 1798) (Image 2)

Calomera angulata was the most common tiger beetle species in reservoir ecosystems and dominated all other species in terms of occurrence (Fig. 2).

Table 3. Climate and soil parameters of the reservoir habitats of tiger beetles recorded at the time of collection

Reservoir	Tempera-ture (°C)	Solar Radiation (w/m²)	Relative Humidity (%)	Wind Speed (MPH)	Soil Type	Soil Colour	Soil Tempe-rature (°C)	Soil pH	Soil Moisture (%)	Soil Salinity (ppt)
Nuwara Wewa	34	159	47	21	sand	black	33	6.9	0.35	0
Thisa Wewa	34	736	48	4	sand	yellow	31	6.7	0.12	0
Mahakanadarawa Wewa	31	64	60	17	sand	very dark grayish-brown	28	7.0	9.14	0
Nachchaduwa Wewa	32.8	256	53	10	sand	dark yellowish-brown	33	7.0	7.94	0
Kala Wewa	38.5	618	52	6	sand	light olive brown	32	7.0	0.64	0
Parakrama Samudra	29.5	64	63	3	sand	light yellowish-brown	30	7.5	0.15	0
Kandalama Wewa	33	56	58	9	sand	brownish-yellow	33	8.0	5.2	0
Devahuwa Wewa	37	363	40	4	sand	reddish-yellow	38.5	6.8	0.13	0
Tabbowa Wewa	39	206	41	7	sand	light olive brown	39	7.0	3.65	0
Batalagoda Wewa	35.2	655	47	9	sand	yellowish-brown	42.5	6.8	11.49	0
Ridiyagama Wewa	33	105	66	8	sand	dark reddish-brown	30	7.0	7.93	0
Average±SE	34.27± 2.96	298.36± 34.11	52.27± 8.65	8.09± 1.17			33.64±2.11	7.08± 0.63	4.25± 0.67	

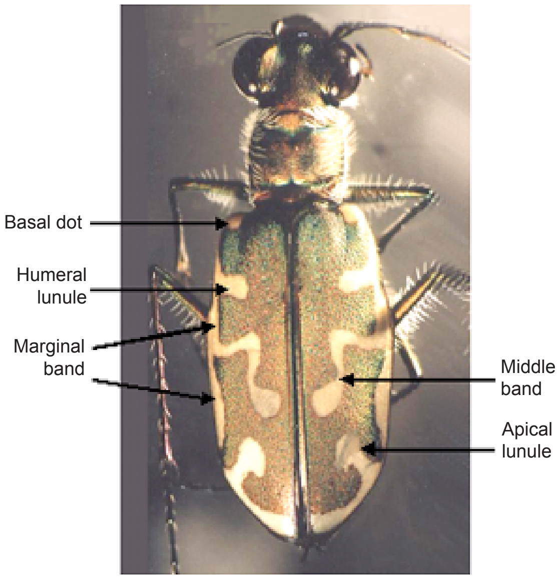

Image 2. *Calomera angulata* (x 10 x 1.0)

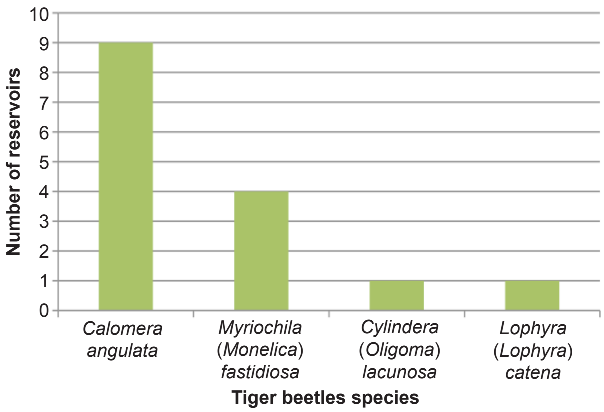

Figure 2. Distribution of Tiger Beetle species in reservoir ecosystems of Sri Lanka

The species was found in nine out of 11 reservoirs and formed large populations of a single species in five of the habitats (Batalagoda Wewa, Kala Wewa, Mahakanadarawa Wewa, Parakrama Samudra, Thisa Wewa), while in the other four tank systems (Devahuwa Wewa, Kandalama Wewa, Nachchaduwa Wewa, Tabbowa Wewa) it co-occurred with either *Myriochila* (*Monelica*) *fastidiosa, Cylindera* (*Oligoma*) *lacunosa* or *Lophyra* (*Lophyra*) *catena* (Table 2). Even when co-occurring, *Calomera angulata* was more abundant than the other species.

***Myriochila* (*Monelica*) *fastidiosa* (Dejean, 1825) (Image 3)**

Myriochila (*Monelica*) *fastidiosa* was recorded from four reservoir ecosystems of Sri Lanka. In three reservoirs, Kandalama Wewa, Nachchaduwa Wewa, Tabbowa Wewa, it co-occurred with *Calomera angulata*, while a single population was found at Nuwara Wewa, Anuradhapura (Table 2).

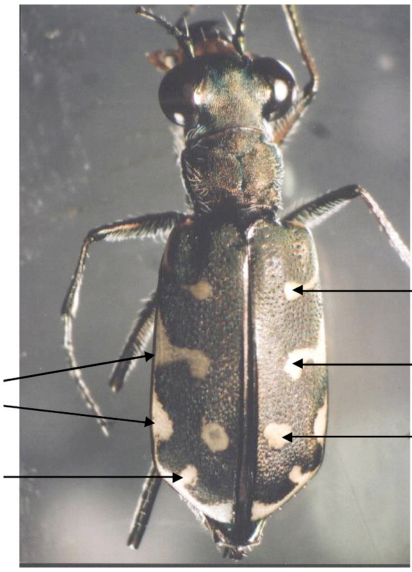

Image 3. ***Myriochila (Monelica) fastidiosa*** **(x 10 x 1.0)**

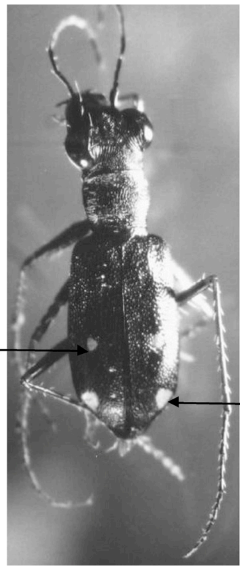

Image 4. ***Cylindera (Oligoma) lacunosa*** **(x 10 x 1.5)**

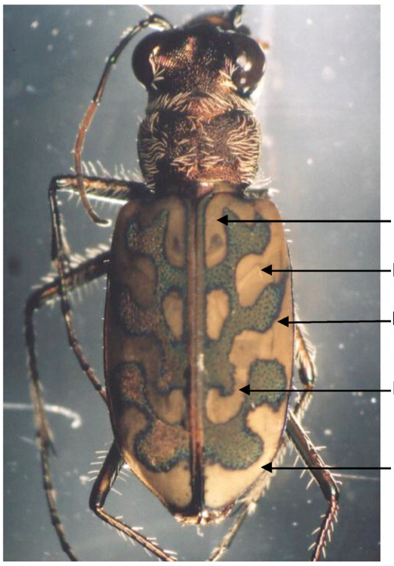

Image 5. ***Lophyra (Lophyra) catena*** **(x 10 x 1.0)**

***Cylindera* (*Oligoma*) *lacunosa* (Putzeys, 1875) (Image 4)**

A single specimen of *Cylindera* (*Oligoma*) *lacunosa* was found co-occurring with *Calomera angulata* and *Lophyra* (*Lophyra*) *catena* at Devahuwa Wewa, Central Province. *C. lacunosa* occupied the wet sandy habitat most close to the water edge of the reservoir.

***Lophyra* (*Lophyra*) *catena* (Fabricius, 1775) (Image 5)**

Lophyra (*Lophyra*) *catena* were encountered at Devahuwa Wewa, Central Province and Ridiyagama Wewa, Southern Province (Table 2). The species occupied sandy bank area of the reservoir shaded by grasses and shrubs.

DISCUSSION

Reservoir ecosystems of Sri Lanka are riparian habitats that were constructed by humans about 2500 years ago (Bandaragoda 2006), and are integrated and inter-woven with the natural environment. The ecosystem consists of a reservoir, a sandy bank, a strip of trees downstream of the reservoir that act as a wind breaking barrier, and paddy fields. The sandy bank formed along the margin of the water level attracts many invertebrates due to accumulated organic matter and high food supply. Such riparian habitats are known to be preferred by tiger beetles not only because of adequate food resources but also due to safety from predators and low human disturbance (Bhargav & Uniyal 2008).

Tiger beetles are known to be specialized species with narrow habitat requirements, hence changes in the habitat can lead to their disappearance (Diogo et al. 1999). Morphological differences between species of tiger beetles are apparently affected by selection for specific habitat requirements (Cardoso & Vogler 2005). Therefore, the discovery of tiger beetles in the reservoir ecosystems of Sri Lanka, identification of the species and recordings of habitat conditions of the ecosystems is of utmost importance.

Tiger beetles are predatory insects that prefer riverine habitats with sandy soils and minimal vegetation, where periodic disturbance by wind and water removes encroaching vegetation (Warren & Buttner 2008). Female tiger beetles are specific in choosing oviposition sites, as larval stages are soil dwelling and spend their entire life in the same location (Brust et al. 2006). The larvae of *Cicindela hirticollis* of Nebraska, USA are known to select burrow locations with at least 7% soil moisture to avoid difficulties associated with digging in loose, dry sand and to avoid abrasion of soft-bodied larvae. Further, soil moisture is known to be necessary for cohesion of soil particles and to prevent the collapse of the burrow walls (Brust et al. 2006). However, certain species that have evolved as sand dune species are known to prefer a soil moisture of less than 4% and have higher amounts of cuticular hydrocarbons to avoid dessication (Romey & Knisley 2002). The tiger beetle species of the reservoir ecosystems of Sri Lanka were found on soils of 4.25±0.67 % moisture, a value in between the above extremes. The colour of the soil on which they occur is also known to be correlated with the structural colouration of species, an apparent adaptation for remaining inconspicuous to natural enemies reliant on visual cues (Seago et al. 2009). The closely packed pits on the elytral surface of tiger beetles and the surface microsculpture of the elytron is capable of reflecting wavelengths that create a diffuse matte brown, green or similarly unsaturated hue; often matching the colour of the surrounding soil (Seago et al. 2009).

The soils of the reservoirs of Sri Lanka inhabited by cicindelids were mainly brown, matching the bronze, copper-green and copper-brown colours of *Calomera angulata*, *Myriochila* (*Monelica*) *fastidiosa*, *Lophyra* (*Lophyra*) *catena* and *Cylindera* (*Oligoma*) *lacunosa*. The expanded white maculations on the elytra may have functioned in lowering the body temperature making them able to forage longer without overheating. According to Seago et al. (2009), *Cicindela formosa* and *Neocicindela perhispida* found on white beaches have expanded white maculations that significantly lowers the body temperature and enabling them to forage longer without overheating. The environmental temperature of the reservoir ecosystems which was 34.27 ± 2.96^0C may also be suitable for the occurrence of tiger beetles as ground temperature ranging from $32–33^0$C is known to be suitable for the activity and viability of tiger beetle populations, and a temperature of $34 – 35^0$C determined the greatest number of matings in *Cicindela* (*Cephalota*) *circumdata leonschaeferi* Cassola (Eusebi et al. 1989).

Table 4. Morphometric characters recorded for the tiger beetle species of reservoir ecosystems of Sri Lanka

Species	Body Weight (mg)	Body Length (mm)	Left Mandible Length (mm)
Calomera angulata	54.69±3.19 (n=25)	11.31±0.88 (n=25)	2.33±0.53 (n=17)
Cicindela (*Monelica*) *fastidiosa*	52.57±2.14 (n=9)	11.72±0.74 (n=9)	2.26±0.51 (n=2)
Cicindela (*Oligoma*) *lacunosa*	17.9 (n=1)	8.1 (n=1)	-
Cicindela (*Lophyra*) *catena*	74.7 (n=1)	11.4 (n=1)	2.35 (n=1)

Calomera angulata was the most common tiger beetle species found in a majority of reservoir ecosystems. When co-occurring it was far more abundant than the other species and only single specimens of *L. catena* and *C. lacunosa* were found co-occurring with *C. angulata* at Devahuwa wewa. The low number of sympatric tiger beetle species in reservoir habitats may be due to competition for food resources as all species in these habitats had more or less similar mandible lengths (Table 4).

Calomera angulata, the key tiger beetle species of the reservoir ecosystems of Sri Lanka, has been reported from Sri Lanka as far back as 1904 (by Horn) and 1912 (by Fowler). However, it was identified as *Cicindela sumatrensis* Herbst 1806 and was reported from riverine and coastal locations, and certain other locations where the habitat is not defined. Wiesner (1975) and Acciavatti & Pearson (1989) have recorded *Calomera angulata* from India and Nepal, but have not recorded the species from Sri Lanka. Wiesner (1975) reports that the species can be found near the water's edge on open, moist sandy banks of rivers. More recently, Shook (1987) has reported *Calomera angulata* from along river habitats in Thailand. However, Satoh & Hori (2004) define *Calomera angulata* as a coastal tiger beetle occurring along the sea coast of Japan co-occurring with other tiger beetle species in most instances.

Myriochila (*Monelica*) *fastidiosa*, a species restricted to Sri Lanka and India has been cited in several works of literature inhabiting grasslands, scrub forests, forest paths and old fields (Horn 1904; Fowler 1912; Naviaux 1984; Acciavatti & Pearson 1989).

Lophyra (*Lophyra*) *catena* was first recorded in Sri Lanka in 1860 by Tennent, and later by Horn (1904), Fowler (1912), Naviaux (1984) and Acciavatti & Pearson (1989). Naviaux (1984) reported the species from margins of rivers and lagoons by the ocean, as well as in large sunny forest clearings. However, field work done in the present study (December 2003 to November 2005) also revealed the species from sandy lawns, foot paths and dry sand of coastal areas away from the water.

Cylindera (*Oligoma*) *lacunosa*, a species restricted to Sri Lanka and Tamil Nadu, India, has been reported from forest openings of Sri Lanka (Horn 1904; Fowler 1912; Naviaux 1984; Acciavatti & Pearson 1989).

None of the above tiger beetle species are endemic to Sri Lanka and can be found in the Indian subcontinent and countries of South East Asia. The vast majority of the endemic flora and fauna of Sri Lanka are restricted to the wet zone of the country as are the tiger beetle species (Dangalle et al. 2011a,b). Therefore, the reservoir habitats of Sri Lanka are perhaps less important than other habitats for supporting endemic tiger beetle species. However, the reservoir habitats may have facilitated the dispersion of tiger beetles within Sri Lanka and may have played a role in facilitation of colonization of wet zone habitats by the endemic tiger beetles, by provision of transitional habitats. The two endemic tiger beetle species, *Cylindera* (*Ifasina*) *waterhousei* and *Cylindera* (*Ifasina*) *willeyi*, reported from the wet zone of Sri Lanka (Dangalle et al. 2011a,b) are species of the genus *Cylindera* which occurs in subtropical and temperate regions of Africa, Madagascar, Eurasia, Asia and South-East Asia (Sota et al. 2011). According to Pearson & Ghorpade (1989) these taxa dispersed to Sri Lanka using continuous forest habitats that were available from south-eastern Asia to the Indian subcontinent, and traveled down the Western and Eastern Ghats to reach central Sri Lanka which was continuous with the southern division of the Western Ghats. The reservoir habitats may have provided a suitable habitat for the dispersal of these small bodied beetles with weak flying abilities. Similarly, as many tanks are connected to a network of canals and streams and thus indirectly to major rivers, it is tempting to theorize that coastal zone species would have made the transition to reservoir habitats along such interconnected waterways. More data on the occurrence and viability of tiger beetle populations along the canal and stream networks of the ancient tank system needs to be collected.

In conclusion our study reveals that reservoir (tank) habitats which are man-made and dating back thousands of years have been colonized ('invaded as new habitat') by tiger beetle species which are known to occupy other types of habitats elsewhere in the world. Suitable climatic and soil conditions of the locations have facilitated the occurrence of tiger beetle species in these habitats and the study reports the habitat preferences of the species of reservoir ecosystems of Sri Lanka.

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