

SYSTEMATIC ACCOUNT ON TWO MAJOR SOIL MACROFAUNA, SCORPIONS (ARACHNIDA: SCORPIONES) AND CENTIPEDES (CHILOPODA: SCOLOPENDROMORPHA) OF CHINNAR WILDLIFE SANCTUARY, KERALA, INDIA

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ABSTRACT

The present study highlighted the diversity of two important soil macro fauna viz., Centipedes (Chilopoda: Scolopendromorpha) and Scorpions (Arachnida: Scorpiones) from Chinnar Wildlife Sanctuary, Idukki District, Kerala, the Southern Western Ghats. Being a rain shadow area, the study area possesses a unique faunal component. We reported 6 species of Scorpions and 7 species of Scolopendrid centipedes from the study area. The study included the first report of the centipede species *Cormocephalus westwoodi westwoodi* (Newport) from Kerala and the listing out of *Cormocephalus* (*Dekanonyx*) *nigrificatus* Verhoeff (endemic to Southern India) and *Otostigmus gravelly* (Jangi and Dass) (Endemic to Kerala) and *Rhysida lithobioides trispinosus* Jangi and Dass (endemic to Deccan plateau).

Key words: Chinnar WLS, Rain shadow forest, Scorpions, Centipedes, Western Ghats.

Introduction

Chinnar Wildlife Sanctuary is an important protected area located in the rain shadow regions in the Anamalai Hills of southern Western Ghats. The peculiarity of geographic location and vegetation along with the dry climatic condition of this area leads to the uniqueness in faunal components of Chinnar Wildlife Sanctuary. Due to significant variation in altitude and rainfall it has a wide range of habitat that are interspersed with plains, hillocks, rocks and cliffs which provide favorable microhabitats for varied forms of life. It may reflect more specifically in the soil arthropod fauna of the area as they are closely associated with the soil types and moisture content of the soil. The present study aims to understand two vital macro fauna of soil arthropods-Scolopendrid centipedes (Chilopoda: Scolopendromorpha) and scorpions (Arachnida: Scorpiones) of Chinnar Wildlife Sanctuary.

Order Scolopendromorpha comprises the multi segmented arthropods bearing one pair of legs per segment and 21-23 body segments of the Class Chilopoda. A perusal of literature reveals the existence of 682 species of scolopendrids (excluding subspecies) globally in five families, 34 extant genera and four extinct genera, representing 17 valid genera of the family Scolopendridae and 9 genera of family Cryptopidae (Khanna, 2008). Regarding India, 90 valid species of Scolopendrid centipedes belonging to 8 genera of the family Scolopendridae and 3 genera of the family Cryptopidae

are known from the country out of which 22 species belonging to the family Scolopendridae are known from Kerala Sureshan *et al.* (2004)

Scorpions are fascinating group of arachnids widely distributed in all continents except Antarctica. They are one of the animal groups, which attract public interest owing to their fearsome appearance, toxicity, and painful sting. Though venom of only a few species of scorpions are lethal to man, such species are rare in India. When compared to the other parts of India, scorpion fauna of Kerala is poorly studied. As per the latest checklist by Bastawade *et al.* (2012), 19 species of scorpions under 8 genera and 3 families are reported from Kerala. With the addition description of two new species from Chinnar Wildlife Sanctuary recently by Aswathi *et al.* (2015), (2016) the number of known taxa from Kerala has been raised to 23 species under 9 genera belonging to 3 families.

Material and Methods

Study area

Geographically the Chinnar Wildlife Sanctuary is located between 10°15'–10°21'N and 77°5'–77°16' E. The sanctuary spreads around 90.44km² and located 18 km north of Marayoor in the Marayoor and Kanthalloor Panchayaths of Devikulam Taluk in the Idukki District of Kerala State. The adjoining protected areas are Eravikulam National Park in southern part and Indira Gandhi Wildlife Sanctuary in north.

Six species of Scorpions and 7 species of Scolopendrid have been reported and *Cormocephalus westwoodi westwoodi* (Newport) have been recorded first time from Kerala.

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The vegetation of Chinnar Wildlife Sanctuary is specific due to the domination of dry deciduous forests having sandal trees. As per the classification of vegetation by Champion and Seth (1968), the vegetation include southern tropical thorn forest (scrub jungle), southern dry mixed deciduous forest (dry deciduous forest), southern moist mixed deciduous forest (moist deciduous forest), tropical riparian fringing forest (riparian forest), southern montane wet temperate forest (montane shola forest) and southern montane wet grassland (grasslands).

Methods

The specimens for the present study include those collected from the Sanctuary during the recent years and those deposited in the faunal holdings of Zoological Survey of India, Western Ghat Regional Centre, Kozhikode, (ZSIK). The specimens were hand- collected under rocks, rock crevices and under logs and preserved in 70% ethanol. They were studied under a stereoscopic binocular microscope (LEICA MZ 16). The photos were taken with the camera model Cannon FX 120. The specimens were registered and deposited in ZSIK. The terminology used in this paper follows Stahnke (1970) and Bonato *et al.* (2010).

Results and Discussion

Diversity and Composition

The systematic account of centipedes includes, 7 species of order Scolopendromorpha including representatives from 4 genera. Among this the notable findings are the first report of *Cormocephalus westwoodi westwoodi* (Newport) from Kerala and the listing out of *Cormocephalus (Dekanonyx) nigrificatus* Verhoeff (endemic to Southern India) and *Otostigmus gravelly* (Jangi and Dass, 1984) (Endemic to Kerala) and *Rhysida lithobiodes trispinosus* Jangi and Dass (endemic to Deccan plateau).

Regarding scorpions, 6 species under 5 genera belonging to 3 families are reported from the sanctuary. Among the 6 species of scorpions, *Buthoscorpio chinnarensis* Aswathi, Sureshan and Lourenco, 2015 was a newly described species and is not reported from any part of the world. The scorpion species *Lychas laevifrons* (Pocock) and *Heterometrus flavimanus* (Pocock), are recently reported for the first time from the sanctuary and also from other places of the Kerala state.

Taxonomic account of Scorpions

Class: Arachnida

Order: Scorpiones

Family: Buthidae

1. *Lychas tricarinatus* (Simon, 1884) (Fig.1)

Isometrus tricarinatus Simon, 1884: 47.

Lychas tricarinatus: Pocock, 1900: 40.

Lychas tricarinatus: Kova ik, 1997: 356

Material examined: 1♀, India: Kerala: Idukki, Chinnar Wildlife Sanctuary (Lat. 10°35'N, Long. 77°23' E, Alt. 371 m), 19.xi.1996, Coll. P. M. Sureshan, Reg. No. ZSI/WGRC/IR/INV/5018.

Diagnosis: Total length 44-54.7 mm. Entire surface of carapace and Mesosomal tergites coarsely granular; three carinae present on mesosomal tergites II-VI, no carinae on tergite I. Metasomal segments I-II with 10 keels and III-IV with 8 keels, but sometimes the III segments may have 10 keels; Pectinal teeth number 20-26 in both sexes. Trichobothria *eb* and *esb* seen closer to the base of the fixed finger. Two sclerites of genital operculum pointed on latero-median portion externally. For trichobothrial pattern (Tikader and Bastawade, 1983)

Distribution: India: Andhra Pradesh, Bihar, Goa, Karnataka, Kerala, Madhya Pradesh, Maharashtra and Tamil Nadu.

Remarks: This is a species endemic to India. Collected immediately under boulders in the thorny scrub forests and not making holes in the soil.

2. *Lychas laevifrons* (Pocock) (Fig.2)

Isometrus shoplandi: Pocock, 1891: 434 (in part)

Archisometrus laevifrons Pocock, 1897: 113.

Lychas laevifrons: Pocock, 1900: 41.

Lychas laevifrons: Kova ik, 1997: 336

Material examined: 2♀, India: Kerala: Idukki, Chinnar Wildlife Sanctuary, Churulipatty (Lat. 10°35'N, Long. 77°19'E, Alt. 553.5 m), 22.v.2014, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC//IR/INV 5016; 1♂, 2♀, Churulipatty (Lat. 10°35' N, Long. 77°29' E, Alt. 371 m), 4.vi. 2015, Coll. Aswathi. K, Reg. No. ZSI/WGRC/IR/INV 4585; 1♂, Chempakkad (Lat. 10°33' N, Long. 77°22'E, Alt. 469 m), 12.ix.2015, Coll. P.M. Sureshan, Reg. No. ZSI/ WGRC/IR/INV4818; 1♂, Alampatty, Chinnar Wildlife Sanctuary (Lat. 10°31' N, Long. 77°18' E, Alt. 877.4 m), 12.ix.2015, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC/IR/ INV/4767.

Diagnosis: Total length 41-69 mm. Entire body coarsely granular; mesosomal tergites II-VI with tricarinae, but carinae weakly developed on tergite II. Male differ from female in having longer metasoma and a deep cut in the beginning of movable fingers of pedipalp. Metasomal segments I-III with 10 keels, segment IV with 8 keels and segment V with 5 keels. Telson, golden brown with thin vesicle possess brown bands ventrally, subaculear tubercle present. Pectinal teeth number 22-25. Legs variegated yellow and black. For trichobothrial pattern see Tikader and Bastawade, 1983: 83p.

Distribution: India: Bihar, Gujarat, Madhya Pradesh, Kerala, Maharashtra, Odisha and West Bengal; Elsewhere: Africa and Oceania.

Remarks: This species is recorded here for the first time from Kerala, collected under boulders in the thorny forests, not making holes.

3. *Buthoscorpio chinnarensis* Aswathi, Sureshan and Lourenco (Figs. 3 and 4)

Buthoscorpio chinnarensis Aswathi et al., 2015: 213-218.

Material examined: 1 ♂ holotype: India: Kerala: Idukki:

Chinnar WLS, Churulipatty tribal colony (Lat. 10°28' N, Long. 77°18' E, Alt. 512 m), 22.v.2014, Coll. P. M. Sureshan, Reg. No. ZSI/WGRC/IR/INV/3603; 2♀ paratypes, same data as that of holotype, Reg. No. ZSI/WGRC/IR/INV/3604.

Diagnosis: Total length 30-41mm. Scattered granulation on lateral portions of carapace; median eyes situated in the ratio 1: 2; basal portion of the femur possess prominent tubercles; mesosomal tergites III-V with dorsal carinae; metasomal segments I-IV wider than long, segment V longer than wide; subaculear tubercle absent on telson; Pectinal teeth number 14-16 in males and 17-17

PLATE 1



Fig. 1: *Lychas tricarinatus*



Fig. 2: *Lychas ldevifrons*



Fig. 3: *Buthoscorpio chinnarensis*



Fig. 4: *Buthoscorpio chinnarensis* (Habitus)

in females. For trichobothrial pattern Aswathi *et al.*, 2015: plate 3.

Distribution: India: Kerala.

Remarks: This species is endemic to southern Western Ghats. This species looks like large beetles due to their glossy black colour and folding the tail over the mesosoma and found under boulders in the thorny scrub forests, not making holes.

4. *Hottentotta rugiscutis* (Pocock) (Fig.5)

Buthus rugiscutis Pocock, 1897: 106.

Hottentotta (Hottentotta) rugiscutis: Kova ík, 1998: 110.

Hottentotta rugiscutis: Kova ík, 1999: 291 (in part).

Material examined: 1♀, INDIA: KERALA: IDUKKI, Chinnar Wildlife Sanctuary (Lat. 10°35'N, Long. 77°23' E, Alt. 371 m), 19.xi.1996, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC/IR/INV/3250.

Diagnosis: Total length 30-60 mm. Entire body coarsely granular and sparsely hirsute, but the pedipalp are densely hirsute with short hairs; chelicera yellow with reticulation present in females, males may with poorly developed reticulation. Manus of pedipalp of male is broader than female. Inferior metasomal carinae black; mesosomal sternite granular with two pairs of granular carinae. Vesicle globular with weak subaculear tubercle and granulation present. Trichobothria *db* situated between *et* and *est* or at the same level as *est*. Pectinal teeth number 21-24 in males and 18-21 in females. Trichobothrial pattern see Tikader and Bastawade, 1983:228p.

Distribution: India: Andhra Pradesh, Jharkhand, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Puducherry, Tamil Nadu and West Bengal.

Remarks: The species is endemic to India. Collected from the Champakkad region of the Sanctuary and found immediately under rocks, not make holes.

Family: Liochelidae

5. *Iomachus laeviceps* (Pocock) (Fig.6)

Iomachus laeviceps: Pocock, 1893: 300.

Iomachus laeviceps: Reddy, 1968: 1066.

Material examined: 3♀, 1♂, 22 juveniles, India: Kerala: Idukki, Chinnar Wildlife Sanctuary, Churulipatty (Lat. 10°35' N, Long. 77°29' E, Alt. 371 m), 22.v.2014, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC/IR/INV 5017; 4♀, Chempakkad (Lat. 10°33'N, Long. 77°22'E, Alt. 469 m), 21.ix.2014, Coll. K.G. Emiliyamma, Reg. No. ZSI/WGRC/IR/INV 3941; 3♀, Churulipatty (Lat. 10.353°N, Long. 77.198°E, Alt. 553.5 m), 21.ix.2014, Coll. K.G. Emiliyamma, Reg. No. ZSI/WGRC/IR/INV3942; 1♀, Alampatty (Lat. 10°31'N, Long. 77°18'E, Alt. 877.4m), 12.ix.2015, Coll. P.M.

Sureshan, Reg. No. ZSI/WGRC/IR/ INV/4768; 2♂, Chempakkad (Lat. 10°36' N, Long. 77°24'E, Alt. 470 m), 12.ix.2015, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC/IR/INV/4817.

Diagnosis: Entire body smooth and finely punctuated; dorso-ventrally flattened body; deep median concavity present at the anterior margin of the carapace; anterior eye situated in the ratio 1: 1.5; dorsally body dark brown except the legs with clear yellow; mesosomal tergites with a median longitudinal projection; metasoma slender. Telson vesicle pyriform with short aculeus. Pectinal teeth number 5-6. Trichobothrial pattern-Tikader and Bastawade, 1983:493p.

Distribution: India: Kerala, Tamil Nadu and Karnataka.

Remarks: Mostly occupy in rock crevices but occasionally seen under large flat rocks. Collected from the thorny scrub forests of Churulipatty and Champakkad regions of the Sanctuary.

Family: Scorpionidae

6. *Heterometrus flavimanus* (Pocock) (Fig.7)

Palamnaeus swammerdami flavimanus Pocock, 1900: 87.

Heterometrus flavimanus: Kovarik, 2004:13

Material examined: 1♂ (young one), INDIA: KERALA: IDUKKI, Chinnar Wildlife Sanctuary (Lat.-12.64233°N, Long.-78.06020° E, Alt.-2066 ft), 19.xi.1996, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC/IR/INV 4243; 1♂ Adult, Chempakkad (Lat. 10°33'N, Long. 77°21'E, Alt. 467 m), 21.ix.2014, Coll. K.G. Emiliyamma, Reg. No. ZSI/WGRC/IR/INV 3940; 1♀ Adult, Churulipatty (Lat. 10°35' N, Long. 77°27' E, Alt. 368 m), 22.v.2014, Coll. P.M. Sureshan, Reg. No. ZSI/WGRC/IR/INV/4244.

Diagnosis: Adult 87-141mm long; body uniformly brown; legs clear yellow; manus of pedipalp yellow with blunt golden brown granules; carapace sparsely granulated; patella of pedipalp without internal tubercle; movable, fixed fingers and cheliceral fingers dark brown; segment V of metasoma longer than femur of pedipalp; telson vesicle longer than aculeus; median eyes situated anteriorly in the ratio 1: 1.5; chela length to width ratio 1.7. Pectinal teeth number 16-22. For trichobothrial pattern see Tikader and Bastawade 1983: 571p.

Distribution: India: Kerala and Tamil Nadu.

Remarks: This species is endemic to India, and usually make holes under rocks but occasionally found immediately under rocks. Collected from the Champakkad part of the Sanctuary.

Taxonomic account of Scolopendromorpha

Order: Scolopendromorpha

Family: Scolopendridae

1. *Cormocephalus westwoodi westwoodi* (Newport, 1844) (Fig: 8)

Scolopendra westwoodi Newport, 1844: 100.

Cormocephalus dispar Porat, 1871: 1155.

Cormocephalus dispar, Attems. 1928: 99.

Cormocephalus westwoodi Kraepelin, 1903: 200.

Cormocephalus westwoodi dispar Lawrence, 1955: 159.

Cormocephalus (C.) westwoodi westwoodi Attems, 1930: 78.

Cormocephalus westwoodi westwoodi (Newport, 1844), Schileyko and Stagl, 2004: 81

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Chinnar Wildlife Sanctuary (Lat. 9.66023°N, Long. 76.99671° E, Alt. 811.60 m), Coll. P.M Sureshan, 4.iv. 2012. Reg No: ZSI/WGRC/IR/INV/2230; 1 ex. INDIA: KERALA: IDUKKI, Churulipatty, Chinnar Wildlife Sanctuary (Lat. 10.353°N, Long. 77.198°E, Alt. 553.5 m), Coll. P.M Sureshan, 20.iv. 2015. Reg No: ZSI/WGRC/IR/INV/3540.

Diagnosis: Body length: 52- 58 mm. Cephalic plate and tergites dark blue. Colour after preservation in 70% alcohol: Cephalic plate and tergites greyish black and legs

blue. Shape of spiracle triangular with a special protruding folding in spiracular opening. Antennae with 19 articles, dorsally 6.5 glabrous. Tergite paramedian suture from T2-T20. T21 with almost complete sulcus. Cephalic plate length: width ratio is almost 1. Sternites with distinct paramedian sutures from S1 to S20. S21 tapering posteriorly and with almost straight posterior margin with a short median sulcus. S21 length 1.33× than width. Forcipular coxosternal tooth not separated clearly, 4 partially fused teeth in one side; outer one is separated from the rest. Trochanteroprefemoral process dentate but teeth not well separated. Second maxillary claw with a prominent spur. Coxopleural process short with two apical spines, one recurved and a very small side spine. Walking legs 1-20 with 2 pretarsal spur. No tarsal spurs. Ultimate legs prefemur with 2 dorsolateral spine, 6 ventromedial spine arranged in 2 rows, and 3 ventro lateral spines. A prominent posteriomedian process with 2 corner spines presents. Tarsus 1 1.6× longer than tarsus 2. No tarsal spurs.

Distribution: India: Gujarat, Maharashtra, Goa, Rajasthan, Goa, Kerala (New record to Kerala); S. Africa, Madagascar, Zimbabwe, Srilanka.

Remarks: *C. westwoodi westwoodi*, a polytypic old world species, is reported for the first time here from the South Indian forests.

2. *Cormocephalus dentipes* Pocock, 1891 (Fig: 9)

Cormocephalus dentipes Pocock 1891, 7: 66.

Cormocephalus pseudonudipes, 1984, Jangi and Dass, 43(2): 37.

Cormocephalus dentipes Pocock 1891, syn . by Khanna: 1994: 310.

Cormocephalus dentipes, Lewis, 2001: 58.

Cormocephalus dentipes, Yadav, 2009: 224.

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Churulipatty, Chinnar Wildlife Sanctuary (Lat. 10.353°N, Long. 77.198°E, Alt. 553.5 m), Coll. P.M Sureshan, 14.iii. 2014. Reg No: ZSI/WGRC/IR/INV/3527.

Diagnosis: Spiracles oval or triangular. Body length: 39 – 65 mm. Colour in life, Cephalic plate and tergites yellowish brown. Colour after fixing in formalin and preservation in 70% ethyl alcohol: Cephalic plate and tergites yellowish brown with basal antennal articles dull violet. Colour after preservation in 70% alcohol: Cephalic plate and tergites greyish black with legs blue/violet. Antennae with 17 articles; 6-7 basal glabrous. Tergite paramedian suture from T1-T20. No sutures on T21. Forcipular coxosternum with 4-5 teeth, outer 1-2 separated from the inner ones. Each forcipular coxosternal toothplate with 4-5 teeth, the lateral teeth is separated from the rest.

PLATE 2



Fig. 5: *Ilottentotta rugiscuits*



Fig. 6: *Iomachus laeviceps*



Fig. 7: *Heterometrus flavimanus*



Fig. 8: Sternite 21 & Coxopleural process of *Cormocephalus westwoodi westwoodi*

Trochanteroprefemoral process dentate with 2-3 teeth in inner side. Coxopleural process with small pores and poreless strip at apex and with two apical spines and a very small lateral spine. Legs 1-20 with 2 pretarsal spur. No tarsal spurs observed. Ultimate leg prefemur with 3 dorsolateral spine, 6 to 12 ventromedial spine arranged in 2 or 3 rows, and 4-6 ventro lateral spines. There is a prominent non spine strip on prefemur; the prefemoral process with 1 or 2 spines. Legs 1-20 with 2 pretarsal spur. No tarsal spurs observed.

Distribution: India : Madhya Pradesh, Orissa, Kerala, West Bengal, Uttar Pradesh, Bihar, Delhi, Himachal Pradesh, Meghalaya, Maharashtra Mizoram, Uttaranchal, Andaman and Nicobar Islands; Nepal (Indo- China).

Remarks: *C. dentipes* is a commonly occurring species found in different ecosystems like forests, agricultural lands and residential areas.

3. *Cormocephalus (Dekanonyx) nigrificatus* Verhoeff, 1937 (Fig: 10)

Cormocephalus (Dekanonyx) nigrificatus Verhoeff, 1937: 81. *Cormocephalus (Dekanonyx) nigrificatus*, Khanna, 2008: 38.

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Churulipatty, Chinnar Wildlife Sanctuary (Lat. 10.353°N, Long. 77.198°E, Alt. 553.5 m), Coll. P. M Sureshan, 12.ix. 2015. Reg No: ZSI/WGRC/IR/INV/6730. 1 ex. INDIA: KERALA: IDUKKI, Champakkad, Chinnar Wildlife Sanctuary (Lat. 10°33'N, Long. 77°22'E, Alt. 469 m), Coll. P. M Sureshan, 12.ix. 2015. Reg No: ZSI/WGRC/IR/INV/6733.

Diagnosis: Body length: 37- 68 mm. Spiracle triangular. Antennae with 17-18 articles, dorsally 5-6 glabrous but with minute hairs from the second article onwards. Tergite paramedian suture from T1-T20. Margination only in T21. No suture in T21.

Colour in life: Cephalic plate and tergites greyish black. Colour after preservation in 70% ethyl alcohol: Cephalic plate and tergites greyish black and blue legs. Cephalic plate moderately punctate and with posterior paramedian sutures. Sternite with distinct paramedian sutures from S1 to S20. S21 without any sutures and with straight posterior end. Each forcipular coxosternal tooth plate with 3 main teeth, teeth are very small and not well separated. Trochanter oprefemoral process not dentate. Coxopleuron densely porous; coxopleural process elongated with two prominent apical spines, one recurved and one lateral. Ultimate leg prefemur with 2 dorsolateral spines, 6 ventromedial spines arranged in 2 rows, and 3 ventro lateral spines. A prominent posteriomedian process with 2 corner spines present. Legs 1-20 with 2 pretarsal spurs. No tarsal spurs.

Distribution: India: Kerala, Goa.

Remarks: *Cormocephalus (Dekanonyx) nigrificatus* is unique because it is endemic to India and reported only from Southern India; Kerala (Sureshan *et al.*, 2006) and Goa (Sureshan and Yadav, 2008) so far. It is characterized by the absence of trochanteroprefemoral process dentition.

4. *Otostigmus gravelyi* (Jangi and Dass, 1984) (Fig. 11)

Digitipes gravelyi Jangi and Dass, 1984: 41

Digitipes gravelyi, Sureshan *et al.*, 2006: 2287.

Otostigmus gravelyi (Jangi and Dass, 1984), Joshi and Edgecombe, 2013: 121.

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Champakkad, Chinnar Wildlife Sanctuary (Lat. 10°33'N, Long. 77°22'E, Alt. 469 m) Coll. P.M Sureshan, 12.ix. 2015. Reg. No: ZSI/WGRC/IR/INV/6727. 1 ex. INDIA: KERALA: IDUKKI, Champakkad, Chinnar Wildlife Sanctuary (Lat. 10°33'N, Long. 77°22'E, Alt. 469 m), Coll. P.M Sureshan, 12.vii. 2015. Reg. No: ZSI/WGRC/IR/INV/6734.

Diagnosis: Body length 73-97mm. Colour in life: The species was observed in the colour patterns of bluish black in tergites, orange in Cephalic plate, T-3-T21 and coxopleural process, T1-T3 brownish. Antennae composed of 2 glabrous basic articles. Coxopleural process with 2 lateral spines, 4 apical spines. Prominent keels from T1-T20. Each coxosternal tooth plate with 5/4 to 6 teeth; the outer two fused and separated from the inner. Median prefemoral process dentate with 3 or 4 teeth. S1 to S20 moderately punctate; anterior paramedian sutures complete on S6 to S20. S21 gradually narrowing in posterior end with concave posterior margin. Walking legs 1-20 with a tarsal spur and 2 claw spurs. Ultimate leg prefemur with 2 dorsolateral spines, 4 ventromedial spines and 3 ventro lateral spines.

Distribution: India: Kerala.

Remarks: This species is endemic to Kerala.

5. *Digitipes barnabasi* Jangi and Dass, 1984 (Fig. 12)

Digitipes barnabasi Jangi and Dass, 1984: 44.

Digitipes barnabasi, Sureshan *et al.*, 2006: 2287.

Digitipes barnabasi, Joshi and Edgecombe, 2013: 102.

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Champakkad, Chinnar Wildlife Sanctuary (Lat. 10°33'N, Long. 77°22'E, Alt. 469 m) Coll. P. M Sureshan, 15.vii. 2015. Reg. No: ZSI/WGRC/IR/INV/6732.

Diagnosis: Body length 51mm to 65 mm. Cephalic plate and T1 dark to reddish brown. Rest tergites chestnut brown. Walking legs pale brown with a bluish tinge. Antennae composed of 17-18 antennal articles, two basal

antennal segments glabrous, flat median ridge from T3 or T5-T20. Continuous longitudinal tuberculate keels from T6 or T9. Each coxosternal tooth plate with 4+4 teeth; the inner two sometimes fused and separated from the outer. Prominent dental setae present. Median prefemoral process dentate with 3 or 4 teeth. Coxopleural process short, tipped with 2 small spines and one lateral spine, porous area extending closely to the dorsal margin. Ultimate leg prefemur with 2 ventro medial spines, 2 or 3 ventro lateral and 0 or 1 dorso medial spines.

Distribution: India: Maharashtra, Kerala.

Remarks: It's a most common forest species collected throughout the forest tracks and from agro forest area. Joshi and Edgecombe (2013) reported it as one of the most widely distributed species of *Digitipes* across Western Ghats.

6. *Rhysida lithobioides trispinosus* Jangi and Dass, 1984 (Fig. 13)

Rhysida lithobioides trispinosus, Jangi and Dass, 1984: 48
Rhysida lithobioides trispinosus, Sureshan *et al.*, 2006: 2288.

Rhysida lithobioides trispinosus, Khanna, 2008: 40.

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Churulipatty, Chinnar Wildlife Sanctuary (Lat. 10.353'N, Long. 77.198'E, Alt. 553.5 m), Coll. P. M Sureshan, 12.ix. 2015. Reg. No: ZSI/WGRC/IR/INV/6716.

Diagnosis: Body length 49 mm- 62mm. Color after preservation in 70% alcohol: Cephalic plate, tergites pale green to orange. T1 and T20 orange red. Antennal articles yellowish, walking legs bluish green ultimate leg greyish yellow. Antennae long, extended up to T4, composed of 21 antennal articles, three basal antennal articles glabrous, rest covered with minute setae. Coxopleural process small, tipped with three prominent spines. Each coxosternal tooth plate with 4+4 teeth, one postdental spur. Median prefemoral process dentate with 4 teeth. T1 and T2 punctate, without any sutures. T3 with an incomplete paramedian sutures. T4-T20 with complete paramedian sutures. T21 smooth, without any sulcus. Lateral margination from T13. Sternites moderately punctate; anterior paramedian sutures complete on S6 to S20. Inverted "v" shaped suture from S9 onwards. S21 smooth with posterior end angular. Coxopleural process small,

PLATE 3



Fig. 9: *Cormocephatus dentipes*



Fig. 10: *Cormocephatus (Dekanonyx) nigrificatus*



Fig. 11: Sternite 21 & Coxopleural process of *Otostigmus graveleyi*



Fig. 12: *Digitipes barnabasi*



Fig. 13: Sternite 21 & Coxopleural process of *Rhysida lithobioides trispinosus*



Fig. 14: *Scolopendra morsitans*

with numerous small pores and poreless narrow median strip. It possess three prominent apical spines. Lateral spines absent. Walking leg 1 with a femoral and tibial spur. 1-18 with two tarsal spurs, 19-20 with one tarsal spur. 1-20 with two claw spurs. Ultimate leg prefemur with 1 ventromedial spine and 2 ventrolateral spines. No paramedian process.

Distribution: Kerala, Tamil Nadu and Maharashtra.

Remarks: This is one of the rare species recorded from the area. It is endemic to Deccan plateau.

7. *Scolopendra morsitans* Linnaeus, 1758 (Fig. 14)

Scolopendra morsitans Linnaeus, 1758: 638.

Scolopendra morsitans, Kraepelin, 1903: 250.

Trachycormocephalus jodhpurensis, Khanna, 1977b: 151-156.

Material examined: 1 ex. INDIA: KERALA: IDUKKI, Churulipatty, Chinnar Wildlife Sanctuary (Lat. 10.353°N, Long. 77.198°E, Alt. 553.5 m), Coll. P.M Sureshan, 21.ix. 2015. Reg. No: ZSI/WGRC/IR/INV/3933. 1 ex, Chinnar Wildlife Sanctuary (Lat. 9.66023°N, Long. 76.99671° E, Alt. 811.60 m), Coll. P.M Sureshan, 4.iv.2012. Reg. No: ZSI/WGRC/IR/INV/2232. 1 ex. Chinnar Wildlife Sanctuary (Lat. 10.353°N, Long. 77.198°E, Alt. 553.5 m), Coll. P.M Sureshan, 12.ix. 2015. Reg. No: ZSI/WGRC/IR/INV/6729.

Diagnosis: Body length 53-101mm. The species observed in different colour patterns ranging from brownish yellow to dark orange, in cephalic plate, T1 and ultimate legs. Large and robust species, 20th pair of walking leg with tarsal spur, ultimate leg prefemur with three longitudinal rows of three spines each on ventral side. Antennae composed of 19-21 articles; tapering distally, the basal three to four articles glabrous. Head capsule curved in anterior end and with almost straight lateral edges. Cephalic plate smooth with minute setae marginally and without any sutures. Each coxosternal tooth plate with 3+3 to 5+4 teeth; the inner and outer ones separated each other. Post dental spur present. Median prefemoral process dentate with 2 or 3 teeth. T1 smooth without any sutures. Paramedian sutures complete on T2-T20 Lateral margination of tergites from T3 or T8 to T21. T21 with straight lateral margin and angular posterior end (Fig. e); very prominent longitudinal median sulcus which may sometimes extended to posterior margin of T20. paramedian sutures complete on S1 to S20. S21 without sutures. Walking legs 1-20 with a tarsal spur and 2 claw spur. Tarsal spur on 20 which distinguishes it from *S.*

amazonica in earlier designations. Coxopleural process with small but distinct pores and poreless strip at apex. It possess two to four apical spines.

Distribution: India: Assam, Arunachal Pradesh, Andhra Pradesh, Andaman & Nicobar Islands, Bihar, Bengal, Delhi, Gujarat, Himachal Pradesh, Haryana, Jammu and Kashmir, Karnataka, Kerala, Maharashtra, Madhya Pradesh, Meghalaya, Manipur, Mizoram, Nagaland, Orissa, Punjab, Rajasthan, Tamil Nadu, Tripura, Sikkim, Uttar Pradesh and Uttaranchal. In all tropical and temperate zones of the world.

Remarks: This species was considered earlier as a sympatric species with its sibling *Scolopendra amazonica* (Bucherl, 1946) without hybridization. Later *Scolopendra amazonica* was synonymized with this species (Jangi and Dass, 1984; Minelli *et al.*, 2006).

Conclusion

Taxonomic studies on the scorpions and centipede collections made from the Chinnar Wildlife Sanctuary, Kerala reveals the presence of 6 species of scorpions belonging to 5 genera under 3 families and 7 species of centipedes from 5 genera under 1 family. Scorpion species are found in the sanctuary are occupying mainly in the dry areas and among them species *Iomachus laeviceps*, *Lychas tricarinatus* and *Lychas laevifrons* are commonly found in the area. The species *Buthoscorpion chinnaensis* and *Hottentotta rugiscutis* are reported only in Chinnar Wildlife Sanctuary till date. The species *Heterometrus flavimanus* was also reported from the foothills of Western Ghats in Palakkad district of Kerala and Coimbatore, Tamil Nadu is the type locality of the species. The distribution of the species *Iomachus laeviceps* is so far restricted in places of Palakkad district and southwards in Kerala. Regarding Scolopendromorpha, *Cormocephalus westwoodi westwoodi* (Newport) is reported first time from Kerala and three endemic species-*Cormocephalus (Dekanonyx) nigrificatus* Verhoeff (endemic to Southern India) and *Otostigmus gravelly* (Jangi and Dass) (Endemic to Kerala) and *Rhysida lithobioides trispinosus* Jangi and Dass (endemic to Deccan plateau) are reported. Another interesting observation was that more number of species of centipedes was collected during post-monsoon (5) and monsoon (4) seasons and in the dry periods of pre-monsoon only 2 species were collected. This might be due to avoid the dry season and being a soil dweller, the Scolopendrids may avoid the dry seasons to escape from the desiccation.

ACKNOWLEDGEMENT

Authors are grateful to Dr. Kailash Chandra, Director, Zoological Survey of India, Kolkata for providing facilities and encouragement. AK is grateful to Department of Science and Technology, Govt. of India for awarding Inspire Fellowship for pursuing Ph.D. DB is thankful to GM (Kerala) Food Corporation of India, Regional Office, Trivandrum for NOC for Ph.D studies under University of Calicut and also thankful to JRF/SRF from Ministry of Environment & Forest, Zoological Survey of India. We are also thankful to the Chief Wildlife warden, Kerala and the forest officials of Chinnar Wildlife Sanctuary, Kerala for granting the permission for faunistic surveys and specimen collection and various helps rendered during the fieldwork.

चिन्नार वन्यप्राणी अभयारण्य, केरल, भारत के दो प्रमुख मृदा बृहत प्राणिजात, स्कॉर्पिओन्स (अराकनिडा : स्कॉर्पिओन्स) और सीन्टिपीडीस (चिलोपोडा : स्कॉलोपीन्ड्रोर्मा) पर सुव्यवस्थित विवरण

के. अस्वथी, धान्या बालन एवं पी.एम. सुरेशन

सारांश

चिन्नार वन्यप्राणी अभयारण्य, इडुक्की जिला, केरल, दक्षिणी पश्चिमी घाटों से दो महत्वपूर्ण मृदा बृहत प्राणिजात, यथा-सीन्टिपीडीस (चिलोपोडा : स्कॉलोपीन्ड्रोर्मा) और स्कॉर्पिओन्स (अराकनिडा : स्कॉर्पिओन्स) की विविधता की मुख्य-मुख्य बातों को इस अध्ययन में बताया गया है। वर्षा वाला क्षेत्र होने के नाते अध्ययन क्षेत्र विलक्षण प्राणिजात घटक वाला क्षेत्र है। हमने अध्ययन क्षेत्र से स्कॉर्पिओन्स की 6 प्रजातियों और स्कॉलोपेन्डाइड सीन्टिपीडीस की 7 प्रजातियों को सूचित किया है। अध्ययन में केरल से सीन्टिपीडी प्रजाति *कॉर्मोसीफेलस वैस्टवूडी वैस्टवूडी* (न्यूपोर्ट) की पहली रिपोर्ट और *कॉर्मोसीफेलस (डीकेनोनीक्स) नाइग्रिकेटस* वरहोइफ (दक्षिणी भारत की स्थानिक) तथा *ओटोस्टिगमस ग्रेवली* (जंगी एवं दास) (केरल की स्थानिक) एवं *हीसिडा लिथोबायोडीस ट्राइस्पिनोसस* जंगी और दास (डेक्कन पठार की स्थानिक) में से सूचीबद्ध करना शामिल है।

REFERENCES

- Aswathi K., Sureshan P.M. and Lourenco W.R. (2015). A new scorpion of the genus *Buthoscorpia* Werner, 1936 (Scorpiones: Buthidae) From Kerala, India, *Taprobanica*, 7 (4): 213-218.
- Attems C. (1928). Neue Scolopendriden der Museen Wien und Hamburg. *Zoologische Anzeiger, Leipzig*, 78 (11/12): 279-309.
- Attems C. (1930). Myriapoda 2. Scolopendromorpha. In: *Das Tierreich, Berlin* (Schulze, F. E. & Kükenenthal, W. ed.), *Walter de Gruyter*, 54: 1-308.
- Bastawade D.B., Jadhav S.S and Sharma R.M. (2012). Scorpionida. *Zoological Survey in India*, 4 (6): 1-16.
- Bonato L., Edgecombe G., Lewis J.G.E., Minelli A., Pereira L.A., Shelley R.M. and Zapparoli, M. (2010). A common terminology for the external anatomy of centipede (Chilopoda). *Zookeys*, 69: 17-51.
- Bucherl W. (1946). Novidades systematics na ordem Scolopendromorpha. *Mem. Inst. Butantan*, 19: 135- 157.
- Jangi B.S. and Dass C.M.S. (1984). Scolopendridae of Deccan. *J. Scientific and Industrial Research*, 43 (2): 27-54.
- Joshi J. and Edgecombe G.D. (2013). Revision of the scolopendrid centipede *Digitipes* Attems, 1930 from India (Chilopoda: Scolopendromorpha): reconciling molecular and morphological estimates of species diversity. *Zootaxa*, 3626 (1). 99-145.
- Khanna V. (1994). Chilopoda: Some ecological observations on the centipede *Cormocephalus* Pocock, with comments on "sexual dimorphism" in the species and on the status of *Cormocephalus pseudonudipes* Jangi and Dass, 1984. In: *Fauna of Conservation area Series 5: Fauna of Rajaji National Park*, Kolkata: Zool. Surv. India, 237-243.
- Kováčik F. (1999). Hemibuthus kraepelini, a junior synonym of *Hottentotta rugiscutis* (Scorpiones: Buthidae). *Acta Societatis Zoologicae Bohemicae*, 63: 291-293.
- Kováčik F. (2004). A Review of the Genus *Heterometrus* Ehrenberg, 1828, with Descriptions of Seven New Species (Scorpiones. Scorpionidae), *Euscorpius*, 15: 1-60.
- Kraepelin K. (1903). Revision der Scolopendriden (Scolopendromorpha). *Mitt. Mus., Hamburg*, 20: 1-276.
- Lawrence R.F. (1955). Chilopoda. Results of the Lund University Expedition in 1950-1951. *South African Animal Life*, 2: 4-56.
- Lewis J.G.E. (2001). The scolopendrid centipedes in the collections of the National Museum of Natural History in Sofia (Chilopoda: Scolopendromorpha: Scolopendridae). *Historia Naturalis Bulgarica*, 13: 5-51.
- Minelli A., Bonato L. and Dioguardi R. (2006 onwards). *Chilobase: a web resource for Chilopoda taxonomy*. Publicly searchable at <http://chilobase.bio.unipd.it>
- Newport G. (1844). A list of the species of Myriapoda, Order Chilopoda, contained in the cabinets of the British Museum with synoptic descriptions of forty-seven new species. *Annals and Magazines of Natural History*, 13: 94-101.
- Pocock R.I. (1891). Notes on the synonymy of some species of Scolopendridae with descriptions of new genera and species of the group. *Ann. nat. Hist.*, 6, 7: 51-68 and 221-231.

- Pocock R.I. (1893). Notes on the classification of Scorpions, followed by some Observations upon Synonymy, with Descriptions of new Genera and Species. *Ann. Mag. Natur. Hist.*, 6: 303-331.
- Pocock R.I. (1897). Descriptions of some new species of scorpions from India. *J. Bombay Natural History Society*, 11:102-117.
- 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.
- Porat C.O. von. (1871). Myriopoda Africae australis in Museo Regio Holmiensi asservata recensuit. Pars I. Chilopoda . *Öfversigt af Kongliga Vetenskaps-Akademiens Förhandlingar*, 28: 1135-1167.
- Schileyko A. A. and Stagl V. (2004). The collection of scolopendromorph centipedes (Chilopoda) in the Natural History Museum in Vienna: a critical re-evaluation of formertaxonomic identifications. *Annals of Natural history. Museum Wien*, Series B, 105B:67-137.
- Simon E. (1884). Arachnidesrecueillis en Birmanie par M. le Chevalier J. B. Comottoetappartenent au Musée Civique d'Histoire Naturelle de Gènes. *Annali del Museo Civico di Storia Naturale di Genova*, 20: 1–48.
- Stahnke H.L. (1970). Scorpion nomenclature and mensuration. – *Entomological News*, 81: 297-316. Philadelphia.
- Sureshan P.M., Khanna V. and Radhakrishnan C. (2006). Additional distributional records of scolopendrid centipedes (Chilopoda: Scolopendromorpha) from Kerala. *Zoos'. print*, 21(6): 2285-2291.
- Sureshan P.M. and Yadav B.E. (2008). Chilopoda: Scolopendromorpha. In: *Fauna of Goa, State Fauna Series*. Kolkata: *Zool. Surv. India*, 16:73-77.
- Tikader B.K. and Bastawade D.B. (1983). *Scorpions (Scorpionida: Arachnida)*. In: *The Fauna of India, Vol. 3* (Edited by the Director). Calcutta: *Zoological Survey of India*, 671pp.
- Verhoeff K.W. (1937). Zwei neue Myriapoden -Gattungen aus Indien und ihre stellung. *Zool. Anz.*, 120: 81-89.
- Yadav B.E. (2009). Chilopoda: Scolopendromorpha. In: *Fauna of Bhimasankar Wildlife Sanctuary*, Conservation Area Series, Kolkata. *Zool. Surv. India*, 42: 1-12.
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