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Orb-weavers (Araneae: Araneidae, Nephilidae) from the Margalla Hills National Park, Pakistan with comments on morphological variation in *Neosconamukerjei* Tikader, 1980 and emasculation in *Nephilapilipes* (Fabricius, 1793)

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ABSTRACT: *Orb-weaving spiders belonging to the family Araneidae and Nephilidae were reported from the Margalla Hills National Park, Islamabad, Pakistan. The data included five genera: Cyrtophora Simon, Eriovixia Archer, Gea C. L. Koch, Neoscona Simon and Nephila Leach represented by a total of seven species: Cyrtophoracitricola (Forsskål), Eriovixiaexcelsa (Simon), Geaspinipes C. L. Koch, NeosconamukerjeiTikader, Neosconatheisi (Walckenaer), Neosconavigilans (Blackwall) and Nephilapilipes (Fabricius). Morphological variation in the female of N. mukerjei was reported accompanied first time with color photographs. Also included were ecological notes on N. pilipes adding observations on reproductive behavior, morphology and phenology of this important species.*

Keyword: Taxonomy, Spiders, Morphology, Behavior, new locality

INTRODUCTION

Araneidae and Nephilidae are important families of ecribellate orb weavers. Araneidae is the third largest family of spiders comprising a total of 178 genera,

while Nephilidae being a less diverse family consists of seven genera (World Spider Catalog, 2023). These spiders are commonly referred to as the orb-weavers because of their habit of

spinning orb-webs, frequently, within vegetation. Widely distributed (Jocque and Dippenaar-Schoeman, 2006) and easy to collect, the orb weavers are often well documented. The present study reports seven species from five genera and is a part of the first study conducted to explore the spider fauna of the Margalla Hills National Park (MHNP), Islamabad, Pakistan. The Margalla Hills National Park (MHNP) is a forested area consisting of grasses, shrubs and deciduous and evergreen trees and provides a rich habitat for orb-weavers. Orb-weavers have frequently been the subject of ecological studies within Pakistan, however there is no comprehensive taxonomic data available on their diversity from the country. The few works that are available are outdated or partial or with dubious records (Parveen et al., 2007, Siliwal and Molur, 2007, Ursani and Soomro, 2010, Mukhtar et al., 2012, Sial et al., 2012, Luqman et al., 2021, Nooreen et al., 2022). Careful review of the records in The World Spider Catalog (2023) is presently the best option available to consult regarding orb-weaver diversity within Pakistan. Table 1 enlists the valid species of Araneidae and Nephilidae from Pakistan. Following is a brief summary of the genera included in the present study.

Cyrtophorais a genus consisting of 49 valid species (World Spider Catalog, 2023). Members of this genus have a flat carapace overhung posteriorly by the very high anterior portion of the abdomen. The abdomen frequently possesses paired protuberances (humps). The present study reports *C. citricola* from Islamabad along with photographs and illustrations.

Eriovixia contains 33 valid species, many of which had been previously relegated to *Araneus* or *Neoscona* (sometimes both) (World Spider Catalog, 2023). Members of this genus are easily recognized on the basis of the peculiar morphology of the habitus. The cephalic region of the carapace is elevated and the abdomen is globular with a tail like hump posteriorly. The epigyna bear short and stout scapes. *E. excels* (Simon) has been previously described from Pakistan (World Spider Catalog, 2023) and the present study extends the distribution range of the species within Pakistan till Islamabad providing fresh data along with photographs and illustrations.

Gea is a small genus of orb-weavers consisting of only 13 valid species (World Spider Catalog, 2023). Members of this genus have a strongly procurved PER which is a feature not commonly found in Araneid spiders. The present

study reports *G.spinipes* C. L. Koch from Islamabad, which is also the only known species of the genus from Pakistan.

Neoscona is another speciose genus with a total of 125 valid species (World Spider Catalog, 2023). Members of this genus have often been studied from Pakistan and the World Spider Catalog (2023) reports 12 species from the country. The present paper provides data on *N. theisi* and *N. vigilans* which are new records for Islamabad, and on *N. mukerjei* which has been reported previously from MHNP, but the current study provides color photographs of its recorded abdominal variations for the first time.

Nephila is a small genus consisting of just nine valid species (World Spider Catalog, 2023). Pakistan seems to have

an endemic species: *N. pakistaniensis* Ghafoor and Beg from the genus. However, this might be a synonym of *N. clavata* L. Koch as given in Tikader (1982) [now classified as *Trichonephilaclavata* (L. Koch)]. Further studies on the type material of *N. pakistaniensis* will resolve this issue. *N. pilipes* is the type species of the genus and has been reported from a number of regions from around the world, including Pakistan (Nooreen et al., 2022, World Spider Catalog, 2023). The present paper provides the first record of the species from the current locality along with photographs and illustrations as well as some ecological notes.

Table 1. Diversity of Araneidae and Nephilidae from Pakistan

| Family | Genus | Species |
|-----------|----------------|---|
| Araneidae | <i>Araneus</i> | <i>A.alboquadratus</i> Dyal <i>A.altitudinum</i> Caporiacco <i>A. bigibbosus</i> (O. Pickard-Cambridge) <i>A.camilla</i> (Simon) <i>A. carnifex</i> (O. Pickard-Cambridge) <i>A. formosellus</i> (Roewer) <i>A. fulvellus</i> (Roewer) <i>A. gibber</i> (O. Pickard-Cambridge) <i>A. gurdus</i> (O. Pickard-Cambridge) <i>A. mitificus</i> (Simon) <i>A. obscurissimus</i> Caporiacco |

| | | |
|--|----------------------|--|
| | | <i>A.paenulatus</i> (O. Pickard-Cambridge) <i>A. panniferens</i> (O. Pickard-Cambridge) <i>A. pella</i> (O. Pickard-Cambridge) <i>A. pontii</i> Caporiacco <i>A.praedatus</i> (O. Pickard-Cambridge) |
| | <i>Araniella</i> | <i>A.cucurbitina</i> (Clerck) <i>A. nympa</i> (Simon) |
| | <i>Argiope</i> | <i>A. anasuja</i> Thorell <i>A. lobata</i> (Pallas) <i>A. pulchella</i> Thorell <i>A. trifasciata</i> (Forsskål) <i>A. versicolor</i> (Doleschall) |
| | <i>Bijoaraneus</i> | <i>B. mitificus</i> (Simon) |
| | <i>Chorizopes</i> | <i>C. congener</i> O. Pickard-Cambridge <i>C. rajanpurensis</i> Mukhtar & Tahir <i>C. stoliczkai</i> O. Pickard-Cambridge |
| | <i>Cyclosa</i> | <i>C. chichawatniensis</i> Mukhtar & Mushtaq <i>C. hexatuberculata</i> Tikader <i>C. kashmirica</i> Caporiacco <i>C. krusa</i> Barrion & Litsinger <i>C. mohini</i> Dyal <i>C. punjabiensis</i> Ghafoor & Beg <i>C. saismarka</i> Barrion & Litsinger <i>C. spirifera</i> Simon |
| | <i>Cyrtarachne</i> | <i>C. pallida</i> O. Pickard-Cambridge |
| | <i>Cyrtophora</i> | <i>C. cicatrosa</i> (Stoliczka) <i>C. citricola</i> (Forsskål) |
| | <i>Eriovixia</i> | <i>E. excelsa</i> (Simon) <i>E. laglaizei</i> (Simon) |
| | <i>Gasteracantha</i> | <i>G. dalyi</i> Pocock |
| | <i>Gea</i> | <i>G.spinipes</i> C. L. Koch |
| | <i>Gibbaranea</i> | <i>G. ullrichi</i> (Hahn) |
| | <i>Guizygiella</i> | <i>G. melanocrania</i> (Thorell) |

| | | |
|------------|--------------------|---|
| | <i>Macracantha</i> | <i>M. hasselti</i> (C. L. Koch) |
| | <i>Neoscona</i> | <i>N. bengalensis</i> Tikader and Bal <i>N. chrysanthusi</i> Tikader and Bal <i>N. huzaiifi</i> Mukhtar <i>N. mukerjei</i> Tikader <i>N. nautical</i> (L. Koch) <i>N. pavida</i> (Simon) <i>N. polyspinipes</i> Yin, Wang, Xie & Peng <i>N. scylla</i> (Karsch) <i>N. shillongensis</i> Tikader & Bal <i>N. sinhagadensis</i> (Tikader) <i>N. theisi</i> (Walckenaer) <i>N. vigilans</i> (Blackwall) |
| | <i>Thelacantha</i> | <i>T. brevispina</i> (Doleschall) |
| Nephilidae | <i>Nephila</i> | <i>N. pakistaniensis</i> Ghafoor & Beg <i>N. pilipes</i> (Fabricius) |

MATERIAL and METHODS

Specimens were kept in 70% ethanol, examined using an Irmeco IM-SZ-500 stereomicroscope and photographed using a Samsung SM-G570F CMOS camera. Additionally for examination of the copulatory organs or photography under high magnification, a SWIFT M7000D compound microscope was used. Male palps were removed and washed while epigyna were removed using a dissecting needle and cleared in a warm solution of 10% potassium hydroxide (KOH) prior to examination. Distribution records (Table 1) of the species were inferred from the World Spider Catalog (2023) and by reviewing

all the available literature on the species. Voucher specimens were deposited at the Laboratory of Arachnology Collection, University of the Punjab, Quaid-e-Azam campus, Lahore, Pakistan.

Abbreviations: ALE, anterior lateral eyes; AME, anterior median eyes; AER, anterior eye row; PER, posterior eye row; PLE, posterior lateral eyes; PME, posterior median eyes; Co, copulatory opening; DE, Dilodged Embolus; ED, epigynal depression; ER, Epigynal Ridge; Sp, spermatheca; Sc, Scapus; SR, Sclerotized Rim; FD, fertilization ducts. Co, Conductor; Pc, Paracymbium; PTS, Paired Tibial Spines; Ra, Radix; STA,

Sub-Terminal Apophysis; TA, Terminal Apophysis, Te, Tegulum.

RESULTS

Genus *Cyrtophora* Simon 1864

Cyrtophoracitricola

(Forsskål 1775)

(Fig. 1A–G)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1284–1326): 2 juveniles, TillaCharouni, Margalla Hills National Park (N33°47.365', E073°07.472', 1352 m), 15 April, 2017, K. H. Jaffry; 11 females, 5 juveniles, Cactus Ridge, Margalla Hills National Park (N33°44.514', E073°03.275', 671 m), 16 April, 2017, K. H. Jaffry; 13 females, 3 juveniles, Sadhu kaBagh, Margalla Hills National Park (N33°43.303', E072°54.916', 773 m), 21 September, 2017, K. H. Jaffry; 8 females, 1 juvenile, PirSohawa road (Bruti), Margalla Hills National Park (N33°46.723', E073°06.082', 1266 m), 7 July, 2018, K. H. Jaffry.

Comments

Epigynum with a broad and short scape having a sclerotized rim (Fig. 1C–F). Cosmopolitan species with distribution range including: Africa, Australia, Brazil, China, Colombia, Costa Rica, Cuba, Dominican Republic, India, Israel, Japan, Malaysia, Middle East,

North America, Poland, Republic of the Seychelles and Southern Europe. The species was previously reported within Pakistan from Lahore by Butt and Siraj (2006). New record for Islamabad.

Genus *Eriovixia* Archer 1951

Eriovixiaexcelsa

(Simon 1889b)

(Fig. 2A–G)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1327–1405): 15 females, 5 juveniles, Trail 2, Margalla Hills National Park (N33°44.079', E073°03.277', 364 m), 23 July, 2016, K. H. Jaffry; 20 females, 5 juveniles, Trail 2, Margalla Hills National Park (N33°44.064', E073°03.268', 351 m), 22 October, 2017, K. H. Jaffry; 10 females, 1 juvenile, PirSohawa road, Margalla Hills National Park (N33°47.019', E073°05.511', 1219 m), 15 April, 2017, Naseer; 13 females, 1 juvenile, Shakarparian Hills, Margalla Hills National Park (N33°41.653', E073°04.363', 560 m), 22 July, 2016, Jaffry; 8 females, 1 juvenile, Sadhu kaBagh, Margalla Hills National Park (N33°43.303', E072°54.916', 764 m), 21 October, 2017, Jaffry.

Comments

Epigynum with a stout scape, copulatory opening anterior, spermathecae posterior (Fig. 2C–G). Previously known from

Africa, China, India, Indonesia, Philippines and Taiwan. Within Pakistan, the species was first described from Lahore by Dyal (1935) and was reported to exist in Pakistan in all subsequent studies up till the recent

work by Dippenaar-Schoeman et al. (2021). This species was also reported from Rawalpindi, Pakistan by Tikader (1982) which is a location adjacent to Islamabad. New record for Islamabad.

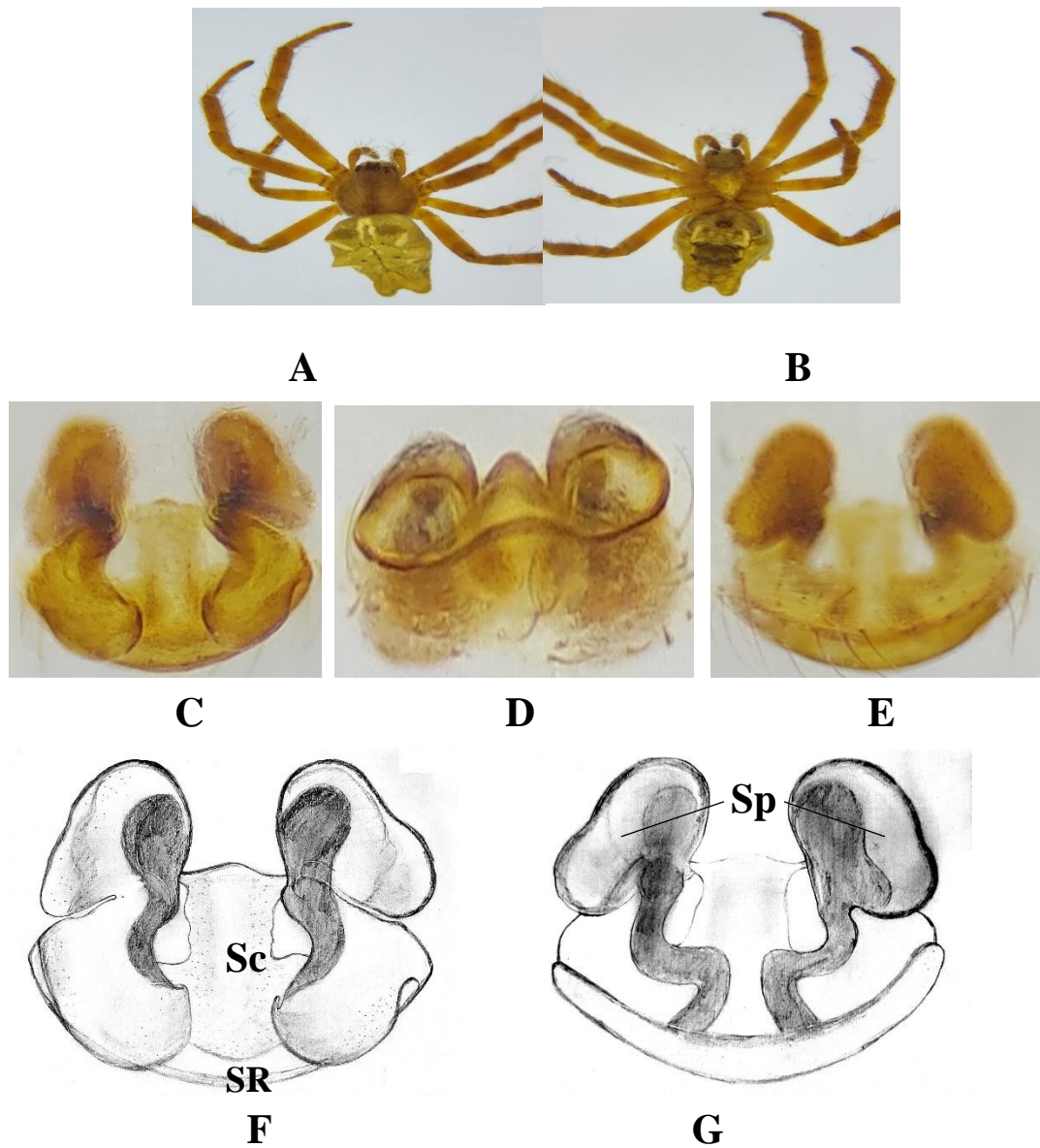


Fig. 1. *Cyrtophoracitricola* (PUZ-MHNP-1320) Female. A–B, Habitus (A, dorsal; B, ventral); C–G, Female genitalia (C, epigynum; D, posterior view epigynum; E, internal genitalia; F,

illustration epigynum; G, illustration internal genitalia). Sc, Scapus; Sp, Spermatheca; SR, Sclerotized Rim

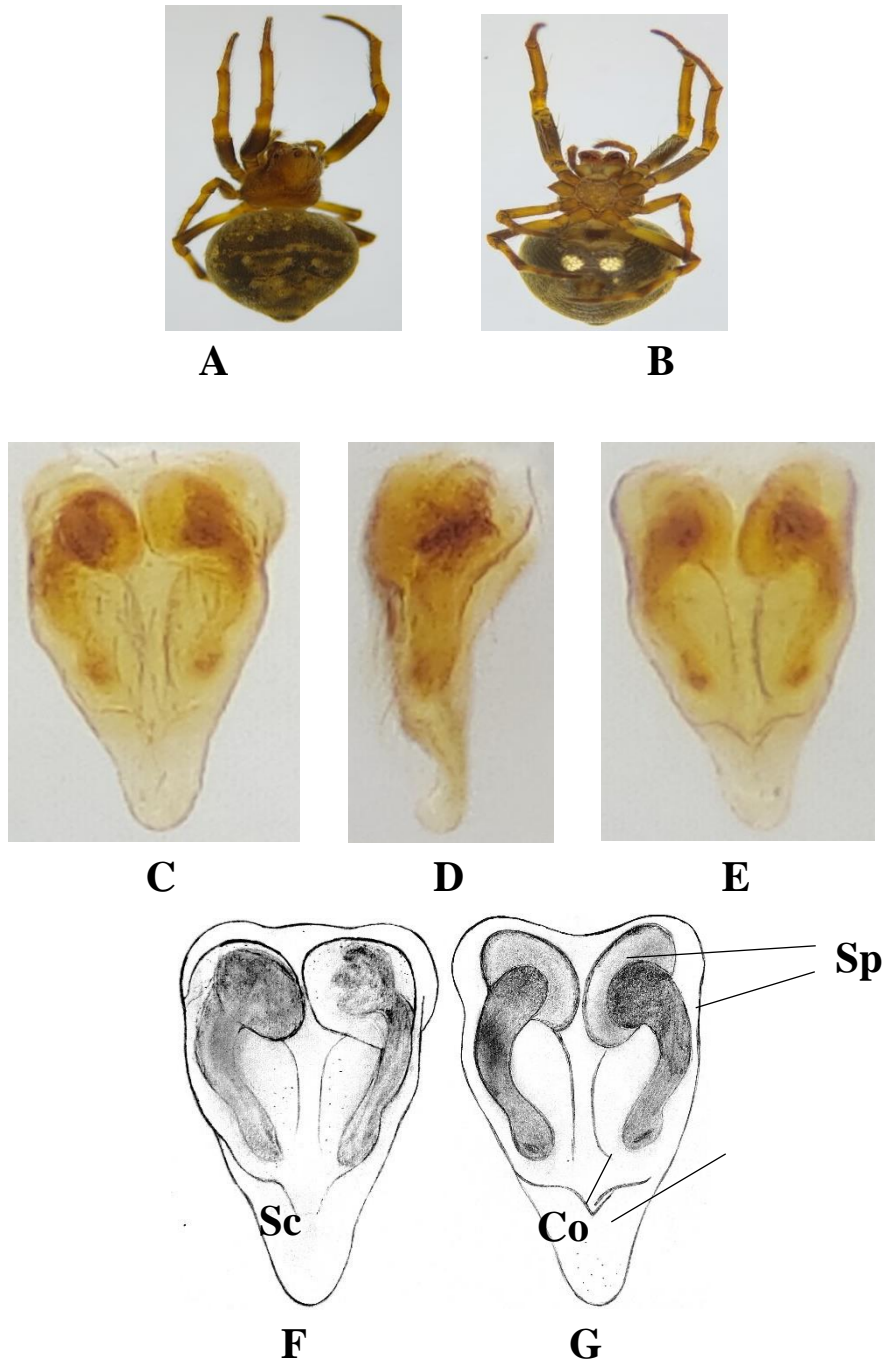


Fig. 2. *Eriovixia excelsa* (PUZ-MHNP-1327) Female. A–B, Habitus (A, dorsal; B, ventral); C–G, Female genitalia (C, epigynum; D, lateral view epigynum; E, internal genitalia; F, illustration

epigynum; G, illustration internal genitalia). Co, Copulatory openings; Sc, Scapus; Sp, Spermatheca

Genus *Gea* C. L. Koch 1843

Geaspinipes

C. L. Koch 1843

(Fig. 3A–F)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1406–1432): 8 females, 5 juveniles, Trail 2, Margalla Hills National Park (N33°44.091', E073°03.296', 369 m), 10 September, 2020, K. H. Jaffry; 13 females, 1 juvenile, Shakarparian Hills, Margalla Hills National Park (N33°41.703',

E073°04.466', 565 m), 11 September, 2020, K. H. Jaffry.

Comments

Epigynum with a sclerotized procurved ridge, epigynal furrow in the form of two semi-circular hollows separated by a sclerotized ridge. Spermathecae are clavate with ducts twisting twice (Fig. 3C–F). Previously reported from Burma, India, China, Taiwan to Indonesia (Borneo). It was recently reported from within Pakistan by Sajid et al. (2021) from Dir Lower. New record for Islamabad.



A



B

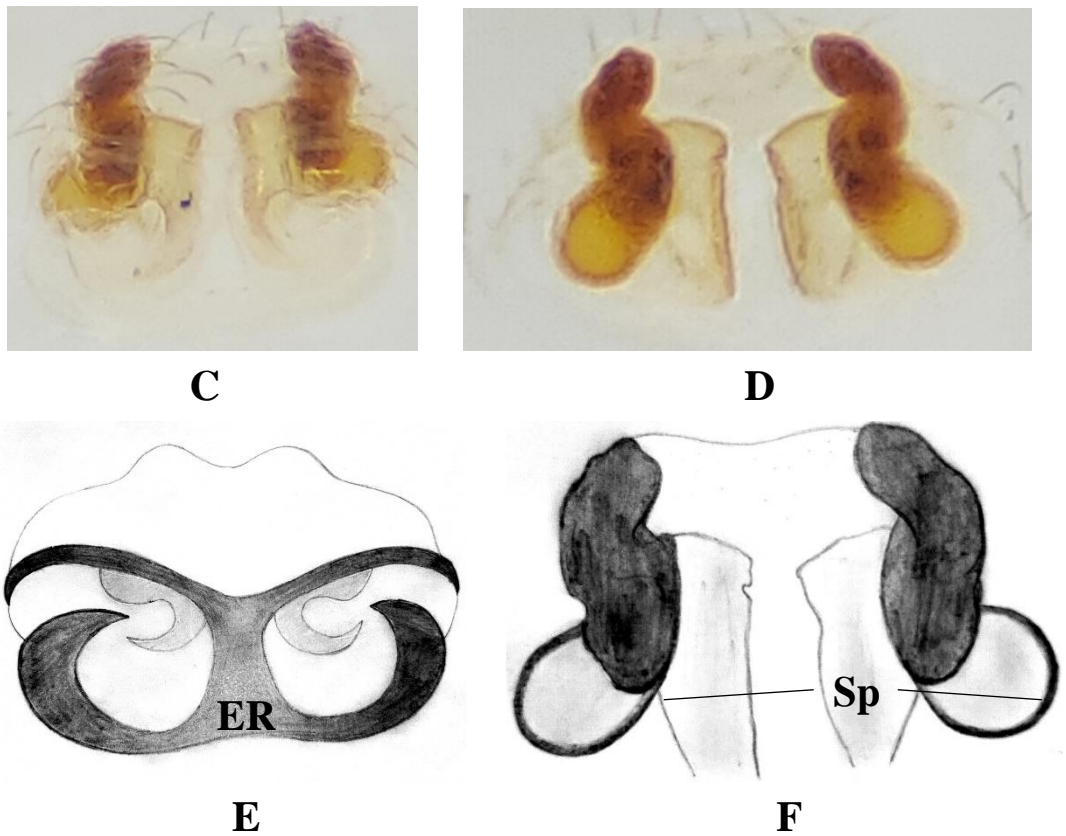


Fig. 3. *Geaspinipes* (PUZ-MHNP-1406) Female. A–B, Habitus (A, dorsal; B, ventral); C–F, Female genitalia (C, epigynum; D, internal genitalia; E, illustration epigynum; F, illustration internal genitalia). ER, EpigynalRidge; Sc, Scapus; Sp, Spermatheca.

Genus *Neoscona* Simon 1864

Neosconamukerjei

Tikader 1980

(Figs. 4A–K, 5A–D)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1433–1472): 12 females, PirSohawa road, Margalla Hills National Park (N33°44.359', E073°02.938', 597 m), 22 October, 2017, K. H. Jaffry; 8 males, 3 females, 1 Juvenile, Trail 2, Margalla Hills National Park (N33°44.091',

E073°03.296', 369 m), 10 September, 2020, K. H. Jaffry; 10 females, 6 males, PirSohawa road, Margalla Hills National Park (N33°44.587', E073°03.544', 681 m), 12 September, 2020, K. H. Jaffry.

Comments

Tikader (1980) reported 18 variants of this species on the basis of different abdominal patterns from a large collection involving nearly 300 specimens from Poona, India. Color change in spiders is well documented

for certain species, for instance, *Misumenavatia* (Clerck) (Packard, 1905; Insausti and Casas, 2008; Riou and Christidès, 2010). Is *N. mukerjei* another example of such behavior in spider species? Tikader (1980) relates two interesting observations: 1) That all the variants he found out were members of the same population (spatially and temporally confluent) and 2) That he observed that the abdominal pattern of the specimens ‘matched well’ with the environment. These observations were similar to those in the present study and hint at the ability of color change within this species rather than the variations being the result of processes such as allopatry. We have found three of the abdominal variants illustrated among

‘Tikader’s 18’ and we provide their photographs for the first time (Fig. 4A–F), while the original work by Tikader provided illustrations only. This rediscovery reinforces the existence of intraspecific color variation in this species. Epigynum with a moderate scape which is deeply constricted and has reduced lateral lobes (Fig. 4G–K). The species is known to exist in Bangladesh and India. From within Pakistan, it was collected by Mukhtar (2012) from 20 different cities of the Punjab province. These included samples from Shakarparian, Islamabad which is a part of the MHNP, however his study did not document the morphological variation within the species. Palp as in Fig. 5C–D.



A



B

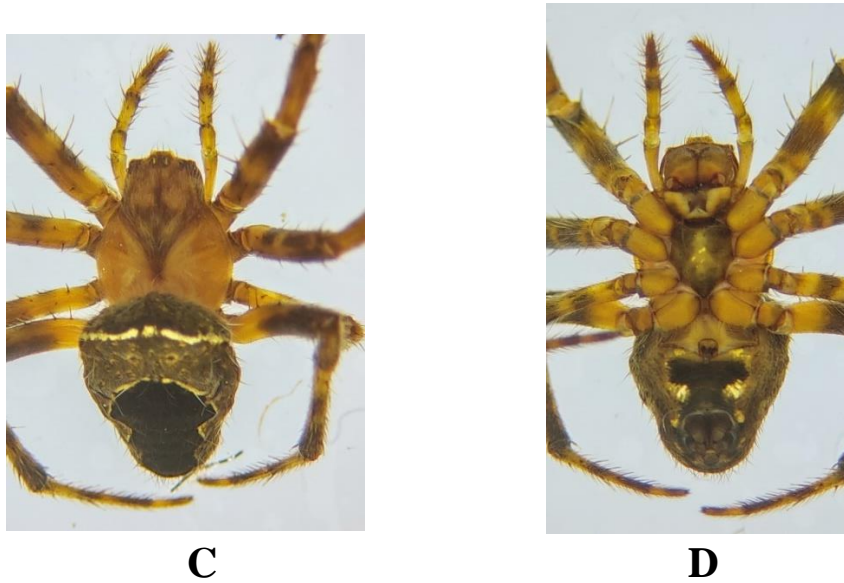


Fig. 4. *Neosconamukerjei* (PUZ-MHNP-1434, 1440) Female. A–D, Habitus variants (A & C, dorsal; B & D, ventral). *Continued...*

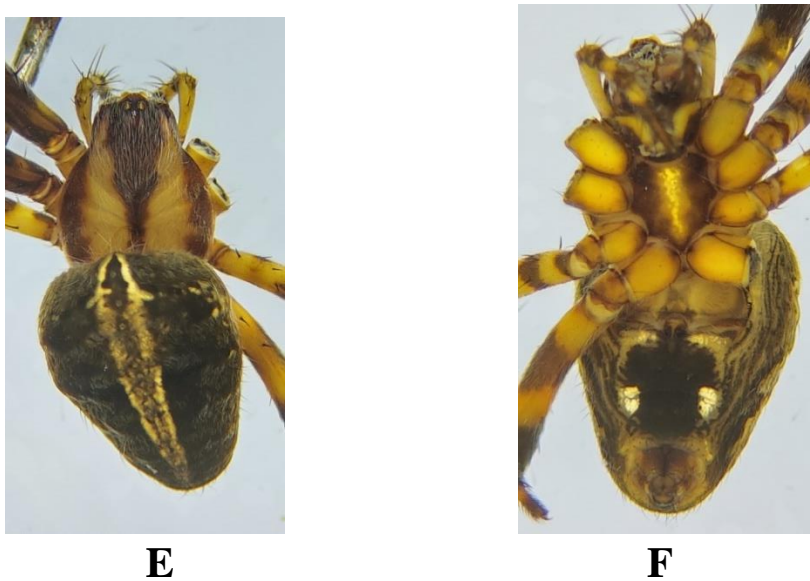


Fig. 4. *Neosconamukerjei* (PUZ-MHNP-1442, 1445) Female. Habitus variants (E, dorsal; F, ventral). *Continued...*

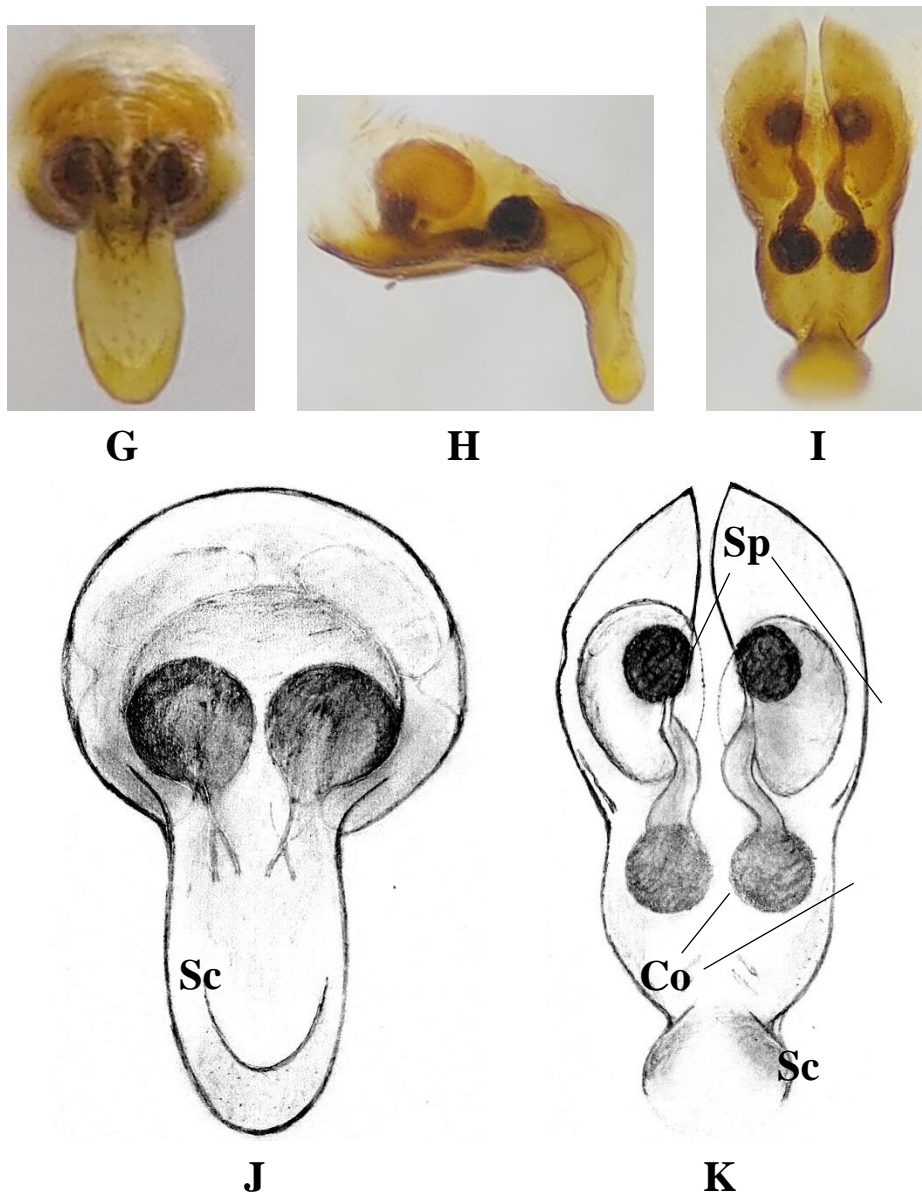


Fig. 4. *Neosconamukerjei* (PUZ-MHNP-1440) Female. G–K, Female genitalia (G, epigynum; H, lateral view epigynum; I, internal genitalia, J, illustration epigynum; K, illustration internal genitalia). Co, Copulatory openings; Sc, Scapus; Sp, Spermatheca.

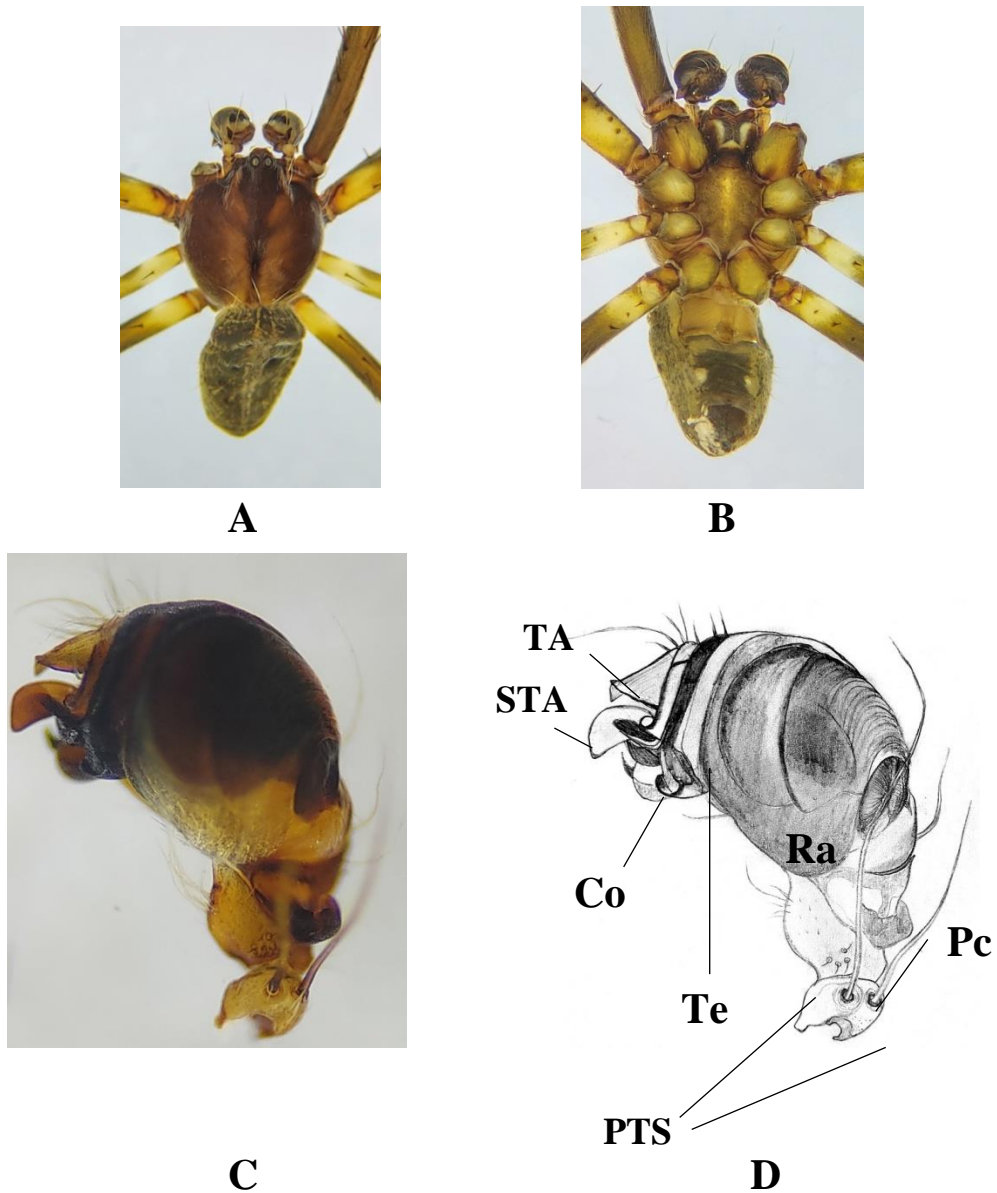


Fig. 5. *Neosconamukerjei* (PUZ-MHNP-1448) Male. A–B, Habitus (A, dorsal; B, ventral); C–D, Palp (C, retrolateral view; D, illustration retrolateral view). Co, Conductor; Pc, Paracymbium; PTS, Paired Tibial Spines; Ra, Radix; STA, Sub-Terminal Apophysis; TA, Terminal Apophysis, Te, Tegulum.

Genus *Neoscona* Simon, 1864

Neosconatheisi

(Walckenaer 1841)

(Fig. 6A–G, 7A–D)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1473–1587): 3 females, 25 juveniles, Shakarparian hills, Margalla Hills National Park

(N33°41.653', E073°04.363', 569 m), 22 July, 2016, K. H. Jaffry; 4 males, 13 Juveniles, Cactus Ridge, Margalla Hills National Park (N33°44.513', E073°03.252', 679 m), 21 October, 2016, K. H. Jaffry; 5 females, 15 juveniles, Trail 2, Margalla Hills National Park (N33°73.477', E073°05.456', 367 m), 22 October, 2017, K. H. Jaffry; 20 females, PirSohawa road, Margalla Hills National Park (N33°44.359', E073°02.938', 630 m), 22 October, 2017, K. H. Jaffry; 5 males, 25 females, PirSohawa road, Margalla Hills

National Park (N33°44.063', E073°03.291', 375 m), 20 September, 2020, K. H. Jaffry.

Comments

Epigynal scape with pronounced border, constricted at the middle, provided with pair of lateral lobes (Fig. 6C–G). Palp as in Fig. 7C–D. Widely distributed in Africa, Australia, Caucasus (Georgia, Russia), China to Indonesia, Cyprus, India, Iran, Israel, Japan, Korea, Pacific Islands, Philippines, Republic of Seychelles and Taiwan. Commonly known in Pakistan (Mukhtar, 2012). New record for Islamabad.



A



B

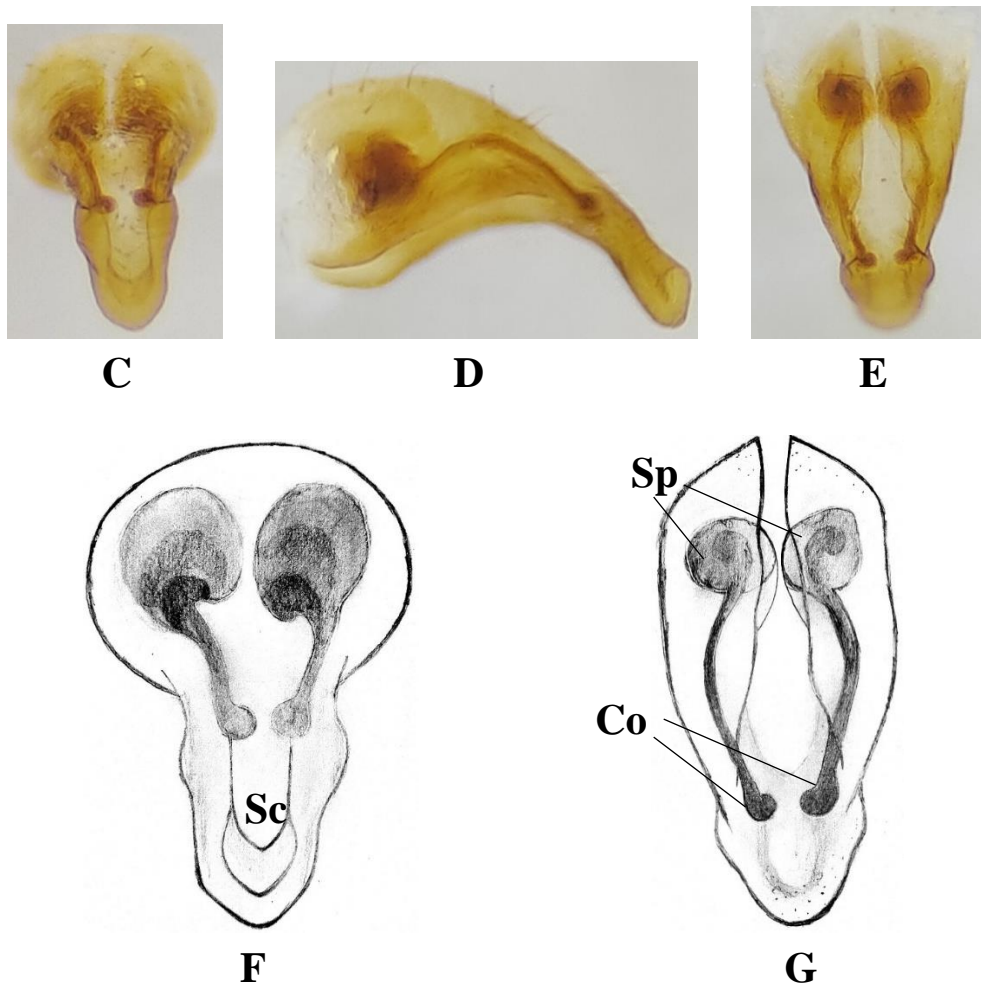


Fig. 6. *Neosconatheisi* (PUZ-MHNP-1473) Female. A–B, Habitus (A, dorsal; B, ventral); C–G, Female genitalia (C, epigynum; D, lateral view epigynum; E, internal genitalia; F, illustration epigynum; G, illustration internal genitalia). Co, Copulatory openings; Sc, Scapus; Sp, Spermatheca.

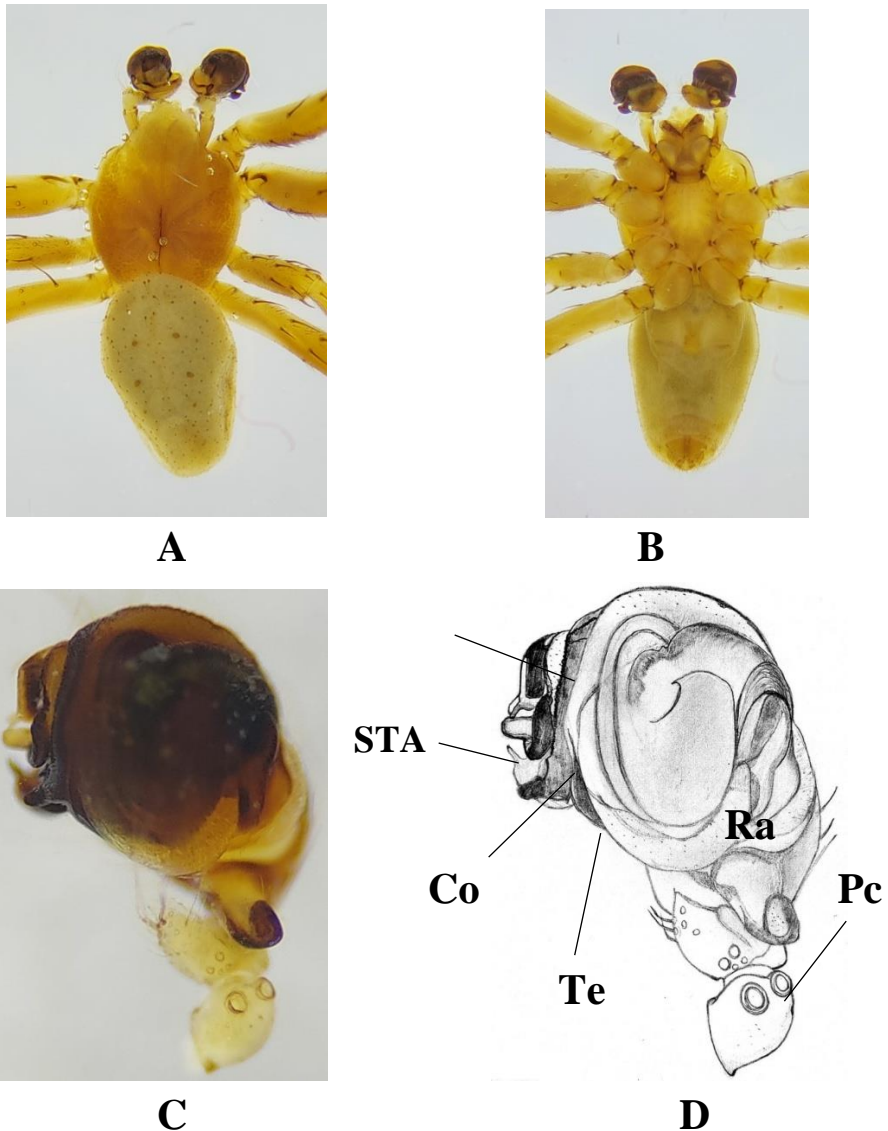


Fig. 7. *Neosconatheisi* (PUZ-MHNP-1477) Male. A–B, Habitus (A, dorsal; B, ventral); C–D, Palp (C, retrolateral view; D, illustration retrolateral view). Co, Conductor; Pc, Paracymbium; Ra, Radix; STA, Sub-Terminal Apophysis; TA, Terminal Apophysis; Te, Tegulum.

Genus *Neoscona* Simon 1864

Neosconavigilans

(Blackwall 1865)

(Figs. 8A–G, 9A–D)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1588–1650): 3 females, 6 juveniles, Shakarparian Hills, Margalla Hills National Park (N33°41.626', E073°04.346', 555 m), 22 July, 2016, K. H. Jaffry; 5 males, 7 juveniles, Trail 2, Margalla Hills National Park

(N33°44.079', E073°03.277', 364 m), 23 July, 2016, K. H. Jaffry; 1 female, 8 juveniles, Trail 2, Margalla Hills National Park (N33°44.313', E073°03.383', 369 m), 23 July, 2016, K. H. Jaffry; 3 males, 2 juveniles, TillaCharouni, Margalla Hills National Park (N33°47.365', E073°07.472', 1354 m), 15 April, 2017, K. H. Jaffry; 11 juveniles, TillaCharouni, Margalla Hills National Park (N33°47.236', E073°06.978', 1219 m), 15 April, 2017, K. H. Jaffry; 5 females, 2 juveniles, PirSohawa road, Margalla Hills National Park (N33°47.019', E073°05.511', 1200 m), 15 April, 2017,

K. H. Jaffry; 10 females, PirSohawa road, Margalla Hills National Park (N33°44.517', E073°02.862', 641 m), 22 October, 2017, K. H. Jaffry.

Comments

Epigynal scape pointed, constricted at the bending, with prominent horn like lateral lobes (Fig. 8C–G). Palp as in Fig. 9C–D. Known from Africa and Asia (except Russia). Reported previously from within Pakistan from Karachi, Sindh by Simon (1884), Peshawar, Khyber Pakhtunkhwa (KPK) by Arshad et al. (1984) and Layyah, Punjab by Mukhtar (2012). New record for Islamabad.



A



B

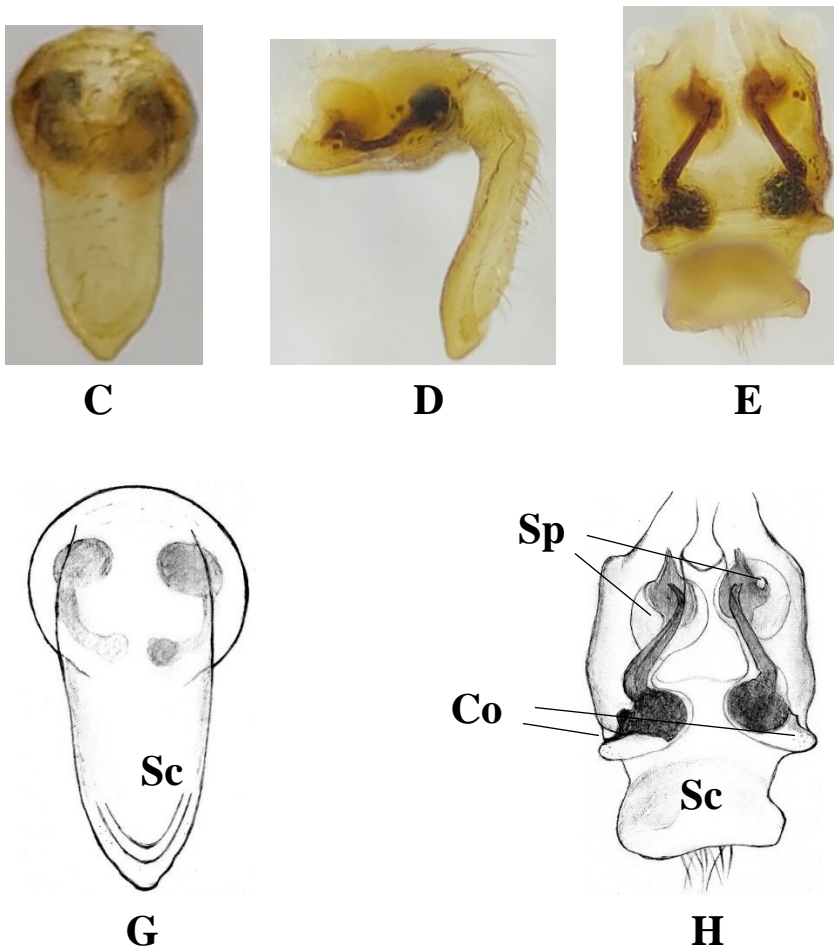


Fig. 8. *Neosconavigilans* (PUZ-MHNP-1588) Female. A–B, Habitus (A, dorsal; B, ventral); C–G; Female genitalia (C, epigynum; D, lateral view epigynum; E, internal genitalia; F, illustration epigynum; G, illustration internal genitalia). Co, Copulatory openings; Sc, Scapus; Sp, Spermatheca.

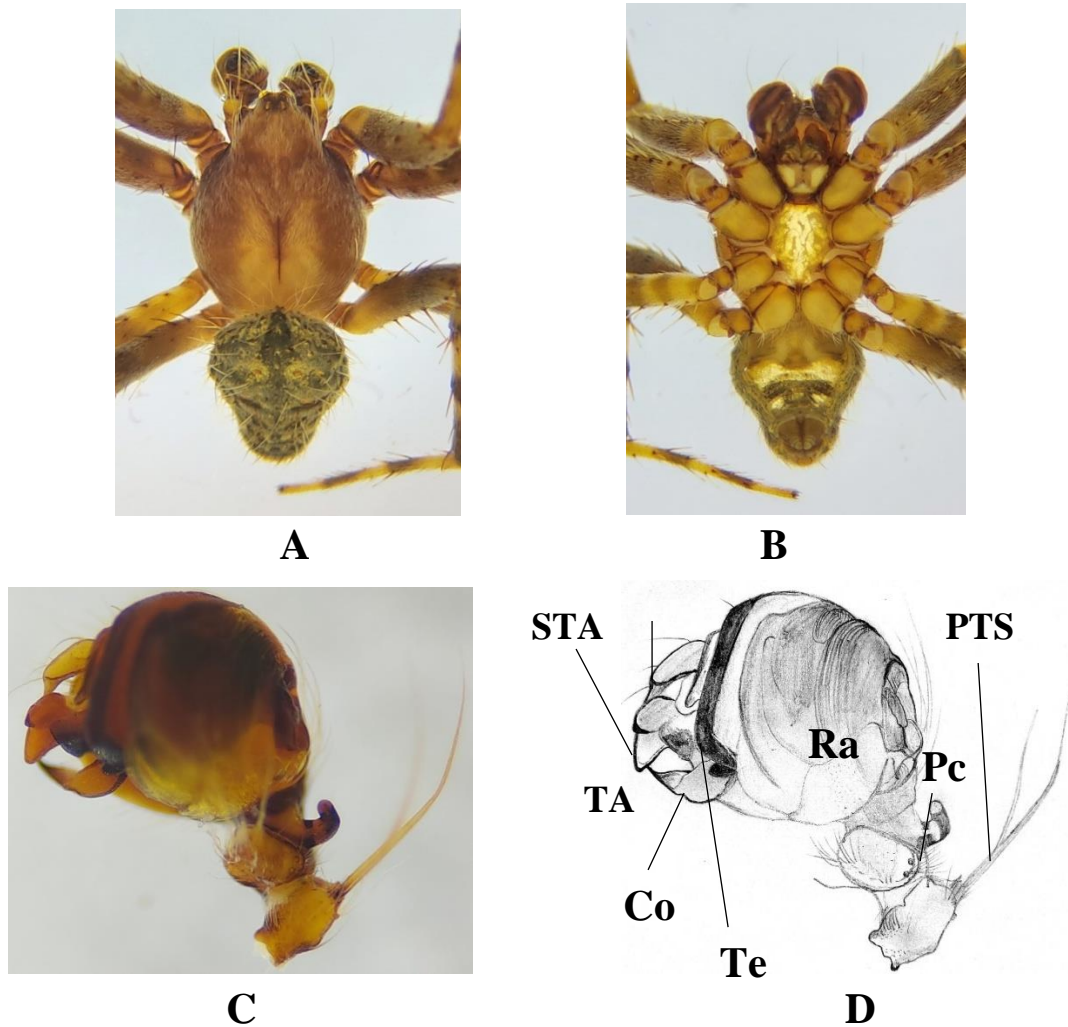


Fig. 9. *Neosconavigilans* (PUZ-MHNP-1592) Male. A–B, Habitus (A, dorsal; B, ventral); C–D, Palp (C, ventrolateral view; D, illustration ventrolateral view). Co, Conductor; Pc, Paracymbium; PTS, Paired Tibial Spines; Ra, Radix; STA, Sub-Terminal Apophysis; TA, Terminal Apophysis; Te, Tegulum.

Genus *Nephila* Leach 1815

Nephilapilipes

(Fabricius 1793)

(Figs. 10A–G, 11A–E, 12A–D)

Material examined (PAKISTAN: Islamabad).

(PUZ-MHNP-1651–1684): 8 females, PirSohawa road, Margalla Hills

National Park (N33°45.168',

E073°03.401', 981 m), 22 October,

2016, K. H. Jaffry; 9 females, 1

juvenile, Trail 2, Margalla Hills

National Park (N33°44.091',

E073°03.296', 369 m), 10 September,

2020, K. H. Jaffry; 5 females, 3

juveniles, PirSohawa road, Margalla

Hills National Park (N33°44.063', E073°03.291', 369 m), 10 September, 2020, K. H. Jaffry; 3 males, 5 females, Off PirSohawa road, Margalla Hills National Park (N33°43.922', E073°03.414', 354 m), 13 September, 2020, K. H. Jaffry.

Comments

Nephilapilipes was observed at the MHNP from April to October. They were observed breeding around September at which time they were in greater numbers. They are diurnal and both male and female spiders build webs in clearings between vegetation and sit at the center of their web with their cephalic end pointed downwards. They exhibit pronounced sexual dimorphism with the females being disproportionately larger than the males and while the males are a uniform deep orange in color [Fig. 12 A, B (color lightened in alcohol)], the females exhibit golden (Fig. 10A) or silver (Fig. 11A) pubescence on the cephalothorax and a patterned abdomen with a black background. During breeding season, multiple males are found in the web of a single female. It was observed that each of the males attempted mating with the female and the female would resist advances from each of them with a nudge from its third or fourth leg once the palp made extended contact with the

epigynum (opportunistic mating?). It is known that after a successful mating attempt by the male, its palpal embolus breaks and plugs the copulatory opening of the female, reaching deep inside the spermatheca (Figs. 10E, 11C–E) and making it impossible for the other suitors to contribute their sperm. Kuntner et al. (2009) have provided some interesting reasons for these observations in terms of an intersexual arms race. They remark that nephilid females respond to selection pressures promoting fitness through fecundity and therefore these females favor polyandry and giantism. In such a scenario, the males attempt to monopolize females through monogamy via opportunistic mating, emasculation through genital mutilation to plug the females, etc. Basically, since the female wants to mate with as many males as she can, a particular male has to go to the extreme of genitalic mutilation to ensure its fitness. This nullifies future prospects of reproduction of the males but ensures paternity protection from a successful mating effort (Fromhage & Schneider, 2006). Epigyne with transverse concave groove overhung by a distinct ridge which is heavily sclerotized. Spermathecae are large, globular, with dislodged palpal emboli in mated females (Figs. 10C–G, 11C–E). Palp

with a very long conductor and embolus (Fig. 12C, D). Widely distributed in Australia, Cambodia, China, India, Japan, Mexico, New Guinea, North America, Vietnam and Philippines. First

reported recently from within Pakistan from Charsadda, Khyber Pakhtunkhwa by Nooreen et al. 2022. New record for Islamabad.

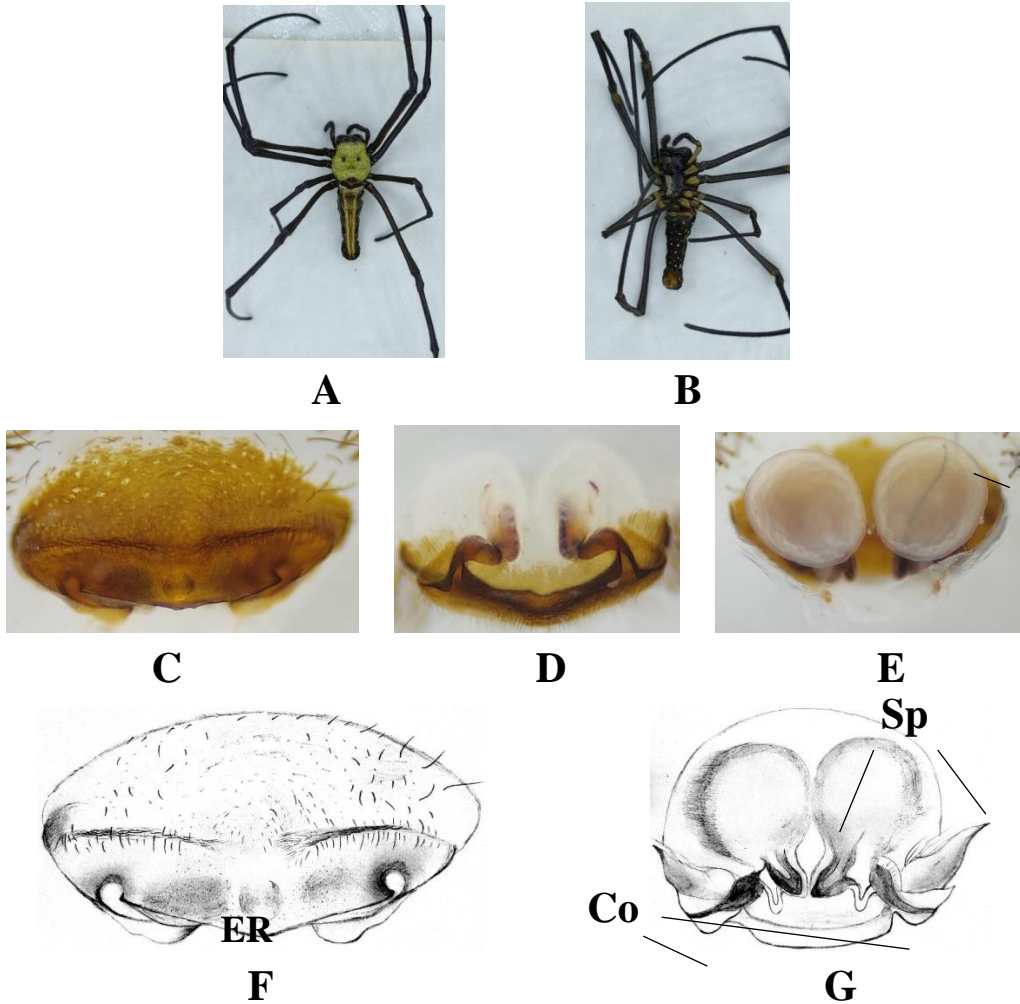


Fig. 10. *Nephilapilipes*(PUZ-MHNP-1655) Female. A–B, Habitus (A, dorsal; B, ventral); C–G, Female genitalia (C, epigynum; D, posterior view epigynum; E, internal genitalia; F, illustration epigynum; G, illustration internal genitalia. Co, Copulatory openings; DE, Dislodged Embolus; ER, Epigynal Ridge; Sp, Spermatheca.

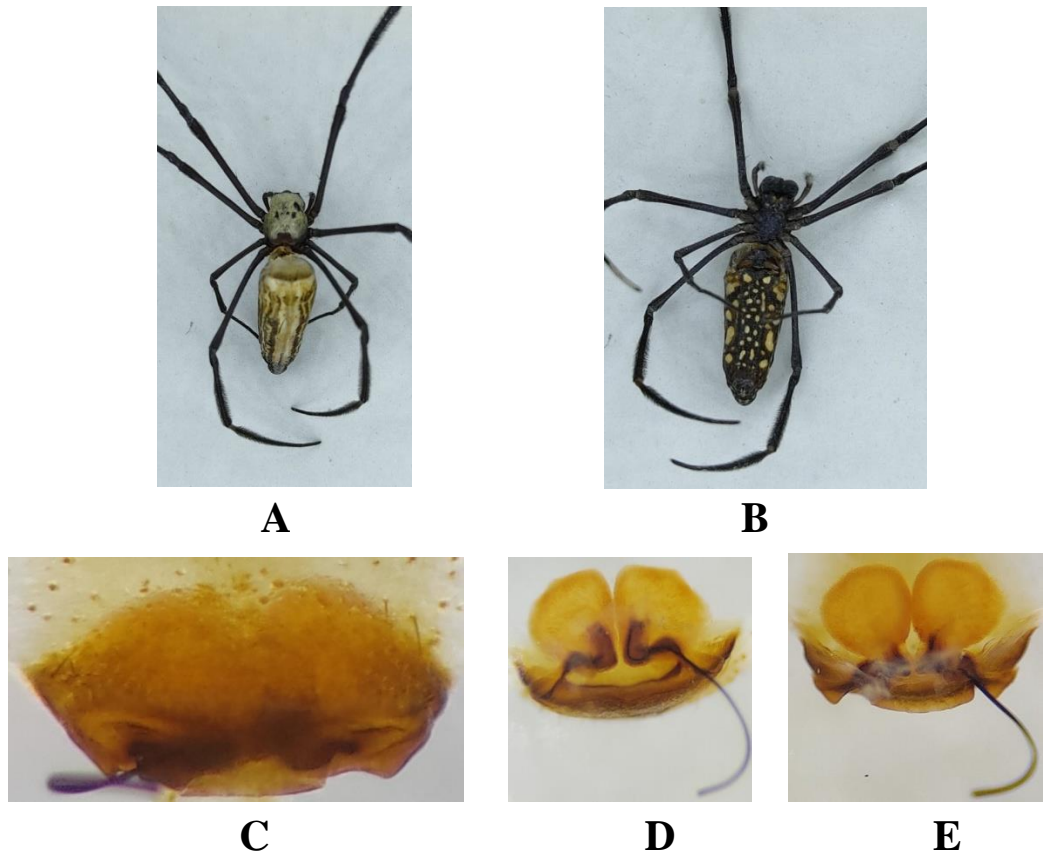
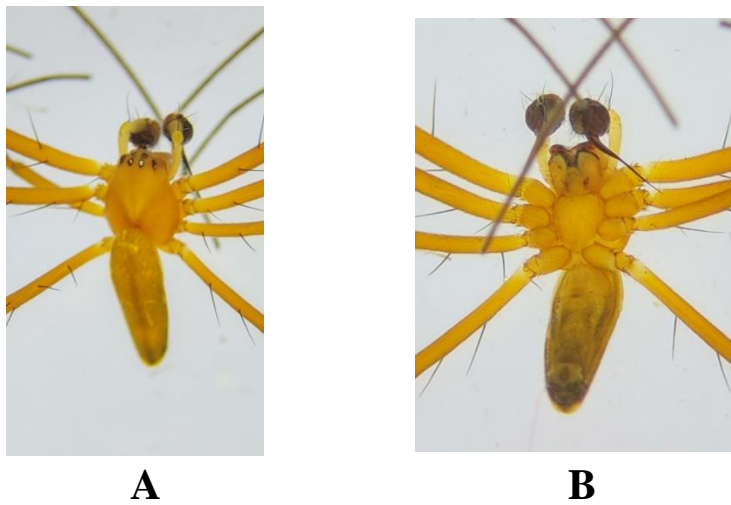


Fig. 11. *Nephilapilipes* (PUZ-MHNP-1681) Female. A–B, Habitus (A, dorsal; B, ventral); C–E, Female genitalia (C, epigynum; D, posterior view epigynum; E, internal genitalia). DE, Dislodged Embolus.



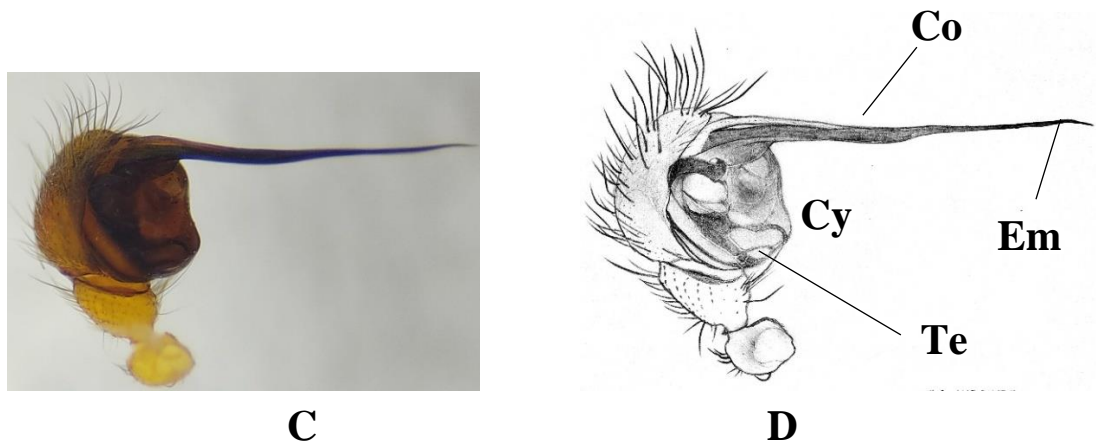


Fig. 12. *Nephilapilipes* (PUZ-MHNP-1683) Male. A–B, Habitus (A, dorsal; B, ventral); C–D, Palp (C, retrolateral view; D, illustration retrolateral view). Co, Conductor; Cy, Cymbium; Em, Embolus; Te, Tegulum.

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