



Revision of Spiders From The Genus *Cyclosa* (Araneae: Araneidae) With Description of Three New Species and The First Record of Male of *C. Conica* and *C. Purnai* From India

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ABSTRACT

Six species of spiders of the genus *Cyclosa* Menge, 1866, collected from different habitat of Akola district i.e. from agroecosystem, garden ecosystem and riverine ecosystem are described. They are as follows: *Cyclosa simoni* Tikader, 1982, *C. conica* Pallas, 1772, *C. hexatuberculata* Tikader, 1982, *C. spirifera* Simon, 1889, *C. moonduensis* Tikader, 1963, *C. purnai* Keswani 2012, and male of *C. conica*, *C. hexatuberculata*, *C. purnai* among them three new species are *C. simoni*, *C. conica*, and *C. hexatuberculata*. Male of *C. moonduensis* Tikader, 1963 is reported for the first time from India.

Introduction

Araneidae is orb weaver spider. Araneidae includes 28 genera from Indian sub-continent (Keswani et al 2012). 170 species of *Cyclosa* were reported from the different corners of the world among them 17 species were recorded in India (Keswani et al 2012). *Cyclosa* is one of the genus which is known for its stabilimenta and decorative line of debris on their webs to attract the prey (Craig & Bernard 1990). In the orb web at the center there are decorative white debris are arranged in linear or circular stabilimenta and at the middle portion the *Cyclosa* species get settle for capturing its prey. The characteristic feature of genus *Cyclosa* is spherical pointed abdomen, elongated behind spinnerets into tail, dorsally two spiny elongated projections are present. Narrow head with posterior median eyes are adjacent. Cephalothorax of *cyclosa* usually with anteriorly narrow cephalic region, and distinctly separated from thoracic region by an oblique groove. Eyes are set in two rows, ocular quadrangle forming trapezium, much narrower behind than in front, posterior median eyes very close, laterals close and situated on conspicuous tubercles, rows of both eyes recurved. The first pair of legs is longer than the others. The abdomen of *cyclosa* has a distinct caudal..... Total body length is about between ---- to 12mm. Taxonomical study help to identification of spider such study yet not available in this region so that present little attempt were made on taxonomical study on araneidae spider *cyclosa* in Akola district. Geographical features of Akola district are at latitude 20.7° North and longitude 77.07° East. Six species of *Cyclosa* were recorded from different habitat of this region such as *Cyclosa simoni*, *Cyclosa conica*, *Cyclosa hexatuberculata*, *Cyclosa spirifera*, *Cyclosa moonduensis*, *Cyclosa*

purnai and male of three species i.e., *C. conica*, *C. hexatuberculata*, *C. purnai* morphological study of this species are described in this paper.

Keys to identify the species:

1. Abdominal anteromedian hump inconspicuous, lateral humps small; epigynal scape without any constriction, basally broad; thoracic radii distinct..... ***simoni*** Tikader
2. Abdomen blackish brown with silvery different patches a pair of mid dorsal tubercle and a pair of posterolateral tubercle and abdomen ends with a small hump..... ***Conica***
3. Abdominal anteromedian hump large and distinct, lateral humps 2 pairs, very prominent ***hexatuberculata*** Tikader
- Abdominal anteromedian hump small or inconspicuous, lateral humps
4. Abdominal anteromedian hump small, bent upward, lateral humps large, prominent; epigynal scape with a median constriction; thoracic radii absent..... ***spirifera*** Simon
5. Abdomen is completely black with silvery yellow patches at the middle dorsally, 2 parallel lateral lines a pair of lateroventral tubercle, abdomen curved upward at posterior end with partially bifurcation..... ***moonduensis***
- 6..... ***Purnai***

Material and Methods:

Spider specimens were collected from the various places from the Akola district such as agriculture field, roadside bushes and garden. By the method of visual search, and hand picking, female of the *Cyclosa simoni*, *Cyclosa conica*, *Cyclosa hexatuberculata*, *Cyclosa spirifera*, *Cyclosa moonduensis*, *Cyclosa purnai* and male of the *Cyclosa conica*, *Cyclosa hexatuberculata* and *Cyclosa purnai* were collected in the present study. Collected specimen bring in the laboratory and photographed in different views i.e. dorsal, lateral and ventral view of every

specimen by using Carl Zeiss stereozoom microscope and then preserved in 70% ethanol. Measurements of body parts were done with help of software, the male and female genitalia was dissected and kept in 10% KOH for 1- 2 hrs. The genitalia was observed and snapped for the further identification. The collected specimen was identified by referring to the morphological descriptions and illustrations given by Tikader 1970 and Hebert Levi 2002.

Morphological study

Cyclosa bifida (Döleschall, 1859)

Female: Total body length 54.13 mm length of Cephalothorax 20.62 mm, length of abdomen 33.51 mm. Cephalothorax is blackish at anterior eye portion and yellow or yellowish patch on posterior cephalic region. The posterior cephalic region is much larger than the other *cyclosa* species. A shallow depression separate the cephalic region to thoracic region. The cephalic region is covered with silvery hairs. The ocular area is completely black in colour. Eight eyes are present in two rows. AME (anterior median) and PME (posterior median) can be seen very clearly because of its larger size as compare to ALE (anterior lateral) and PLE (posterior lateral). Pair of AME, PME and pair of ALE and PLE are equal in size. The lateral eyes are much closer. The chelicera are dark yellowish brown in colour bearing two rows of teeth promarginally four and retromarginally three teeth are present. Labium

and maxillae are blackish brown in colour. The sternum is wider at anterior side and get reduced upto posterior region which ends with elongated pointed or it takes heart shape. Sternum is completely black and bears the hairs. Legs moderately long only the third pair of leg is shorter, yellow with brownish black bands are present. Palps are blackish. Coxa and trochanter are blackish in colour, femora are partly light yellow and halfly dark blackish brown in colour. Patella is yellowish brown but only darken at the joint. Tibia, metatarsus and tarsus with light yellowish brown and light bands are present. Palpus does not having the bands. Silvery hairs and spines are present on the legs and palpus.

Abdomen

Dorsally the abdomen is blackish with silvery yellowish patches and at the mid-dorsal portion 'x' shaped silvery white patch can be seen. From anterior to posterior region the abdomen is cylindrical in shape ends with a hump. A pair of mid-ventrolaterally the blackish brown tubercles are present. ventrally at the anterior portion of abdomen the dark blackish brown external epigynum can be seen with bilobes. At the submid ventrally the blackish spinnerets followed a pair of blackish brown tubercles with some dots of silvery patch. The abdomen is looks pulled upward at the posterior end on tubercle.

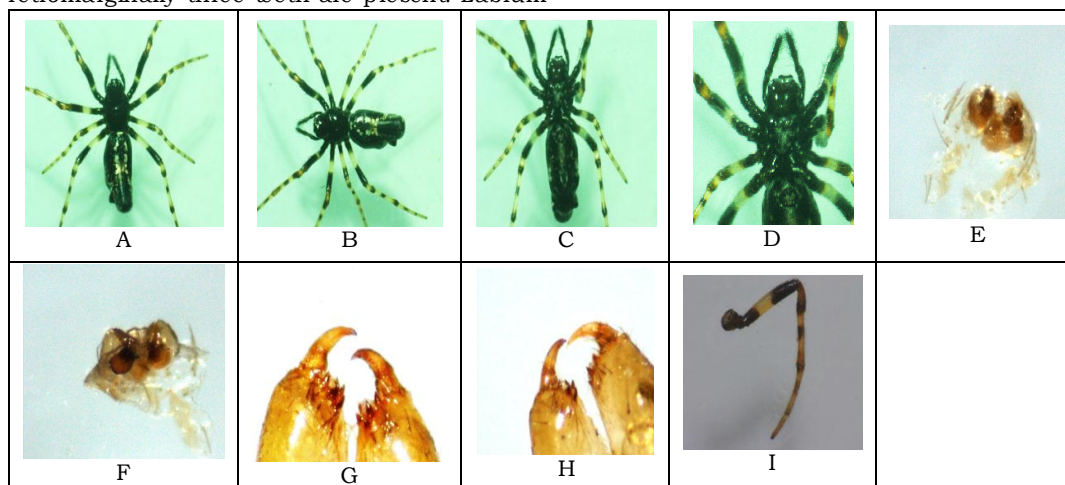


Plate no.1 *Cyclosa bifida* (Döleschall, 1859):A- Dorsal view, B- Lateral view, C- ventral view, D -View of labium, maxillae, sternum and external epigyne, E- dorsal view of epigyne, F- ventral view of epigyne after decolourisation, G, H- chelicerae with retromarginal and promarginal of teeth along with fangs , I- Leg pattern

Table 2. Measurement of body from dorsal and ventral side

Body parts	Dorsal				Body parts	Ventral			
	length	Width				Length	Width		
		anterior	middle	Posterior			Anterior	middle	Posterior
Ce phalothorax	20.62	3.74	16.07	10.06	Sternum	10.9	6.03	10.04	2.64
Abdome n	33.51	6.15	15.21	8.32	spinneret	2.61	6.69		
Total	54.13								

Measurements of legs and palp

Measurement of legs and palp shows that comparatively fourth pair of legs longer than the

other pair of legs length of all legs and third pair of legs is shortest in *Cyclosa simoni* (table 1). Palp is about 5.2mm in length.

Table1. : Measurement of legs and palp of *Cyclosa simoni* in mm

Parts of Leg	leg 1	leg 2	leg 3	leg 4	Palp
Coxa	0.8	0.9	0.4	0.8	0.3
Trochantor	0.4	0.3	0.1	0.6	0.2
Femur	4.2	3.7	2.7	4.3	1.3
Patella	1.4	1.5	0.9	1.2	0.6
Tibia	2.8	2.5	1.9	3.3	1.1
Metatarsus	2.6	2.4	1.7	2.7	1
Tarsus	1.4	1.4	1.2	1.3	0.7
Total	13.6	12.7	8.9	14.2	5.2

2. Cyclosa insulana

The colouration of the body is very attractive cephalic region is brownish in colour with yellow striations. The cephalic region is separated from thorax region by a pair of groove. The anterior side of cephalic region is dark brownish in colour and possess eight eyes. Both rows of eyes are recurved, especially the anterior one the median ocular area is widest anteriorly and is longer than wide. The median ocular area is widest anteriorly, Chelicera with 3 promarginal and 3 retromarginal teeth, clypus is narrow, sternum dark brown and possess the light coloured dots .Legs are light yellow with brown patella and dark on joints. Thick spines and silvery hairs are present on legs.

Abdomen

Opisthosoma is blackish median pattem with white or light yellow on yellow-cream background. Sides marked with grey-black patches. The underside of the opisthosoma is blackish, with a pair of very distinct light spots across the middle. At the mid dorsal, posterolateral a pair of dark coloured tubercle are present and posteriorly a hump is present. Dark brown bilobed epigynum covered with inverted ‘v’ shaped flap with light yellow colouration and hairs. Spinneret is brown coloured. Ventrally the opisthosoma is coloured with brownish yellow and silvery patches.

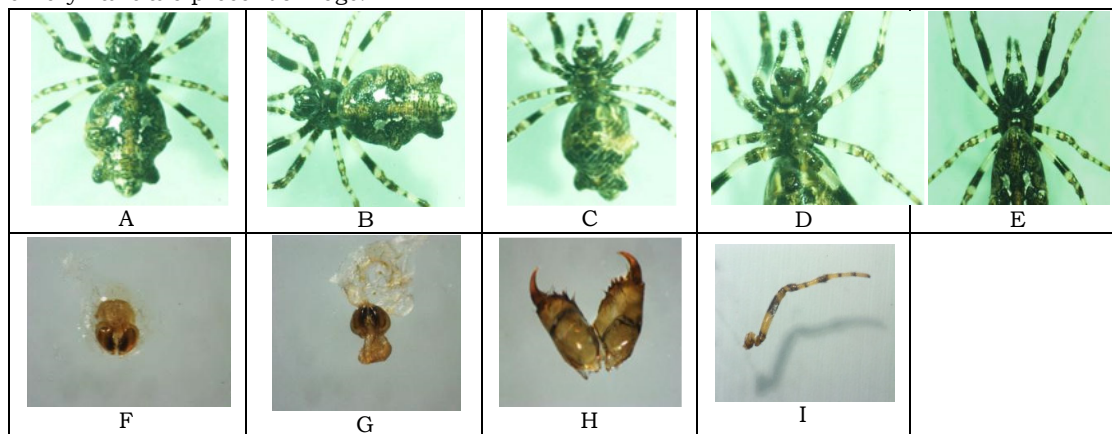


Plate no. 2 *Cyclosa insulana*: A-Dorsal view, B- Lateral view, C- ventral view, D -View of labium, maxillae, sternum and external epigyne, E- eye and palps ,F- dorsal view of epigyne, G- ventral view of epigyne after decolourisation, H- chelicerae I- Leg pattern .

Measurements of Legs

Column1	leg 1	leg 2	leg 3	leg 4	Palp
coxa	0.5	0.9	0.4	0.5	0.3
Trochanter	0.3	0.2	0.3	0.3	0.2
Femur	2.7	2.5	1.7	2.9	1.2
Patella	1	1	0.5	0.8	0.7
tibia	1.9	1.5	1.2	1.9	0.8
Me tarsus	1.8	1.6	1	1.8	0.8
Tarsus	0.8	0.8	0.6	0.8	0.4
Total	9	8.5	5.7	9	4.4

Dorsal view measurements				
	Length	Width		
		Anterior	Middle	Posterior
Cephalothorax	24.63	5.51	21.57	16.44
Abdomen	67.47	5.73	36.17	2.59
Total	92.1			

3. Cyclosa hexatuberculata

Cephalothorax is brownish at ocular region and it is separated by two semicircular lateral grooves. Yellow striations on cephalic region. Anteriorly narrow and posteriorly wider. The chelicera is yellowish brown. Labium and maxillae are light yellow in colour. The sternum is brownish yellow upto the coxa and trochanter. the sternum heart shape and it is narrow or pointed at posterior end, the whitish yellow spots near coxa of IInd and IIIrd leg. 1,2 and 4 leg have the same banding pattern with dark brown and light bands, while 3 leg has the light yellowish brown and white banding pattern with spines and silvery hairs. The female palpus are also having the light and dark yellow banding pattern covered with silvery hairs.

Abdomen

Dorsally abdomen is partly blackish brown anteriorly and halfly yellowish brown posteriorly and with longitudinal silvery white band which runs downward ends upto a tubercle. From the longitudinal silvery white band two lateral lines are arise which goes upto spinneret. The opisthosoma is wider in middle portion and posteriorly ends with a narrow tubercle. A pair of Mid-dorsolateral brown tubercle is present. Ventrally the abdomen is brownish and the tubercles are blackish in colour. The spinnerets are blackish brown. The books lungs are externally seen in whitish yellow colour and brown coloured epigynum which is covered with a flap like inverted tongue like process.

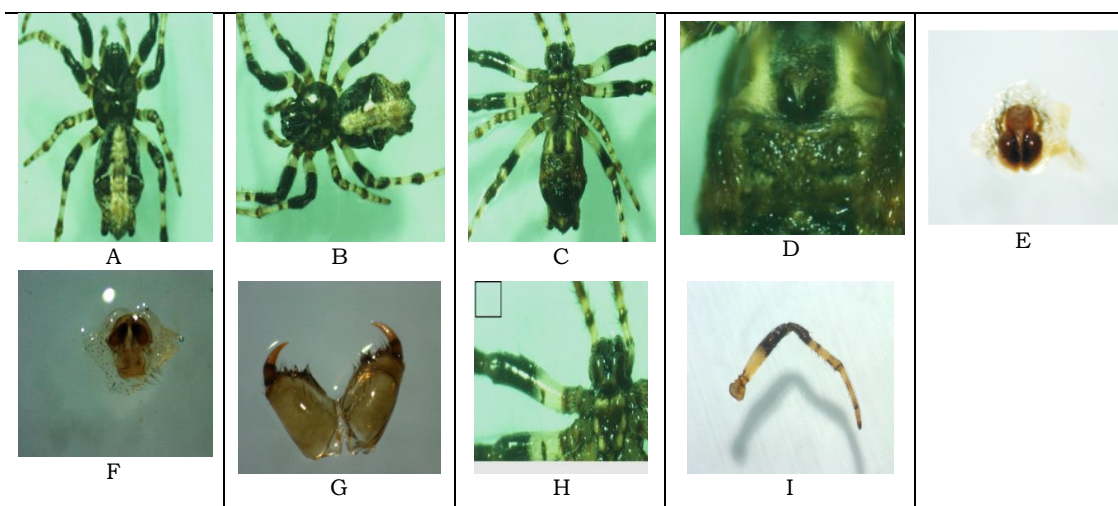


Plate No. 3 *Cyclosa hexatuberculata*: A-Dorsal view, B- Lateral view, C- ventral view, D- External view of epigyne, E- dorsal view of epigyne, F- ventral view of epigyne after decolourisation, G- chelicerae ,H- View of labium, maxillae, sternum, I- Leg pattern

Measurements of leg (in mm):

parts of leg	leg 1	leg 2	leg 3	leg 4	Palp
coxa	0.4	0.8	0.4	0.6	0.3
Trochanter	0.3	0.3	0.4	0.4	0.1
Femur	2.8	2.5	1.8	0.3	1.2
Patella	0.8	1	0.5	0.8	0.4
tibia	1.8	1.4	1	1.8	0.8
Metatarsus	1.8	1.6	0.9	1.8	0.8
Tarsus	0.8	0.8	0.6	0.8	0.4
Total	8.7	8.4	5.6	6.5	4

Body parts	Dorsal				Body parts	Ventral			
	length	Width				Length	Width		
		anterior	middle	Posterior			anterior	middle	Posterior
Cephalothorax	23.91	6.31	22.14	15.84	Sternum	15.72	9.605	11.98	2.34
Abdomen	69.17	80.8	37.02	3.15	spinneret	7.74	11.32		
Total	93.08								

4. Cyclosa spirifera

Female Cyclosa spirifera Simon, 1889

Female: Cephalothorax is blackish at anterior eye portion and yellow or yellowish patch on posterior cephalic region. The posterior cephalic region is much larger than the other *cyclosa* species. A shallow depression separate the cephalic region to thoracic region. The cephalic region is covered with silvery hairs. The ocular area is completely black in colour. Eight eyes are present in two rows. AME and PME can be seen very clearly because of its larger size as compare to ALE and PLE. Pair of AME and PME and pair of ALE and PLE are equal in size. The lateral eyes are much closer. The chelicera are dark yellowish brown in colour bearing two rows of teeth promarginally four and retromarginally three teeth are present. Labium and Maxillae are yellowish in colour. The sternum is wider at anterior side and get reduced upto posterior region which ends with elongated pointed or it takes heart shape. Sternum bears the yellow band at wider portion and four spots are present near the coxa of second and third leg. Legs moderately long only the third pair of leg is

shorter, yellow with brownish black bands are present. Leg formula 1423. Palps yellow with blackish brown bands, tibia and single clawed tarsus spinous. Coxa and trochanter are yellowish brown in colour, femora are partly light yellow and halfly dark blackish brown in colour. Patella is yellowish brown but, only darken at the joint. Tibia, metatarsus and tarsus are light yellowish brown in colour only darken at their joints. Palpus also having the banding pattern at their joints but the bands are lighter in colour. Silvery hairs and spines are present on the legs and palpus.

Abdomen

Dorsally abdomen is blackish brown with longitudinal silvery white and yellowish or silvery band which runs downward ends upto a tubercle. Anterior it is wider and posteriorly ends with a narrow tubercle. A pair of Mid- dorsolateral blackish brown tubercle is present. At the mid dorsal a silvery narrow bands from both sides are present. Ventrally the abdomen is brownish black with silvery yellowish or white patches and the tubercles are blackish in colour.

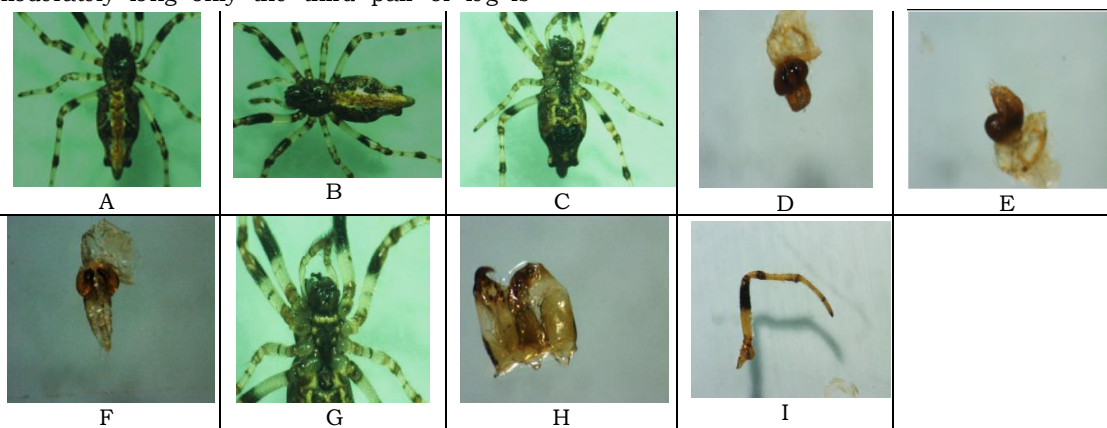


Plate no. 4 Female *Cyclosa spirifera*: A- Dorsal view ,B- Lateral view, C- ventral view, D- ventral view of epigyne, E- dorsal view of epigyne, F- ventral view of epigyne after decolourisation, G- View of labium, maxillae, sternum and external epigyne, H- chelicerae, I- Leg pattern

Parts of leg	leg 1	leg 2	leg 3	leg 4	palp
coxa	0.7	0.5	0.4	0.6	0.1
Trochanter	0.3	0.3	0.3	0.4	0.1
Femur	2.8	2.6	1.7	2.8	1.4
Patella	0.9	1	0.4	0.9	0.3
tibia	2	1.5	1.1	1.9	1.3
Metatarsus	1.8	1.6	1.1	1.7	0.7
Tarsus	0.8	0.8	0.6	0.8	0.1
Total	9.3	8.3	5.6	9.1	4

Body parts	Dorsal				Body parts	Ventral			
	length	Width				Length	Width		
		anterior	middle	Posterior			anterior	middle	Posterior
Cephalothorax	22.25	8.03	20.66	13.49	Sternum	13.59	8.2	10.31	2.34
Abdomen	46.98	6.98	24.96	3.73	Spinneret	3.98	6.09		
Total	69.23								

5. Cyclosa moonduensis Female

The cephalothorax is black in colour, anterior part at the eye region it is narrow and also can be distinguish with the thoracic region by a cephalic groove and black striations. Cephalic region is 'U' shaped at posterior part. AME and PME forms the trapezium shape at the middle in which the AME are bigger and bulging as compare to PME but close to each other a subequal size. ALE and PLE are much closer looks like the jointed. Eyes are black with shining. Sternum is dark brownish black in colour and bears the heart shape and covered with small hairs. Sternum is broader at the anterior side and pointed at posterior side. Labium and maxillae are blackish in colour and broad. Chelicerae brownish black with blackish brown promarginal and retromarginal teeth are present. Fangs are yellowish in colour. Coxa, Trochanter, femur and patella of leg Ist and IInd

pair are completely black. Tibia, metatarsus and tarsus are banded with whitish yellow colour. But in IIIrd and IVth pair banding starts from femur. The legs are having spines and also small hairs and tarsus ends with three claws. are present in the legs. Palps are blackish with small hairs and single clawed.

Abdomen is elongated cylinder in shape, blackish coloured with median longitudinal silvery six patches are present. A pair of posterolateral elongated spines and at the end of abdomen there is a biforked caudal hump is present, just above the subposterolateral humps there are two parallel silver bands nearer to the spinnerets. Spinnerets are ventrally at subposterior side and covered with small hairs. The epigyne is blackish brown, chitinized. Clearly two lobes are visible which are joined and forms the 'V' shape.

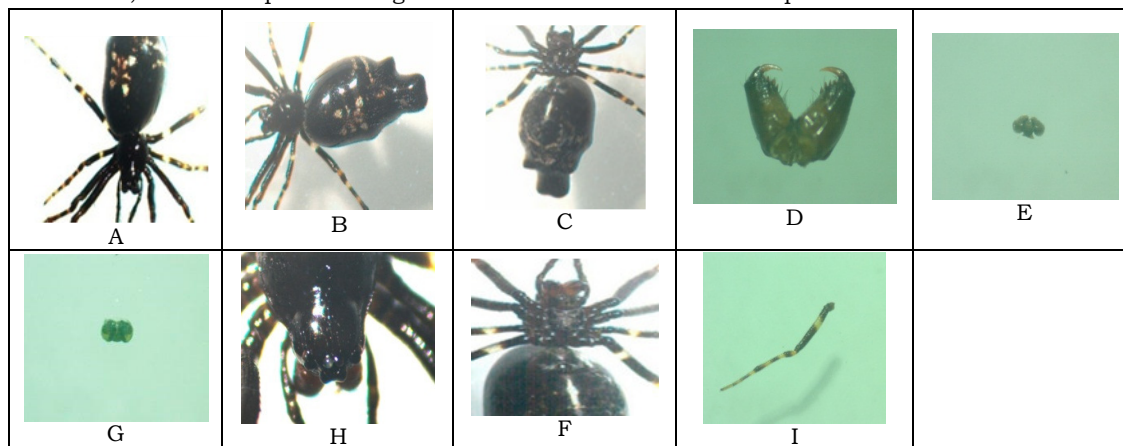


Plate No. 5 : *Cyclosa moonduensis*: A-Dorsal view ,B- Lateral view, C- ventral view, D- Chelicerae, E- dorsal view of epigyne, F- ventral view of epigyne, G- Eyes, H-View of labium, maxillae, sternum and external epigyne, I- Leg pattern

Parts of leg	leg 1	leg 2	leg 3	leg 4	palp
coxa	0.8	0.5	0.7	0.8	0.3
Trochanter	0.5	0.3	0.3	0.3	0.2
Femur	3.3	3	2.1	3.2	1.6
Patella	1.2	1	0.7	1	0.6
tibia	2.1	2	1.3	2.3	1.2
Metatarsus	1.9	1.7	1.2	2	0.9
Tarsus	1.1	1	0.8	1.1	0.4
Total	10.9	9.5	7.1	10.7	5.2

Body parts	Dorsal				Body parts	Ventral			
	Length	Width				Length	Width		
		Anterior	Middle	Posterior			anterior	middle	Posterior
Cephalothorax	23.01	9.48	22.76	13.69	Sternum	10.98	7.16	11.48	2.12
Abdomen	34.47	7.87	12.83	9.12	spinneret	4.96	6.89		
Total	57.48								

6. *Cyclosa purnai*

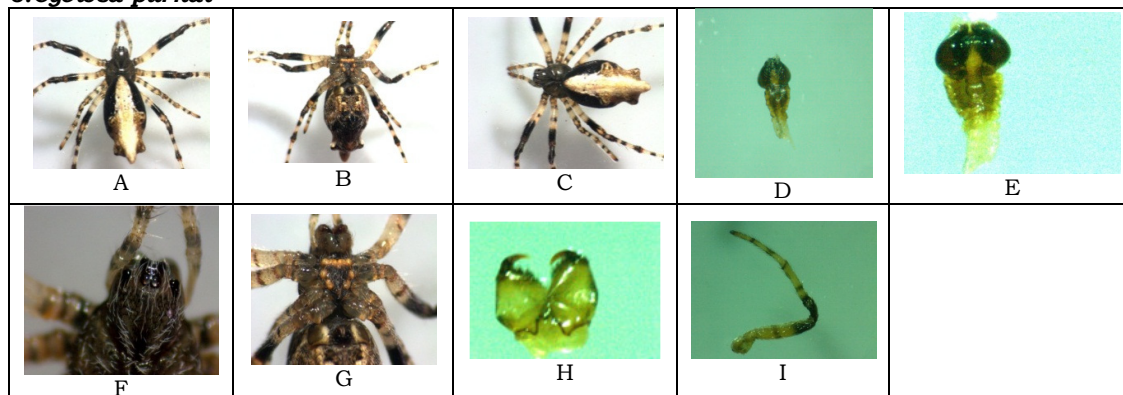


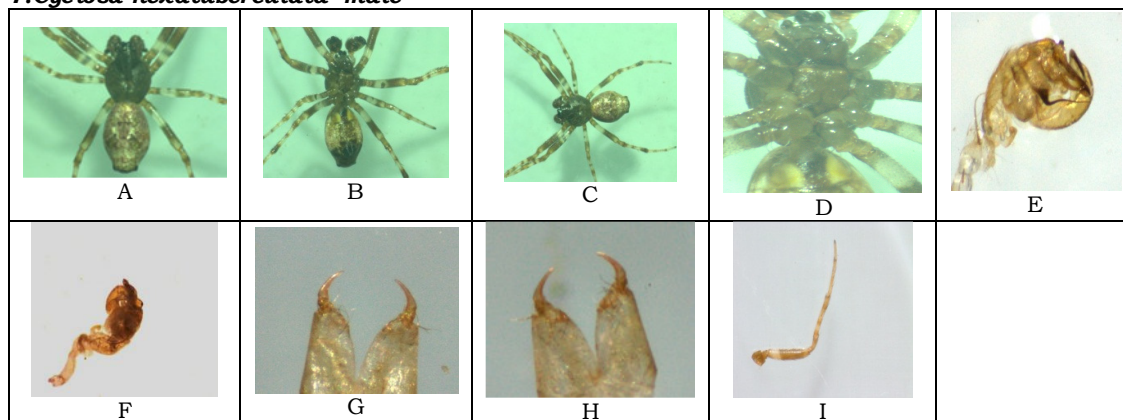
Plate no.6 *Cyclosa purnai*: A- Dorsal view, B- Ventral view, C- Lateral view, D- Dorsal view of epigyne, E- Ventral view of epigyne, F-Eye pattern, G- Labium, sternum, external epigyne, H- Chelicera, I- Banding pattern.

Measurement (in mm)

Parts of leg	leg 1	leg 2	leg 3	leg 4	Palp
coxa	2.2	1.7	1.6	1.9	1.1
Trochanter	1.5	1.3	0.5	0.8	0.6
Femur	8.4	7.3	5	7.8	2.4
Patella	3	2.4	1.8	2.6	1.6
tibia	5.7	5.2	3.1	5.6	1.8
Metatarsus	5.5	4.9	2.7	5.3	0.9
Tarsus	2.3	2.6	2	2.6	2.5
Total	28.6	25.4	16.7	26.6	10.9

Body parts	Dorsal				Body parts	Ventral			
	length	Width				Length	Width		
		Anterior	middle	Posterior			anterior	middle	Posterior
Cephalothorax	21.34	6.47	19.64	15.91	Sternum	10.79	7.73	8.21	1.87
Abdomen	50.49	4.3	27.26	3.73	spinneret	4.82	7.04		
Total	71.83								

7. *Cyclosa hexatuberculata male*

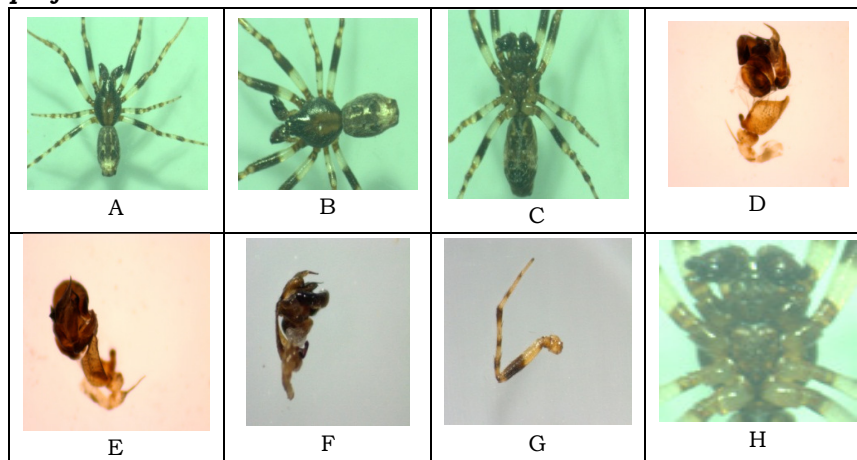


Parts of leg	leg 1	leg 2	leg 3	leg 4
coxa	0.62	0.54	0.5	0.71
Trochanter	0.23	0.23	0.33	0.29
Femur	2.6	2.2	2	2.3
Patella	0.87	0.87	0.75	0.76
tibia	1.9	1.5	1.4	1.7
Metatarsus	1.8	1.4	1.2	1.6
Tarsus	0.82	0.77	0.7	0.7
Total	8.84	7.51	6.88	8.06

Taaable :

Body parts	Dorsal				Body parts	Ventral			
	Length	Width				Length	Width		
		anterior	middle	Posterior			anterior	middle	Posterior
Cephalothorax	3.2	0.77	2.5	1.1	Sternum	1.19	0.53	0.98	0.5
Abdomen	3.9	1.1	2.5	1.3	spinneret	0.63	0.3	1	0.32
Total	7.1								

8. Cyclosa spirifera male

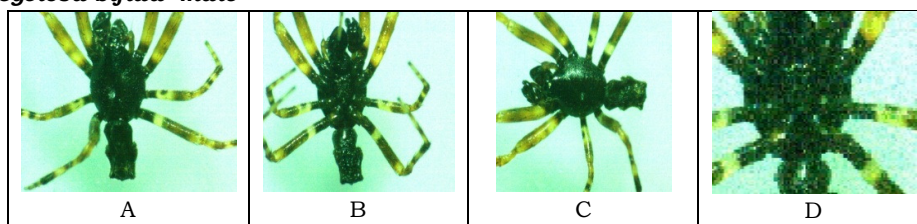


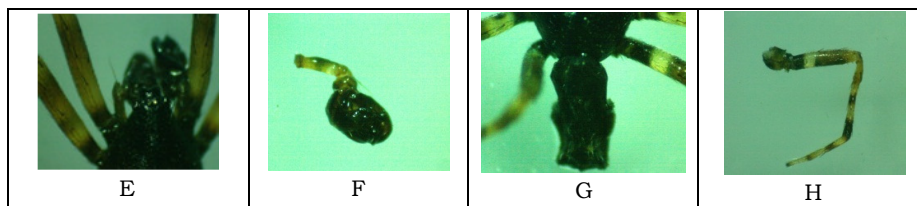
length of all legs

Column1	leg 1	leg 2	leg 3	leg 4
coxa	0.63	0.67	0.82	0.72
Trochanter	0.35	0.36	0.29	0.49
Femur	2.6	2.5	2.1	3
Patella	0.86	0.8	0.61	0.89
tibia	1.9	1.6	1.5	2.2
Metatarsus	1.6	1.3	0.82	1.9
Tarsus	0.79	0.7	0.76	1
Total	8.73	7.93	6.9	10.2

Body parts	Dorsal				Body parts	Ventral			
	Length	Width				Length	Width		
		anterior	middle	Posterior			anterior	middle	Posterior
Cephalothorax	2.3	0.61	1.7	0.6	Sternum				
Abdomen	2.4	0.8	1.3	0.6	spinneret				
Total	4.7								

9. Cyclosa bifida male





length of all legs				
Parts of Leg	leg 1	leg 2	leg 3	leg 4
coxa	0.3	0.27	0.16	0.26
Trochanter	0.36	0.29	0.22	0.27
Femur	3.9	3.6	2.1	3.8
Patella	1.4	1.4	0.6	1.1
tibia	3.1	2.8	1.6	2.8
Metatarsus	2.2	1.8	1.2	1.5
Tarsus	1.2	1.3	0.74	0.71
Total	12.46	11.46	6.62	10.44

Body parts	Dorsal				Body parts	Ventral			
	Length	Width				Length	width		
		anterior	middle	Posterior			anterior	middle	Posterior
Cephalothorax	4.4	1.8	3.3	1.2	Sternum	0.71	0.31	0.54	0.8
Abdomen	3.2	1.3	1.8	1.4	spinneret				
Total	7.6								

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