A NEW CAVE-DWELLING MYGALOMORPH SPIDER OF THE GENUS *PHLOGIELLUS* POCOCK, 1897 (ARANEAE: THERAPHOSIDAE: SELENOCOSMIINAE) FROM BURDEOS, POLILLO ISLAND, QUEZON PROVINCE, PHILIPPINES

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ABSTRACT

A new tarantula species of the genus *Phlogiellus* Pocock, 1897, *P. kwebaburdeos* n. sp. is described and illustrated based on a series of specimens collected inside the Puting Bato Cave 3-4 in Burdeos, Polilio Island, Quezon Province, Philippines. *P. kwebaburdeos* Barrion-Dupo, Barrion and Rasalan n. sp., a cave-dwelling mygalomorph spider represents the fifth and sixteenth species of *Phlogiellus* reported in the Philippines and in South- and Southeast Asia, respectively.

KEYWORDS: Araneae, cave-dwelling mygalomorph, Polillo Island, tarantula

INTRODUCTION

The tarantula spiders are medium to large-sized and long-lived hairy mygalomorphs common on deep burrows along village pathways (Smith, 1986 & 1990), roadside slopes and canals, and mountain trails. These spiders belong to the large family Theraphosidae represented by 11 subfamilies, 125 genera and 939 species worldwide (Jacobi, 2013) mostly inhabiting tropical and subtropical regions. Currently, Philippine- tarantulas comprise only 11 species (1.06% of the world's total) under two subfamilies, namely, Ornithoctoninae, *Cyriopagopus dromeus* (Chamberlin, 1917) and Selenocosmiinae, *Selenocosmia samarae* (Giltay,1935; Platnick, 2013); *Orphnaecus pellitus* Simon, 1892; *O. philippinus* (Schmidt, 1999); *Orphnaecus* sp.; *Phlogiellus baeri* (Simon, 1877); *P. bundokalbo* (Barrion & Litsinger, 1995); *P. insularis* (Simon, 1877); *P. mutus* (Giltay, 1935); and

Selenocosmia peerboomi (Schmidt, 1999). The 11th species from the Philippines, *Mygale mindanao* Walckenaer, 1847 is listed (Murphy & Murphy, 2000) but its status at the moment is not clear. These findings strongly connote that the Philippine fauna is clearly poorly studied and needs more intensive research to properly document the true nature of tarantula diversity in the country prior to its possible extinction triggered likely by habitat loss due to deforestation, slash-and-burn farming and other natural calamities.

Recently, while examining the spider collections of the National Research Council of the Philippines-funded research, "Understorey and Ground-dwelling Spider Diversity of Philippine Forest Ecosystems," we recognized the occurrence of an interesting species of tarantula new to the Philippine fauna and new to science. To make the name available, we describe the new species of *Phlogiellus* based on the 2012 and 2013 collected specimens from the walls and ground floor of Puting Bato Cave 3-4 of Burdeos, Polillo Island, Quezon Province, Philippines.

The genus *Phlogiellus* was described by Pocock (1897) based on type species *Phlogiellus atriceps* Pocock, 1897 by original designation from Java, Indonesia (Pocock, 1897; Murphy and Murphy, 2000; Platnick, 2013). To date, 15 species of *Phlogiellus* have been described throughout South- and Southeast Asia and New Britain (Table 1). Of these, only four species occur in the Philippines, namely, *P. baeri* (Simon, 1877) from Manila; *P. bundokalbo* (Barrion & Litsinger, 1995) from Siniloan, Laguna and Real, Quezon; *P. insularis* (Simon, 1877) from Luzon or Basilan; and *P. mutus* (Giltay, 1935) from Samar Island.

Table 1. Checklist and distribution records of all known *Phlogiellus* species reported in South-and Southeast Asia including New Britain.

Species	Distribution (Type locality)
1. *Phlogiellus aper* (Simon, 1891)	Java
2. *Phlogiellus atriceps* Pocock, 1897	Java
3. *Phlogiellus baeri* (Simon, 1877)	Philippines (Manila)
4. *Phlogiellus bicolor* Strand, 1911	New Britain
5. *Phlogiellus brevipes* (Thorell, 1897)	Myanmar
6. *Phlogiellus bundokalbo* (Barrion & Litsinger, 1995)	Philippines (Siniloan, Laguna & Real, Quezon)
7. *Phlogiellus inermis* (Ausserer, 1871)	Malaysia to Lombok Island
8. *Phlogiellus insularis* (Simon, 1877)	Philippines (Luzon or Basilan)

9. *Phlogiellus mutus* (Giltay, 1935)	Philippines (Samar Island)
11. *Phlogiellus ornatus* (Thorell, 1897)	Myanmar
12. *Phlogiellus subarmatus* (Thorell, 1891)	Nicobar Island
13. *Phlogiellus subinermis* (Giltay, 1934)	SE Asia
14. *Phlogiellus watasei* (Kishida, 1920)	Taiwan
15. *Phlogiellus xinping* (Zhu & Zhang, 2008)	China

MATERIALS AND METHODS

Field sampling. The tarantulas also known as bird-eating or baboon spiders were trapped by sweep net and vial tapping using wide-mouth polyethylene plastic caps on the walls and ground floor of Puting Bato Cave 3 and 4 in Burdeos, Polillo Island, Quezon Province, Philippines (N 14°55'8.5" E 121°59'55.9").

Preservation. All field collected specimens were preserved in 80% ethyl alcohol provided with complete labels and GPS data [Country, Island or Province, Town, Barangay; Habitat, Name of Collector, Method and Date of Collection) and collection numbers.

Examination of male pedipalp and female spermathecae. The male palpal bulb was separated from the cymbium for a closer examination of its shape and structure particularly the keel, curvature and tip of the embolus. In the female, the abdominal venter was cut along the epigastric fold up to the ventroapical margin and lifted slowly to separate it from the entire abdomen. The cut epigyne was cleared in clove oil for 4-6 hours and the spermathecae and shape of the seminal receptacles were examined and compared to the previously described taxa. All specimens were examined and measured using a Nikon stereomicroscope with a micrometer eyepiece. Photos were taken using a Panasonic Lumix digital camera mounted on the eyepiece of the microscope while grid method was used in illustrating the specimens.

Type depository and measurements. The type series are deposited in the UP Los Baños Museum of Natural History (UPLBMNH), Los Baños, Laguna, Philippines. All measurements are given in mm. Pedipalp measurements refer to total pedipalp length (TPL) of femur + patella + tibia + tarsus. Leg measurements are shown as total leg length (TLL) of femur + patella + tibia + metatarsus +tarsus and leg formula 4123 means the longest leg IV > leg I > leg II > leg III.

Abbreviations and Acronyms

AbH abdominal height
AbL abdominal length
AbW abdominal width
asl above sea level

AER anterior eye row
AME anterior median eye
ALE anterior lateral eye
BPBc Burdeos Puting Bato Cave
CH carapace height
CL carapace length
CTP cheliceral teeth on promargin
CW carapace width
NMM National Museum of the Philippines, Manila
NRCP National Research Council of the Philippines
PER Posterior eye row
PLE Posterior lateral eye
PLS Posterior lateral spinnerets
PME Posterior median eye
TL total length (carapace length + abdominal length) exclude chelicerae & spinnerets
TLL total leg length (femur, patella, tibia, metatarsus and tarsus)
TPL total pedipalp length (femur, patella, tibia and tarsus [cymbium]
UPLBMNH University of the Philippines Los Baños Museum of Natural History
♀♀ females
♂♂ males

TAXONOMY

Order Araneae
Family Theraphosidae Thorell, 1869
Subfamily Selenocosmiinae Simon, 1889d
Tribe Phlogiellini West, Nunn & Hogg, 2012
Genus *Phlogiellus* Pocock, 1897
Phlogiellus Pocock 1897: 595; Pocock 1900: 202; Raven 1985: 118; Platnick, 1997: 165, 2013; Murphy & Murphy 2000: 73-74.
Type species: *Phlogiellus atriceps* Pocock, 1897, by original designation.

Phlogiellus kwebaburdeos Barrion-Dupo, Barrion and Rasalan, new species (Figs. 1-3)

MALE HOLOTYPE, TL 32.00 CL 15.00, CW 12.50, CH 6.30. AbL 17.00, AbW 9.50, AbH 8.40 (Fig. 1A).

CARAPACE. Black, mat cover of short whitish yellow hairs dorsally, golden yellow to yellowish brown long hairs along anterior and lateral margins, 1.2x longer than wide. Cephalic area higher than thoracic area, all eight eyes in two rows housed in transversely oblongate tubercle with

relatively thick, long hairs in front of AME and midposterior PME area. Fovea deeply concave, 2x longer than AME diameter. Chelicerae porrect, moderately convex, hairy dorsally and retrolaterally except smooth dorso-basal area, and flat inner side. Chelicerae promargin bears 10 teeth, retromargin lined with orange red scopulae, and 47 intercheliceral pegs present between promarginal tooth (T7) and retromarginal rows. Fang strongly sickle-shaped, tip sharply pointed with poison-release opening thinly oblongate located subapicodorsally. Ventrobasal sclerotized plate of fang subrectangular with strongly rebordered lip-like anterior margin, transversely rugose median area and subbasal area bearing longitudinal fovea-like scar medially and dip pit sublaterally. Pedipalps dark grayish brown covered with longer and thinner hairs on tibia, bulb and embolus blackish brown, and cymbium with two lobes of dirty white to golden yellow scopulae. Maxillae reddish brown, 1.87x longer than wide, inner margins with orange scopulae and inner basolateral one-third bearing >300 cuspules. Mxillary lyra present, length 1.65, height 1.10 with three long and three short clavate paddle-shaped setae and > 250 spiniform setae. Labium (Figs. 1D, 2C) reddish brown except blackish brown basal one-fourth, 1.13x wider than long and with >280 cuspules line apical one-third. Sternolabial junction (Fig. 2C) or groove distinct and relatively wide. Sternum blackish brown (Fig. 1B), subanterior median area bearing two pale brown finely reticulated and interconnected concave marks with all three arms not reaching sternolabial groove. Four sigilla present, small anterior pair near lateral margins opposite coxa II and larger oblongate posterior inner pair opposite coxa III.

EYES. All eight eyes (Figs. 1, 2A-B) borne on dark brown, transverse tubercle with relatively long and erect hairs anterior of AME and thicker set of long and short hairs posterior of AME and between PME. Eyes dull to pale yellow except lustrous golden yellow PME. AER procurved and slightly longer than recurved PER. Eye diameter: AME (0.57) > ALE (0.39) > PLE (0.34) > PME (0.29); height vs diameter: ALE (0.63 x 0.39) > AME (0.57 x 0.57) > PLE (0.51 x 0.34) > PME (0.51 x 0.29). Eye separation: PME-PME (1.27) > AME-AME (0.29) > PME-ALE (0.17) > PLE-ALE (0.16) > AME-ALE (0.14) > PME-AME (0.11) > PME-PLE (0.07). Clypeus height wide, 1.35x AME diameter.

LEGS. Brownish grey relatively thick mat of long hairs. Longest dorsobasal hair in tibia I 2x longer than diameter of tibia I. Metatarsi and tarsi bearing thick scopulae midlongitudinally divided by at least 2-3 longitudinal rows of spines in metatarsus IV and 4-6 irregular rows in tarsus IV. Ventroapical tip of metatarsus IV has three strong spines, median spine sliding to hairless and finely reticulated ventrobasal area of tarsus. Ventral scopulae of tarsus IV transversely divided slightly above midlength. Tip of tarsus IV with three claws, each superior claw- with blunt tip and three minute ventrobasal tubercles. Leg formula 4123.

Figure 1. *Phlogiellus kwebaburdeos* n. sp., holotype male (BPBc 2112012-1). habitus, dorsal view (A); sternum (B); eyes, dorsal view (C); labium, ventral view (D); tegulum (bulb) and embolus (E and F); tip of embolus, close-up view (G).

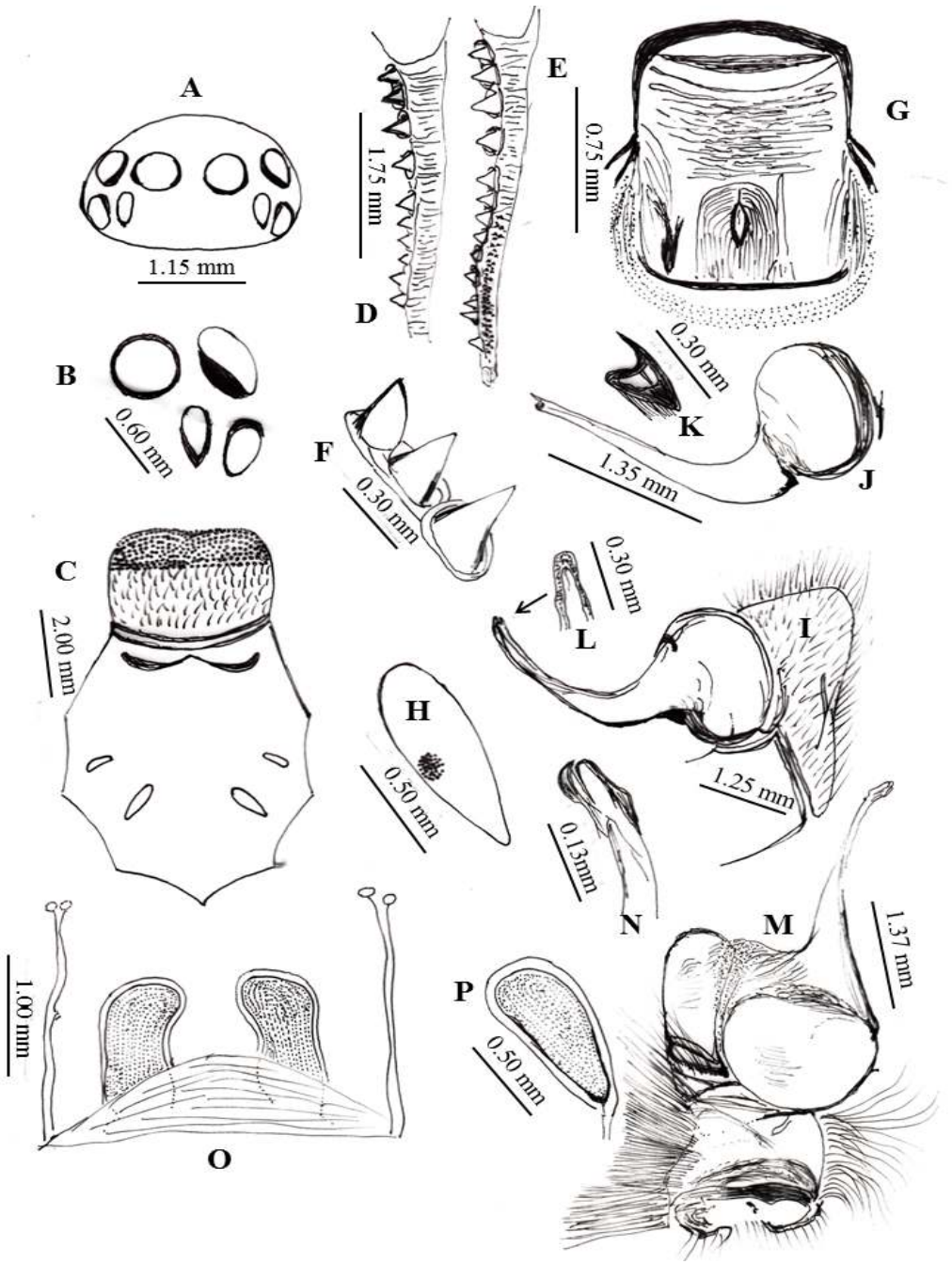

Figure 2. Line drawings of *Phlogiellus kwebaburdeos* n. sp., A-H, J,K,M,N. holotype male (BPBc 2112012-1). eyes, dorsal area (A); close-up of AME, ALE, PME & PLE (B); labium and sternum (C); promarginal teeth (D) with T1-T3 (F); paratype male with 13 teeth (BPBc 2112012-7) (E); ventrobasal plate of fang (G); sigillum with fine reticulation (H); paratype male (BPBc 2162013- 1) palpal organ prolateral view (I); tegulum (bulb) and embolus (J) and close-up of its tip (K); paratype male tip of embolus (L); ventrolateral view of detached palpal organ (M) and its tip (N); spermathecae of paratype female (BPBc 2112012-2)(O) and top view of dorsal area of spermatheca (P).

Leg measurements (mm):

Leg No.	Leg Segments					Total
	Femur	Patella	Tibia	Metatarsus	Tarsus	
I	15.25	7.45	13.25	10.00	5.75	51.70
II	13.13	6.60	10.50	9.75	5.50	45.48
III	10.31	5.30	7.45	9.50	5.30	37.86
IV	14.00	6.40	11.60	13.88	6.38	52.26
Pedipalp	8.90	5.40	6.90	-	2.50	23.70

ABDOMEN. Oblongate, grayish brown and thickly hirsute dorsally, laterally and ventrally, 1.8x longer than wide. Ventrobasal area anterior of epigastric furrow bearing brown bell-shaped patch enclosed by two long brown longitudinal sigilla. Posterior lateral spinnerets red brownish gray, upcurved, segment III (3.35 mm) > segment I (2.95 mm) > segment II (2.10 mm). Segment I refers to basal segment while segment III is basal. Posterior lateral spinnerets barely 0.61x and 0.84x length of metatarsus IV and metatarsus I, respectively. Posterior median spinnerets spinnerets about one-half length of posterior spinneret segment III.

PALPAL ORGAN. Bulb globose (Figs. 1E-F, 2I-J), dark reddish brown exceptmembranous whitish yellow to yellow ventrobasal median area and small basoretrolateral tubercle present. Embolus relatively long (Fig. 2J), concave and partly twisted forming long midlength "triangular-like" tube, bearing flat bifurcate tip. Bulb length and embolus approximately 0.52x length of palpal tibia and 1.2x longer than tarsus. Male tibial spur on tibia 1, absent.

FEMALE PARATYPE. (Coll. no. 2112012-2) TL 39.50. CL 19.50, CW 15.00, CH 10.75. AbL 20.00, AbW 11.90, AbH 19.00. (see Table 3 for other female paratypes examined)

CARAPACE. Dark reddish brown covered with dense mat of dull whitish yellow hairs, 1.3x longer (CL) than wide (CW) and 1.26x wider than abdominal width (AbW). Cephalic area higher than thoracic area, all eight eyes on tubercle with hairs anterior and posterior of AME and between PME similar in pattern as male. Fovea deeply concave, 3.94x longer than AME diameter. Chelicerae as in male, parallel-sided, 8.0 long and 3.0 wide, frontally covered with strong setae dorsally and retrolaterally, prolaterally flat; sparsely lined with fine setae medially and long curved hairs along promarginal teeth area. Cheliceral promargin (Figure 2D) bearing 10 teeth with T1,smallest. Retromargin has thick orange red scopulae. Fang robustly black,sharply pointed tip, dorsobasal half with 12-16 transverse lines, dorsomedian base rough and file-like, ventrobasal plate longer than wide and strongly sclerotized as seen in male. Maxillae, labium and sternum similar to male except for a slightly wider sternum (7.70 long x 7.90 wide) and absence of double concave groove midposterior of labiosternal junction. Each sigillum of posterior pair

Figure 3. *Phlogiellus kwebaburdeos* n. sp., (Paratypes) in life. detail of nest made in cave crevice (A); color morphs among individuals (B,C,D); nesting female clutching egg case (E). Photos: AB Dupo and JB Rasalan

2.42x longer (1.45) than wide (0.60). Inner face of maxillae with central mat of golden yellow hairs, pointed spines, and six club-like setae (lyra) of similar sizes in transverse line.

EYES. All eight eyes located in transverse subglobose tubercle. AER slightly procurved and slightly longer than recurved PER. Eye height and diameter (mm): ALE (0.67 x 0.49) > AME (0.66 x 0.66) > PME (0.63 x 0.31) > PLE (0.60 x 0.40). ALE obliquely oblongate. PME ovoid, 2.03x longer than wide and narrowed posteriorly. Eye separation: PME-PME (1.51) > posterior AME-ALE (0.71) > AME-AME (0.41) > ALE-PME (0.40) > ALE=PLE (0.29) > anterior AME-ALE (0.26) > AME-PME (0.14) > PME-PLE (0.11). Clypeus height 1.26x AME diameter, its anteroclypeal margin lined with strong black porrect spines medially and converging brownish setae laterally.

LEGS. Strong, thickly hirsute and reddish brown with two longitudinal rows of bald dark reddish brown bands running from femora to tarsi but thinly separated by longitudinal row of long hairs dorsobasally and short hairs apicodorsally. Metatarsus III bearing single dorsal subapical median spine, metatarsus IV with two subapical laterodorsal and three ventroapical spines. Tarsus IV slightly broader than metatarsus IV, ventral scopulae divided by irregular number of spines in longitudinal rows and ventrobasal one-fifth with oblongately bald groove. Leg segments clothed with short brown and long golden yellow hairs. Longest dorsal hairs on tibiae and metatarsi about 1.45-2x and 2.6-2.9x as long as leg segment diameter, respectively. Leg formula 1423.

Leg measurements (mm):

Leg No.	**Leg Segments**					**Total**
	Femur	Patella	Tibia	Metatarsus	Tarsus	
I	15.00	9.38	12.19	9.25	6.56	52.88
II	13.00	7.50	9.87	8.75	5.75	44.87
III	11.25	6.75	7.31	9.06	5.00	39.37
IV	14.37	7.12	11.37	13.12	6.50	52.48
Pedipalp	10.25	6.60	7.31	-	6.87	31.03

ABDOMEN. Elongate and brownish gray, darker toward spinnerets, with broad yellow brown patch medially, 1.68x longer than wide with subtruncated posterior end. Venter grayish brown with very long upwardly projected posterior pair of posterior lateral spinnerets and posterior median spinnerets Basal segment I of posterior pair of spinnerets slightly shorter than distal segment III (3.60 vs 3.70) and segment III 1.85x longer than segment II. Posterior lateral spinnerets as long as metatarsus I and approximately 0.7x the length of metatarsus IV. Anterior spinnerets about as long as segment II posterior spinnerets.

SPERMATHECAE. "Feet-like" (Figure 2O-P), 2.03x longer than wide (1.85: 0.91) with concave midinner margins and converging rounded apical ends. Tips of spermathecae bean-shaped dorsally separated from each other by about 0.94x spermathecal diameter.

Table 2. Variations observed in six males of *Phlogiellus kwebaburdeos* n. sp. based on body size, carapace, abdomen, general color, and number of promarginal teeth in the chelicerae.

Paratype ♂♂ (coll. no.)	Character dimensions (mm) & other features					
	TL	CL	CW	AbL	AbW	Other features
BPBc2112012-4	29.00	14.00	12.12	15.00	8.50	TL < TL holotype
BPBc2112012-5	23.00	12.60	10.50	14.12	8.13	TL < TL holotype; midventral base of bulb yellowish white
BPBc2112012-7	31.00	15.00	13.13	16.00	8.60	CTP= 13 teeth; abdomen oblongate, reddish brown with black posterior one-third
BPBc2112012-12	31.50	14.00	11.87	17.50	10.40	Cephalic area dark reddish brown & thoracic area reddish brown; abdomen brownish yellow
BPBc2112012-13	33.37	17.12	13.87	16.25	9.00	Carapace black with a mat of short whitish yellow hairs; abdomen brown with long brownish yellow hairs
BPBc2162013-1	30.90	16.70	13.00	16.20	10.20	Carapace blackish brown; abdomen brown
Range	23.00-33.37	12.60-17.12	10.50-13.87	14.12-17.50	8.13-10.40	
Mean ± SE	29.79±3.29	14.90±1.58	12.41±1.08	15.85±1.06	9.14±0.86	

Table 3. Variations observed in six females of *Phlogiellus kwebaburdeos* n. sp. based on body size, carapace, abdomen, general color, number of promarginal teeth in the chelicerae, and spines in metatarsi III & IV.

Paratype ♀♀ (coll. no.)	**Character dimensions (mm) & other features**					
	TL	CL	CW	AbL	AbW	Other features
BPBc2112012-2	39.50	19.50	15.00	20.00	11.90	Abdomen has a yellow patch medially; meta IV 1.4x longer than PLS; CW>AbW
BPBc2112012-3	32.00	14.00	11.20	17.50	11.12	CW slightly wider than AbW
BPBc2112012-9	30.60	12.60	10.10	18.00	10.50	Promargin has 12 teeth
BPBc2112012-10	28.12	13.50	11.20	14.62	9.25	Subglobose abdomen yellow medially and posterior one-third black; metatarsi III & IV each with two anterodorsal & two anteroventral spines
BPBc2112012-11	33.50	15.00	12.25	18.00	9.90	Carapace yellow brown; anterior margin of abdomen whitish and "neck-like" & lower than rest of abdomen; promargin has 13 teeth
BPBc2112012-14	34.00	16.50	14.00	17.50	10.50	Abdomen blackish brown with a rectangular dorsomedian yellow spot
Range	28.12-39.50	12.60-19.50	10.10-15.00	14.62-20.00	9.25-11.90	
Mean ± SE	32.95±3.51	15.18±2.28	12.29±1.70	17.60±1.58	10.53±0.84	

MATERIAL EXAMINED. Holotype male (UPLBMNH ARA-00537), PHILIPPINES, Polillo Island, Burdeos, Puting Bato Cave 3 & 4, 02 November 2012, Joseph B. Rasalan; paratypes: 7 females (UPLBMNH ARA-00538, UPLBMNH ARA-00539, UPLBMNH ARA-00540, UPLBMNH ARA-00541, UPLBMNH ARA-00542, UPLBMNH ARA-00543,UPLBMNH ARA-00544) and 5 males (coll. no.UPLBMNH ARA-00545, UPLBMNH ARA-00546, UPLBMNH ARA-0547, UPLBMNH ARA-00548, UPLBMNH ARA-00549 and two immatures (UPLBMNH ARA-00550), same data as holotype and 1 paratype male (UPLBMNH ARA-00551), same type locality, 16 February 2013, Joseph B. Rasalan.

ETYMOLOGY. The specific epithet *kwebaburdeos* is derived from the combination of habitat (cave = kweba in Tagalog) + type-locality (Burdeos).
REMARKS. Tables 2 & 3 show the variations in body size (TL), color (Figure 3A-D), carapace (CL & CW), abdomen (AbL & AbW) and the number and sizes of promarginal teeth in the chelicerae. The number of intercheliceral teeth also varies in both sexes.

DIAGNOSIS. The new species, *Phlogiellus kwebaburdeos* n. sp. closely resembles *P. inermis* (Ausserer, 1871) distributed in Indonesia, Malaysia and Singapore (Koh, 1989; Murphy and Murphy, 2000) but can be separated from the latter by the larger body size and longer pedipalp segments. It differs from *P. baeri, P. muta* and *P. watasei* in terms of eye diameter and eye separation, leg length and formula, length of posterior lateral spinnerets vs metatarsus IV, length and shape of tip of embolus, shape of bulb or tegulum in male and spermathecae in female (Haupt & Schmidt, 2004).

This species also exhibits an unusual habit of colonizing the cave environment (Figure 3) of its type locality as most *Phlogiellus* spp. tend to inhabit the forest floor. A follow up paper on the nesting ecology of this species will also be prepared.

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