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Unexpected Discovery of Another New Species of Philippine False Gecko (Gekkonidae; *Pseudogekko*) from the Bicol Peninsula of Luzon Island

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Abstract: Philippine False Geckos (genus *Pseudogekko*) are secretive, delicate, slender-bodied, arboreal members of an obligate forest specialist clade that is substantially more species diverse than previously assumed. Over the last century, few species were added to this Philippine endemic genus. During the last decade, however, revisionary studies have resulted in the recognition of six new species. Several of these appear to be rare, have restricted geographic ranges, or exhibit patchy, fragmented areas of occurrence. In this study we report on the discovery of a second Luzon Island species in the *P. brevipes* complex, a clade in which members typically have diminutive bodies. Although the new species is readily diagnosed from all congeners, we estimated its systematic affinities with a phylogenetic analysis of DNA sequence data and confirm that it is nested within the *P. brevipes* clade. The new species constitutes an exception to the general appearance of other members of the *P. brevipes* complex, in that it has a relatively heavy-bodied, robust stature, separating it phenotypically from all members of the group. Our new species constitutes the second Luzon lineage in this group of rainforest species (considered previously to be restricted to the Negros-Panay and Mindanao Pleistocene aggregate island complexes [PAICs] in the central and southern landmasses of the archipelago). Given the lack of available biodiversity information for the major remaining forests of the Bicol Peninsula, which necessarily come from targeted faunal surveys, the new species' conservation status cannot yet be assessed. In light of the highly fragmented nature of forested habitats of southern Luzon, we suspect the new species might be vulnerable to extinction as a result of habitat loss.

Key words: Biodiversity; Caramoan Peninsula; Endemism; Faunal subregions; Forest Geckos; Obligate forest species; Patchy distributions; Rare species; Sorsogon Province

With nearly 60 described species, the Philippine archipelago supports a diverse, yet incompletely understood gekkonid lizard fauna. Nearly 85% of Philippine species are endemic to the archipelago (Brown and Alcala 1970, 1978; Siler et al. 2017) and many are so poorly known that systematists have waited decades for the accumulation of specimens necessary to describe these insufficiently documented new species (Brown et al. 2000, 2009; Grismer et al. 2013; Siler et al. 2014a,b, 2016).

Nine gecko genera are recognized in the island nation, but the genus *Pseudogekko* is the archipelago's only endemic gekkonid genus (Taylor 1922; Brown and Alcala 1978; Brown et al. 2011; Grismer 2011), and is nested in the widespread southwestern Pacific clade traditionally referred to as *Lepidodactylus*, sensu lato (Heinicke et al. 2012; Oliver et al. 2018). Other native Philippine genera include house geckos of the genera *Gehyra* (1 species), and *Hemidactylus* (1 endemic species, 4 additional nonendemic but native taxa), and large bodied, primarily habitat generalists in the genera *Cyrtodactylus* (9 endemic species; Welton et al. 2009, 2010a,b), *Gekko* (12 endemics, 2 additional nonendemic but native taxa; Brown and Alcala 1978; Rösler et al. 2006; Brown et al. 2008, 2009, 2011; Linkem et al. 2010; Siler et al. 2012), and *Ptychozoon* (1 endemic; Brown et al. 1997, 2012a). Another group is represented by the minute, poorly understood, and imperiled coastal forest and mangrove specialists of the genera *Hemiphyllodactylus* (2–4 endemics, 1 nonendemic widespread native species; Grismer et al. 2013) and *Lepidodactylus* (7–10 endemics, 1 nonendemic widespread native species; Brown and Alcala 1978; Siler et al. 2014a; Oliver et al. 2018). A final set of taxa are the flap-legged geckos, or wolf geckos of the genus *Luperosaurus* (eight endemics; Brown and Diesmos 2000; Brown et al. 2007, 2010, 2011, 2012b; Gaulke et al. 2007) and false geckos or Philippine forest geckos of the genus *Pseudogekko* (nine endemics; Taylor 1922; Siler et al. 2014a,b, 2016, 2017; Davis et al. 2015a). Recent phylogenetic analyses (Brown et al. 2012b; Oliver et al. 2018) have made it clear that among these last three genera, only *Pseudogekko* is monophyletic—albeit deeply nested, along with various subclades of *Luperosaurus*—within *Lepidodactylus* (Oliver et al. 2018). Clearly, a comprehensive, phylogeny-based review of generic boundaries constitutes a priority for ongoing phylogenomic studies (Brown et al. 2012b; Heinicke et al. 2012; Oliver et al. 2018).

Because of their secretive behavior, rarity, highly specialized microhabitat preferences, and/or cryptic coloration and morphology, most species of *Pseudogekko* are encountered seldomly and, subsequently, are rare in collections (Brown and Alcala 1978; Brown et al. 2012c; Siler et al. 2014a,b). However, despite the paucity of properly vouchered genetic material and confusion surrounding allocation of taxa to genera (Brown and Tanner 1949; Brown 1964; Brown and Alcala 1978; Siler et al. 2014a), a series of recent studies have identified unrecognized species diversity in both the *P. compresicorpus* and *P. brevipes* species complexes (Siler et

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al. 2014a, 2017; Davis et al. 2015a,b). Although four distinct, allopatric species were identified masquerading in the former (Siler et al. 2014b, 2016), and two species have likewise been identified in the latter (Davis et al. 2015a; Siler et al. 2017), a number of additional, genetically divergent lineages have been identified but currently cannot be taxonomically evaluated because of a paucity of specimens and/or genetic material (Siler et al. 2014b, 2016, 2017). These are represented by single specimens, corresponding to suspected undescribed species for which taxonomic descriptions have been held in abeyance pending the collection of voucher specimens sufficient for taxonomic study (Brown et al. 2013a; Siler et al. 2014a,b).

During recent faunal surveys in Sorsogon (extreme southern Bicol Peninsula) and Camarines Sur (central Bicol, Caramoan Peninsula) provinces of Luzon (Fig. 1), phenotypically distinct specimens of *Pseudogekko* were collected at low elevations, in fragments of lower montane forest and beach coastal forest (Fig. 2), and matching the distinctive appearance of specimens first observed and photographed by JBF years before in the Pocdol Mountain, of the Bacon-Manito Mountain Range, Albay Province, Bicol Peninsula (Fig. 3). Here, we justify recognition of one new taxon, and discuss the identification of a second, closely related, probable new species, represented currently by only a single immature individual (a population requiring further study). We diagnose the new species based on phenotypic traits, and we utilize mitochondrial DNA sequence data to infer its phylogenetic affinities. Our phylogeny identifies relevant comparisons for diagnosis, and genetic divergence estimates provide crude approximations of the degree of genetic distinctiveness among the new species and closely related congeners of the *P. brevipes* complex—all of which sets the stage for future, in-depth studies of *Pseudogekko* across Luzon's Bicol Peninsula.

Materials and Methods

Fieldwork and Specimen Collection

We conducted fieldwork on southern Luzon Island (Fig. 1) every 2–4 mo, from September 2015 through August 2018. Specimens of *Pseudogekko* were collected by focusing search efforts on upper surfaces of leaves of shrubs and saplings, on *Pandanus* axils, on thin twigs at distal ends of understory tree branches and vines, and on inner surfaces of tree holes and hollow bamboo cavities (Fig. 2). We euthanized specimens with aqueous chloretone, removed genetic material by dissection (liver, preserved in 100% laboratory grade ethanol), fixed vouchers in 10% buffered formalin, and transferred specimens to 70% ethanol within 2 mo. For comparative purposes, we examined specimens and/or sequenced genetic material deposited in U.S. and Philippine biodiversity repositories (Appendix I); institutional abbreviations follow Sabaj (2016).

DNA Sequence Data

Previously published *Pseudogekko* sequences for the mitochondrial NADH dehydrogenase subunit 2 (ND2) are available on GenBank (Appendix I; see Siler et al. 2014a, 2017). We collected homologous data by extracting total genomic DNA from newly collected genetic material with a Maxwell® RSC Tissue DNA kit and a Promega Maxwell®
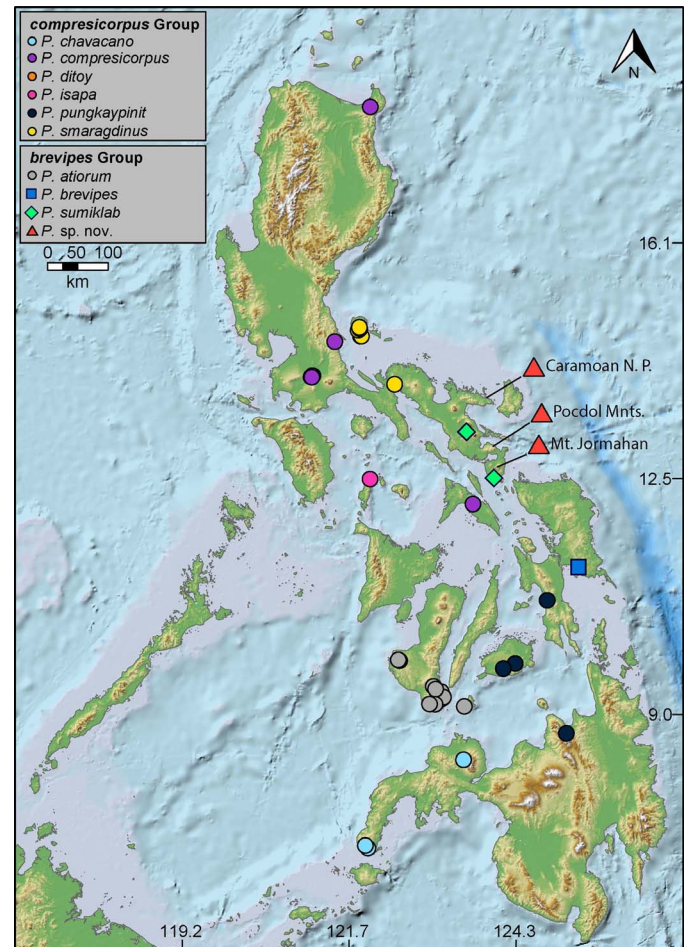

Fig. 1.—Map of the Philippines, with sampling localities of *Pseudogekko hungkag* and congeners included in phylogenetic analyses (see text for details; Fig. 8), indicated by various symbols (legend). A color version of this figure is available online.

RSC extraction robot, targeting the same ND2 mitochondrial protein-coding gene employed previously (Siler et al. 2014a,b, 2016, 2017; Davis et al. 2015a). We successfully amplified and sequenced the ND2 gene region from two samples of the new species from the southernmost tip of Luzon's Bicol Peninsula in Sorsogon Province and a single immature individual we tentatively assign to the new species, from the Caramoan Peninsula of Camarines Sur Province (Fig. 1). Primers and protocols for all sequencing efforts follow Siler et al. (2014a,b, 2017), and newly collected sequence data are deposited at GenBank (Appendix II).

Alignment and Phylogenetic Analysis

We outsourced PCR products (visualized on 1.0% agarose gels) to GENEWIZ® for purification, cycle sequencing, and sequence determination. We sequenced target regions in both directions and confirmed congruence in Geneious vR11 (available at https://www.geneious.com/; Biomatters, Inc., San Diego, CA, USA). The ND2 protein-coding region and the three tRNAs were aligned using the MAFTT v7.017 (Katoh and Standley 2013) plugin under Geneious™ defaults and we used Mesquite v3.04 (Maddison and Maddison 2015) to establish the correct amino acid protein coding reading frame by confirming the absence of stop

FIG. 2.—Luzon Island habitat variation of *Pseudogekko hungkag*: (A) exterior appearance of sandy, coastal forests, extending upwards to limestone karst towers in the vicinity of Tayak Lagoon, Municipality of Caramoan, Camarines Sur Province; (B) interior appearance of low-elevation, second-growth limestone foothills of Mt. Jormahan, Sorsogon Province, Luzon Island; and (C) interior forest habitat characteristics of sandy, coastal forests, Municipality of Caramoan, where *P.* cf. *hungkag* (KU 349299) was collected from vines in the upper right corner of this figure. A color version of this figure is available online.

codons. We partitioned ND2 by codon positions and included all tRNAs as a fourth partition. The best-fit models of molecular evolution were estimated in IQ-TREE (Nguyen et al. 2015; Trifinopoulos et al. 2016) using the Bayesian information criterion (BIC; Table 1). We calculated simple pairwise sequence divergence estimates (Table 2) in MEGA v7.0.26 (Kumar et al. 2016).

Phylogenetic analyses were performed in IQ-TREE (Nguyen et al. 2015; Trifinopoulos et al. 2016) and nodal support was assessed with 1,000 bootstrap pseudoreplicates, using the ultrafast bootstrap approximation algorithm (Minh et al. 2013). All nodes with ultrafast bootstrap values (UFBs) of ≥95 were considered significantly supported (Minh et al. 2013). We performed Bayesian analyses in BEAST v2.4.6 (Bouckaert et al. 2014) to estimate phylogeny while simultaneously exploring and estimating substitution models and parameters in bModelTest (Bouckaert and Drummond 2017). Bayesian analyses were implemented for 50 million generations, sampling every 5,000 generations. We visualized

our resulting log file with Tracer v1.5 (Drummond et al. 2012), and ensured that all parameter effective samples sizes (ESS) reached stationarity (ESS values ≥200). Finally, we used TreeAnnotator v2.4.6 (Bouckaert et al. 2014) with a 25% burn in to generate a maximum clade credibility tree including mean heights and considered all posterior probabilities (PP) of ≥0.95 as strongly supported (Hulsenbeck and Ronquist 2001; Wilcox et al. 2002).

Phenotypic Data

We examined preserved specimens for color pattern and scored mensural (continuously varying measurements) and meristic data (scale and color pattern character counts), using the same character definitions and methods from earlier studies (Siler et al. 2014b, 2016, 2017; Davis et al. 2015a,b). Sex was determined by eversion of hemipenes in the field in males, by confirmation of presence of oviductal eggs in females (visible through the ventral body wall; clutch size invariably $n = 2$), or by gonadal inspection to control for

FIG. 3.—The first photograph of an uncollected *Pseudogekko hungkag* of unknown sex, observed on Pocdol Mountain, Bacon-Manito Mountain Range, Albay Province (photo by JBF, July 2013): note uniquely possessed diagnostic traits: bright golden iris, and inverted Y-shaped markings from the pelvic girdle, through the entire length of the tail. A color version of this figure is available online.

occasional instances of ambiguity in *Pseudogekko* secondary sexual characteristics (Davis et al. 2015b). We took measurements with digital calipers (±0.1 mm) and counted scales under a stereo microscope. Character definitions followed Siler et al. (2014b, 2017) and included snout–vent length (SVL); tail length, depth, and width; head width and absolute and relative head length (measured as snout to posterior edge of tympanum, and posterior tip of mandible); absolute and relative snout length (Siler et al. 2014b); midbody trunk width and eye diameter; eye–nares, internarial, interorbital, and axilla–groin distances; femur and tibia lengths; and numbers of supralabials, infralabials, circumorbitals, precloacal pore-bearing scales, Finger-III and Toe-IV scansors paravertebrals, midbody scale rows, and

TABLE 1.—Best-fit models for evolution of clades within *Pseudogekko* inferred by the Bayesian information criterion from the IQ-TREE-webserver (Trifinopoulos et al. 2016) and by model averaging from bMODELTEST applied in BEAST v2.4.6 (Bouckaert et al. 2014), and applied as part of a partitioned, model-based phylogenetic analyses of our DNA sequence data set.

Partition	Model selected IQ-TREE	Model selected bMODELTEST
ND2, first codon position	GTR+F+I+Γ4	123124
ND2, second codon position	TPM3u+F+I+Γ4	123123
ND2, third codon position	TIM2+F+Γ4	121343
tRNAs (concatenated)	TIM2+F+I+Γ4	121321

ventrals. We used Köhler's (2012) standardized color codes for description of the color pattern of the new species.

Species Concept

In taxonomic studies of Philippine lizards (Brown et al. 2007, 2008, 2009, 2010; Siler et al. 2014b, 2016, 2017), we have consistently applied the general lineage concept (de Queiroz 1998, 1999) as the modern extension of the evolutionary species concept (Simpson 1961; Wiley 1978; Frost and Hillis 1990; de Queiroz 2005) as a framework for recognition of lineage-based species. We take an integrative approach to species delimitation by emphasizing multiple lines of evidence, with the potential to inform on the independence and cohesion of ancestor–descendant, or temporal, series of populations (de Queiroz 2005).

We assess putative new species and congeners for the presence of (1) fixed or discretely varying (diagnostic) phenoytypic character state differences—nonoverlapping ranges of character states; (2) discontinuous ranges of size-related continuously varying dimensions; (3) presence or absence of fixed color pattern elements; (4) phylogenetic position with respect to phenotypically similar and/or sympatric congeners; and (5) ecological information, microhabitat differences, and/or discrete, noncontiguous geographic distributions (allopatric areas of occurrence which, in the Philippines, typically take the form of separate islands, island banks, mountains, or disrupted habitat types such as isolated geological formations). Although we consider a putative species' phylogenetic affinities to be informative for identifying relevant comparisons (Brown et al. 2008, 2009; Welton et al. 2010a) and/or potentially refuting the hypothesis of conspecificity in nonsister taxa (Brown 2015; Brown et al. 2010, 2016), we use genetic distances as a crude comparative indication of relative divergence only, and not as justification for species delimitation.

TABLE 2.—Mean uncorrected pairwise sequence divergence (%) for mitochondrial data (ND2, below the bolded diagonal) between species pairs; within-species interpopulational mean p distances, in eight named *Pseudogekko* taxa for which genetic data are available (no genetic materials currently are available for *P. isapa*) and one putative species with insufficient specimens for species description (*P.* cf. *hungkag*, Caramoan) are presented in bold along the diagonal.

	hungkag	cf. hungkag	atiorum	brevipes	chavacano	compresicorpus	ditoy	pungkaypinit	smaragdinus
hungkag	**0.000**								
cf. hungkag	0.200	**N/A**							
atiorum	0.182	0.327	**0.000**						
brevipes	0.182	0.273	0.145	**N/A**					
chavacano	0.200	0.345	0.236	0.255	**0.000**				
compresicorpus	0.175	0.289	0.240	0.244	0.171	**0.105**			
ditoy	0.200	0.345	0.255	0.255	0.127	0.198	**0.000**		
pungkaypinit	0.207	0.324	0.236	0.211	0.207	0.153	0.193	**0.072**	
smaragdinus	0.114	0.273	0.218	0.198	0.220	0.179	0.202	0.169	**0.009**

Fig. 5.—Dorsal (A) and ventral (B) habitus of adult female paratype *Pseudogekko hungkag* sp. nov. (KU 346539) before preservation, from Mt. Jormahan (type locality), Municipality of Irosin, Sorsogon Province, Bicol Peninsula, Luzon Island. Scale bar = 5 mm. Photos: JBF and RMB. A color version of this figure is available online.
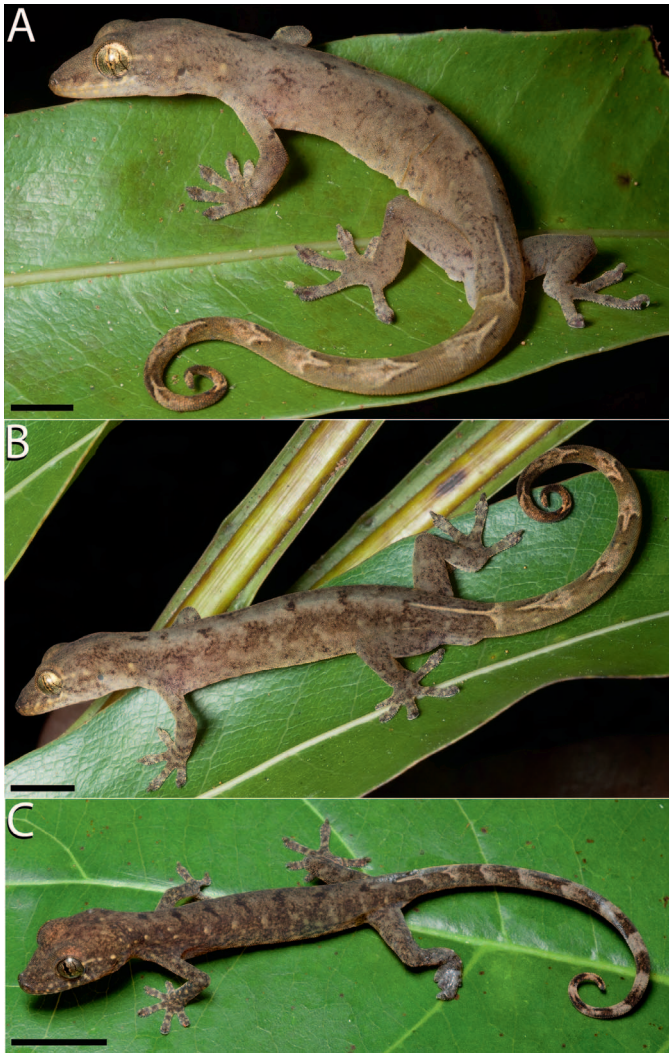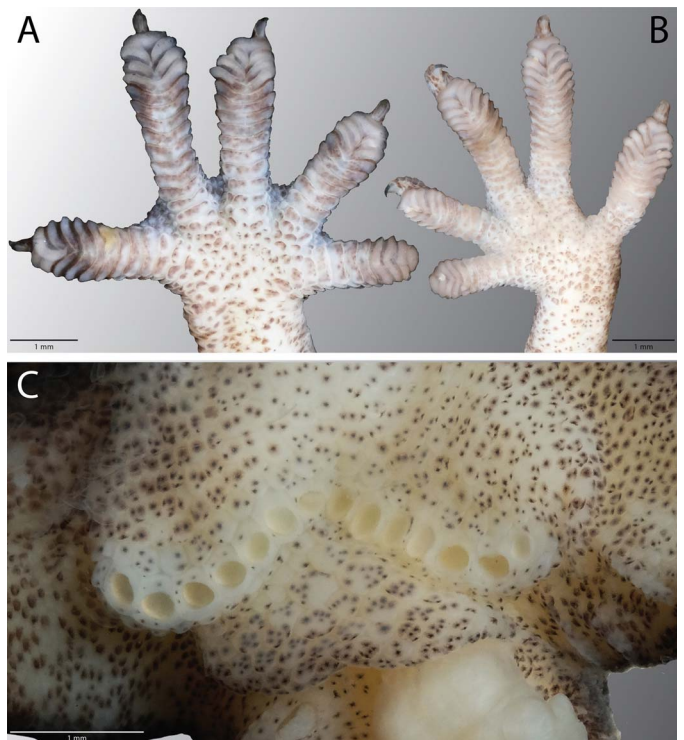
Fig. 4.—Photographs in life of *Pseudogekko hungkag* sp. nov. (A, B) adult female holotype (PNM 9864, formerly KU 346540) from Mt. Jormahan (type locality), Municipality of Irosin, Sorsogon Province, Bicol Peninsula, Luzon Island. (C) juvenile male specimen, tentatively referred to the new species, from Municipality of Caramoan, Camarines Sur Province, Bicol Peninsula, Luzon Island (KU 349299). Scale bars = 5 mm. Photos: JBF and RMB.

Fig. 6.—Palmar view of right hand (A), plantar view of right foot (B) and details of differentiated precloacal pore-bearing scale series, in male *Pseudogekko hungkag* paratype (PNM 9865; RMB Field No. 24081, formerly KU 346538). Scale bars = 1 mm. A color version of this figure is available online.

Taxonomic Account

Pseudogekko **hungkag** sp. nov.
(Figs. 2–6)

Holotype.—PNM 9864 (RMB Field No. 24085, formerly KU 346540), adult female, collected between 2200 and 2300 h on 5 August 2017, in regenerating secondary forest, near the peak of Mt. Jormahan, Barangay Cogon, Municipality of Irosin, Sorsogon Province, Luzon Island, Philippines (12.76116°N, 124.00356°E; in all cases, datum = WGS84; 643 m above sea level [a.s.l.]), by CGM and E. Bondal.

Paratypes.—KU 346539, 346542 (RMB 24082, 24090), two adult females, PNM 9865 (RMB 24081, formerly KU 346538), KU 346541 (RMB 24087; Fig. 4), two adult males, collected with the holotype, between 2200 and 2300 h, within 500 m of the site of holotype collection, but at slightly lower elevations (500–640 m a.s.l.).

Referred specimen.—KU 349299 (RMB 24361; Fig. 4C), immature male, collected at 1915 h on 22 November 2017, in coastal beach forest scrub and mixed secondary forest at Tayak Lagoon, Barangay Pandanan, Municipality of Caramoan, Camarines Sur Province, Luzon Island, Philippines (13.7902°N, 123.9273°E; 2 m a.s.l.), by RMB, JFB, and MAC.

Diagnosis.—*Pseudogekko hungkag* is diagnosed from all congeners by the following combination of characters: (1) body moderate, robust (all measurements in millimeters; males = SVL 42.0–45.5; females = 42.0–52.1); (2) axilla–groin distance relatively short (males = 21.7–24.4; females = 24.7–27.3); (3) head (males = 11.3–12.1; females = 11.8–13.8) and snout (males = 4.6–5.2; females = 4.9–5.7) short; (4) Finger-III scansors 11–13; (5) Toe-IV scansors 13–15; (6) supralabials 11–14; (7) infralabials 11–14; (8) circumorbitals 34–40; (9) paravertebrals 222–236; (10) ventrals 85–94; (11) enlarged precloacal pore-bearing scale series 13–14; (12) femorals undifferentiated; (13) postcloacals enlarged, in three prominent rows; (14) mental and postmentals small, undifferentiated (the latter juxtaposed); (15) transverse tail bands absent (adults, Sorsogon), or present (juvenile, Caramoan); (16) light, inverted Y-shaped caudal chevrons present for full length of tail (n = 8–10 in adults from Sorsogon; Fig. 4A,B), or limited to tail base (n = 3 for the juvenile from Caramoan; Fig. 4C); (17) iris bright silver to gold, ring absent (Fig. 4A); (18) superciliaries not brightly colored.

Comparisons.—*Pseudogekko hungkag* is most closely related to the members of the *P. brevipes* complex (Fig. 7), so we focus primarily on comparisons to *P. atiorum*, *P. brevipes*, and *P. sumiklab* for the purpose of diagnosis (in all comparisons, values for *P. hungkag* are presented first). *Pseudogekko hungkag* can be distinguished from *P. atiorum* by having fewer supralabials (11–14 vs. 15–17) and ventrals (85–94 vs. 119–129), and by the absence (vs. presence) of a light interorbital band, presence (vs. indistinct or absent) of bold, light inverted Y-shaped caudal chevrons, and presence (vs. absence) of cream to gold postorbital and labial spots. From *P. brevipes* the new species differs by having fewer infralabials (11–14 vs. 14–15) and ventrals (85–94 vs. 96–117), more circumorbitals (36–40 vs. 33–35) and precloacals (13–14 vs. 12), and by the absence (vs. presence) of a light interorbital band, and presence (vs. indistinct or absent) of bold inverted Y-shaped caudal chevrons. From *P. sumiklab* the new species differs by having fewer ventrals (85–94 vs. 106–109), and by the presence (vs. absence) of bold inverted Y-shaped caudal chevrons.

Although only body size (SVL) discretely differed in comparisons between *P. hungkag* (males = 42.0–45.5; females = 45–52.1) and *P. brevipes* (male = 39.0; females = 34.5–42.4), the new species generally is a heavy-bodied species, differing from *P. atiorum*, *P. brevipes*, and *P. sumiklab* by its robust (vs. slender, elongate) body shape (Fig. 4A,B vs. 7A), and differs further from *P. sumiklab* and *P. brevipes* by its relatively larger head length, and from *P. sumiklab* by its relatively larger head width and snout length (Tables 3 and 4).

From all members of the *P. compresicorpus* complex (Fig. 7B), *P. hungkag* can be diagnosed by its relatively larger head width, and from *P. punkaypinit* and *P. smaragdinus* by its relatively larger head length (Table 4). The new species is

Fig. 7.—Lateral views of live specimens, representing typical members of the (A) *Pseudogekko brevipes* complex (adult female paratype of *P. sumiklab* [KU 343847], from Sorsogon Province, southern Bicol Peninsula, Luzon Island) and (B) the *P. compresicorpus* complex (adult male *P. compresicorpus* RMB 24978 [deposited at KU] from Quezon Province, southern Luzon Island). Scale bars = 10 mm. Photos: JBF and RMB. A color version of this figure is available online.

further diagnosed from the distantly allopatric Mindanao Island species, *P. chavacano*, by its smaller body (SVL 42.0–52.1 vs. 54.7–55.9 mm), fewer Finger-III scansors (11–12 vs. 15–16), Toe-IV scansors (13–15 vs. 17–20), supralabials (11–12 vs. 15–16), infralabials (11–14 vs. 16–17), circumorbitals (36–40 vs. 46), ventrals (85–94 vs. 122–123), and precloacals (13–14 vs. 16). Additionally, the new species has more paravertebrals (222–235 vs. 195–197), and is further distinguished by the absence (vs. presence) of neon green limb spots, and presence of bold inverted Y-shaped caudal chevrons (vs. simple transverse caudal bands). From *P. compresicorpus* (Fig. 7B), the new species differs by its smaller body (SVL 42.0–52.1 vs. 54.9–59.7 mm), fewer Finger-III scansors (11–12 vs. 15–17), Toe-IV scansors (13–15 vs. 18–19) supralabials (11–12 vs. 16–17), ventrals (85–94 vs. 127–130), and by the absence of bright iris ring coloration (vs. presence, light blue) and presence (vs. absence) of bold inverted Y-shaped caudal chevrons (Tables 3 and 4).

Pseudogekko hungkag is further diagnosed from the allopatric Mindanao, Samar, and Leyte islands species *P. ditoy* and the Sibuyan Island endemic *P. isapa* by its smaller female body size (SVL 42.0–52.1 vs. 52.6 mm [*P. ditoy*], 63.4 [*P. isapa*]), axilla–groin distance (21.7–27.3 vs. 32.1–33.0 [*P. isapa*]), head length (11.3–13.3 vs. 9.3–9.6 [*P. ditoy*]), and fewer Finger-III scansors (11–13 vs. 14–15 [*P. ditoy*]), Toe-IV scansors (13–15 vs. 16–17 [*P. ditoy*], 17 [*P. isapa*]), supralabials (11, 12 vs. 17, 20 [*P. ditoy*], 20, 21 [*P. isapa*]), infralabials (11–14 vs. 16–17 [*P. ditoy*], 17–19 [*P. isapa*]), ventrals (85–90 vs. 111–118 [*P. ditoy*], 135–141 [*P. isapa*]), circumorbitals (36–40 vs. 40–52 [*P. ditoy*], 50–54 [*P. isapa*]),

TABLE 3.—Distribution of selective diagnostic meristic character states and color pattern element characters (+ present; − absent) for all known species of *Pseudogekko* (adults only; m = male; f = female; Appendix 1). In cases of scale count variation within species, numbers of specimens exhibiting each state are provided in parentheses.

Character	*hungkag* (2 m, 3 f)	*sumiklab* (3 f)	*atiorum* (8 m, 7 f)	*brevipes* (1 m, 3 f)	*chavacano* (1 m, 1 f)	*compresicorpus* (3 m, 4 f)	*ditoy* (1 m, 1 f)	*isapa* (1 m, 1 f)	*pungkappinit* (4 m, 2 f)	*smaragdinus* (16 m, 17 f)
Finger-III scansors	11 (1) 12 (5) 13 (2)	11 (2) 12 (1)	12 (3) 13 (9) 14 (3)	12 (4)	15 (1) 16 (1)	15 (4) 16 (2) 17 (1)	14 (1) 15 (1)	13 (2)	15 (3) 16 (1) 17 (2)	15 (1) 16 (4) 17 (9) 18 (19)
Toe-IV scansors	13 (2) 14 (6) 15 (3)	13 (2) 14 (1)	14 (1) 15 (2) 16 (2) 17 (10)	15 (4)	17 (1) 20 (1)	18 (5) 19 (2)	16 (1) 17 (1)	17 (2)	17 (1) 18 (2) 19 (2) 21 (1)	16 (1) 18 (6) 19 (8) 20 (12) 21 (5) 22 (1)
Supralabials	11 (2) 12 (3) 13 (4) 14 (2)	14 (3)	15 (7) 17 (4)	13 (2) 14 (2)	15 (1) 16 (1)	16 (1) 17 (1) 18 (3) 19 (1) 20 (1)	17 (1) 20 (1)	20 (1) 21 (1)	16 (1) 18 (2) 19 (2) 20 (1)	16 (8) 17 (10) 18 (11) 19 (4)
Infralabials	11 (3) 12 (1) 13 (4) 14 (1)	13 (1) 14 (2)	12 (1) 13 (4) 14 (9) 15 (1)	14 (1) 15 (3)	16 (1) 17 (1)	13 (1) 15 (2) 16 (4)	16 (1) 17 (1)	17 (1) 19 (1)	17 (4) 18 (1) 19 (1)	14 (6) 15 (12) 16 (10) 17 (5)
Circumorbitals	36 (1) 37 (1) 38 (2) 40 (2)	39 (1) 44 (1) 46 (1)	35–38	33–35	46	39–45	40, 43	50 (1) 54 (1)	50–55	33–35
Paravertebrals	222–235	220–224	226–240	211–218	195–197	226–234	180, 185	240–246	265–280	241–252
Ventrals	85–94	106–109	119–129	96–117	122–123	127–130	111, 118	135–141	125–155	124–130
Precloacals	13–14	13–14	13–15	12	16	10–14	18	15	17–20	32–41
Femorals	−	−	−	−	−	−	−	−	−	+
Mental enlarged	−	−	−	−	−	+	+	−	−	−
Dominant body coloration	Gray to gray-brown	Medium brown to tan	Dark brown	Unknown	Light brown	Dark brown to tan	Light brown	Brownish tan	Grayish brown	Bright neon yellow to orange (undisturbed) to neon green (disturbed)
Cephalic spots	−	+, sparse, black and cream	+, sparse, cream	Unknown	+, dense, neon green	+, dense, neon green	−	+	−	+, dense black, sparse white
Light postorbital markings	+, cream to gold	−	+, −	−	−	−	−	−	−	−
Dorsolateral spots	+, cream	+, cream	+, cream	+	+, neon green	+, faint, neon green	−	−	−	+, large black, small white
Vertebral spots or bars	+, black spots	+, black spots	−	−	−	−	−	−	−	−
Limb spots	−	−	−	−	+, dense, neon green	+, faint, neon green	−	−	−	+, sparse black and white
Transverse caudal bands/markings	+ or −, inverted Y-shaped[1]	−	−	−	+	−	−	Unknown	−	+, neon yellow, white, and neon orange
Black subcaudal stripe	−	+ or −	−	−	−	−	−	−	−	−
Body (trunk) stripes	−	−	−	−	−	−	−	−	+, lateral	−
Interorbital band	−	−	+, light brown	+	−	−	+	+	−	−
Iris ring coloration	−	−	−	Unknown	−	+, light blue	−	−	−	−
Iris coloration	Silver to Gold	Silver	Silver	Silver	Yellow	Tan	Gray	Light gray to silver	Yellow	Yellow

[1] Light, inverted Y-shaped caudal marking repeated (n = 8–10) for full tail length in adults from Sorsogon, or limited (n = 3) to tail base in juvenile, from Caramoan (replaced distally by alternating light-and-dark transverse bands).

TABLE 4.—Summary of selective mensural characters for adult specimens (m = male; f = female; Appendix I; immature specimens excluded) of all known species of *Pseudogekko*. General geographical distribution included for reference; table entries presented as range (mean ± 1 SD) in mm.

Character	*hungkag* (2 m, 3 f)	*sumiklab* (3 f)	*atiorum* (8 m, 7 f)	*brevipes* (1 m, 3 f)	*chavacano* (1 m, 1 f)	*compresicorpus* (3 m, 5 f)	*ditoy* (1 m, 1 f)	*isapa* (1 m, 1 f)	*pungkaypinit* (4 m, 2 f)	*smaragdinus* (16 m, 17 f)
Locality	Bicol Peninsula (Luzon Island)	Bicol Peninsula (Luzon Island)	Negros and Panay islands	Bohol, Samar, and Leyte islands	Mindanao Island	Luzon and Polillo islands	Samar and Leyte islands	Sibuyan Island	Mindanao, Samar, and Leyte islands	Polillo Island and Bicol Peninsula (Luzon Island)
SVL (m)	42, 45.5	–	41.1–52.5 (47.0 ± 4.5)	39.0	55.9	55.9–58.8 (57.6 ± 1.5)	49.4	63.4	66.6–76.8 (71.8 ± 5.1)	54.2–64.3 (59.4 ± 2.5)
SVL (f)	45–52.1 (47.2 ± 4.5)	41.8–46.6 (44.3 ± 2.4)	44.8–48.7 (46.3 ± 1.5)	34.5–42.4 (38.6 ± 4.0)	54.7	54.9–59.7 (57.1 ± 2.6)	52.6	62.1	75.2–75.3	50.2–61.7 (57.4 ± 3.5)
Axilla–groin distance	21.7–27.3 (24.6 ± 1.9)	23.6, 25.8	19.4–28.4 (24.8 ± 2.4)	17.8–29.8 (21.7 ± 5.5)	26.7–30.0	27.0–32.6 (30.4 ± 1.8)	25.1, 29.7	32.1–33.0	37.2–41.2 (39.6 ± 1.8)	26.2–35.5 (31.5 ± 2.2)
Total body length	46.0–60.5 (52.5 ± 7.3)	87.8, 91.0	80.2–113.5 (97.3 ± 13.0)	72.0–87.5 (77.3 ± 7.3)	95.8	105.9–117.3 (111.7 ± 5.7)	N/A	N/A	125.3–141.2 (135 ± 8.6)	103.6–129.7 (119.4 ± 6.4)
Head length	7.0–10.6 (9.3 ± 1.0)	5.8, 5.8	7.4–9.4 (8.5 ± 0.6)	6.2–9.5 (7.4 ± 1.5)	10.4	9.2–11.3 (9.7 ± 0.3)	9.3, 9.6	11.7–11.8	11.4–13.6 (12.6 ± 0.9)	7.8–10.7 (9.5 ± 0.7)
Head length/SVL	218.8–20.2 (26.3 ± 1.5)	14.0, 12.4	16.0–19.8 (18.3 ± 0.9)	16.7–24.4 (19.2 ± 3.6)	18.6–19.1	16.1–18.1 (17.1 ± 0.7)	18.2, 18.9	18.6–18.9	16.0–18.3 (17.2 ± 0.8)	14.9–17.4 (16.3 ± 0.6)
Head width	7.5–9.0 (8.1 ± 0.6)	5.7, 6.7	5.9–8.3 (7.1 ± 0.7)	5.6–6.5 (5.9 ± 0.5)	7.8–8.5	7.5–10.1 (8.2 ± 0.8)	7.7, 7.9	7.4–10.1	9.3–11.2 (10.6 ± 0.9)	7.1–9.8 (8.6 ± 0.6)
Head width/SVL	16.9–17.8 (17.3 ± 0.3)	13.6, 14.4	14.3–16.4 (15.3 ± 0.6)	14.2–16.8 (15.2 ± 1.2)	14.3–15.2	13.0–16.3 (14.2 ± 1.0)	14.7, 15.9	15.2–16.0	14.0–15.2 (14.7 ± 0.4)	13.8–16.0 (14.8 ± 0.6)
Snout length	4.6–5.7 (5.2 ± 4.4)	4.0, 4.0	4.3–5.8 (5.1 ± 0.4)	3.8–4.4 (4.1 ± 0.2)	5.8–6.0	5.3–7.4 (5.9 ± 0.7)	5.4, 5.7	7.2–7.5	6.7–7.5 (7.2 ± 0.4)	4.5–6.5 (5.7 ± 0.4)
Snout length/Head length	51.4–58.2 (56.1 ± 2.2)	69.2, 69.0	55.1–69.1 (59.5 ± 3.7)	44.4–62.3 (56.5 ± 8.3)	55.2–58.0	56.1–64.6 (59.6 ± 3.0)	57.4, 59.3	61.9–64.1	53.6–68.4 (60.0 ± 4.8)	50.7–67.9 (60.3 ± 2.9)

precloacals (13–14 vs. 18 [*P. ditoy*], 15 [*P. isapa*]), paravertebrals (222–235 vs. 240–246 [*P. ditoy*], 240–246 [*P. isapa*]), and by the presence (vs. absence in both species) of bold inverted Y-shaped caudal chevrons (Fig. 4A,B). *Pseudogekko hungkag* is further diagnosed from *P. pungkaypinit* by its smaller body size (SVL 42.0–52.1 vs. 75.2–75.3), axilla–groin distance (21.7–27.3 vs. 37.2–41.2), snout length (4.6–5.7 vs. 6.7–7.5), fewer Finger-III scansors (11–13 vs. 15–17), Toe-IV scansors (13–15 vs. 17–21), supralabials (11–14 vs. 16–20), infralabials (11–14 vs. 17–19), circumorbitals (36–40 vs. 50–55), paravertebrals (222–235 vs. 265–280), ventrals (88–94 vs. 125–155), precloacals (13, 14 vs. 17–20), and by the presence (vs. absence) of bold inverted Y-shaped caudal chevrons.

Pseudogekko hungkag is diagnosed from *P. smaragdinus* by its smaller body size (SVL 42.0–52.1 vs. 50.2–64.3), fewer Finger-III scansors (11–13 vs. 15–18), Toe-IV scansors (13–15 vs. 16–22), supralabials (11–14 vs. 16–19), infralabials (11–14 vs. 14–19), paravertebrals (222–235 vs. 241–252), ventrals (88–94 vs. 124–130), and precloacals (13, 14 vs. 32–41 precloacofemorals), by its overall gray ground (vs. bright neon yellow to orange [undisturbed] to neon green [disturbed]) coloration, and by the presence of bold inverted Y-shaped caudal chevrons (vs. transverse dark/light caudal bands; Tables 3 and 4).

Description of holotype.—Adult female in excellent condition; two large eggs visible through slightly transparent ventrum (similar to paratype in Fig. 4A); small incision in the sternal region (liver sample preserved separately for genetic material). Body relatively large, robust, SVL 52.1 mm; limbs well developed, robust, relatively muscular; tail long, intact, 60.5 mm, tapering to slender tip, thickened at laterally compressed base; margins of limbs smooth; cutaneous flaps, ornate tuberculation, and dermal folds absent.

Head size moderate, well differentiated from neck, with moderately hypertrophied temporal and adductor musculature; calcium deposits of endolymphatic sacs visible as moderate swellings in lateral nuchal region; snout broadly rounded in dorsal view, bluntly rounded in lateral view; head width 110% midbody width, 84.9% head length; head length 20.0% SVL; snout length 63.3% head width, 53.8% head length; dorsal surfaces of head smooth and homogeneous, with only slightly detectable concavities in postnasal, internasal, prefrontal, and interorbital regions; auricular opening small, subcircular, its position posteroventral to temporal swellings on either side of head; tympanum deeply sunken (Fig. 3A,B); orbit and eye large, pupil vertical, margin wavy; limbs relatively long, femur 8.8 mm, tibia 7.5 mm; hands and feet moderate, digits robust, unreduced; hindlimbs more robust and thicker than forelimbs; tibia length 14.4% SVL, 85.2% femur length.

Rostral broad, wrapping nearly around total anterior surface of rostrum, widely rectangular in anterodorsal view, much broader than high; narial opening surrounded by rostral, first labial, the first (outer) enlarged supranasal, and two differentiated postnasals (ventral enlarged; dorsal smaller); snout with a total of four differentiated supranasals, arranged in two separate pairs, with pairs separated by two irregular small median scales; circumorbitals 38/39 (L/R).

Total number of differentiated supralabials 12/13 (8–12/9–13 subocular); row of snout scales bordering supralabials dorsally undifferentiated, barely enlarged; total number of

differentiated infralabials 14/13 (10–14/9–13 subocular); rows of enlarged scales ventrally bordering infralabials only extend to fifth labial, before abruptly continuing posteriorly as undifferentiated postrictal scales; mental minute, smaller than first infralabials; followed by five rows of enlarged postmentals (chin shields), transitioning abruptly to undifferentiated ventral head and throat scales at the level of fifth infralabial; gulars small, homogenous in size, shape, and texture, round, juxtaposed to slightly imbricate.

Dorsal cephalic scales homogeneous in size, shape, and texture: nearly flat to slightly convex, round to subcircular; postnasal, prefrontal, internasal, and interorbital depressions shallow; undifferentiated posterior head scales granular, round to sharply rounded or even slightly conical; ornamental cephalic tuberculation, cutaneous flaps, and dermal projections all absent (Figs. 4B and 5B).

Axilla–groin distance 52.4% SVL; undifferentiated dorsal trunk scales homogeneous in size, shape, and texture: round to ovoid, granular, convex to pointed, many with raised posterior edges forming points, juxtaposed or slightly overlapping; most middorsal trunk scales tightly juxtaposed, few with surrounding, barely evident five or six interstitial granules; on flanks, scalation consists of more typically cycloid convex scales, with more space between scales and interstitial granules readily visible; ventrolateral scales transition to imbricate ventrals, transition near complete by edges of ventrolateral–ventral body surface; paravertebrals between midpoints of limb insertions 227; ventrals between midpoints of limb insertions 95; midbody scales 114 (24 of which differentiated, enlarged, imbricate transverse ventrals) scales on dorsal surfaces of limbs more imbricate than dorsals; scales on dorsal surfaces of hands and feet imbricate, similar in size or slightly smaller than dorsal limb scales; ventral body scales relatively homogeneous in size and appearance: flat, cycloid, strongly imbricate, markedly larger than lateral or dorsal trunk scales; 14 differentiated (enlarged), dimpled scales in continuous precloacal series (homologous with pore-bearing precloacals in males), arranged in a widely obtuse, inverted V-shaped formation; precloacals preceded anteriorly by one row of slightly enlarged scales; followed by three rows of enlarged, plate-like unpored scales, and two rows of undifferentiated ventrals along edge of vent opening.

Digits expanded, with only minute extent of interdigital webbing, and with subdigital surfaces covered by bowed, undivided but notched scansors; subdigital scansors of left/right Finger III 12/12; scansors of Toe IV 13/14; second and third penultimate scansors deeply notched; all scansors bordered laterally (on palmar and plantar surfaces) by two or three slightly enlarged scales that form a near-continuous series with enlarged scansors; palmar and plantar scales small, granular, juxtaposed; all digits clawed, but first (medial) claw greatly reduced to form subcircular nail-like scale; remaining terminal claw-bearing phalanges compressed, with moderately sized recurved claws rising free of pads at terminal surfaces.

Tail relatively long (compared to body): length 116% SVL; vertically ovoid in cross section at base, not depressed; depth 70.5% tail width; caudals similar in size to dorsals, subcaudals similar in size to ventrals; tail lacking any vestiges of ornate tubercles, enlarged scales, whorl differentiation, or lateral dermal projections.

Coloration of holotype (Fig. 4).—Employing color codes of Köhler (2012), live coloration (from field notes and photographs of JBF and RMB; Fig. 4A,B) consists of dorsal ground color on head, trunk, and tail base gray (293, 296); tail buff (15) to clay (20) with horn (11) or chamois pale tan (84) inverted light chevrons. Dorsal surfaces with diffuse drab gray–brown (19) blotches, and small chestnut to sepia (30, 40) speckles, devoid of pattern except irregularly aggregated into a series of vertebral blotches (boldest in scapular and pelvic regions), and densely clustered around first beige (254) inverted Y-shaped chevron at tail base. Nuchal region with sulphur yellow (80) round, distinct nuchal spots, and five (left) or six (right) similar yellow spots spanning dorsolateral surface of trunk; similar yellow spots number two (right) or three (left) in eye–tympanum region. Labial region straw yellow (53) with bright sulphur yellow (80) spots. Limbs colored and patterned as dorsal body surfaces, with distal segments (forearms, tibia) appearing darker on account of denser aggregation of black (300) speckles; dorsal surfaces of digits with alternating fawn/purplish-brown (258) and beige (254) transverse bars on dorsal surfaces, and buff (15) to smoky white (261) plantar surfaces of subdigital scansors.

Ventral ground color of the head, trunk white (261), with suffuse pale creamy yellow (82) to olive clay yellow–brown (85) around margins (ventrolateral surfaces) of head, limbs, and trunk; tail darkens steadily from base to distal tip: sulphur yellow (base: 95) to light yellow–green (100) to olive brown (100), and finally black (300) tip.

Lateral surfaces of head, trunk, and tail with gradual color transition between the dorsal ground color of gray (293, 296) and the ventral base color of smoky white (261). In life, with continued disturbance, dorsolateral and flank surfaces darkened to dark brown (277) and vertebral blotches became darker brown (280) and more distinct.

Eyes golden yellow (79) with lighter gold to silver outer margins (80) and vertical black (300) pupils; silvery-gold iris covered with web-like network of dark brown (280) connected lines.

In fluid, 6 mo following preservation (see paratype, Fig. 4A,B), all yellow, golden, greenish, and/or yellowish-brown elements are lost, and pattern elements (nuchal spots, labial spots, dorsolateral spots, and inverted Y-shaped tail chevrons) are difficult to discern. In general, dorsal surfaces are drab dark brown (45) to dark olive brown (292) and ventral surfaces are neutral (297) to medium gray (298); ventral surfaces of digits with light gray (296) scansors.

Measurements of holotype (millimeters) and scale counts.—SVL 52.1; tail 60.5; axilla–groin 23.6; head length 13.8 (to posterior edge of tympanum), 10.6 (to posterior tip of mandible); head width 9.0; snout 5.7; eye diameter 3.2; eye–nares distance 3.4; internarial distance 2.5; interorbital distance 2.7; midbody trunk width (horizontal diameter) 8.2; femur 8.8; tibia 7.5; tail width 3.1, height 4.4; supralabials 13, 13 (left, right); infralabials 14/13; circumorbitals 37/38; paravertebral scales 227; ventral scales 95; Finger-III scansors 12/12; Toe-IV scansors 14/15.

DNA sequence data, genetic divergences, and phylogenetic estimate.—*Pseudogekko hungkag* is genetically divergent from congeners, with pairwise uncorrected mtDNA distances varying 10.9–20.0% (Table 2), which meets or exceeds the general magnitude of divergence
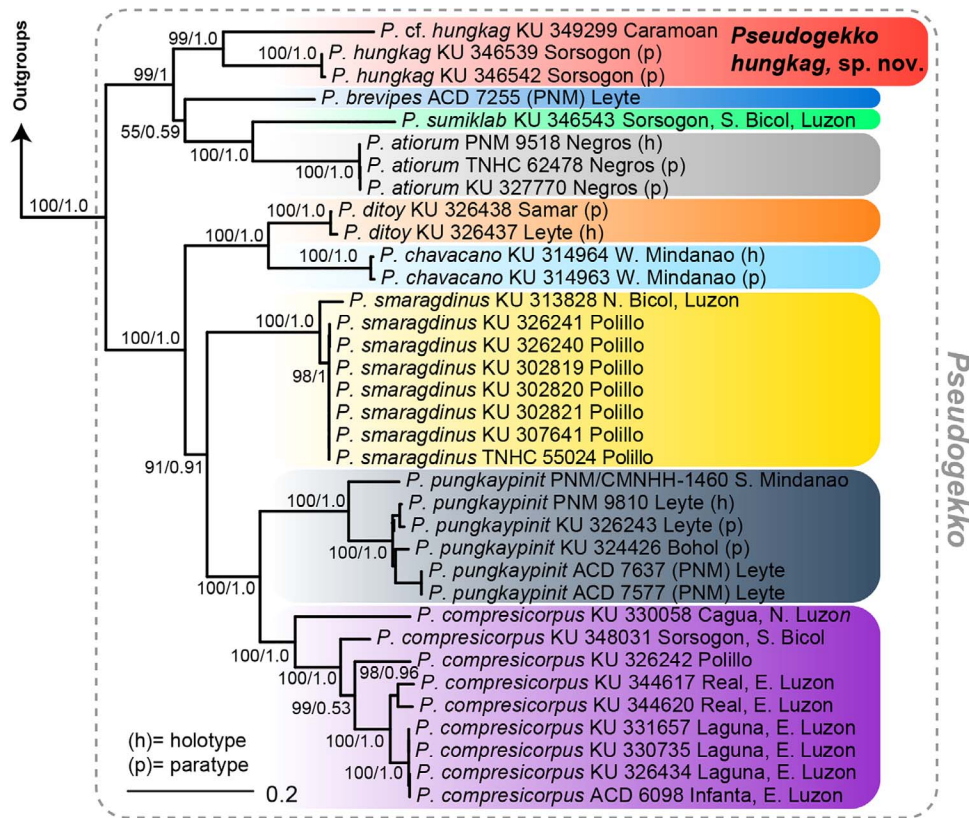
Fig. 8.—Preferred phylogenetic estimate (maximum likelihood [ML] topology) with species boundaries emphasized by variably colored translucent shading. Nodal support is indicated with ML bootstraps and Bayesian posterior probabilities and distant outgroups (not shown) were selected from higher-level studies of Brown et al. (2012b), Heinicke et al. (2012) and Oliver et al. (2018). Scale = substitutions per site; tip labels include genus and species identity, museum catalog number, and general locality. A color version of this figure is available online.

observed among other recognized species of *Pseudogekko* (e.g., Siler et al. 2014b, 2017; Davis et al. 2015a). We note that the single, immature specimen from the Caramoan Peninsula (Fig. 4C) is 20.0% divergent from Mt. Jormahan, Sorsogon specimens (the type locality), and that the Caramoan population most likely represents an additional, undescribed species (Fig. 8). We take no taxonomic action at this time concerning this specimen because of the absence of adult specimens available for study in biodiversity repositories.

Natural history, habitat, geographic distribution, and conservation status.—The type locality (Mt. Jormahan, Barangay Cogon, Municipality of Irosin, Sorsogon Province) is a small, partially forested, extinct volcano cone (<700 m a.s.l.), situated on the western edge of the Mt. Bulusan Volcano, just outside of the boundary of the protected area of Bulusan Volcano Natural Park (Fig. 1; Binaday et al. 2017:Fig. 1). The steep rocky slopes of Mt. Jormahan are covered with disturbed but regenerating second-growth forest that we assume was previously contiguous with nearby patches of original forest on the lower slopes of Mt. Bulusan (now within the boundaries of the unstudied protected area). Although the area immediately surrounding Lake Bulusan was surveyed briefly 18 yr ago (Brown et al. 2002), the Mt. Bulusan Protected Area Management Board (PAMB) has restricted herpetological inventory work within the boundaries of the park to non-specimen-based visual-encounter surveys only (Binaday et al. 2017). As a result, nothing is

known of herpetological diversity and community composition within the park's interior, particularly above mid- (>300 m) to high-elevation interior forests. Nevertheless, we assume the new species may be widely distributed throughout the lower elevation (<600 m) forests of Mt. Bulusan, which should provide it with reasonably well-protected habitat. The assumption of potential distribution of *P. hungkag* within Mt. Bulusan Volcano Natural Park remains unverified; we know of no *Pseudogekko* species records above 900–1,000 m elevation, so much of the park's high-elevation interior might not actually represent optimal habitat. Until proper survey work can be conducted by experienced fieldworkers within these relatively undisturbed forested areas, conclusions about the new species' extent of occurrence, habitat requirements, and conservation status will remain speculative at best. The new species is thereby considered "Data Deficient" in accordance with IUCN's (2016) formulaic conservation status assessment criteria.

When first observed, the holotype was perched on the tip of an understory tree branch 3–4 m above ground; this specimen, the four paratypes, and the single Caramoan specimen all slowly crawled away from the approaching field biologist when illuminated by headlamps, retreating to the back side of the slender branch on which they were first spotted (personal observations). One specimen (which later escaped) was captured inside a hollow bamboo cavity at the base of Mt. Jormahan, and another evaded capture by

dropping into a hollow tree trunk upon approach of field workers.

The new species' tendency to retreat into natural cavities and tube-shaped hollow spaces inside trees, bamboo, and other similar structural microhabitats has been observed at an additional forested area in the Pocdol Mountains, of the Bacon-Manito series of volcanic peaks, currently under private land tenure (and, thus, afforded some level of protection) in southern Albay Province. Like the Mt. Bulusan bamboo- and tree-hole cavity observations, the Albay Province specimens have eluded capture by retreating into PVC pipes driven into the soil of mid-elevation forest floor (used as botanical forest community study plot markers; JBF, personal observation).

Etymology.—We derive the new species' masculine name from the Tagalog (Filipino) adjective *hungkag*, meaning "hollow" or "empty," and used in reference to the new species' use of a unique microhabitat type: hollow cavities and crevices (hollow bamboo trunks/stems, cavities in tree branches, and other tube-shaped, or sheltered microhabitats). We also apply this specific epithet in reference to the lack of information on the new species' (and most other lesser-known vertebrates) status and distribution within Bicol's protected areas. With regard to *P. hungkag*, we have been unable to study populations within parks adjacent to the only known sites of occurrence, because of administrative restrictions preventing the study of biodiversity within these large forested areas. Although we have sampled outside the boundaries of Mt. Bulusan, the Pocdol Mountains, Mt. Isarog, Mt. Mayon, Mt. Malinao, and Caramoan National Park, to date, these regions continue to remain virtually unstudied for native herpetofauna (but see Brown et al. 2002; Binaday et al. 2017). Because of these restrictions, most Bicol protected areas exist today as areas characterized by the conspicuous absence of data, distribution gaps for many species, and geographic range maps typically with numerous pockets or "hollows" depicting the absence of data from unstudied mountains—where we would expect to find many imperiled Philippine vertebrates. Suggested common name: Bicol Hollow-dwelling Forest Gecko.

Discussion

The new species is only the second member of the *Pseudogekko brevipes* complex described from the Luzon Pleistocene aggregate island complex (PAIC; Voris 2000; Brown and Diesmos 2009), and its discovery was an unanticipated surprise, coming so soon after the recently described *P. sumiklab* (Siler et al. 2017) from Mt. Mayon (Albay Province) and the southern tip of the Bicol Peninsula (Sorsogon Province). Two other species in this clade are locally endemic to the archipelago's central West Visayan PAIC islands (*P. atiorum*; Brown and Alcala 1978; Ferner et al. 2000; Davis et al. 2015a; Supsup et al. 2016) and the Philippines' southern landmasses of the Mindanao PAIC (*P. brevipes*; Siler et al. 2014a,b, 2016; Davis et al. 2015a,b). The extent of sympatry between the two Luzon species has yet to be assessed, and at present we consider them sympatric in Sorsogon and Albay (but possibly not Caramoan), but possibly not syntopic if the crevice and hollow cavity microhabitat preference is widespread in *P. hungkag*. We

also note that the branching pattern in our inferred phylogenetic estimate (Fig. 8) suggests equally parsimonious biogeographical patterns of colonization for Bicol *P. brevipes* complex species: a single putative colonization of southern Luzon, followed by one back-dispersal versus the possibly of two separate invasions of Luzon, resulting in isolation and divergence of Bicol's two *Pseudogekko* species, who are not each other's closest relatives.

Systematic revision of *Pseudogekko* have resulted in the removal of species from this genus and their transfer to the genus *Lepidodactylus* (*L. shebae*, *L. labialis*; Brown 1964; Siler et al. 2014a) and widely sampled phylogenetic analyses have established that the continued recognition of *Pseudogekko* now renders *Lepidodactylus* paraphyletic (Brown et al. 2012b; Heinicke et al. 2012; Oliver et al. 2018). Previously considered a small clade composed of four widely distributed species (Brown and Alcala 1970, 1978), the content of the genus now stands at 10 named taxa (Siler et al. 2017). Multiple taxonomically understudied populations are likely to represent additional, undescribed species (e.g., the genetically divergent Caramoan population, at present only represented by a single immature specimen; Fig. 4C).

The two or three areas where *Pseudogekko hungkag* has been recorded (Mt. Jormahan, Sorsogon Province; the Pocdol Mountains of Albay Province; and possibly the Caramoan Peninsula of Camarines Sur Province; Fig. 1) contain patches of forest, separated by heavily disturbed agricultural regions with dense human populations and little or no natural vegetation. Estimates of natural low-elevation vegetation in these inhospitable habitat matrices indicate that <1% of their natural forests are protected (Siler et al. 2014c). We suspect that continued alteration of any forests in the vicinities of Bicol's volcanic peaks (such as the unprotected Mt. Jormahan—the new species' type locality) will pose an immediate and direct threat to the long-term viability of populations of *P. hungkag*. Like other *Pseudogekko* species (Siler et al. 2014b, 2017), *P. hungkag* is likely restricted to relatively undisturbed forest habitats at low- to mid-elevations, only a small fraction of which are protected in the Bicol Region (Heaney et al. 1999; Primavera 2000; Posa and Sodhi 2006; Polidoro et al. 2010; Siler et al. 2014c).

Localities intervening the sites of documented occurrences of the new species have been the focus of a few biodiversity surveys targeting forests of the central and northern regions of the Bicol Peninsula (Brown et al. 2002; Brown and Gonzalez 2007; Siler et al. 2009, 2010; Binaday et al. 2017). A greatly expanded and comprehensive analysis of the Bicol Faunal Region herpetological diversity is long overdue, however, given its conservation importance. Such a synthesis would markedly improve the conservation community's practical effectiveness—and the regional government's ability to manage the challenge posed by dense human populations at city centers surrounding Bicol's forested volcanoes effectively (Goodman and Gonzales 1990; Heaney et al. 1999; Brown et al. 2002; Siler et al. 2014c).

Although widespread natural habitat degradation and wholesale removal of low-elevation forests now characterize most of the Bicol Peninsula (Siler et al. 2014c), the paucity of reliable information from Bicol's herpetological communities limits our ability to infer the conservation status of many endemic taxa, including *P. hungkag*. This is because negative

occurrence data (the absence of documented geographical records, resulting in no actual understanding of the attributes governing a species' distribution) and an absence of basic data on the ecological characteristics of the new species prevent us from evaluating its status under the IUCN criteria (IUCN 2016; Leviton et al. 2018) nor understanding the significance of potentially suitable protected habitat in unsurveyed protected areas (e.g., the Bulusan Volcano Natural Park, where biologists are not permitted to conduct the scientific research that would inform conservation and management policy). We anxiously await field studies throughout the southern Bicol Peninsula, particularly within and around its few—but critically important—protected areas (Brown et al. 2013b).

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APPENDIX I

Specimens Examined

All specimens from the Philippines; value in parentheses immediately following binomial represents sample size.

Pseudogekko atiorum (16).—NEGROS ISLAND: Negros Occidental Province: *Municipality of Cauayan* (CAS-SUR 19372, 21122); Negros Oriental Province: *Municipality of Valencia*: Cuernos de Negros, Mt. Talinis (CAS 134292); *Municipality of Sibulan* (CAS 128956, 128959, 128963, 128971); *Municipality of Valencia*: Barangay Bongbong (PNM 9518 [holotype, formerly KU 302818], KU 327770, TNHC 62478); *Municipality of Pamplona* (CAS 138097, 145793, 147491); *Municipality of Siatan* (CAS 134269, CAS-SUR 26778); Siquijor Province: *Municipality of San Juan* (CAS 145710).

Pseudogekko brevipes (7).—SAMAR ISLAND (SMF 8988 [holotype]); BOHOL ISLAND: Bohol Province: *Municipality of Sierra Bullones* (CAS 131855, 147527, 147528, CAS-SU 24596, 25108, 25111).

Pseudogekko chavacano (4).—MINDANAO ISLAND: Zamboanga City Province: *Municipality of Zamboanga City* (PNM 9812 [holotype, formerly KU 314963], KU 314964 [paratype]); Zamboanga del Norte Province: Cuot Creek (CAS-SU 23548, 23549).

Pseudogekko compresicorpus (12).—LUZON ISLAND: Laguna Prov-ince: *Municipality of Los Baños*: Barangay Batong Maiake (KU 326434, 326436); Barangay Bagong Silang (KU 330735, 331657); Quezon Province: *Municipality of Infanta*: Barangay Magsaysay, Infanta-Marikina Highway, Southern Sierra Madre Mountain Range (KU 334017, 344614–20); MASBATE ISLAND: Masbate Province: *Municipality of Mobo* (CAS 141560).

Pseudogekko cf. compresicorpus (1).—POLILLO ISLAND: Quezon Province: *Municipality of Polillo*; vicinity of Polillo Town (KU 326242).

Pseudogekko cf. compresicorpus (2).—LUZON ISLAND: Cagayan Province: *Municipality of Gonzaga*: Barangay Magrafil, Mt. Cagua (KU 330058).

Pseudogekko ditoy (3).—LEYTE ISLAND: Leyte Province: *Municipality of Baybay*: Barangay Gabas, Sitio Cienda (PNM 9811 [holotype, formerly KU 326437], KU 326438 [paratype]).

Pseudogekko isapa (16).—SIBUYAN ISLAND: Romblon Province: *Municipality of Magdiwang*: Barangay Tampayan, Mt. Guiting-Guiting Natural Park (PNM 9816 [holotype]), UPLB MNH-Z NS 4606–20; TABLAS ISLAND: Romblon Province: *Municipality of San Agustin* (CAS 139713 [paratype]).

Pseudogekko pungkaypinit (6).—BOHOL ISLAND: Bohol Province: *Municipality of Sierra Bullones*: Barrio Dusita (CAS 131854 [paratype], CAS-SU 23655 [paratype]); Raja Sikatuna Natural Park (KU 324426 [paratype]); LEYTE ISLAND: Leyte Province: *Municipality of Baybay* (KU 326243 [paratype]); Barangay Guadalupe (PNM 9810 [holotype, formerly KU 326435]); MINDANAO ISLAND: Misamis Oriental Province: *Municipality of Gingoog City*: Barangay Lawaan, Sitio Kibuko, Mt. Lumot (KU 334019 [paratype]); SAMAR ISLAND: Eastern Samar Province: *Municipality of Balangiga*, Barangay Guinmaayohan, Sitio Bangon, Kaantulan River Drainage (KU 344446–48).

Pseudogekko smaragdinus (35).—POLILLO ISLAND: Quezon Province: *Municipality of Polillo* (KU 302819–302831, 303995–304002, 307638–307647, 326240, 326241, 331721); LUZON ISLAND: Camarines del Norte Province: *Municipality of Labo*: Barangay Tulay Na Lupa (KU 313828).

Pseudogekko sumiklab (3).—LUZON ISLAND: Albay Province: *Municipality of Tabaco*: Barangay Mariroc, Sitio Nagsipit, Mt. Mayon: PNM 9843 (holotype); Sorsogon Province: *Municipality of Irosin*: Barangay Cawayan, Mt. Cawayan: KU 343847 (paratype); *Municipality of Bulusan*: Barangay Salvacion: KU 346543.

APPENDIX II.—Specimen information, locality data, and GenBank accession numbers. KU = University of Kansas Biodiversity Institute herpetological collections; TNHC = Texas Natural History Collections of the Texas Memorial Museum, University of Texas at Austin; ACD = Arvin Diesmos field series, deposited at the National Museum of the Philippines (PNM).

Species	Voucher	Locality	GenBank accession numbers (ND2)
Pseudogekko atiorum	KU 302818	Mt. Talinis, Barangay Bongbong, Municipality of Valencia, Negros Oriental Province, Negros Island (genetic sample from holotype PNM 9518).	KF875323
P. atiorum	KU 327770	Mt. Talinis, Barangay Bongbong, Municipality of Valencia, Negros Oriental Province, Negros Island.	KF875324
P. atiorum	PNM 9518, KU 302818	Mt. Talinis, Barangay Bongbong, Municipality of Valencia, Negros Oriental Province, Negros Island.	KF875323
Pseudogekko brevipes	ACD 7255	Municipality of Sogud, Leyte Province, Leyte Island.	KF875330
Pseudogekko chavacano	KU 314963	Sitio Canucutan, Barangay Pasanonca, Municipality of Pasonanca, Zamboanga City Province, Mindanao Island (genetic sample from holotype PNM 9812).	KF875339
P. chavacano	KU 314964	Sitio Canucutan, Barangay Pasanonca, Municipality of Pasonanca, Zamboanga City Province, Mindanao Island (paratype).	KF875341
Pseudogekko compresicorpus	KU 330735	Mt. Makiling, Barangay Bagong Silang, Municipality of Los Banos, Laguna Province, Luzon Island.	KF875337
P. compresicorpus	KU 331657	Mt. Makiling, Barangay Bagong Silang, Municipality of Los Banos, Laguna Province, Luzon Island.	KF875338
P. compresicorpus	KU 330058	Mt. Cagua, Barangay Magrafil, Municipality of Gonzaga, Cagayan Province, Luzon Island.	KF875327
P. compresicorpus	KU 348031	Mt. Cawayan, Barangay Cawayan, Municipality of Irosin, Sorsogon Province, Luzon Island.	MN786335
P. compresicorpus	KU 326242	Barangay Danicop, Municipality of Sierra Bullones, Bohol Province, Bohol Island.	KF875340
P. compresicorpus	KU 344617	Infanta-Marikina Highway, Southern Sierra Madre Mountain Range, Barangay Magsaysay, Municipality of Infanta, Quezon Province, Luzon Island	MN786333
P. compresicorpus	KU 344620	Infanta-Marikina Highway, Southern Sierra Madre Mountain Range, Barangay Magsaysay, Municipality of Infanta, Quezon Province, Luzon Island	MN786334
P. compresicorpus	KU 326434		KF875336
P. compresicorpus	ACD 6098		KF875326
Pseudogekko ditoy	KU 326438	Sitio Cienda, Barangay Gubas, Municipality of Baybay, Leyte Province, Leyte Island (paratype).	KF875329
P. ditoy	KU 326437	Sitio Cienda, Barangay Gubas, Municipality of Baybay, Leyte Province, Leyte Island (genetic sample from holotype PNM 9811/0).	KF875333
Pseudogekko pungkaypinit	KU 324426	Barangay Danicop, Municipality of Sierra Bullones, Bohol Province, Bohol Island (paratype).	JQ437898
P. pungkaypinit	ACD 7577	Municipality of Sogud, Leyte Province, Leyte Island.	KF875331
P. pungkaypinit	ACD 7637	Municipality of Sogud, Leyte Province, Leyte Island.	KF875332
P. pungkaypinit	H-1460	Mt. Busa, Barangay Binate, Municipality of Kiamba, South Cotabato Province, Mindanao Island, Philippines.	KF875328
P. pungkaypinit	PNM 9810	LSU-Visca campus, Calbiga-a creek, Barangay Guadalupe, Municipality of Baybay, Leyte Province.	KF875334
P. pungkaypinit	KU 326243	Municipality of Baybay, Leyte Province, Leyte Island.	KF875335
Pseudogekko smaragdinus	KU 302821	Barangay Pinaglubayan, Municipality of Polillo, Quezon Province, Polillo Island.	KF875344
P. smaragdinus	KU 302819	Barangay Pinaglubayan, Municipality of Polillo, Quezon Province, Polillo Island.	JQ437897
P. smaragdinus	KU 313828	Mt. Labo, Barangay Tulay Na Lupa, Municipality of Labo, Camarines Norte Province, Luzon Island.	KF875342
P. smaragdinus	KU 326241	Barangay Aluyon Municipality of Burdeos Quezon Province, Polillo Island.	KF875348
P. smaragdinus	KU 326240	Barangay Aluyon Municipality of Burdeos Quezon Province, Polillo Island.	KF875347
P. smaragdinus	KU 302820	Barangay Pinaglubayan, Municipality of Polillo, Quezon Province, Polillo Island.	KF875343
P. smaragdinus	KU 307641	Barangay Salipsip, Municipality of Polillo, Quezon Province, Polillo Island.	KF875346
P. smaragdinus	TNHC 55024	Municipality of Polillo, Quezon Province, Polillo Island.	KF875345
P. sumiklab	KU 346543	Barangay Salvacion, Municipality of Bulusan, Sorsogon Province, Luzon Island.	MN786337
Pseudogekko hungkag, n. sp.	KU 346539	Barangay Cogon, Municipality of Irosin, Sorsogon Province, Luzon Island (holotype).	MN786338
P. hungkag, n. sp.	PNM 9865 (KU 346538)	Barangay Cogon, Municipality of Irosin, Sorsogon Province, Luzon Island (paratype).	MN786336
P. cf. *hungkag*	KU 349299	Barangay Pandanan, Municipality of Caramoan, Camarines Sur Province, Luzon Island.	MN786332