First records and a new genus of comb-tailed spiders (Araneae: Hahniidae) from Thailand with comments on the six-eyed species of this family

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Abstract. The family Hahniidae is reported from Thailand for the first time. The genus Hexamattia gen. nov. and two new species, Hexamattia seekhaow gen. et sp. nov. and Hahnia ngai sp. nov., are described and illustrated. DNA sequences are provided for all the species reported here. The phylogenetic position of the novel genus Hexamattia gen. nov. and its relation to Hahnia are discussed. Based on these results, a new combination is proposed for Hexamattia senaria (Zhang, Li & Zheng, 2011) gen. et comb. nov. = Hahnia senaria. Known distribution of the species Hahnia saccata Zhang, Li & Zheng, 2011, originally described from China, is expanded. A brief review and notes on the taxonomy of the six-eyed hahniids are included.

Keywords. Thai, Chiang Mai, new species, hahniids, phylogeny.

Introduction

The family Hahniidae Bertkau, 1878 is relatively easy to identify due to the advanced location of the tracheal spiracle in relation to the spinnerets and the characteristic arrangement of these in more or less one transverse row (at least in the Hahniinae Bertkau, 1878) (Lehtinen 1967; Opell & Beatty 1976). Other members of this family (e.g., Cicurina Menge 1871 and Cybaeolinae Lehtinen, 1967) do not share this transverse arrangement of the spinnerets (Roth 1967; Wang et al. 2019). The Hahniidae currently
includes 351 species in 23 genera distributed worldwide (WSC 2020). The family status of Hahniidae has been confirmed by molecular phylogenies being placed within the RTA clade, closely related to Cybaeidae Banks, 1892 and Dictynidae O. Pickard-Cambridge, 1871 (J.A. Miller et al. 2010; Wheeler et al. 2017). However, the relations and delimitations of its genera have always been problematic. Only a few local revisions have been done, two for Nearctic species (Gertsch 1934; Opell & Beatty 1976) and one for New Zealand species (Forster 1970). Beside these revisions, Lehtinen (1967) published some comparative tables including diagnostic characters of 17 extant genera (10 currently valid, WSC 2020) and one more from Baltic amber. Presently, two genera, Cicurina and Hahnia C.L. Koch, 1841, have served as ‘wastebin taxa’ for new species descriptions, having a great morphological heterogeneity and accounting together for almost 70% of all the valid hahniid species (WSC 2020). The great heterogeneity and unclear delimitations in these and other hahniid genera are a recurrent note in new species publications (Forster 1970; Zhang et al. 2013; Huang et al. 2017).

The Hahniidae have a worldwide distribution, being more diverse in the Americas and Asia but also having a fair number of species described from Europe, Africa and Oceania (WSC 2020). In Asia, eight genera and 93 species have been recorded distributed from the Middle East to Eastern Russia and Japan. In South and Southeast Asia, hahniids have been reported from Hong Kong, Indonesia, Laos, Philippines, Southern China, Sri Lanka, Taiwan and Vietnam (Lehtinen 1967; Bosmans 1992; Barrion & Litsinger 1995; Tang et al. 1996; Zhang et al. 2011, 2013; Zhang & Zhang 2013; Liu et al. 2015; Huang et al. 2017). This is the first time the Hahniidae are reported from Thailand. Here we describe a new genus and two new species in this family based on molecular and morphological data. Additionally, we include a brief literature review on the rare six-eyed hahniids.

Material and methods

The hahniid species reported here were collected in the Chiang Mai Province, Thailand, between July 16th and 28th 2018. All the specimens were captured using methods optimized for ground dwelling spiders: leaf litter sifting, Winkler extractors, pitfall traps and direct collecting on ground, among leaf litter and under rocks or logs.

Specimen habitus and other somatic characters were photographed under a Leica MI6SC stereo microscope equipped with a Nikon DS-Ri2 camera. Genitals were photographed using a Leica DM 2500 microscope attached to the same camera. Specimens were observed in ethanol using semi permanent slide preparations (Coddington 1983). Female genitalia were dissected, digested using pancreatine solution (Álvarez-Padilla & Hormiga 2007) and cleared with methyl salicylate.

Four legs were taken from one individual of each species for DNA extraction. Six gene fragments (COI, H3, 12S, 16S, 18S and 28S) were amplified following M.A. Miller et al. (2010) and Wheeler et al. (2017) protocols; list of primers is provided in the Supplementary material (Supplementary file 1). Sequences were edited in Geneious Prime 2020.0.5. New sequences generated for this study were deposited in GenBank; accession numbers are reported in Table 1. All the specimens used here have been deposited in the collection of the Naturalis Biodiversity Center, Leiden, the Netherlands (RMNH.ARA.18411–RMNH.ARA.18415).

We used sequences from the three species we collected, as well as 15 other species with available sequences in GenBank. We used in total 14 species of Hahniidae, three species of Cybaeidae Banks, 1892, and one species of Agelenidae C.L. Koch, 1837, Agelena labyrinthica Walckenaer, 1805, as an outgroup. The sequences used to test the relationships and position of the new species within the Hahniidae are listed in Table 1. We used MAFFT ver. 7.450 online (https://mafft.cbrc.jp/alignment/server/) with default parameters to build the alignments. Alignments for 18S were further trimmed manually due to the size difference of some sequences. 16S and 12S were not used due to the low availability of these loci for
the Hahniidae in GenBank; Table 1 only reports accession numbers of these markers for our sequences. * marks the new sequences generated for the present work.

Table 1. GenBank accession numbers of DNA sequences used for our analyses.

| Family     | Species                          | COI      | H3       | 12S       | 16S       | 18S       | 28S       |
|------------|----------------------------------|----------|----------|-----------|-----------|-----------|-----------|
| Agelenidae | Agelena labyrinthica            | FN554797 | KR074077 |           |           |           |           |
| Cybaeidae  | Calymmaria sp. 1                | DQ628611 | DQ628638 |           |           |           |           |
| Cybaeidae  | Cryphoea exileae                | KM840792.1 | MN590107.1 |           |           |           |           |
| Cybaeidae  | Cybaeus morosus                 | FJ263792 | DQ628641 |           |           |           |           |
| Hahniidae  | Antistea brunnea                | HQ580602.1 | MN590134.1 |           |           |           |           |
| Hahniidae  | Cybaeolus cf. rastellus         | KY017745 | KY018252 |           |           |           |           |
| Hahniidae  | Cybaeolus pusillus              | KY018253.1 | KY016482.1 |           |           |           |           |
| Hahniidae  | Hahnia clathrata                | FJ949005 | FJ949043 |           |           |           |           |
| Hahniidae  | Hahnia nava                     | KY270115 | KY018254.1 |           |           |           |           |
| Hahniidae  | Hahnia ngai sp. nov.            | MT433973* | MT445988* | MT434973* | MT437224* | MT434975* |           |
| Hahniidae  | Hahnia ononidum                 | MG047916.1 | MN590137.1 |           |           |           |           |
| Hahniidae  | Hahnia saccata                  | MT433972* | MT434903* |           |           |           |           |
| Hahniidae  | Hahnia sp. ZZ-2016 (China)      | KR074066 | KR074092 |           |           | KR074014 |           |
| Hahniidae  | Hahnia zhejiangensis            | KR074067.1 | KR074093.1 |           |           | KR073991.1 | KR074041.1 |
| Hahniidae  | Hexamatia seekhaow sp. nov.     | MT433971* | MT445987* | MT434972* | MT437221* | MT434974* |           |
| Hahniidae  | Neoantistea agilis              | HQ580773.1 | DQ628644.1 |           |           | DQ628714.1 | DQ628678.1 |
| Hahniidae  | Neoantistea quelpartensis       | JN817206.1 |           |           |           |           | JN816788.1 | JN816996.1 |

**Abbreviations** (in text and figures)

- **A** = epigynal atrium
- **ALE** = anterior lateral eyes
- **ALS** = anterior lateral spinnerets
- **AME** = anterior median eyes
- **BI** = Bayesian inference
- **Cd** = copulatory duct
CF = cymbial furrow
Co = copulatory opening
Cy = cymbium
E = embolus
F = femur
Fd = fertilization duct
G = glands
LE = lateral eyes
MA = median apophysis
ML = maximum likelihood
MP = maximum parsimony
P = patella
PA = patellar retrolateral apophysis
PLE = posterior lateral eyes
PLS = posterior lateral spinnerets
PME = posterior median eyes
PMS = posterior median spinnerets
RTA = retrolateral tibial apophysis
S = spermatheca
Sd = spermatic duct
Ss = secondary spermatheca
T = tibia
Te = tegulum

Results

Phylogenetic analyses

Topologies inferred by the three different phylogenetic analyses recovered nearly identical topologies (Fig. 1a–c). The genus Hahnia was homogeneously recovered as diphyletic. The clade Hahnia 1 was formed by six species of Hahnia, and Hahnia 2 by H. ngai sp. nov. and H. saccata, the two species of Hahnia we captured in Thailand. The clade Hahnia 1 showed high support, although the internal relationships are not fully resolved, having moderate to weak support values in the ML and MP analyses. This clade was found as a sister group to the new genus Hexamatia gen. nov. in all our trees. The clade Hahnia 2 appears to be more related to Antistea + Neoantistea. This branch is recovered and highly supported in all the analyses. The cluster formed by Antistea + Neoantistea is strongly supported although its internal relationships are not resolved and show weak to moderate support in the MP and ML. The three cybaeid representatives form a highly supported group that is consistently recovered as a sister to the monophyletic Hahnidae. Our BI showed an average deviation of split frequencies below 0.003 after 1 000 000 generations. None of the Estimated Sample size parameters fell below the commonly used threshold of 200 suggesting that our BI ran for an adequate length (Drummond et al. 2006; Lanfear et al. 2016). The trace plot and histograms of both runs are available in Supplementary files 3–4. Pairwise genetic distances for our alignment showed Hexamatia gen. nov. to have a wide range of distances with respect to species of Hahnia. When compared to species in Hahnia 1, this range went from 9.5 to 25% while the distance from Hahnia 2 was between 10.7 and 17.8%. In comparison, the distances between Hexamatia gen. nov. and Antistea + Neoantistea were higher and less variable, between 18.0 and 19.2%. See Supplementary file 5 for complete distance matrix.
Fig. 1. Tree topologies obtained by different analyses. a. Maximum parsimony most parsimonious tree, numbers at nodes indicate bootstrap support. b. Maximum likelihood, numbers at nodes indicate bootstrap support. c. Bayesian inference, numbers at nodes indicate posterior probabilities. The agelenid *Agelena labyrinthica* Walckenaer, 1805 was used as an outgroup of Cybaeodinae Simon, 1893 and Hahniidae Bertkau, 1878. Fourteen species of Hahniidae and three of Cybaeidae Banks, 1892 were used. Note the diphily of *Hahnia* C.L. Koch, 1841 and the position of *Hexamata* gen. nov. as a sister group to *Hahnia* 1.


**Taxonomy**

Class Arachnida Lamarck, 1801  
Order Araneae Clerck, 1757  
Family Hahniidae Bertkau, 1878  

Genus *Hexamatia* gen. nov.  
urn:lsid:zoobank.org:act:D9504970-17C3-43FF-9231-4D020BC176C7

**Type species**  
*Hexamatia seekhaow* gen. et sp. nov.

**Diagnosis**  
*Hexamatia* gen. nov. is distinguished from most hahniid genera by the combination of the following characters: presence of only six eyes, small body size close to 1 mm, and body pale yellow to white, lacking abdominal patterns in males and having faint chevron lines in females (Zhang *et al.* 2011: fig. 23a–b). It can be separated from other six-eyed hahniids by the following combination of characters: from *Amaloxenops* Schiapelli & Gerschman, 1958 by having a backward curved RTA without twists, and presence of PA on the pedipalp patella and MA on the bulb; from *Intihuatana* Lehtinen, 1967 by having an unbifurcated RTA, a shorter and bifurcated PA, and presence of MA; and from *Scotospilus* Zhang, Li & Pham, 2013 by the comparatively short RTA, bifurcated PA and presence of MA.

**Etymology**  
The genus name is formed from two Greek roots: *hexa* (six) and *mati* (eye). It refers to the number of eyes present in this genus, one of its diagnostic characters. The gender is feminine.

**Composition**  
*Hexamatia seekhaow* gen. et sp. nov. and *Hexamatia senaria* (Zhang, Li & Zheng, 2011) gen. nov., based on the original description and illustrations.

**Distribution**  
*Hexamatia seekhaow* gen. et sp. nov. is known from Chiang Mai, Thailand; and *Hexamatia senaria* gen. nov. from Yunnan, China (Fig. 8).

**Hexamatia seekhaow** gen. et sp. nov.  
urn:lsid:zoobank.org:act:1D1D0DE7-8A2A-4469-8867-666F9AD6EAEB  
Figs 2–3

**Diagnosis**  
*Hexamatia seekhaow* gen. et sp. nov. greatly resembles *H. senaria* gen. nov. but can be distinguished by the bifurcated PA and having a slightly shorter RTA with a blunter tip (Figs 2f, 3d–e; Zhang *et al.* 2011: figs 21a–d, 22). Another putative difference is the presence of denticles in the distal portion of the RTA; these are not mentioned nor illustrated for *H. senaria* gen. nov.

**Etymology**  
The species epithet is a derivation of the Thai *seekhaow* (white); refers to the lack of color on the body of the holotype of this species.
Type material

Holotype
THAILAND • ♂; Chiang Mai Province, Doi Suthep National Park; 18°48.502' N, 98°53.528' E; 1409 m a.s.l.; 24–28 Jul. 2018; Booppa Petcharad, Jeremy Miller and F. Andrés Rivera-Quiroz leg.; montane evergreen forest with pine; hand coll. among leaf litter; RMNH.ARA.18411 (four legs used for DNA extraction).

Description

Male holotype
Carapace yellowish-white, pale brown in cephalic region (Fig. 2b–c). Legs same color as carapace. Abdomen white without chevron pattern, oval, longer than wide (Fig. 2a–c). Six eyes in two triads,
Fig. 3. *Hexamatia seekhaow* gen. et sp. nov., holotype, ♂ (RMNH.ARA.18411). a–e. Palp. a. Ventral view, cleared. b. Retrolateral view. c. Dorso-retrolateral view, cleared. d. Prolateral view. e. Dorso-retrolateral view. f. Male spinnerets, ventral view. g. Chelicera. Posterior view. Scale bars: a–f = 0.15 mm; g = 0.5 mm.
AME absent ALE 0.04 mm, PME 0.02 mm, PLE 0.02 mm, ALE–ALE 0.02 mm, PME–PME 0.03 mm, PME–PLE contiguous (Fig. 2d). Chelicerae with three promarginal and two retromarginal teeth (Fig. 3g). Tracheal spiracle near middle of abdomen (Fig. 2a).

PALP. Pale brown, same color as cephalic region (Fig. 2c). CF darker, almost as long as RTA (Figs 2e–f, 3b), oval-shaped from ventral view (Figs 2f, 3a). Median apophysis narrow, elongate and transparent (Fig. 3a–b). Embolus filiform, black and long, originating retrrolleraterally and coiling clockwise around bulb (Figs 2f, 3a–b). RTA spur-like with dark rings. Patellar apophysis short and bifid, with the longer prong hook-shaped (Fig. 3c).

MEASUREMENTS (in mm). Total length 1.1, carapace 0.46 long, 0.33 wide; clypeus 0.01; chelicera 0.2 long, 0.1 wide; pedipalp 0.4 long; palpb bulb 0.11 wide; leg I: femur 0.32, patella 0.13, tibia 0.26, metatarsus 0.22, tarsus 0.15; leg II: femur 0.31, patella 0.12, tibia 0.19, metatarsus 0.19, tarsus 0.15; leg III: femur 0.27, patella 0.08, tibia 0.16, metatarsus 0.17, tarsus 0.15; leg IV: femur 0.34, patella 0.11, tibia 0.22, metatarsus 0.21, tarsus 0.16; leg formula IV-I-II-III; abdomen 0.45 long, 0.34 wide.

Distribution
Known from the type locality, Doi Suthep National Park, Chiang Mai, Thailand (Fig. 8).

Notes
See the Discussion for remarks on six-eyed species.

Genus Hahnia C.L. Koch, 1841

Hahnia C.L. Koch, 1841: 61.

Type species
Hahnia pusilla C.L. Koch, 1841.

Hahnia ngai sp. nov.

urn:lsid:zoobank.org:act:F9A7FE4B-77C4-4D9B-AFDB-A2FC6F5E0739
Figs 4, 6a–c

Diagnosis
Hahnia ngai sp. nov. can be easily separated from other members of this genus by the simplified female genitalia. Copulatory ducts show only slightly swollen areas with glandular insertions (Figs 4g, 6b–c) but do not form a receptacle or secondary spermathecae (as seen in Figs 5g, 6e–f).

Etymology
The species epithet is a derivation of the Thai ngai (simple), in reference to the relatively simple vulva without the well-formed secondary spermathecae commonly seen in other species of Hahnia.

Type material
Holotype
THAILAND • ♀; Chiang Mai Province, Doi Suthep National Park; 18°48.502’ N, 98°53.528’ E; 1409 m a.s.l.; 24–28 Jul. 2018; Booppa Petcharad, Jeremy Miller and F. Andrés Rivera-Quiroz leg.; montane evergreen forest with pine; Winkler extractor; RMNH.ARA.18415 (four legs used for DNA extraction).
Paratypes
THAILAND • 1 ♀; Chiang Mai Province, Doi Inthanon National Park; 18°35.268′ N, 98°29.240′ E; 2572 m a.s.l.; 24–28 Jul. 2018; Booppa Petcharad, Jeremy Miller and F. Andrés Rivera-Quiroz leg.; cloud forest; Winkler extractor; RMNH.ARA.18414 • 1 ♀; same collection data as for preceding; hand coll.; RMNH.ARA.18413.

Description
Female
Carapace pear-shaped, reddish-brown, slightly darker in cephalic region; texture smooth (Fig. 4c). AME 0.04 mm, ALE 0.06 mm, PME 0.07 mm, PLE 0.04 mm, AME–AME 0.03 mm, AME–

Fig. 4. Hahnia ngai sp. nov., holotype, ♀ (RMNH.ARA.18415). a–c. Habitus. a. Ventral view. b. Lateral view. c. Dorsal view. d. Prosome, anterior view. e. Chelicerae, posterior view. f–g. Epigynum. f. Dorsal view, cleared. g. Ventral view. Scale bars: a–c = 1.0 mm; d–e, g = 0.25 mm; f = 0.1 mm.
ALE 0.02 mm, PME–PME 0.05 mm, PME–PLE 0.03 mm (Fig. 4d). Chelicerae with three promarginal and three retromarginal teeth (Fig. 4e). Legs pale brown, slightly darker on distal segments. Abdomen dark grey with light patches forming five to six chevron bands, oval, longer than wide (Fig. 4c). Tracheal spiracle near middle of abdomen (Fig. 4a).

VULVA. Epigynal plate semitransparent, spermathecae well visible due to transparency. Copulatory openings close together, forming small semi-circular atrium (Figs 4f–g, 6c). Spermatheca sub-spherical with brownish-red coloration (Fig. 4f). Copulatory ducts very simple, slightly swollen centrally (Figs 4f, 6b–c).

MEASUREMENTS (in mm). Total length 2.8, carapace 1.25 long, 0.91 wide; clypeus 0.09; chelicera 0.45 long, 0.25 wide; leg I: femur 0.95, patella 0.37, tibia 0.71, metatarsus 0.72, tarsus 0.55; leg II: femur 0.94, patella 0.34, tibia 0.72, metatarsus 0.68, tarsus 0.55; leg III: femur 0.89, patella 0.33, tibia 0.63, metatarsus 0.71, tarsus 0.51; leg IV: femur 1.12, patella 0.34, tibia 0.93, metatarsus 1.01, tarsus 0.62; leg formula IV-I-II-III; abdomen 1.65 long, 1.23 wide.

Distribution
Known from two localities in Chiang Mai, Thailand (Fig. 8): Doi Suthep National Park (type locality), and the neighboring Doi Inthanon National Park.

*Hahnia saccata* Zhang, Li & Zheng, 2011
Figs 5, 6d–f

*Hahnia saccata* Zhang, Li & Zheng, 2011: 16, figs 14a–e, 15a–h, 16a–g.

Material examined
THAILAND • 2 ♀♂; Chiang Mai Province, Doi Suthep National Park; 18°48.780’ N, 98°55.928’ E; 643 m a.s.l.; 25–28 Jul. 2018; Booppa Petcharad, Jeremy Miller and F. Andrés Rivera-Quiroz leg.; *Dipterocarpus* forest; hand coll.; RMNH.ARA.18412 (four legs of one specimen used for DNA extraction).

Description
Female
Carapace pear-shaped, reddish-brown, slightly darker in cephalic region; texture smooth (Fig. 5c). AME 0.06 mm, ALE 0.11 mm, PME 0.08 mm, PLE 0.05 mm, AME–AME 0.02 mm, AME–ALE 0.01 mm, PME–PME 0.06 mm, PME–PLE 0.04 mm (Fig. 5d). Chelicerae with three promarginal and seven retromarginal teeth (Fig. 5e). Legs same color as carapace, darker on proximal and distal part of each segment. Abdomen dark grey with light patches forming five to six chevron bands, oval, longer than wide (Fig. 5c). Tracheal spiracle near middle of abdomen (Fig. 5a).

VULVA. Epigynal plate dark. Copulatory openings close together but not forming an atrium (Figs 5g, 6f). Spermatheca sub-spherical with brown coloration (Fig. 5f). Copulatory ducts forming secondary spermatheca (Figs 5f, 6e–f).

MEASUREMENTS (in mm). Total length 3.20, carapace 1.45 long, 1.04 wide; clypeus 0.10; chelicera 0.70 long, 0.33 wide; leg I: femur 1.22, patella 0.46, tibia 1.13, metatarsus 0.92, tarsus 0.63; leg II: femur 1.12, patella 0.45, tibia 0.90, metatarsus 0.81, tarsus 0.61; leg III: femur 0.98, patella 0.41, tibia 0.75, metatarsus 0.80, tarsus 0.49; leg IV: femur 1.31, patella 0.45, tibia 1.12, metatarsus 1.03, tarsus 0.65; leg formula IV-I-II-III; abdomen 1.73 long, 1.20 wide.
Distribution
Known from the Menglun Nature Reserve, Yunnan, China (type locality), and Doi Suthep National Park, Chiang Mai, Thailand (present work) (Fig. 8).

Discussion
The Hahniidae, especially the Hahniinae, have traditionally been seen as an easily diagnosable group in part due to the transversal comb-shaped position of the spinnerets. Nevertheless, their position as a family has changed overtime, being initially considered a subfamily of the Agelenidae (Simon 1875; Fig. 5. *Hahnia saccata* Zhang, Li & Zheng, 2011, ♂ (RMNH.ARA.18412). a–c. Habitus. a. Ventral view. b. Lateral view. c. Dorsal view. d. Prosoma, anterior view. e. Chelicerae, posterior view. f–g. Epigynum. f. Dorsal view, cleared. g. Ventral view. Scale bars: a–c = 1.0 mm; d = 0.50 mm; e–g = 0.25 mm.)
Gertsch 1934; Lehtinen 1967, among others) and Dictynidae (Lehtinen 1967; Paquin & Duperré 2009; Wang et al. 2019, among others). Currently, the monophyly of the family is largely recognized, and its relations have been indirectly tested as a part of broad scoped phylogenetic studies (J.A. Miller et al. 2010; Wheeler et al. 2017). However, the relations between its genera have never been phylogenetically tested. Although our data did not include representatives of all the known hahniid genera, we found some consistent and well supported results with the 14 hahniid species and four loci we analyzed. The position of the new genus Hexamatoria gen. nov. as a sister group to the core species of Hahnia in our study is confidently recovered in all our topologies. We consider that this plus the

Fig. 6. Female spinnerets and genitals. a–c. Hahnia ngai sp. nov., holotype (RMNH.ARA.18415). a. Spinnerets, ventral view. b. Epigynum, cleared, dorsal view. c. Ventral view. d–f. Hahnia saccata Zhang, Li & Zheng, 2011 (RMNH.ARA.18412). d. Spinnerets, ventral view. e. Epigynum, cleared, dorsal view. f. Ventral view. Scale bars: a, d–f = 0.25 mm; b–c = 0.1 mm.
Fig. 7. Examples of eye reduction in the Hahniidae Bertkau, 1878. a. Eight eyes with minute AME, *Alistra myops* (Simon, 1898); modified from Schiapelli & Gerschman de P. 1959. b–d. Six eyes. b. *Amaloxenops vianai* Schiapelli & Gerschman, 1958; modified from Schiapelli & Gerschman de P. 1958. c. *Scotospilus longus* Zhang, Li & Pham, 2013; modified from Zhang et al. 2013. d. *Hexamatia seekhaow* gen. et sp. nov. e–f. No eyes, *Iberina mazarredoi* Simon, 1881; modified from Fernández-Pérez et al. 2014. Scale bars: a–d = 0.1 mm; e–f = 0.5 mm.
morphological differences between the new genus and \textit{Hahnia} (presence of six eyes, small size close to 1 mm and almost complete lack of coloration and abdominal patterns) are sufficient to consider it outside of the \textit{Hahnia} 1 group, and as a genus of its own. We also propose a new combination for \textit{Hexamatia senaria} gen. nov. Although we were not able to test the relationships between \textit{Hexamatia} gen. nov. and other six-eyed hahniids like \textit{Amaloxenops} (Lehtinen 1967; Schiapelli & Gerschman de P. 1958), \textit{Intihuatana antarctica} (Simon, 1902) (Dupérré & Harms 2018) and \textit{Scotospilus} (Zhang \textit{et al.} 2013), clear morphological differences could be observed in somatic and genital characters like body size, coloration, size and shape of RTA and PA, and the presence of MA (see the diagnosis of \textit{Hexamatia} gen. nov.).

The clade \textit{Hahnia} 2 formed by \textit{H. saccata} and \textit{H. ngai} sp. nov. was found to be closely related to \textit{Antistea}+\textit{Neoantistea} in our analyses (Fig. 1a–c), suggesting that these species might be misplaced in \textit{Hahnia}. However, these and many other Asian hahniids require a broader revision and more comprehensive phylogeny to fully resolve their relations within this family. Therefore, \textit{H. ngai} sp. nov. and \textit{H. saccata} remain in \textit{Hahnia}; in the case of the later, as it was originally described by Zhang \textit{et al.} (2011).

\textbf{Fig. 8.} Map of mainland Southeast Asia, showing the collecting sites of Zhang \textit{et al.} (2011) (\textit{Hahnia saccata} Zhang, Li & Zheng, 2011 and \textit{Hexamatia senaria} (Zhang, Li & Zheng, 2011) gen. et comb. nov.), circle; and our new hahniid specimens (\textit{Hexamatia seekhaow} gen. et sp. nov., \textit{Hahnia ngai} sp. nov. and \textit{Hahnia saccata}), square.
Eye reduction in the Hahniidae

This phenomenon appears to be rare in hahniid spiders. Most known species of this family have eight eyes; still, some instances of eye reduction have been documented in at least six genera. The modifications of eyes range from size reduction of AME and lack of AME, to complete absence of eyes (Lehtinen 1967). The evolution of this phenomenon in this family has never been studied, and the relations of the species with reduced eyes are largely unknown. Even their taxonomy has been constantly a subject of debate (Lehtinen 1967; Schiapelli & Gerschman de P. 1959; Catley 1999; Dupérré & Harms 2018).

Size reduction of the AME (Fig. 7a) is relatively common being observed in several species of the following genera: Alistra Thorell, 1894 (Lehtinen 1967; Forster 1970; Ledoux 2004), Amaloxenops (Schiapelli & Gerschman de P. 1959; Catley 1999; Dupérré & Harms 2018), Hahnia (Lehtinen 1967; Ubick et al. 2005, among others) and Neohahnia Mello-Leitão, 1917 (Mello-Leitão 1917; Lehtinen 1967; Heimer & Müller 1988). Reduction in number of eyes (Fig. 7b–d) is much rarer being documented only in a few species: Amaloxenops vianai Schiapelli & Gerschman, 1958 (Schiapelli & Gerschman de P. 1958; Lehtinen 1967), Hexamata senaria gen. nov. (Zhang et al. 2011), Hexamata seekhaow gen. et sp. nov., Intihuatana antarctica (Dupérré & Harms 2018), Scotospilus longus Zhang, Li & Pham, 2013 (Zhang et al. 2013), and two unpublished species documented in a revision of South American hahniids (Catley 1999); a quick examination of the illustrations and descriptions of these species suggest that they are not closely related. Finally, complete lack of eyes (Fig. 7e–f) has only been reported in the genus Iberina (Fernández-Pérez et al. 2014; Ledoux 2014). This wide range in the degree of eye reduction and broad geographical spread of this phenomenon suggest that eyes are a very plastic character and the loss or reduction might have evolved independently several times within this family. Nevertheless, a more comprehensive phylogeny of the Hahniidae is necessary to test this hypothesis.

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**Supplementary material**

Supplementary file 1. List of primers used in this study. https://doi.org/10.5852/ejt.2020.724.1157.3141

Supplementary file 2. Aligned matrix in nexus format. https://doi.org/10.5852/ejt.2020.724.1157.3143

Supplementary file 3. Results of the BI analysis shown in a trace plot using the program Tracer ver. 1.7.1 (Rambaut et al. 2018). https://doi.org/10.5852/ejt.2020.724.1157.3145

Supplementary file 4. Results of the BI analysis shown in a histogram using the program Tracer ver. 1.7.1 (Rambaut et al. 2018). https://doi.org/10.5852/ejt.2020.724.1157.3147

Supplementary file 5. Pairwise genetic distance for our data set obtained using MEGA X (Kumar et al. 2018). https://doi.org/10.5852/ejt.2020.724.1157.3149