Phaenospila gen. nov. (Hymenoptera: Braconidae: Alysiinae) and three new species from Thailand

Yao, J., C. van Achterberg (Cornelis), Sharkey, M.J., Chapman, E.G., Fang, S., Aizezi, A., , Li, J.

DOI:
https://doi.org/10.11646/zootaxa.5195.5.5

Zootaxa 5195 (5): 468–484
https://www.mapress.com/zt/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

https://doi.org/10.11646/zootaxa.5195.5.5
http://zoobank.org/urn:lsid:zoobank.org:pub:BC6FDDF5-45B9-4F4B-B9B2-4EBB8A070F59

Phaenospila gen. nov. (Hymenoptera: Braconidae: Alysiinae) and three new species from Thailand

JUNLI YAO[1*], CORNELIS VAN ACHTERBERG[2], MICHAEL J. SHARKEY[3,4], ERIC G. CHAPMAN[3,5], SHUQIAN FANG[1,6], AYIZUOHERE AIZEZI[1,7] & JIMIN LI[1,8]

[1]*Biological Control Research Institute, Fujian Agriculture & Forestry University, Fuzhou, Fujian 350002, China.*
[2]*Naturalis Biodiversity Center, Postbus 9517, 2300 RA Leiden, the Netherlands.* https://orcid.org/0000-0002-6495-4853
[3]*Department of Entomology, University of Kentucky, Lexington KY 40546-0091, U.S.A.*
[4] https://orcid.org/0000-0001-6201-7340
[5] https://orcid.org/0000-0003-3464-3074
[6] https://orcid.org/0000-0002-9216-2132
[7] https://orcid.org/0000-0002-6664-6088
[8] https://orcid.org/0000-0002-7436-6609
[*]*Corresponding author.* rjuneyao@outlook.com; https://orcid.org/0000-0002-6064-1315

Abstract

A new braconid genus belonging to the tribe Alysiini. *Phaenospila* van Achterberg & Yao, **gen. nov**. (type species: *Phaenospila signator* Yao, **sp. nov.**), is described. The genus is identified with morphological characters and a phylogenetic analysis of COI sequence data; GenBank accession numbers of fifty generated sequences from the three species are included. Three new species are described and illustrated, *Phaenospila brevicarinata* van Achterberg & Yao **sp. nov.**, *Phaenospila areolator* Yao & van Achterberg **sp. nov.**, *Phaenospila signator* Yao **sp. nov.** A key to the species of the genus *Phaenospila* is included.

Key words: Alysiini, taxonomy, identification, new genus, Oriental, South Asia, key

Introduction

Alysiini (Hymenoptera, Braconidae, Alysiinae) is a large tribe with 76 genera and over 1565 valid species (Yu *et al.* 2016). It is known that Alysiini includes mostly koinobiont endoparasitoids of cyclorrhaphous dipteran larvae, which use their mandibles (usually with 3–4 teeth or lobes) to break open the puparium of the host (Wharton 1977). Among the Alysiini collected in Thailand, 90 specimens were found to belong to a new genus, *Phaenospila,* with three new species recognised because of the lamelliform postpectal carina present ventrally, vein m-cu of hind wing largely unsclerotised, vein 1-R1 long (1.4–1.9 x as long as pterostigma), and antenna with white band.

Methods

Species concepts

The biological species concept is used with indirect evidence drawn from cytochrome *c* oxidase subunit I (COI) sequences and morphological characters. COI was the primary source of evidence with no particular percent divergence employed as a cut-off. The sequence data were checked against morphological data and these corroborated the sequence data.

Morphology, specimen collection and deposition

The terminology and measurements used follow van Achterberg (1979, 1988). The following abbreviations are used: POL = postocellar line; OOL = ocular-ocellar line, measured from ocellus directly to eye; OD = maximum

 Accepted by J. Jennings: 23 Sept. 2022; published: 14 Oct. 2022

diameter of lateral ocellus; T1 = first metasomal tergite; medial length of T1 is measured from the apex of adductor to the apex of tergite; AS = antennomeres. For additional references see Yu *et al.*(2016).

Specimens were malaise trap collected and photographs for species plates were produced using a JVC digital camera mounted on a Leica MZ16 microscope and Auto-Montage® stacking software. Photos were slightly processed (cropped and background modified) in Photoshop. Holotypes and most paratypes are deposited in the Queen Sirikit Botanic Gardens Entomology Collection, in Chiang Mai, Thailand (QSBG); other paratypes are deposited in the Beneficial Insects Institute Collection, Fujian Agriculture and Forestry University, China (BIIC) and Naturalis Biodiversity Center, Leiden, The Netherlands (RMNH).

DNA extraction, PCR and sequencing

For protocols of DNA extraction, PCR and sequencing see Yao *et al.*(2020).

Phylogenetic analysis

Sequence processing is as described in Yao *et al.* (2020). Forty-five sequences used in this paper are deposited on the GenBank database (see Appendix, Table A1) and five additional sequences yielded are listed in this paper (see Appendix, Table A2). Maximum likelihood (ML) phylogenetic analyses were conducted on a 658 bp data set (fifty in-group terminals, thirteen outgroup terminals) using MEGA (v. 5; Tamura *et al.* 2011) with default settings. For outgroup rooting, we included thirteen sequences from two species of *Neurolarthra* Fischer that we generated because they were close to *Phaenospila* (shown in the tree from figshare as *Alysiasta*) in a larger analysis of 170 alysiine sequences (13 genera) that we generated (not published, available from figshare at https://figshare.com/s/91fcb49829d2b0215f2c) and one species of *Gnathopleura* Fischer we consider to be close to *Phaenospila* via morphological examination. The data were partitioned by codon position. The best-fitting nucleotide substitution model with the lowest BIC score was determined using MEGA 5. Analyses were performed under the HKY+I, and support for the inferred ML tree was inferred by bootstrapping with 1000 replicates.

Results and discussion

Phylogenetics

The ML phylogenetic tree, based on COI sequence data, of a sampling of *Phaenospila* from Thailand is presented in Figure 1. This tree clearly shows that we have three species. Out of 655 bp of COI sequence data, the mean difference between the twenty-nine sequences of *P. signata* is 1.26% (uncorrected p-distance = 0.01259). Fifteen sequences of *P. areolator* are about 0.14% (uncorrected p-distance = 0.00142) different. The average difference between the two species is in the range of 21.44% (uncorrected p-distance = 0.21440). Seven sequences of *P. brevicarinata* differ by 0.33% (uncorrected p-distance = 0.00329). *P. brevicarinata* and *P. areolator*, *P. brevicarinata* and *P. signator* are 22.16% (uncorrected p-distance = 0.22161) and 24.66% (uncorrected p-distance = 0.24656) different, respectively.

Taxonomy

Phaenospila van Achterberg & Yao, gen. nov.

(Figs 2–4)

Type species: *Phaenospila signator* Yao, **sp. nov.** Gender: feminine.

Etymology. From a combination of two generic names (*Phaenocarpa* and *Cratospila*) because it belongs to the *Phaenocarpa* group of genera and shares with *Cratospila* the very elongate antennomeres (AS). However, in the latter genus the first flagellomere is longest instead of the second.

Diagnosis. Antenna with white band, AS4 strongly elongate and 1.8–2.7 × as long as AS3; clypeus semi-circular and ventrally obtuse; precoxal sulcus complete and crenulate; postpectal carina present ventrally and more or less lamelliform; vein r issued distinctly behind middle of pterostigma; marginal cell of fore wing reaching apex of wing (rarely remaining removed from apex) and vein 1-R1 1.4–1.9 × as long as pterostigma (Fig. 2B, 3B, 4F);

veins 1-M and m-cu of fore wing subparallel (Fig. 2B, 3B, 4F); vein 1-SR+M of fore wing evenly curved basally; vein 1r-m of hind wing gradually merging into vein 1-M; vein m-cu of hind wing far antefurcal and unsclerotised basally; vein M+CU of hind wing 0.7–1.0 × as long as vein 1-M; setose part of 0.4–0.5 × as long as fore wing and 1.1–1.6 × as long as hind tibia, ovipositor sheath setae long and moderately dense (Figs 2I, 3I, 4H).

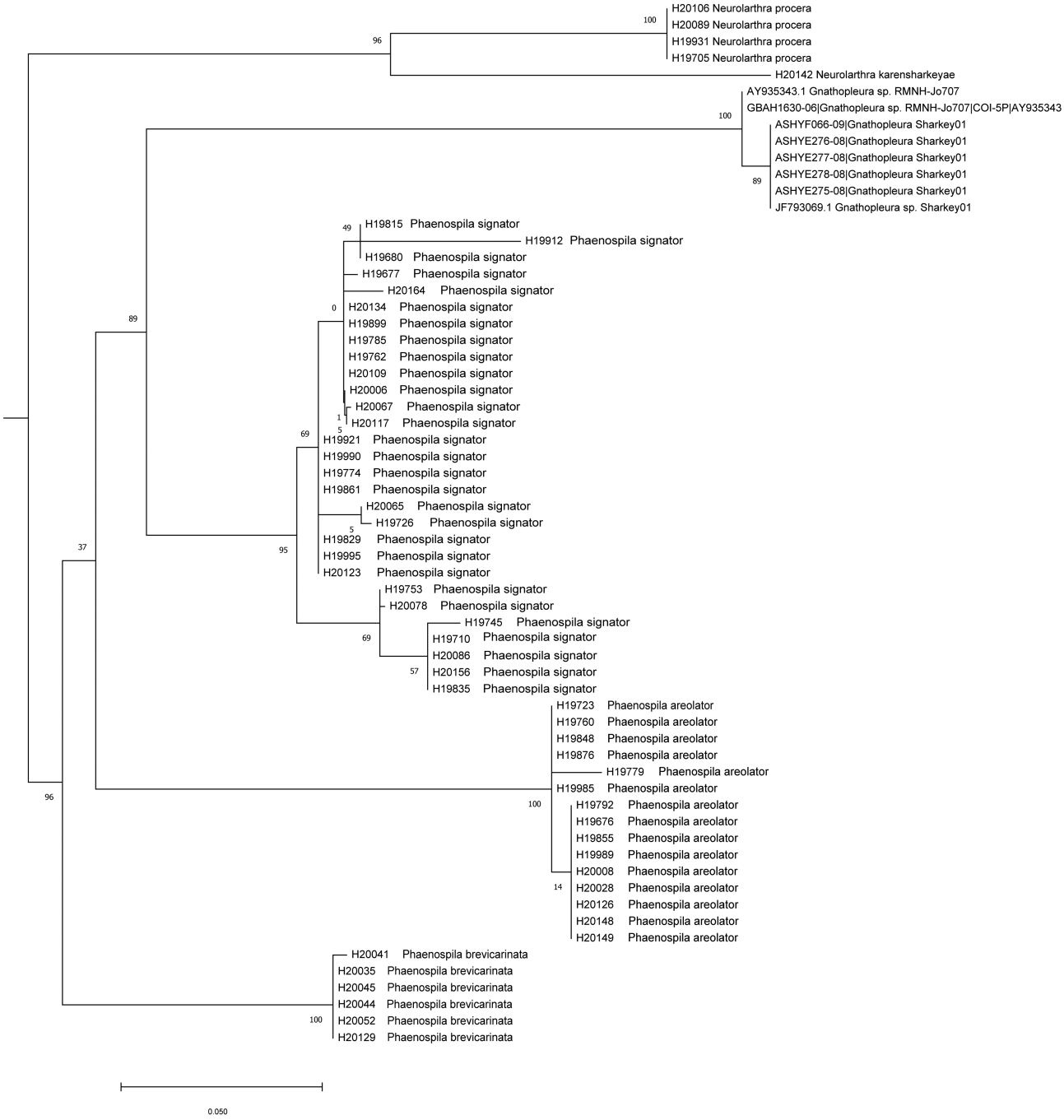

FIGURE 1. Tree of highest log-likelihood from 100 ML search reps of the COI data set, including three outgroup genera. ML Bootstrap values (500 replicates) ≥50 are plotted above the nodes.

Distribution. Oriental (Thailand).

Biology. Unknown.

Notes. The genus *Phaenospila* van Achterberg & Yao, **gen. nov.** runs in the key to the genera and subgenera of the Alysiini by Zhu *et al.* (2017) to *Alysiasta*. However, the new genus can be separated from *Alysiasta* Wharton as follows:

1 Postpectal carina present ventrally, lamelliform (Figs 2C, 3C); vein m-cu of hind wing largely unsclerotised (Figs 2B, 3B, 4F);

vein 1-R1 1.5–1.6 x as long as pterostigma (Figs 2B, 3B, 4F); antenna with white band (Figs 2A, 3A, 4A); fourth antennomeres very elongate, 1.8–2.7 x longer than third segment (Figs 2F, 3D, 4E); wing membrane subhyaline; metanotum not or slightly protruding dorsally (Figs 2F, 3G, 4E); veins 1-M and m-cu of fore wing subparallel (Figs 2B, 3B, 4F); biology unknown; Old World . . . . . ***Phaenospila*** van Achterberg & Yao, **gen. nov.**

- Postpectal carina absent ventrally; vein m-cu of hind wing distinctly sclerotised basally (Fig. 20 Wharton 1980; Fig. 1C Dix 2010); vein 1-R1 1.1–1.2 x as long as pterostigma (Figs 19, 25 Wharton 1980; Fig. 1B Dix 2010); antenna without white band; fourth antennomeres less elongate, 1.3–2.0 x longer than third segment (Figs 5, 6 Wharton 1980); wing membrane darkened; metanotum more or less acutely protruding dorsally; veins 1-M and m-cu of fore wing strongly covering posteriorly (Figs 19, 25 Wharton 1980; Fig. 1B Dix 2010); parasitoids of Sarcophagidae; New World, East Palaearctic?. . ***Alysiasta*** Wharton, 1980

Notes (by CvA). The genus *Alysiasta* Wharton, 1980 (as treated in this paper has a New World distribution, with the possibly exception of the East Palaearctic species *A. udaegae* Belokobylskij, 1998. This species may belong to *Alysiasta* despite a fore wing marginal cell that is longer than normal for *Alysiasta*, but vein 1-R1 of the fore wing is 1.1 times longer than the pterostigma (which is similar to New World *Alysiasta*). The oblique vein m-cu of fore wing and the far antefurcal vein m-cu of hind wing allow for retaining this species in *Alysiasta*, but the partly pale antenna and subhyaline wing membrane indicate that it might not belong to this genus. Fischer (2006) included the Oriental *Phaenocarpa abbreviata* Bhat, 1979 and *P. sikkimensis* Bhat, 1979 in *Alysiasta* but the first species belongs to a yet undescribed genus and the second to *Idiasta* Foerster, 1863 (**comb. nov.**) because of the comparatively long hind wing vein M+CU. *Alysiasta triangulum* Fischer, 2006 belongs to a newly described genus *Anamalysia* van Achterberg, 2022. Two Afrotropical species are included by Fischer (2006): *A. multicrenis* Fischer, 2006 has a long vein 1r-m and strongly widened marginal cell of fore wing indicating that it does not belong in *Alysiasta.* Most likely is an aberrant species of *Heratemis* Walker, 1860 (**comb. nov.**). The second species, *A. levigata* Fischer, 2006 is insufficiently described to place the species in a genus, but the illustrated fore wing (e.g. marginal cell reaching tip of wing and vein m-cu angled with vein 2-CU1) indicates that it does not belong to *Alysiasta*. The description does not indicate why it should be included in *Alysiasta* and the description does not supply arguments against inclusion in *Idiasta* Foerster, 1863, therefore, it is treated provisionally as belonging to *Idiasta*.

Key to species of the genus *Phaenospila* van Achterberg & Yao, gen. nov.

1. Only anterior quarter of propodeum with medio-longitudinal carina and slightly wrinkled laterally, remainder of propodeum reticulate (Fig. 2H); notauli present on anterior 1/3, sparsely crenulate (Fig. 2E); midpit round and small; face with almost complete strong and smooth medio-longitudinal carina, with slight rugae ventrally (Fig. 2C); vein m-cu slightly antefurcal; Thailand . . . . . .***Phaenospila brevicarinata*** van Achterberg & Yao, **sp. nov.**
- At least anterior half of propodeum with medio-longitudinal carina and smooth laterally, propodeum with clear areolae, one pentagon-shaped areola or several longitudinal areolae posteriorly (Fig. 3H, 4G); notauli present on anterior 0.6–0.7 and crenulate (Figs 3E, 4C); midpit elliptical and larger, 2.0 × longer than wide; face with less strong Y-shaped carinae dorsally, with strong bell-shaped rugae ventrally (Figs 3C, 4B); vein m-cu interstitial to slightly postfurcal; Thailand. 2
2. Only anterior half of propodeum with medio-longitudinal carina, posterior half of propodeum with a pentagon-shaped areola medially and rectangle areolae laterally, otherwise smooth (Fig. 3H); scutellar sulcus smooth, except one strong medio-longitudinal carina; Thailand . . . . . ***Phaenospila areolator*** Yao & van Achterberg, **sp. nov.**
- Propodeum with complete medio-longitudinal carina, posterior half of propodeum with several longitudinal areolae and with dense irregular rugae laterally (Fig. 4G); scutellar sulcus with one strong medio-longitudinal carinae and 2–4 weak carinae laterally (but one specimen [H20038] with one medio-longitudinal carina,); Thailand . . . .***Phaenospila signator*** Yao, **sp. nov.**

Phaenospila brevicarinata van Achterberg & Yao sp. nov.

(Fig. 2: A–I)

Consensus barcode. AGTTTTATATTTTTTATTTGGTATTTGAGCTGGTTTTGTAGGTTTATCAATAAGAAT-
TATTATTCGATTAGAATTAGGGGTATCAGGTTCATTATTAATAAATGATCAAATTTATAATAGGGTAG-
TAACAGCTCATGCTTTTGTAATAATTTTTTTTATAGTTATGCCAGTAATATTAGGGGGGTTTGGTA-
ATTGATTAATTCCTTTAATATTAGGGGCACCTGATATAGCTTTTCCTCGAATGAATAATATAAGAT
TTTGATTATTATTACCTTCATTATTATTATTAGTTTTAAGAGGTTTATTGAATGTAGGAGTTGGTACT-
GGTTGAACAGTTTATCCTCCTTTATCATCAAGAATTGGGCATAGAGGGATTTCTGTAGATTTAG-
CAATTTTTTCTTTACATTTAGCAGGGGTATCTTCTATTATAGGAGTAATTAATTTTTTAACAACAATT
TTTAATATAAAATCTTATAAAATAAAATTTGATCAATTAAGTTTATTTGTGTGGTCAATTATAATTACG-

GCAATTTTATTATTATTATCATTACCAGTTTTAGCTGGTGCTATTACTATATTATTAACTGATCGTAATTTA-AATACTACTTTTTTTGATTTTTCAGGGGGGGGGGATCCAATTTTATTTCAACATTTATTT

Description. Holotype, ♀ (QSBG), length of body 2.0 mm; length of fore wing 2.3 mm.

Head. Antenna 33 antennomeres, 1.6 × as long as fore wing, AS3: AS4: AS5=7:19:10; AS3 3.4 × its maximum wide, AS4 7.8 × longer its maximum wide, (Fig. 2F); head 2.2 × as wide as long, 1.8 × as wide as mesoscutum (in dorsal view); head at level of eyes 1.2 × wider than at level of temples (Fig. 2E); eyes 3.2 × as long as the temples (Fig. 2E); distance between antennal sockets slightly longer than their diameter, distance from eye to antennal socket slightly shorter than diameter of antennal socket; glabrous between antennal sockets; frons with a round pit; distance of ocelli from each other shorter than diameter of ocellus; OOL slightly longer than width of ocellar area (Fig. 2E); frons, vertex, occiput and temples smooth, with sparse setae (Fig. 2E); epicranial suture weak (Fig. 2E); face 1.6 × wider than high, smooth and covered with long setae, with complete and glabrous medio-longitudinal carina (Fig. 2C); clypeus protruding, 2.0 × wider than long, glabrous medially, edge smooth, with long setae, epistomal groove with fine wrinkles (Fig. 2C); mandible 2.5 × as long as wide, lower edge almost straight, curve near tooth 3, upper slightly up curved, apical width about 0.9 × basal width; tooth 1 small, upper edge curve, tooth 2 pointed, much larger than tooth 1 and tooth 3, tooth 3 pointed downwards; outer surface of mandible smooth, with sparse setae, teeth glabrous, deeply hollowed out medially (Fig. 2D); maxillary palp barely reaching mid femur (Fig. 2D, F), nearly 2.0 × longer than height of head, 1.1 × hind femur.

Mesosoma. Mesosoma 2.2 × as long as high; pronope present (Fig. 2E), pronotum smooth laterally, with transverse ridges medially and sparse setae posteriorly (Fig. 2E); mesopleuron with sparse and long setae anteriorly and posteriorly, but glabrous medially (Fig. 2F); precoxal sulcus crenulated and complete, widened medially (Fig. 2F); pleural sulcus slightly crenulate ventrally, remainder smooth; episternal scrobe medium-sized, round and not connected to pleural sulcus; metapleuron reticulate and covered with dense setae around edge and posteriorly, antero-dorsally glabrous with a pit, hollowed out antero-ventrally (Fig. 2H); mesoscutum slightly wider than long, median lobe slightly protruding, with several short setae along notaulic trace, otherwise glabrous; notauli present anterior 1/3, crenulate sparsely (Fig. 2E); midpit round; scutellar sulcus with one strong medio-longitudinal carina and two weak carinae laterally (Fig. 2H); scutellum slightly convex, with sparse setae laterally; metanotum with one full length ridge and two half-length ridges, crenulated laterally (Fig. 2H); propodeum with several setae laterally, anterior 1/4 of propodeum with medio-longitudinal carina and glabrous medially, slightly wrinkled laterally, remainder of propodeum reticulate (Fig. 2H); postpectal carina present ventrally and more or less lamelliform (Fig. 2C).

Wings. Fore wing: pterostigma wide and oval shaped, vein r emitted from posterior 1/3 of pterostigma, length of vein r 0.6 × as long as pterostigma width, forming an obtuse angle with vein 3-SR; vein SR1 extending above wing tip; vein SR1 4.1 × longer than vein 3-SR; vein 2-SR: vein 3-SR: r-m = 6: 5: 3; 1-SR+M slightly sinuate; vein m-cu slightly antefurcal. 2nd submarginal cell 2.4 wider than height, narrow posteriorly, vein cu-a slightly postfurcal, vein 1-CU1: 2-CU1 = 1: 8 (Fig. 2B); vein 3-CU1: vein CU1b=1:1. Hind wing: vein M+CU 1.3 × vein 1-M; vein m-cu antefurcal (Fig. 2B).

Legs. Hind coxa and femur slender, entirely with dense, long setae; hind tibia slender; hind femur 5.9 × longer than its maximum width; hind femur 0.8 × longer than hind tibia, hind femur 1.6 × longer than hind basitarsus.

Metasoma. Length of T1 about 2.1 × its apical width, apical width 1.4 × its basal width, dorsope large and protruding, dorsal carinae not converging, extending to apical 1/3 of T1; area between dorsal carinae smooth, remainder of T1 regularly longitudinally striate (Fig. 2H); ovipositor long, maximal visible part roughly 1.8 × mesosoma, ovipositor sheath with dense setae (Fig. 2I) and its setose part as long as hind tibia (Fig. 2I).

Color. Dark yellow. Antenna pale white to dark brown, two basal segments and AS3 dark yellow, AS4 light brown, apical segment 3–16 pale white, the remainder dark brown; palpi pale yellow; frons, vertex, occiput and temples setae white; epicranial suture black; head dark yellow except apical part of mandible, ocellar area and eyes dark brown; mesosoma dark yellow, antero-ventrally light yellow; metasoma dark yellow, metasoma brown apically; legs light yellow to yellow; pterostigma dark yellow, veins light brown.

Material examined. **Holotype** ♀ (H20045) THAILAND Petchaburi, Kaeng Krachan NP, Panernthung/km30, viewpoint, 12°49.259'N, 99°22.059'E, elevation 970m, Malaise trap 15–22.viii.2008, Sirichai & Jatupon leg., (QSBG) T4365. **Paratypes**: 2♀ (H20035, H19738) same data as holotype (RMNH, BIIC); 3♂ (H20041, H20068) same data as holotype, (BIIC, QSBG); 3♀ (H20044, H20098, H20161), same data as holotype, except km33/helipad,

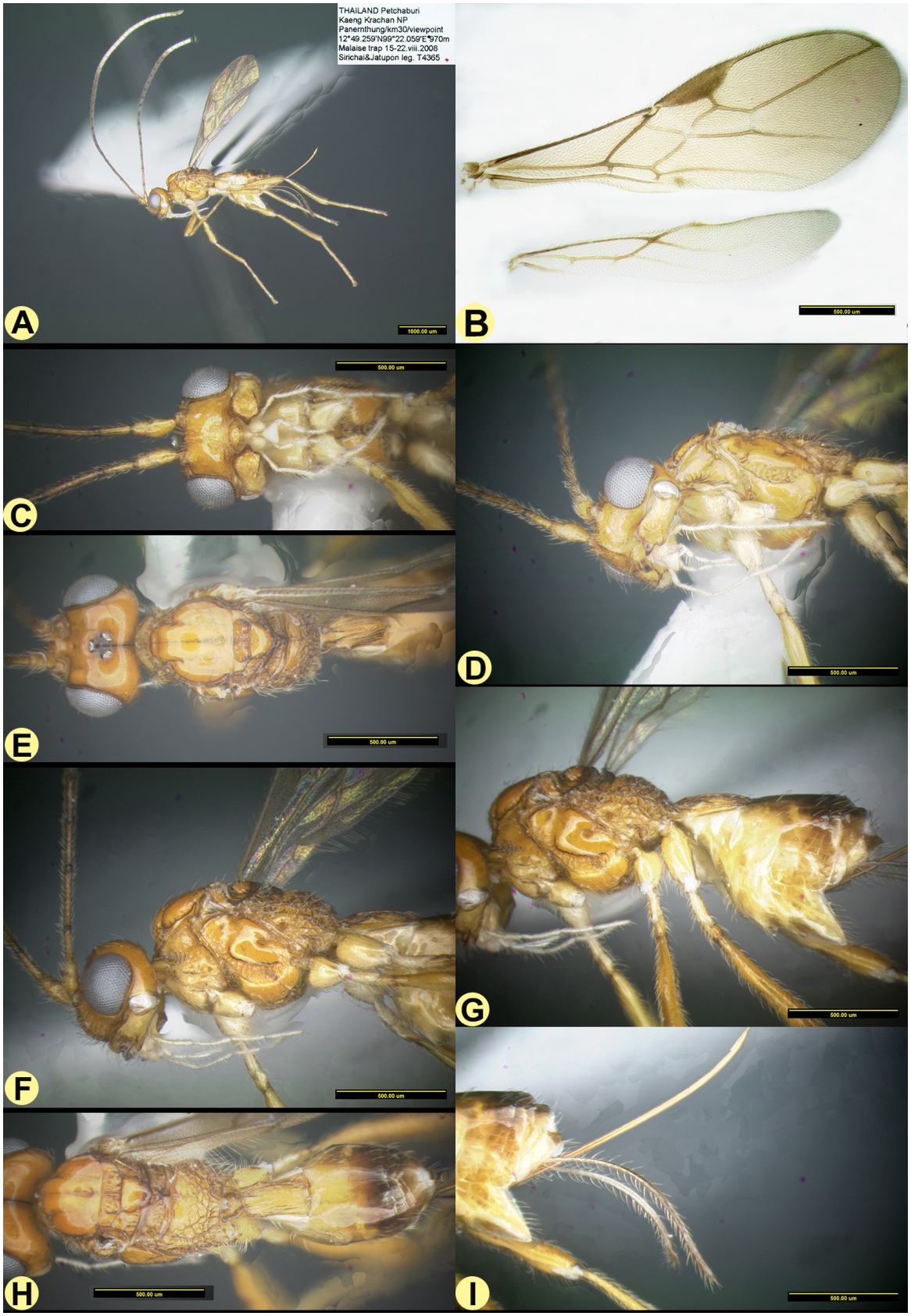

FIGURE 2. A–I. *Phaenospila brevicarinata* van Achterberg & Yao **sp. nov.**, ♀, holotype. A, habitus, lateral aspect; B, wings; C, head, anterior aspect; D, head and mesosoma, full sight on mandible; E, head and mesosoma, dorsal aspect; F, head and mesosoma, lateral aspect; G, mesosoma and metasoma, lateral aspect; H, mesosoma and metasoma, dorsal aspect; I, ovipositor, lateral aspect.

12°50.177'N, 99°20.688'E, elevation 735m, Malaise trap 28.xii.2008–4.i.2009, Sirichai, leg., (QSBG, RMNH, BIIC) T4407; 3♀ (H20129, H20145, H19964) same data as holotype, except km33/helipad, 12°50.177'N, 99°20.688'E, elevation 735m, Malaise trap 28.xii.2008–4.i.2009, Sirichai, leg., (RMNH, BIIC) T4407; 2♀ (H20139 , H20097) same data as holotype, except km33/helipad, 12°50.177'N, 99°20.688'E, elevation 735m, Malaise trap 28.xii.2008–4.i.2009, Sirichai, leg., (BIIC, RMNH) T4407; 1♀ (H20052) THAILAND Loei, Phu Kradueng NP, Mixed deciduous/N Na Noy office, 16°48.17'N, 101°47.67'E, elevation 276m, Malaise trap 14–1.v.2008,Thonghuay Phatai leg., (BIIC) T5007.

Variation. Body length: 2.0–2.6 mm; length of fore wing 2.0–2.6 mm; width of head 2.1–2.4 × as wide as long; 31–41 antennomeres, apical antennomeres 3 to apical antennomeres 12–15 pale yellow; scutellar sulcus with one or three ridges; frons of one specimen without round pit; male mostly same as female, except scutellar sulcus with one ridge, antenna apical half light brown, basal half brown, notauli present on anterior 1/3 and smooth, vein 3-CU1: vein CU1b=2:3.

Distribution. Thailand.

Host. Unknown.

Etymology. The name refers to the relatively short medio-longitudinal carina of the propodeum; “brevis” is Latin for short and “carina” is Latin for keel, or ridge.

***Phaenospila areolator* Yao & van Achterberg sp. nov.**
(Fig. 3: A–I)

Consensus barcode. CTTGGTCAACAAATTCATAAAGATATTGGAATTTTATATTTTTTATTTGGGATTT-GATCTGGTATAGTTGGTTTATCTATAAGAATTATTATTCGATTAGAATTAGGTATAGCTGGATCTTTATTA-ATAAATGATCAAATTTATAATACTTTAGTTACTTCTCATGCTTTTGTAATAATTTTTTTTATAGTTATACCAGT-TATGTTAGGAGGATTTGGAAATTGATTAATTCCATTAATATTAGGAGCTCCTGATATAGCTTTCCCAC-GAATAAATAATATAAGATTTTGATTATTATTACCTTCTTTAATATTATTACTTTTAAGAGGTTTATTA-AATGTAGGTGCTGGTACTGGTTGAACAGTTTATCCTCCTTTATCTGCAAATGTTGGTCATAGGG GTATATCAGTAGATTTAGCAATTTTTTCTTTACATTTAGCTGGAATTTCTTCTATTATAGGGGTAATTA-ATTTTTTGACAACAGCTTTTAATATAAAATTTTATTGTATAAAATATGATCAAGTAAGATTATTTGTAT-GATCAATTATTATTACTGCAGTTTTGTTATTATTATCTTTGCCTGTTTTAGCAGGAGCTATTACTATATTAT-TAACTGATCGTAATTTAAATACTACTTTTTTTGATTTTTCAGGTGGTGGAGATCCTATTTTATTTCCCCCT

Description. Holotype, ♀ (QSBG), length of body 2.3 mm; length of fore wing 2.5 mm.

Head. Antenna broken, one remaining 20 antennomeres, the other one remaining 25 antennomeres, apical two pale; AS3:AS4:AS5=11:20:15, AS3 5.0 × its maximum wide, AS4 8.8 × longer than maximum width, (Fig. 3F); head 2.4 × as wide as long, 1.7 × as wide as mesoscutum (in dorsal view); head at level of eyes 1.2 × wider than at level of temples (Fig. 3E); eyes 3.4 × as long as the temples (Fig. 3E); distance between antennal sockets longer than their diameter, distance from eye to antennal socket slightly shorter than diameter of antennal socket; frons with a upside down V-shaped sculpture, otherwise smooth; distance of ocelli from each other shorter than diameter of ocellus, OOL slightly longer than width of ocellar area (Fig. 3E); vertex, occiput and temples smooth, with sparse setae (Fig. 3E); epicranial suture deep, especially between posterior ocelli (Fig. 3E); face 1.6 × wider than high, smooth and covered with long setae, with Y-shaped ridges started from antennal sockets, converging at dorsal 1/3 of face, ended at ventral 1/4 of face, ventral 1/4 of face bell-shaped and crenulate (Fig. 3C); clypeus protruding, 1.8 × wider than long, smooth medially, edge smooth, with long setae, epistomal groove wide and deep, 0.5 × as long as height of clypeus and wrinkled (Fig. 3C); mandible 1.7 × as long as wide, lower edge almost straight, apical width about 1.3 × basal width; tooth 1 small, upper edge curve, tooth 2 pointed, much larger than tooth 1 and tooth 3, up edge curve, tooth 3 pointed downwards; outer surface of mandible smooth, with sparse setae, teeth glabrous, deeply hollowed out medially (Fig. 3D); maxillary palp reaching mid femur (Fig. 3C), nearly 2.6 × as long as height of head, 1.7 × hind femur.

Mesosoma. Mesosoma 1.4 × as long as high; pronope present (Fig. 3E), pronotum smooth laterally, with transverse ridges anteriorly and a longitudinal ridge ventrally (Fig. 3F); mesopleuron with sparse and long setae ventro-posteriorly, glabrous medially (Fig. 3F), precoxal sulcus crenulated and complete, wider medially; pleural sulcus slightly crenulate; episternal scrobe medium-sized, round and not connected to pleural sulcus; metapleuron

reticulate sculptured and covered with dense setae around edge and posteriorly, antero-dorsally glabrous, hollow out antero-ventrally (Fig. 3F); mesoscutum 1.3 × wider than long, median lobe slightly protruding, with several short setae along notauli trace, otherwise glabrous; notauli present anterior 2/3 and crenulate (Fig. 3E); midpit glabrous and elliptical, 2.0 × longer than wide; scutellar sulcus glabrous, with one strong medio-longitudinal carina (Fig. 3H); scutellum flat, with sparse setae laterally; metanotum with one full length ridge and two half-length ridges, crenulated laterally (Fig. 3H); propodeum with several setae laterally, anterior 1/2 of propodeum with medio-longitudinal carina and curve and complete transverse ridge, posterior 1/2 with a pentagon-shaped areola medially and rectangle areolae laterally, otherwise glabrous (Fig. 3H); postpectal carina present ventrally and more or less lamelliform (Fig. 3C).

Wings. Fore wing: pterostigma wide and oval shaped, vein r emitted from posterior 1/3 of pterostigma, length of vein r 0.4 × as long as pterostigma width, forming an obtuse angle with vein 3-SR; vein SR1 extending above wing tip; vein SR1 2.9 × longer than vein 3-SR; vein 2-SR : vein 3-SR : r-m = 15 : 14 : 6; 1-SR+M slightly sinuate; vein m-cu interstitial; 2nd submarginal cell 2.6 wider than height, narrow posteriorly; vein cu-a slightly postfurcal, vein 1-CU1: 2-CU1 = 1: 8; vein 3-CU1: vein CU1b=1:1 (Fig. 3B). Hind wing: vein 1-M 1.5 × vein M+CU; vein m-cu antefurcal (Fig. 3B).

Legs. Hind coxa and femur slender, entirely with dense, long setae; hind tibia slender; hind femur 5.8 × longer than its maximum width; hind femur 0.7 × longer than hind tibia, hind femur 1.9 × longer than hind basitarsus (Fig. 3I).

Metasoma. Length of T1 about 2.6 × its apical width, apical width 1.1 × its basal width; dorsope large and protruding, dorsal carinae not converging, extending to apical 1/2 of T1; area between dorsal carinae smooth, remainder of T1 reticulate (Fig. 3H); ovipositor long, maximal visible part roughly 1.1 × as long as mesosoma, ovipositor sheath with dense setae (Fig. 3I) and its setose part 1.1 × as long as hind tibia. (Fig. 3I).

Color. Dark yellow to brown, bicoloured; antenna pale white to brown, two basal antennomeres and AS3 yellow, AS4-F5 dark yellow, apical antennomeres pale white (antenna broken), and remainder brown; head setae white, palpi pale yellow; head dark brown except face, clypeus and apical half of mandible brownish yellow, ocellar area dark brown; mesosoma dark brown except antero-ventral part of pronotum, mesoscutum and scutellum yellow, metanotum brownish yellow; metasoma brown, apical of T1 dark yellow; legs yellow to brownish yellow; pterostigma brownish yellow, veins light brown.

Material examined. **Holotype** ♀ (H19672) THAILAND Petchaburi, Kaeng Krachan NP, Panernthung/km27, 12°49.302'N, 99°22.263'E, elevation 950m, Malaise trap 25.v–1.vi.2009, Sirichai leg., (QSBG) T5258; **Paratypes**: 2♀ (H19676, H19685) same data as holotype, (RMNH, BIIC); 1♀ (H19848) same data as holotype, except Panernthung/km30/old lavatory, 12°49.484'N, 99°21.909'E, elevation 970m, Malaise trap 27.vi–4.vii.2008, leg., (QSBG) T4339; 1♀ (H19775) same data as previous, (BIIC);1♀ (H19876) same locality as holotype, Malaise trap 24.iv–4.v.2009, leg., (BIIC) T4933; 3♀ (H19952, H19875, H19855) same data as previous, (RMNH, BIIC); 1♀ (H19723) same data as holotype, except Panernthung/km27/water pump, 12°49.151'N, 99°22.483'E, elevation 970m, Malaise trap 10–17.x.2008, leg., (QSBG) T4383; 1♀ (H19756) same data as previous, (BIIC); 2♀ (H20008, H20028) same data as holotype, except km15/campground, 12°47.963'N , 99°27.188'E, Malaise trap 5–12.ix.2008, Sirichai & Prasit leg., (BIIC) T4375; 2♀ (H20149, H20092) same data as holotype, except km15/campground, 12°47.963'N , 99°27.188'E, Malaise trap 5–12.ix.2008, Sirichai & Prasit leg., (QSBG, RMNH) T4375; 3♀ (H20152, H19991, H20100) same data as holotype, except km15/campground, 12°47.963'N , 99°27.188'E, Malaise trap 5–12.ix.2008, Sirichai & Prasit leg., (RMNH, BIIC) T4375; 2♀ (H19985, H20148) same locality as holotype, Malaise trap 25.iii–3.iv.2009, leg., (BIIC) T4739; 3♀ (H20119, H19997, H20153) same locality as holotype, Malaise trap 25.iii–3.iv.2009, leg., (QSBG, RMNH, BIIC) T4739; 2♀ (H20058, H20013) same locality as holotype, Malaise trap 25.iii–3.iv.2009, leg., (RMNH, BIIC) T4739; 1♂ (H20126) same data as previous, (BIIC); 1♂ (H19989) THAILAND Surat Thani, Khao Sok NP, Headquarter, 8°54.896'N, 8°31.81'E, elevation 155m, Malaise trap 9–16.vi.2009, Pongphan leg., (BIIC) T4926; 1♀ (H19936) same locality as holotype, 3–10.iv.2009, leg., (HBIIC) T4738; 1♀ (H20016) same data as holotype, except km33/helipad, 12°50.177'N, 99°20.688'E, elevation 735m, Malaise trap 28.xii.2008–4.i.2009, Sirichai leg., (QSBG) T4407; 1♂ (H19792) same locality as holotype, 15–22.vi.2009, leg., (QSBG) T5267; 1♀ (H19760) same locality as holotype, 10–17.iv.2009, leg., (BIIC) T4737; 1♀ (H19779) same data as previous (BIIC).

Variation. Body length: 2.2–3.2 mm, length of fore wing 2.3–2.9 mm, width of head 2.1–2.6 × as wide as long; antennomeres of ♀36–38, apical antennomeres 2–3 to 13–15 pale yellow. **Male**: similar to female, antennomeres of ♂ 33–35, apical antennomeres t 2–3 to 5–6 pale white.

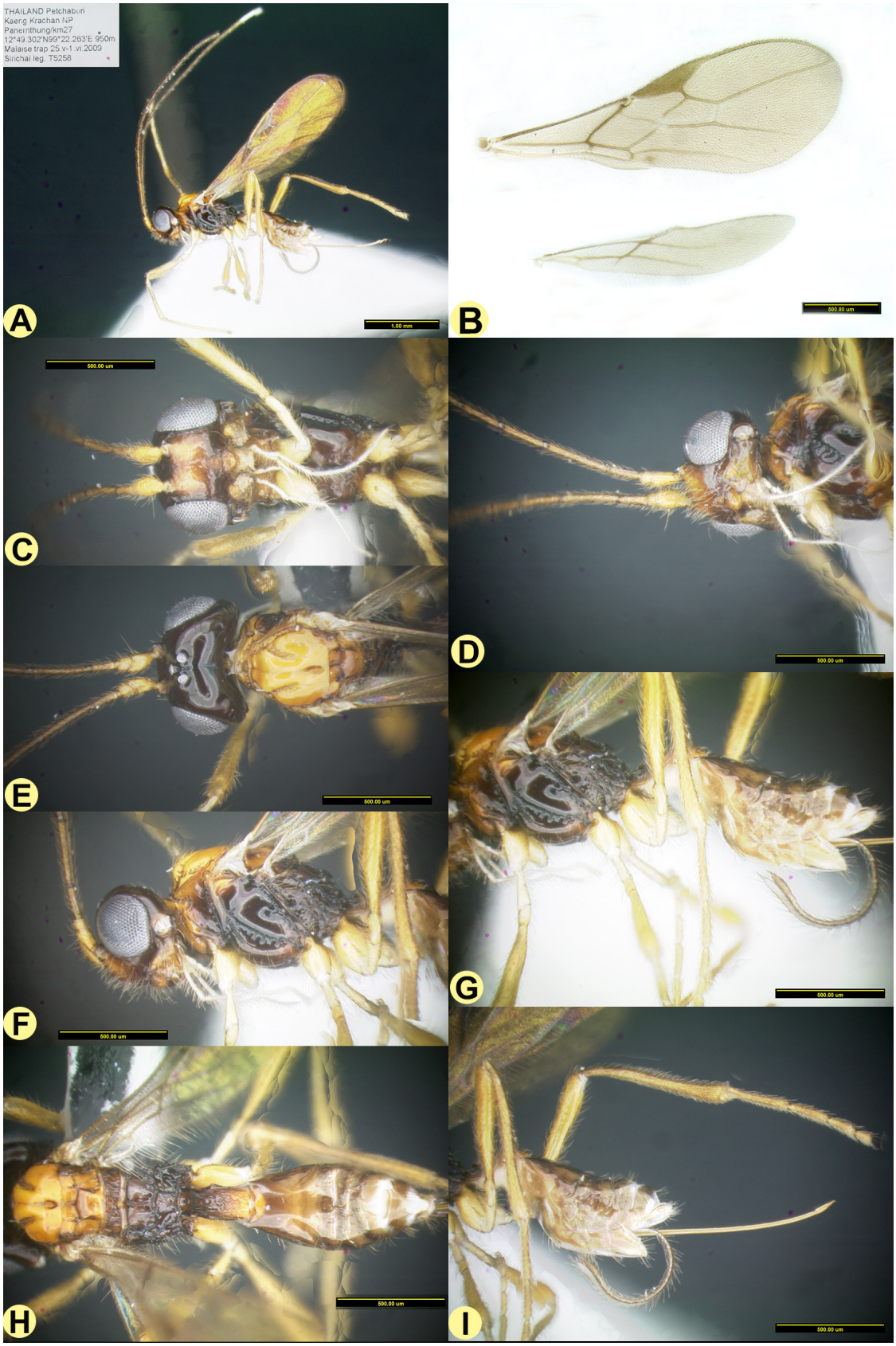

FIGURE 3. A–I. *Phaenospila areolator* van Achterberg & Yao **sp. nov.**, ♀, holotype. A, habitus, lateral aspect; B, wings; C, head, anterior aspect; D, head, full sight on mandible; E, head and mesoscutum, dorsal aspect; F, head and mesosoma, lateral aspect; G, mesosoma and metasoma, lateral aspect; H, mesosoma and metasoma, dorsal aspect; I, metasoma and ovipositor, lateral aspect.

Distribution. Thailand.

Host. Unknown.

Etymology. The name refers to the pentagon-shaped areola of the propodeum.

***Phaenospila signata* Yao sp. nov.**

(Fig. 4: A–H)

Consensus barcode. GGTATTATATTTTTTATCTGGATTTTGATCTGGTATAGTAGGGTTATCTATAAGTATA-ATTATTCGGTTAGAATTAGGGATAGCTGGATCTTTATTAAAAAATGATCAAATTTATAATAGAATTGTAA-CAGCTCATGCTTTTGTTATAATTTTTTTTATAGTTATACCAATTATATTAGGAGGATTTGGTAATTGATTAA TTCCTTTAATATTAGGGGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGGTTATTAT-TACCTTCTTTAATATTATTAGTTTTAAGAGGTTTATTAAATATTGGAGTTGGTACTGGATGAACAGTT-TATCCACCTTTATCTTCAGGAATTGGTCACAGGGGTATTTCAGTTGATTTAGCTATTTTTTCT TTACATTTAGCTGGGGTATCTTCTATTATAGGAGTAATTAATTTTTTAACAACAATTTTTAATATAAAAT-TATATAATTTAAAATTTGATCAATTAAGTTTATTTATTTGATCAATTATAATTACGGCAATTTTATTATTAT-TATCTTTACCTGTTTTAGCTGGAGCTATTACTATATTGTTAACTGATCGTAATTTAAATACTACTTTTTTT-GATTTTGCTGGTGGGGGGGATCCTATTTTATTTCAACATTTATTT

Description. Holotype, ♀ (QSBG), length of body 2.8 mm; length of fore wing 2.6 mm.

Head. Antenna 35 antennomeres, 1.8 × as long as fore wing, length of AS3: AS4: AS5=6: 15: 12; AS3 4.0 × its maximum width, AS4 10.0 × longer than its maximum width (Fig. 4E); head 2.7 × as wide as long, 1.7 × as wide as mesoscutum (in dorsal view); head at level of eyes 1.2 × wider than at level of temples (Fig. 4C); eyes 4.0 × as long as the temples (Fig. 4C); distance between antennal sockets as long as their diameter, distance from eye to antennal socket shorter than diameter of antennal socket, with a upside down V-shaped sculpture between antennal sockets, otherwise smooth; distance of ocelli from each other shorter than diameter of ocellus; OOL slightly longer than width of ocellar area (Fig. 4C); frons, vertex, occiput and temples smooth, with sparse setae ventrally (Fig. 4C); epicranial suture deep, especially between posterior ocelli, sharply bent in middle of it (Fig. 4C); face 1.7 × wider than high, smooth and covered with long setae, dorsal half of face with weak medio-longitudinal ridge, ventral half of face bell-shaped and crenulate (Fig. 4B); clypeus protruding, 2.3 × wider than long, smooth and with long setae, epistomal groove crenulated (Fig. 4B); mandible 2.3 × as long as wide, lower edge almost straight, apical width about 1.1 × basal width; tooth 1 round, upper edge curve, tooth 2 pointed, much larger than tooth 1 and tooth 3, up edge curve, tooth 3 pointed downwards; outer surface of mandible with sparse setae, wrinkled medially, otherwise smooth; teeth glabrous, deeply hollowed out medially (Fig. 4D); maxillary palp reaching mid femur (Fig. 4B), nearly 2.5 × longer than height of head, 1.3 × longer than hind femur.

Mesosoma. Mesosoma 1.4 × as long as high; pronope present (Fig. 4C); pronotum smooth laterally, with wide transverse ridges (Fig. 4E); mesopleuron with sparse and long setae posteriorly, otherwise glabrous (Fig. 4E); precoxal sulcus crenulated and complete, wider medially (Fig. 4E); pleural sulcus slightly crenulate; episternal scrobe medium-sized, round and not connected to pleural sulcus; metapleuron reticulate sculptured and covered with dense setae around edge and posteriorly, antero-dorsally glabrous, hollow out antero-ventrally (Fig. 4G); mesoscutum 1.2 × wider than long, median lobe slightly protruding, with several short setae along notauli trace, otherwise glabrous; notauli present anterior 0.6 and crenulate (Fig. 4C); midpit glabrous and elliptical, 2.0 × longer than wide; scutellar sulcus with one strong medio-longitudinal carinae and two weak carinae laterally (Fig. 4C); scutellum slightly convex, with sparse setae laterally; dorsal half of metanotum with three ridges, crenulate laterally (Fig. 4G); propodeum with several setae laterally, with complete medio-longitudinal carina and complete curved transverse ridge, dorsal half smooth, posterior 1/2 with several longitudinal areolae, medial areolae slightly wrinkled (Fig. 4G); postpectal carina present ventrally and more or less lamelliform.

Wings. Fore wing: pterostigma wide and oval shaped, vein r rising from posterior 3/5 of pterostigma, length of vein r 0.4 × as long as pterostigma width, forming an obtuse angle with vein 3-SR; vein SR1 extending above wing tip; vein SR1 4.1 × longer than vein 3-SR; vein 2-SR: vein 3-SR: r-m =10 : 9 : 6; 1-SR+M slightly sinuate; vein m-cu slightly postfurcal; 2nd submarginal cell 2.1× wider than height, narrow posteriorly, vein cu-a slightly postfurcal, vein 1-CU1: 2-CU1 = 1: 7; vein 3-CU1: vein CU1b=3:2(Fig. 4F). Hind wing: vein 1-M 1.1 × longer than vein M+CU; vein m-cu antefurcal (Fig. 4F).

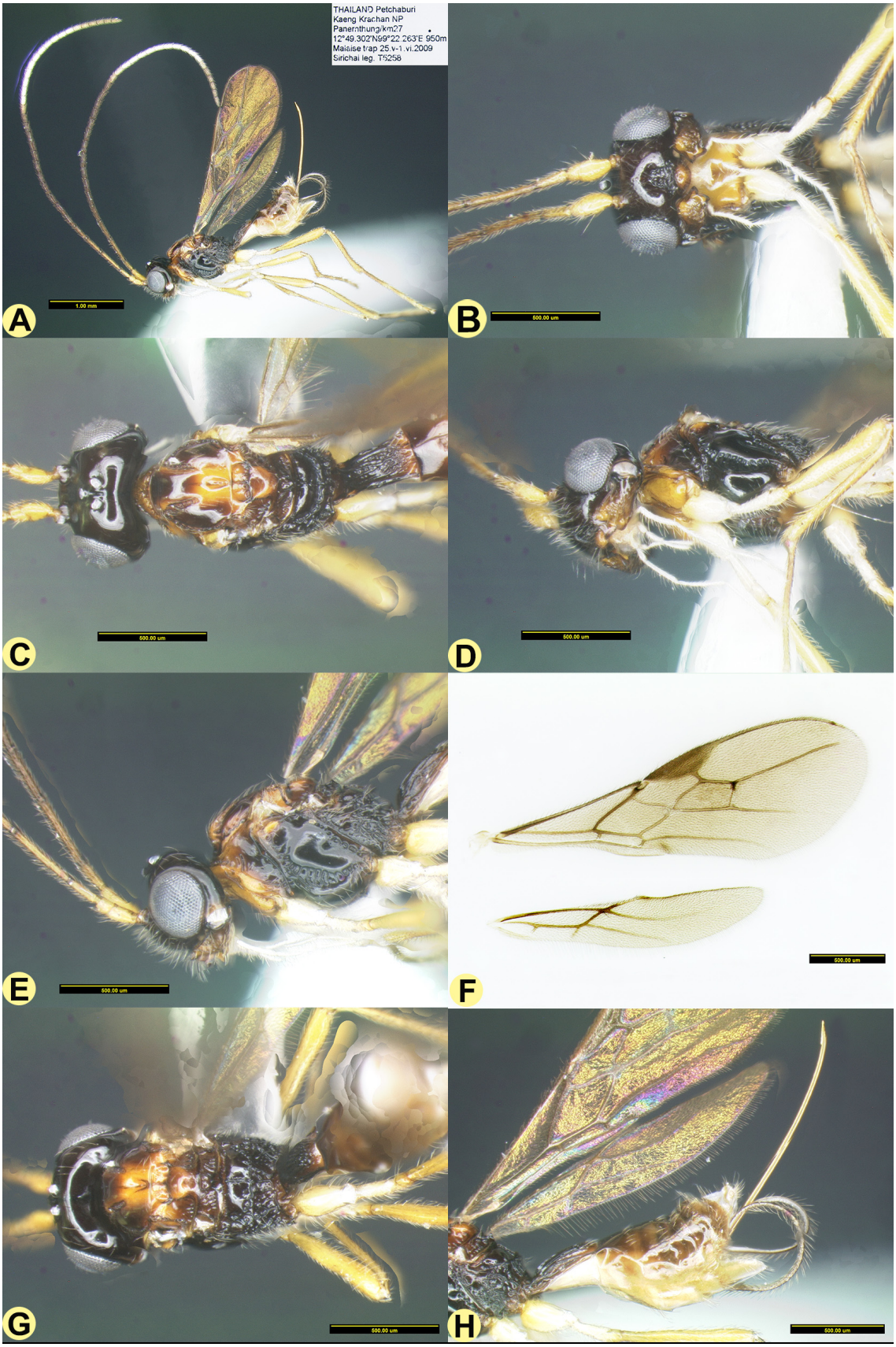

FIGURE 4. A–H. *Phaenospila signator* Yao **sp. nov.**, ♀, holotype. A, habitus, lateral aspect; B, head, anterior aspect; C, head, dorsal aspect; D, head and mesosoma, full sight on mandible; E, head and mesosoma, lateral aspect; F, wings; G, head and mesosoma, full sight on scutellum; H, propodeum and metasoma, lateral aspect.

Legs. Hind coxa and femur slender, entirely with dense, long setae. Hind tibia slender. Hind femur 6.0 × longer than its maximum width. Hind femur 0.8 × longer than hind tibia, hind femur 1.7 × longer than hind basitarsus.

Metasoma. Length of T1 about 2.0 × longer than its apical width, apical width 1.5 × its basal width; dorsope large , dorsal carinae converged at apical 1/4, extending close to end of T1; area between dorsal carinae smooth, apical 0.1 of T1 smooth; remainder of T1 with longitudinal striae (Fig. 4C); ovipositor long, maximal visible part roughly 1.1 × longer than mesosoma, ovipositor sheath with dense setae (Fig. 4H) and its setose part 1.2 × longer than hind tibia.

Color. Dark brown, but partly dark yellow; antenna pale white to brown, two basal segments and AS3 yellow, apical 7-16 segments pale white, the remainder brown; palpi pale yellow; head setae white; head dark brown except clypeus and apical half of mandible brownish yellow; mesosoma and metasoma mostly dark brown, propleuron, basal third of pronotum, apical 1/4 of mesoscutum, scutellum and apical 0.1 of T1 brownish yellow; legs pale yellow to yellow; pterostigma brown, veins light brown.

Material examined. **Holotype** ♀ (H19677) THAILAND Petchaburi, Kaeng Krachan NP, Panernthung/km27, 12°49.302'N, 99°22.263'E, elevation 950m, Malaise trap 25.v–1.vi.2009, Sirichai leg.(QSBG) T5258; **Paratypes**: 1♀1♂ (H19762, H20123) same data as holotype, except Panernthung/km30/viewpoint, 12°49.259'N, 99°22.059'E, elevation 970m, Malaise trap 15–22.viii.2008, Sirichai & Jatupon leg., (BIIC) T4365; 1♀1♂ (H19992, H20134) same data as previous (BIIC); 1♀ (H19690) same locality as preview, 1–8.viii.2008, Sirichai & Chusak leg., (RMNH) T4366; 2♀ (H20006, H20067) same data as holotype, except Panernthung/km27/water pump, 12°49.151'N, 99°22.483'E, elevation 950m, Malaise trap 1–8.viii.2008, Sirichai & Chusak leg., (QSBG, RMNH) T4353; 1♀ (H20164) same data as previous, except 27.vi–4.vii.2008, leg., (RMNH) T4325; 1♀ (H20109) same locality as holotype, 25.iii–3.iv.2009, leg., (BIIC) T4739; 1♀ (H20065) same data as holotype, except Panernthung/km30/ old lavatory, 12°49.484'N, 99°21.909'E, elevation 970m, Malaise trap 17–26.vii.2008, leg., (QSBG) T4328; 1♂ (H19815) same locality as previous, 27.vi–4.vii.2008, Sirichai leg.,(BIIC) T4339; 1♀1♂ (H20167, H19995) same data as holotype, except km33/helipad, 12°50.177'N, 99°20.688'E, elevation 735m, Malaise trap 18–25.i.2009, Sirichai leg., (BIIC) T4406; 1♀ (H20117) same data as previous (BIIC); 1♀ (H19934) same data as holotype, except km16/road/stream2, 12°48.107'N, 99°26.669'E, Malaise trap 25.iii–3.iv.2009, Sirichai leg., (BIIC) T4689; 1♀ (H19829) same data as holotype, except km33/helipad, 12°50.177'N, 99°20.688'E, elevation 735m, Malaise trap 28.xii.2008–4.i.2009, Sirichai leg., (QSBG) T4407; 1♀ (H19824) same data as previous (BIIC); 1♀ H19774) THAILAND Sakon Nakhon, Phu Phan NP, North of well, 17°3.543'N, 103°58.452'E, elevation 312m, Malaise trap 23–30.i.2007, Sailom Tongboonchai leg., (BIIC) T1525; 1♀(H19861) THAILAND Chiang Mai, Doi Chiangdao NP, Headquarter, 19°24.278'N, 8°55.311'E,elevation 491m, Malaise trap 18–25.ix.2007, S. Jugsu & A. Watwanich leg., (QSBG) T5696; 1♀ (H19887) same data as previous, except Mae Fang Hotspring, 19°57.961'N, 99°9.355'E, elevation 569m, Malaise trap 7–14.ix.2007, P.Wongchai leg., (BIIC) T6167; 1♂ (H19990) same locality as previous, 21–28.ix.2007, P.Wongchai leg., (BIIC) T6169; 1♀ (H19921) THAILAND Nan, Doi Phu Kha NP, Office 4, 19°12.562'N, 101°4.93'E, elevation 1374m, Malaise trap 8–15.ix.2007, Charoen & Nikom leg., (QSBG) T3212; 1♀ (H19899) same data as previous, except Office 5, 19°12.418'N, 101°4.809'E, elevation 1326m, 22–29.ix.2007, Charoen & Nikom leg., (BIIC) T3218; 2♀ (H19739, H19900) same data as previous (BIIC, RMNH); 1♀ (H19912) same data as previous, except Office 10, 19°12.557'N, 101°5.041'E, elevation 1380m, 1–8.xi.2007, Charoen & Nikom leg., (QSBG) T3252; 1♀ (H19911) same data as previous, except 22–29.xi.2007, Charoen & Nikom leg., (BIIC) T3255; 1♀ (H19894) same data as previous, except Office 8, 19°12.439'N, 101°4.825'E, elevation 1358m, 1–8.x.2007, Charoen & Nikom leg., (BIIC) T3235; 1♀ (H19785) THAILAND Nakhon Nayok, Khao Yai NP, Nature trail in secondary moist evergreen forest, 14°24.515'N, 101°22.432'E, elevation 750m, Malaise trap 5.vii–12.viii.2006, Pong Sandao leg., (QSBG) T400; 1♀ (H19680) same data as previous, except Nature trail in moist evergreen forest, 14°24.482'N, 101°22.388'E, elevation 755m, Malaise trap 26.viii–2.ix.2006, Pong Sandao leg., (BIIC) T410; 1♀ (H20027) THAILAND Surat Thani, Khao Sok NP, Headquarter, 8°54.896'N, 98°31.81'E, elevation 155m, Malaise trap 9–16.vi.2009, Pongphan leg., (BIIC) T4926; 1♀ (H20051) same data as previous, except Klong Morg Unit, 8°53.725'N, 98°39.025'E, elevation 87m, Malaise trap 9–16.xii.2008, Pongphan leg., (QSBG) T3896; 1♂ (H19726) THAILAND Mae Hong Son, Namtok Mae Surin NP, Nature trail, 19°20.616'N, 97°59.3'E, elevation 334m, Malaise trap 16–23.xii.2007, Areerat Kamkhun leg., (BIIC) T5969; 1♀ (H19710) THAILAND Ubon Ratchathani, Pha Taem NP, Pah mhon, 15°24.304'N, 105°31.258'E, elevation 230m, Malaise trap 12–18.viii.2006, Bunlu Subsiri leg.,(QSBG) T464;1♀ (H19753) same data as previous, except Don Rong pond, 15°24.582'N, 105°30.935'E, elevation 250m, Pan trap 9–10.viii.2006, Bunlu Subsiri leg., (BIIC) T458; 1♀ (H20038) same data as previous,

10–11.viii.2006, leg., (BIIC) T459; 1♀(H20078) THAILAND Nan, Doi Phu Kha NP, Office 12, 19°12.138'N, 101°4.711'E, elevation 1331m, Malaise trap 15–22.xi.2007, Charoen & Nikom leg.,(QSBG) T3262; 1♀ (H19745) THAILAND Chaiyaphum, Tat Tone NP, Entrance to Pa Eang waterfall, 15°57.52'N, 101°54.442'E, elevation 297m, Malaise trap 5–12.x.2006, Tawit Jaruphan leg., (RMNH) T678; 1♀ (H19835) THAILAND Phitsanulok, Thung Salaeng Luang NP, Mixed deciduous 1/Gang Sopan waterfall, 16°52.64'N, 100°49.44'E, elevation 481m, Malaise trap 7–15.v.2007, Pongpitak leg., (BIIC) T5195; 1♀ (H20086) THAILAND Sakon Nakhon, Phu Phan NP, Dry evergreen near house no.1567, 16°48.627'N, 103°53.511'E, elevation 512m, Malaise trap 16–22.vi.2007, Winlon Kongnara leg., (QSBG) T2498; 1♀ (H20156) THAILAND Loei, Phu Kradueng NP, Mixed deciduous/N Na Noy office, 16°48.17'N,101°47.67'E, elevation 276m, Malaise trap 21–28.v.2008, Thonghuay Phatai leg., (BIIC) T5009; 1♀ (H19794) THAILAND Kamphaeng Phet, Mae Wong NP Chong Yen, 16°5.212'N99°6.576'E, elevation 1306 m, Malaise trap 5–12.xi.2007, Piluek C. & Inpuang A. leg. (BIIC) T3628; 1♀ (H19797) THAILAND Kamphaeng Phet, Mae Wong NP Chong Yen, 16°5.212'N99°6.576'E, elevation 1306 m, Malaise trap 12–19.xi.2007, Piluek C. & Inpuang A. leg. (BIIC) T3630.

Variation. Body length: 2.0–3.4 mm, length of fore wing 2.5–3.4 mm, width of head 2.1–2.7 × its lateral length; antennomeres of ♀ 33–37; apical antennomeres 5–10 to 15–19 pale yellow; frons smooth, with a round pit or with a upside down V-shaped sculpture and deep around antenna sockets; scutellar sulcus with one strong medio-longitudinal carinae and two weak carinae laterally or with one carina (H20038); vein 3-CU1: vein CU1b=1:3–3:2; vein 1-M 0.8–1.1 × longer than vein M+CU; vein m-cu interstitial or slightly postfurcal; male similar to female, one specimen (H19990) with propodeum strongly sculptured apically; dark yellow to dark brown and partly dark yellow.

Distribution. Thailand.

Host. Unknown.

Etymology. The name refers to pale mark on the antenna; “signum” is Latin for mark.

Discussion

Three new species are morphologically very similar. *Phaenospila areolator* and *P*. *signator* are close to each other and the variation in *P*. *signator* is obvious, while characters of *P*. *areolator* are more stable.

Acknowledgements

We thank the staff at Queen Sirikit Botanic Garden in Chiang Mai, Thailand (QSBG) for sorting the many hundreds of samples and for the Thai park staff for operating Malaise traps and other collection devices. A special thanks to Chaweewan Hutacharern for managing the Thai end of the TIGER project. We are grateful to Dr Dicky Yu (Ottawa) for making literature available for this study and for creating the Taxapad database. We thank John Jennings and another reviewer for their comments on the draft manuscript. Funding was provided by National Natural science Foundation of China (32000319); NSF grants DEB-0542864 and EF-0337220, a University of Kentucky Research Activity Award, and by Hatch projects KY008041 and KY008065 (to MJS). The information reported in this paper (No. 18-08-049) is part of a project of the Kentucky Agricultural Experiment Station and is published with the approval of the Director.

References

van Achterberg, C. (1979) A revision of the subfamily Zelinae auct. (Hymenoptera, Braconidae). *Tijdschrif voor Entomologie*, 122, 241–479.

van Achterberg, C. (1988a) Revision of the subfamily Blacinae Foerster Hymenoptera, Braconidae). *Zoologische Verhandelingen* Leiden, 249, 1–324.

van Achterberg, C. (1988) The genera of the *Aspilota*-group and some descriptions of fungicolous Alysini from the Netherlands (Hymenoptera: Braconidae: Alysiinae). *Zoologische Verhandelingen Leiden*, 247, 1–88.

van Achterberg, C. (1990) Illustrated key to the subfamilies of the Holarctic Braconidae (Hymenoptera: lchneumonoidea) *Zoologische Mededelingen Leiden*, 64, 1–20.

van Achterberg, C. (1993) Illustrated key to the subfamilies of the Braconidae (Hymenoptera: Ichneumonoidea). *Zoologische Verhandelingen Leiden*, 283, 1–189.
van Achterberg, C. (1998) *Phaenocarpa helophilae* spec. nov. (Hymenoptera: Braconidae), a gregarious parasitoid of *Helophilus* larvae (Diptera: Syrphidae), with notes on related species. *Zoologische Mededelingen Leiden*, 72, 15–27.
van Achterberg, C. (2009) A new species of the genus *Phaenocarpa* Foerster from Madagascar (Hymenoptera: Braconidae: Alysiinae). *Zoologische Mededelingen Leiden*, 83 (3), 667–671.
Yao, J.-L., van Achterberg, C., Sharkey, M.J., Chapman, E.G. & Chen, J.-H. (2020) Five species and a genus new for Thailand, with description of five new species of *Hylcalosia* Fischer (Hymenoptera: Braconidae: Alysiinae). *Insect Systematics & Evolution*, 51 (4), 610–636.
https://doi.org/10.1163/1876312X-00002303
Yu, D.S.K., van Achterberg, C. & Horstmann, K. (2016) *Taxapad 2016, Ichneumonoidea 2015*. Nepean, Ontario. Database on flash-drive. Available from: http://www.taxapad.com (accessed 19 July 2022)

APPENDIX TABLE 1

Specimen no.	Taxon name	Country/region	COI accession
H19676	*Phaenospila areolator*	Thailand/Petchaburi	MG912696
H19677	*Phaenospila signator*	Thailand/Petchaburi	MG912697
H19680	*Phaenospila signator*	Thailand/Nakhon Nayok	MG912698
H19710	*Phaenospila signator*	Thailand/Ubon Ratchathani	MG912699
H19723	*Phaenospila areolator*	Thailand/Petchaburi	MG912700
H19745	*Phaenospila signator*	Thailand/Chaiyaphum	MG912701
H19753	*Phaenospila signator*	Thailand/Ubon Ratchathani	MG912702
H19760	*Phaenospila areolator*	Thailand/Petchaburi	MG912703
H19762	*Phaenospila signator*	Thailand/Petchaburi	MG912704
H19774	*Phaenospila signator*	Thailand/Sakon Nakhon	MG912705
H19785	*Phaenospila signator*	Thailand/Nakhon Nayok	MG912706
H19815	*Phaenospila signator*	Thailand/Petchaburi	MG912707
H19829	*Phaenospila signator*	Thailand/Petchaburi	MG912708
H19835	*Phaenospila signator*	Thailand/Phitsanulok	MG912709
H19848	*Phaenospila areolator*	Thailand/Petchaburi	MG912710
H19855	*Phaenospila areolator*	Thailand/Petchaburi	MG912711
H19861	*Phaenospila signator*	Thailand/Chiang Mai	MG912712
H19876	*Phaenospila areolator*	Thailand/Petchaburi	MG912713
H19899	*Phaenospila signator*	Thailand/Nan	MG912714
H19921	*Phaenospila signator*	Thailand/Nan	MG912715
H19985	*Phaenospila areolator*	Thailand/Petchaburi	MG912716
H19989	*Phaenospila areolator*	Thailand/Surat Thani	MG912717
H19990	*Phaenospila signator*	Thailand/Chiang Mai	MG912718
H19995	*Phaenospila signator*	Thailand/Petchaburi	MG912719
H20006	*Phaenospila signator*	Thailand/Petchaburi	MG912721
H20008	*Phaenospila areolator*	Thailand/Petchaburi	MG912722
H20028	*Phaenospila areolator*	Thailand/Petchaburi	MG912723
H20035	*Phaenospila brevicarinata*	Thailand/Petchaburi	MG912724
H20041	*Phaenospila brevicarinata*	Thailand/Petchaburi	MG912725
H20044	*Phaenospila brevicarinata*	Thailand/Petchaburi	MG912726
H20045	*Phaenospila brevicarinata*	Thailand/Petchaburi	MG912727
H20052	*Phaenospila brevicarinata*	Thailand/Loei	MG912728
H20065	*Phaenospila signator*	Thailand/Petchaburi	MG912729
H20067	*Phaenospila signator*	Thailand/Petchaburi	MG912730
H20078	*Phaenospila signator*	Thailand/Nan	MG912731
H20086	*Phaenospila signator*	Thailand/Sakon Nakhon	MG912732
H20109	*Phaenospila signator*	Thailand/Petchaburi	MG912733
H20117	*Phaenospila signator*	Thailand/Petchaburi	MG912734
H20123	*Phaenospila signator*	Thailand/Petchaburi	MG912735
H20126	*Phaenospila areolator*	Thailand/Petchaburi	MG912736
H20129	*Phaenospila brevicarinata*	Thailand/Petchaburi	MG912737
H20134	*Phaenospila signator*	Thailand/Petchaburi	MG912738
H20148	*Phaenospila areolator*	Thailand/Petchaburi	MG912739
H20149	*Phaenospila areolator*	Thailand/Petchaburi	MG912740
H20156	*Phaenospila signator*	Thailand/Loei	MG912741

APPENDIX TABLE 2.

Specimen no.	Taxon name	Country/region	Consensus barcode
H19726	*Phaenospila signator*	Thailand/Mae Hong Son	as follow
CTTGGTCAACAAAATCATAAAGATATTGGGGTATTATATTTTTTATTTGGATTTTGATCTGGTATAGTAGGGTT ATCTATAAGTATAATTATTCGGTTAGAATTAGGGATAGCTGGATCTTTATTAAAAAATGATCAAATTTATAAT AGAATTGTAACAGCTCATGCTTTTGTTATAATTTTTTTTATAGTTATACCAATTATATTAGGAGGATTTGGTAA TTGATTAATTCCTTTAATATTAGGGGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGGTTAT TATTACCTTCTTTAATATTATTAGTTTTAAGAGGTTTATTAAATATTGGAGTTGGTACTGGGTGAACAGTTTAT CCACCTTTATCTTCAGGAATTGGTCACAGGGGTATTTCAGTTGATTTAGCTATTTTTTCTTTACATTTAGCTGG GGTATCTTCTATTATAGGAGTAATTAATTTTTTAACAACAATTTTTAATATAAAATTATATAATTTAAAATTTG ATCAATTAAGTTTATTTATTTGATCAATTATAATTACGGCAATTTTATTATTATTATCTTTACCTGTTTTAGCTG GAGCTATTACTATATTGTTAACTGATCGTAATTTAAATACTACTTTTTTTGATTTTGCTGGTGGGGGGGATCCT ATTTATCACCT		
H19779	*Phaenospila areolator*	Thailand/Petchaburi	as follow
TGGTCAACAAATCCATAAAGATATTGGAATTTTATATTTTTTATTTGGGATCTGATCTGGTATAGTTGGTTTAT CTATAAGAATTATTATTCGATTAGAATTAGGTATAGCTGGATCTTTATTAATAAATGATCAAATTTATAATAC TTTAGTTACTTCTCATGCTTTTGTAATAATTTTTTTTATAGTTATACCAGTTATGTTAGGAGGATTTGGAAATT GATTAATTCCATTAATATTAGGAGCTCCTGATATAGCTTTCCCACGAATAAATAATATAAGATTTTGATTATT ATTACCTTCTTTAATATTATTACTTTTAAGAGGTTTATTAAATGTAGGTGCTGGTACTGGTTGAACAGTTTATC CTCCTTTATCTGCAAATGTTGGTCATAGGGGTATATCAGTAGATTTAGCAATTTTTTCTTTACATTTAGCTGGA ATTTCTTCTATTATAGGGGTAATTAATTTTTTGACAACAGCTTTTAATATAAAATTTTATTGTATAAAATATGA TCAAGTAAGATTATTTGTATGATCAATTATTATTACTGCAGTTTTGTTATTATTATCTTTGCCTGTTTTAGCAG GAGCTATTACTATATTATTAACTGATCGTAATTTAAATACTACCCTTTCTTTGATTTTTCAGGTGGTGGAGATC CCTATTTTTTTTCCACCCA		
H19792	*Phaenospila areolator*	Thailand/Petchaburi	as follow
CTTGGTCAACAAATTCATAAAGATATTGGAATTTTATATTTTTTATTTGGGATTTGATCTGGTATAGTTGGTTT ATCTATAAGAATTATTATTCGATTAGAATTAGGTATAGCTGGATCTTTATTAATAAATGATCAAATTTATAAT ACTTTAGTTACTTCTCATGCTTTTGTAATAATTTTTTTTATAGTTATACCAGTTATGTTAGGAGGATTTGGAAA TTGATTAATTCCATTAATATTAGGAGCTCCTGATATAGCTTTCCCACGAATAAATAATATAAGATTTTGATTA TTATTACCTTCTTTAATATTATTACTTTTAAGAGGTTTATTAAATGTAGGTGCTGGTACTGGTTGAACAGTTTA TCCTCCTTTATCTGCAAATGTTGGTCATAGGGGTATATCAGTAGATTTAGCAATTTTTTCTTTACATTTAGCTG GAATTTCTTCTATTATAGGGGTAATTAATTTTTTGACAACAGCTTTTAATATAAAATTTTATTGTATAAAATAT GATCAAGTAAGATTATTTGTATGATCAATTATTATTACTGCAGTTTTGTTATTATTATCTTTGCCTGTTTTAGC AGGAGCTATTACTATATTATTAACTGATCGTAATTTAAATACTACTTTTTTTGATTTTTCAGGTGGTGGAGATC CTATTTTATTTCCCCCT		
H19912	*Phaenospila signator*	Thailand/Petchaburi	as follow
TGGTCAACAAATCGATAAAGATATCTGGGGTATTATATTTTCTATGTGGATTTTGATCTGGTATAGTAGGGTT ATCTATAAGTATAATTATTCGGTTAGAATTAGGGATAGCTGGATCTTTATTAAAAAATGATCAAATTTATAAT AGAATTGTAACAGCTCATGCTTTTGTTATAATTTTTTTTATAGTTATACCAATTATATTAGGAGGATTTGGTAA TTGATTAATTCCTTTAATATTAGGGGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGGTTAT TATTACCTTCTTTAATATTATTAGTTTTAAGAGGTTTATTAAATATTGGAGTTGGTACTGGGTGAACAGTTTAT CCACCTTTATCTTCAGGAATTGGTCACAGGGGTATTTCAGTTGATTTAGCTATTTTTTCTTTACATTTAGCTGG GGTATCTTCTATTATAGGAGTAATTAATTTTTTAACAACAATTTTTAATATAAAATTATATAATTTAAAATTTG ATCAATTAAGTTTATTTATTTGATCAATTATAATTACGGCAATTTTATTATTATTATCTTTACCTGTTTTAGCTG GAGCTATTACTATATTGTTAACTGATCGTAATTTAAATACTACTTTTTTTGATTTTGCTGGTGGGGGGGATCCT ATTTACTCACCCT		

.....continued on the next page

APPENDIX TABLE 2. (Continued)

Specimen no.	Taxon name	Country/region	Consensus barcode
H20164	*Phaenospila signator*	Thailand/Petchaburi	as follow
TGGTCAACAAATCATAAAGATATTGGGGTATTATATTTTTTATTTGGATTTTGATCTGGTATAGTAGGGTTATC			
TATAAGTATAATTATTCGGTTAGAATTAGGGATAGCTGGATCTTTATTAAAAAATGATCAAATTTATAATAGA			
ATTGTAACAGCTCATGCTTTTGTTATAATTTTTTTTATAGTTATACCAATTATATTAGGAGGATTTGGTAATTG			
ATTAATTCCTTTAATATTAGGGGCACCTGATATAGCTTTTCCTCGAATAAATAATATAAGATTTTGGTTATTAT			
TACCTTCTTTAATATTATTAGTTTTAAGAGGTTTATTAAATATTGGAGTTGGTACTGGGTGAACAGTTTATCCC			
CCTTTATCTTCAGGAATTGGTCACAGGGGTATTTCAGTTGATTTAGCTATTTTTTCTTTACATTTAGCTGGGGT			
ATCTTCTATTATAGGAGTAATTAATTTTTTAACAACAATTTTTAATATAAAATTATATAATTTAAAATTTGATC			
AATTAAGTTTATTTATTTGATCAATTATAATTACGGCAATTTTATTATTATTATCTTTACCTGTTTTAGCTGGA			
GCTATTACTATATTGTTAACTGATCGTAATTTAAATACTACTTTTTTTGATTTTGCTGGTGGGGGGGATCCCTA			
TTTAATTCAACCA			