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Aphid parasitoids (Hymenoptera, Braconidae, Aphidiinae) from Thailand

PETR STARÝ[1], EHSAN RAKHSHANI[2], ŽELJKO TOMANOVIĆ[3], NICKOLAS G. KAVALLIERATOS[4] & MICHAEL SHARKEY[5]

[1]*Institute of Entomology, Biology Centre, Academy of Sciences of the Czech Republic, Branišovská 31, 370 05 České Budějovice, Czech Republic. E-mail: stary@entu.cas.cz*

[2]*Department of Plant Protection, College of Agriculture, University of Zabol, P.O.Box 998615–538, Zabol, I. R. Iran. E-mail: rakhshani@uoz.ac.ir*

[3]*Institute of Zoology, Faculty of Biology, University of Belgrade, Studenstki trg 16, 11000 Belgrade, Serbia. E-mail: ztoman@bio.bg.ac.rs*

[4]*Laboratory of Agricultural Entomology, Department of Entomology and Agricultural Zoology, Benaki Phytopathological Institute, 8 Stefanou Delta str., Kifissia, 14561, Attica, Greece. E-mail: nick_kaval@hotmail.com*

[5]*Hymenoptera Institute, Department of Entomology, University of Kentucky, Sciences Centre North, Lexington, KY, 40546–0091, USA. E-mail: msharkey@uky.edu*

Abstract

Original information on aphidiine braconids from Thailand is presented. Collections of specimens from 2006 through 2008 using Malaise traps and yellow pan traps yielded 7 new species records for the country, i.e., *Binodoxys indicus* Subba Rao et Sharma, *Bioxys japonicus* Starý et Schlinger, *Diaeretus leucopterus* (Haliday), *Ephedrus lacertosus* (Haliday), *Fissicaudus thailandicus* Starý et Rakshshani, *Indaphidius curvicaudatus* Starý and *Parabioxys songbaiensis* Shi et Chen. The new records demonstrate faunal connections with India, Vietnam, the eastern Palaearctic, and more interestingly disjunct connections with the western Palaearctic, i.e. *Ephedrus lacertosus* (Haliday), *Diaeretus leucopterus* (Haliday), *Lipolexis gracilis* Förster, and afrotropical regions, i.e. *Aphidius autriquei* Starý. In all, 11 species belonging to 10 genera are presented.

Key words: aphids, parasitoids, biodiversity, national parks, Thailand

Introduction

Current knowledge of the aphidiine fauna of Thailand is limited. A first attempt was made by Starý *et al.* (2008) in which a new species, *Areopraon thailandicum* Starý was described; and other species were recorded for the first time, i.e. *Aphidius autriquei* Starý, *Archaphidus greenideae* Starý et Schlinger, *Lipolexis gracilis* Förster, *Lipolexis oregmae* (Gahan), *Toxares shigai* Takada. One species identification was tentative, and several specimens were identified only to the generic level. More recently (Starý *et al.* 2010) a new species, *Fissicaudus thailandicus* Starý et Rakhshani, was described. With the aim of facilitating taxonomic research on aphidiine parasitoids of south east Asia in general and Thailand in particular, the present contribution encorporates new information derived from a three-year Thailand inventory project (http://sharkeylab.org/tiger/) in which terrestrial arthropods were sampled using Malaise traps and yellow pan traps. National parks were choosen as sampling sites since they are most likely to preserve indigenous fauna (Ervin 2003, Starý *et al.* 2008).

Material and methods

Specimens were collected from 2006 through 2008 using Malaise traps and yellow pan traps. Every year of

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the three year survey an average of 10 different National parks were surveyed. Of these parks specimens of Aphidiinae were captured in the following: Doi Inthanon, Khao Kho, Khao Yai, Nam Nao, Pha Hin Ngam, Pha Taem, Phu Kradueng, Phu Phan, Phu Ruea, Tat Tone, Thung Salaeng Luang. (map1 link). Three Malaise traps were set up in each park resulting in approximately 30 Malaise trap years of collecting in each of the 3 years of the project. Twenty five pan traps were placed in each park for two days each week and these were often placed under the main panels of Malaise traps to catch falling insects, much like a flight interception trap. Thus there were approximately 2,600 pan trap days each year or about 7,000 pan trap days over the life of the project. From this extensive sampling only about 460 specimens of Aphidiinae were collected indicating the rarity of the subfamily in tropical climates. Material is deposited in the Queen Sirikit Botanic Garden insect collection in Chiang Mai (QSBG). Some duplicate specimens are deposited in the collection of Petr Starý (České Budějovice) and the Hymenoptera Institute (University of Kentucky). Specimens were originally preserved in 80% ethanol and later were selected either for dry-mounting or slide-mounting.

A number of specimens of *Aphidius*, *Binodoxys*, *Trioxys* and *Praon* could not be identified because of taxonomic problems and limited specimen numbers, and only material determined to species level is included in this paper.

Results

Review of parasitoid species

The parasitoid species are listed alphabetically. The following seven species are reported from Thailand for the first time: *Binodoxys indicus* Subba Rao et Sharma, *Bioxys japonicus* Starý et Schlinger, *Diaeretus leucopterus* (Haliday), *Ephedrus lacertosus* (Haliday), *Fissicaudus thailandicus*, *Indaphidius curvicaudatus* Starý, *Parabioxys songbaiensis* Shi et Chen. For each species, the locality name is followed by the sample number and then the number of examined specimens, in the format "000/0".

Abbreviations: MAP-Malaise trap and pan trap. NP-National Park. Collectors (in brackets): AA–A. Areeluck, KB-Katae Sa-nog & Buakaw Adnafai, LJ–Leng Jangteab, NH–Noopien Hongyothee, NK–Noo Kerdlom, PS-Ponpitak and Sathit, PT–P. Tuntip, ST-Sailom Tongboonchai, SG-Sutin Gonglasae, SoTh-Soravit and Thongdee, TJ–Tawit Jaruphan, TS–Thanongsak Srisa-ad, WK–Winlon Kongnara, WS–Wirat Sukho, YA–Y. Areeluck SCSS-Somchai Chachumnan and Sa-ink Singhtong.

Aphidius autriquei Starý

Chiang Mai, Doi Inthanon NP, Kew Maepan trail, 18°33. 162´ N, 98°28. 810´ E, 2200m: 1847/1 22–29 IV 07 (AA). (MAP)

Archaphidus greenideae Starý et Schlinger

Phetchabun, Khao Kho NP, mixed decidous forest, 16°32. 539´ N, 101°02. 483´ E, 524m, Pan traps: 1777/1 11–12 XII 06 (SCSS). Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen, 16°36. 284´ N, 100°53. 128´ E, 749m: 1283/1 16–22 XII 06 (PS). Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen, 16°35. 805´ N, 100°52. 286´ E, 726m: 1287/1 22–28 XII 06 (PS). 1293/1 4–11 I 07 (PS). Chiang Mai, Doi Inthanon NP, Kew Maepan trail, 18°33. 162´ N, 98°28. 810´ E, 2200m: 1783/1 26 I–2 II 07 (AA). 1841/1 5–22 IV 07 (AA). 1931/1 12–19 I 07 (YA). Chiang Mai, Doi Inthanon NP, campground pond, 18°32. 40´ N, 98°31. 80´ E, 1200m: 1919/2 Pan traps, 12–13 I 07 (YA). 1920/1:23-24 I 07 (YA). 1921/1: 19–21 I 07 (YA). (MAP)

Note: This species was redescribed by Starý and Harten (1983).

***Binodoxys indicus* Subba Rao et Sharma**

Phetchabun, Khao Kho NP, mixed deciduous forest, 16°32. 539´ NN, 101°02. 483´E, 524m, Pan traps: 1177/2 11–12 XII 06 (SCSS). 1179/1: 12–19 XII 06 (SCSS). 1186/1: 19–26 XII 06 (SCSS). (MAP)

***Bioxys japonicus* Starý et Schlinger**

Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen, 16°35. 805´ N, 100°52. 286´ E, 726m: 1284/2 16–22 XII 06 (PS). (MAP)
Note: This species was reported as a parasitoid of callipterine aphids on *Ficus* sp. in Japan (Starý et Schlinger 1967). It has also been reported as a parasitoid of *Machilaphis machili* Takahashi from Japan (Starý 1975) under the synonyms *Trioxys machilaphidis* (Takada 1968) and *Trioxys staryi* Mackauer.

***Diaeretus leucopterus* (Haliday)**

Phetchabun, Nam Nao NP, checkpoint, 16°43. 687´ N, 101°33. 754´ E, 924m: 2284/1 1–8 III 07 (LJ). (MAP)
Note: Revision of the "conspecific" material is recommended due to high variation.

***Ephedrus lacertosus* (Haliday)**

Chiang Mai, Doi Inthanon NP, summit forest, 18°35, 361´ N, 98°29. 157´ E, 2500m: 1798/6. 9–16 II 07 (AA). 1896/1 29 XII 06–5 I 07 (YA). 1948/1 18°35. 361´ N, 98°29. 157´ E, 19–26 I 07 (YA). Chiang Mai, Doi Inthanon NP, summit marsh, 18°35. 361´ N, 98°29. 157´ E, 2500m: 1828/1 8–15 V 07 (AA). Chiang Mai, Doi Inthanon NP, Kew Maepan trail, 18°33. 162´ N, 98°28, 810´ E, 2200m 1866/1 24 XI–1 XII 06 (YA). Doi Inthanon NP, check point 2, 18°31. 554´ N, 98°29. 940´N, 1700m: 1912/1, 8–15 XI 06 (YA). (MAP)
Note: The same species was recorded as "*E.* cf. *longistigma*" in Starý *et al.* (2008).

***Fissicaudus thailandicus* Starý et Rakhshani**

Chiang Mai, Doi Inthanon NP, summit forest 18°35, 361´ N, 98°29, 157´ E, 2500m: 1798/1, 9–16 II 07 (AA). 1896/2 1948/1 26 I 07 (YA). 1949/1 12–19 I 07 (YA). 1896/2, 29 XII 06–5 I 07 (YA). Chiang Mai, Doi Inthanon NP, summit marsh, 18°35. 361´ N, 98°29. 157´ E, 2500m: 1892/1 29 XII 07 (YA). Chiang Mai, Doi Inthanon NP, summit marsh, 18°35. 351´N, 98°29. 157´ E, 2500m: 1952/1 19–20 I 07 (AA). (MAP)

Note: *F. confucius* from Thailand reported by Starý *et al.* (2008), probably belongs to this new species. On the basis of the semicircular ovipositor sheath, *Fissicaudus thailandicus* is closely related to *F. confucius*, differring from the latter by having straight prongs with almost parallel sides and bearing 3 long setae on the dorsal surface (Starý *et al.* 2010).

***Indaphidius curvicaudatus* Starý**

Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen, 16°35. 805´ N, 100°52. 286´ E, 726m: 1293/1 34–11 I 07 (PS). (MAP)

Note: The species is reported as a parasitoid of *Mollitrichosiphum nandii* Basu, *Mollitrichosiphum.* sp. (both Greenideinae) and *Macrosiphum rosae* L. in Meghalaya, Sikkim and West Bengal–India (Raychaudhuri 1990, Starý 1979, Starý and Ghosh 1983). The evidence for *M. rosae* as a host species need verification.

***Lipolexis gracilis* Förster**

Phetchabun, Nam Nao NP, heliport, 16°43. 184´ N, 101°35. 137´ E, 875: 1432/1 18–26 XII 06 (LJ). Sakon Nakhom, Phu Phan NP, west of well, 17°03. 521´ N, 101°58. 450´ E, 322m, Pan traps: 1511/1 7–8 I 07 (ST). Chiang Mai, Doi Inthanon NP, Kew Maepan trail, 18°33. 162´ N, 98°28. 810´E, 2200m: 1841/1 15–22 IV 07 (AA). (MAP)

***Lipolexis oregmae* (Gahan)**

Chiang Mai, Doi Inthanon NP, Kew Maepan trail, 18°33. 163′ N, 98°28.810′ E, 2200m: 233/6 22–30 VII 06 (YA). 1931/1 12–19 I 07 (YA). 1934/1 12–19 I 07 (YA). Chiang Mai, Doi Inthanon NP, summit marsh, 18°35. 361′ N, 98°29. 157′ E, 2500m: 1788/1 2–9 II 07 (AA). Chiang Mai, Doi Inthanon NP, campground pond, 18°32. 40′ N, 98°31. 80′ E, 1200m: 1868/1 24 XI–1 XII 06 (YA). 1916/1 Pan traps 12–13 I 07 (YA). Sakon Nakhon, Phu Phan NP, dry dipterocarp forest, at foot hill forest unit, 17°09. 921′ N, 103°54. 485′ E, 206m: 699/2 6–13 X 06 (WK). Sakon Nakhon, Phu Phan NP, west of well, 17°03. 521′ N, 103°58. 450′ E, 322m: 1510/4 Pan traps 6–7 I 07 (ST). 1511/5 Pan traps, 7–8 I 07 (ST). Uban Ratchatchani, Pha Taem NP, 16°27. 407′ N, 105°34. 867′ E, 230m: 1053/1 4–11 XI 06 (SoTh). Loei, Phu Kradueng NP, 16°49. 099′ N, 101°47. 624′ E: 1074/1 14–20 XI 06 (SGI). Loei, Phu Kradueng NP, savannah in pine forest, 16°53. 092′ N, 101°47. 413′ E, 1257: 1226/1 9–16 I 07 (TS). Loei, Phu Kradueng NP, forest protection unit, Loei 5 (Phakbung) 16°50. 540′ N, 101°41. 663′ E: 1489/1 Pan traps 8–9 II 07 (NK). 1496/3 7–13 II 07 (SG). 1499/1 13–19 II 07 (WK). 1502/2 19–25 II 07 (NK). Loei, Phu Ruea NP, 17°29. 540′ N, 101°20. 995′ E, 1130m: 115/2 5–12 XI 06 (PT). Loei, Phu Ruea NP, 17°29. 652′ N, 101°21. 020′ E: 1122/1 19–26 XI 06 (PT). Chaiyaphum, Tat Tone NP, dry dipterocarp forest nr. swamp at Saon Somboon forest unit, 16°01. 069′ N, 101°58. 603′ E, 674m: 140/1 12–19 XI 06 (TJ). Chaiyaphum, Pa Hin Ngam NP, deciduous forest, 15°39. 966′ N,101°27.198′ E, 357: 2478/4 13–19 VI 07 (KB). Phetchabun, Thung Salaeng Luang NP, Kaeng Wang Nam Yen, 16°36. 587′ N, 100°53. 395′ E: 1157/1 16-22 XI 06 (PS). 1158/2 16-22 XI 06 (PS). 1159/1 16-22 XI 06 (PS). 1160/1 22-29 XI 06 (PS). 1167/1 6-13 XII 06 (PS). 1168/2 6-13 XII 06 (PS). 1168/2 6–13 XII 06 (?). Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen, 16° 35. 789′ N, 100°52. 286′ E, 769m: 1282/1 16–22 XII 06 (?). Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen,16°36. 284′ N, 100°53. 128′ E, 749m: 1283/2 15–22 XII 06 (PS). Phetchabun, Thung Saleang Luang NP, pine forest, Gang Wang Nam Yen, 16°35. 805′ N, 100°52. 286′ E: 1293/1 4–11 I 07 (PS). Phetchabun, Khao Kho NP, mixed deciduous forest, 16°32. 539′ N, 101°02. 483′ E, 524m: 1177/6 Pan traps, 11–12 XII 06 (SCSS). 1179/4 (SCSS). 1182/1 12–19 XII 06 (SCSS). 1185/8 19–26 XII 06 (SCSS). 1188/6 26 XII 06–2 I 07 (SCSS). 1189/9 26 XII 06–2 I 07 (SCSS). Phetchabun, Khao Kho NP, mixed deciduous forest, 16°32. 561′ N, 101°02. 479′ E, 537m: 1178/1 5–12 XII 06 (SCSS). 1181/7 12–19 XII 06 (SCSS). 1184/8 19–26 XII 06 (SCSS). 1187/10 26 XII 06–2 I 07 (SCSS). Phetchabun, Khao Kho NP, mixed deciduous forest, 16°32. 546′ N, 101°02. 501′ E, 560m: 1183/17 12–10 XII 06 (SCSS). 1186/5 19–26 XII 06 (SCSS). Phetchabun, Nam Nao NP, hill evergreen forest,16°44. 371′ N, 101°34. 649′ E, 834m: 1327/1 27 XI 06 (LJ). 1329/4 27 XI–4 XII 06 (NH). 1330/1 14–11 XII 06 (LJ). Phetchabun, Nam Nao NP, hill evergreen forest, 16°44. 387′ N, 101°34. 531′ E, 838m: 1331/2 4–11 XII 06 (NH). 1334/2 11–18 XII 06 (LJ). Phetchabun, Nam Nao NP, heliport, 16°43. 134′ N, 101°35. 137′ E, 875m: 1432/1 18–26 XII 06 (LJ). 1435/2 26 XII 06–1 I 07 (LJ). Phetchabun, Nam Nao NP, heliport, 16°43. 156′ N, 101°35. 118′ E, 890m: 1433/2 18–25 XII 06 (NH). Phetchabun, Nam Nao NP, heliport, 16°43. 113′ N, 101°35. 134′ E, 889m: 1437/3 25 XII 06–1 I 07 (NH et LJ). Nakhon Nayok, Khao Yai NP, Lum Ta Kong viewpoint, 14°25. 565′ N, 101°23. 442′ E, 726m,: 2127/2 19–26 VI 07 (WS). Nakhon Nayok, Khao Yai NP, secondary forest near Hnong Pakchee, 14°27. 167′ N, 1091°21. 850′ E, 758m: 2269/1 19–25 V 07 (WS). (MAP)

***Parabioxys songbaiensis* Shi et Chen**

Chiang Mai, Doi Inthanon NP, summit forest, 18°35. 361′ N, 98°29. 157′ E, 2500m: 1798/2 9–16 II 07 (AA). (MAP)

Note: The original description from China (Chen and Shi 2001) lacks host records. The species has been reared from *Greenidea kuwanai* (Pergande) on *Quercus dentata* (Pergande) in North Korea (Starý *et al.* 2010).

Discussion

Our collections, using Malaise and pan traps, confirm that *L. oregmae* is a widespread and common species. It

is oligophagous and parasitizes aphid hosts which usually belong to the genera *Aphis*, *Rhopalosiphum* and *Toxoptera* (Miller *et al.* 2002). *Binodoxys indicus* Subba Rao et Sharma, an important parasitoid species of *Aphis craccivora* Koch, *Aphis gossypii* Glover and *Aphis nerii* Boyer de Fonscolombe (Agarwala 1983) are recorded from Thailand for the first time. Both *L. oregmae* and *B. indicus* have been utilized in biological control programs against important aphid pests on citrus and leguminous or cucurbit crops respectively (Singh and Agarwala 1992, Singh and Rao 1995, Miller *et al.* 2002, Persad *et al.* 2007). The Thailand aphidiine fauna shares numerous species with Bangladesh, China, India, North Korea, South Korea, Malaysia, Japan, Pakistan, Vietnam and with some western Palaearctic, i.e. *E. lacertosus*, *D. leucopterus*, *L. gracilis*, and afrotropical elements, i.e. *A. autriquei* (Starý and Ghosh 1983, Starý and Zelený 1983, Ng and Starý 1986, Starý *et al.* 2008, 2010).

Aphidiine species attacking the greenideid aphids, *A. greenideae*, *F. thailandicus*, *I. curvicaudatus*, and *P. songbaiensis* are common in Thailand as well as in East and North Asia (Starý *et al.* 2008, 2010). Similarly, *D. leucopterus* and *Pauesia* spp. which are associated with cinarine aphids on conifers, are present in northern Thailand parks (Starý *et al.* 2008).

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