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DIVERSITY OF *CHELIPODA* MACQUART, 1823 (DIPTERA: EMPIDIDAE: HEMERODROMIINAE) IN NORTHERN THAILAND WITH DISCUSSION OF A BIODIVERSITY 'HOT SPOT' AT DOI INTHANON

Adrian R. Plant
Department of Biodiversity & Systematic Biology, National Museum of Wales, Cathays Park, Cardiff, CF10 3NP, UK

***ABSTRACT.* –** Nine species of *Chelipoda* Macquart, 1823 (Diptera: Empididae) are described from northern Thailand: *C. chaiamnata*, new species; *C. inthawichayanona*, new species; *C. kameawuta*, new species; *C. laisoma*, new species; *C. manggawna*, new species; *C. meenamluang*, new species; *C. nakladam*, new species; *C. nakropa*, new species and *C. thaosuranaria*, new species. One species, *C. macrosceles* new species is described from Vietnam and also reported from Thailand. In total, fourteen species of *Chelipoda* are reported from northern Thailand and an identification key provided. Descriptions of *C. flavida* Brunetti, 1913; *C. guangxiensis* Yang & Yang, 1986; *C. hubeiensis* Yang & Yang, 1990 and *C. menglunana* Grootaert, Yang & Saigusa, 2000 are augmented. Eleven species (including seven endemics) occurred on the mountain Doi Inthanon which was identified as a 'hotspot' of *Chelipoda* diversity. Species richness and abundance increased with altitude and seasonal influences on adult phenology were greatest at lower elevations. The uplifting of Doi Inthanon coincided with development of seasonal monsoon patterns and orogenesis of mountain ranges connecting with the eastern Himalaya. It is hypothesised that: (a) seasonal relaxation at higher altitudes provided moist refugia into which *Chelipoda* and other ombrophilous fauna migrated vertically in response to the intensification of seasonality at lower elevations. Subsequent uplifting of Doi Inthanon's basement well above the present day surrounding area would have isolated these faunal elements and promoted speciation; (b) the mountain may have been colonised from the Himalaya via 'Palaearctic corridors' of suitable moist forest habitat along intervening mountain chains.

***KEY WORDS.* –** Diptera, Empididae, *Chelipoda*, Thailand, new species.

INTRODUCTION

The empidid genus *Chelipoda* Macquart, 1823, contains 92 described species distributed across all faunal realms except the Afrotropical, but little is known of the Asian fauna apart from in China where 20 species have been reported (Yang & Yang, 2004). The present work describes nine new species of *Chelipoda* from northern Thailand, one species from Vietnam which is also found in Thailand, supplements the descriptions of four previously known species and presents a key to all the northern Thailand species. The mountain Doi Inthanon was identified as a hotspot of *Chelipoda* diversity and aspects of the ecology, altitudinal zonation and origins of the mountain's fauna were investigated.

MATERIALS AND METHODS

Material used in this study was collected during 2006 and 2007 as part of a three year project (TIGER– Thailand Insect Group for Entomological Research) sampling terrestrial invertebrates in national parks of Thailand. Sampling effort was concentrated in the following mostly northern and north eastern parks (with numbers of Malaise trap and pan trap samples respectively in parenthesis). –Doi Inthanon (265, 62), Nam Nao (106, 63), Thung Salaeng Luang (108, 63), Phu Kradueng (72, 41), Phu Ruea (132, 77), Pa Nin Ngam (133, 73), Phu Phan (132, 77), Tat Tone (141, 77), Pha Taem (126, 77) and Khao Yai (140, 84) [a total of 1,355 Malaise trap and 694 pan trap samples were searched for *Chelipoda* species]. Two specimens were also included from Khao Phu – Khao Ya National Park, in Trang Province, southern Thailand. A total of 923 Thai specimens of *Chelipoda* resulted. Additionally, 50 specimens from Vietnam belonging to a species also found in the Thailand samples were studied. Repository institutions for material were: – IRSNB, Royal Belgian Institute of Natural Sciences, Brussels, Belgium; NMWC, National Museum of Wales, Cardiff, UK; RMNH, Nationaal Natuurhistorisch Museum, Leiden, Netherlands; QSBG, Queen Sirikit Botanical Garden, Chiang Mai, Thailand.

Morphological terms are essentially those of McAlpine (1981) and Stuckenberg (1999). Interpretation of genitalic homology follows Cumming et al. (1995) and Sinclair (2000). Colour descriptions refer to ground colour (i.e. not colour due to pruinosity) unless stated otherwise. Orientation is denoted by pd, posterodorsal; pv, posteroventral. C_1, C_2 and C_3 refer to the front, mid and hind coxae respectively; F_1–F_3 and T_1–T_3 to the corresponding femora and tibiae. Other abbreviations used are: – BP, before present; dc, dorsocentral setae; Epan, epandrium; Hypan, hypandrium; lpo, lower postocular setae; MYA, million years ago; npl, notopleural setae; ocl, ocellar setae; poped, postpedicel; sa, supraalar setae; sct, scutellar setae; upo, upper postocular setae; vtl, vertical setae.

The front femur bears four rows of setae ventrally comprising two rows of long setae between which is a double (occasionally single) row of much shorter peg-like setae (Fig. 27). This study employs the term spine to describe setae of the outer rows and denticle to denote the shorter setae between the rows. One or two spines are often present basally and although these are actually a continuation of the av or pv series of spines, they are regarded separately as 'basal spines' because they are positioned basally to the major quadruple rows of setae. For those species having two rows of denticles placed between two rows of spines, the femoral formula (Plant, 2007) is employed to describe their position and abundance. This records the median number and statistical range of spines or denticles in each row starting from the most anterior and working posteriorly. Thus a femoral formula of 5(4–5)/22(19–26)/14(12–18)/4(4–5) +1 indicates that there are 5 (range 4–5) av spines, 22 (range 19–26) av denticles, 14 (range 12–18) pv denticles, 4 (range 4–5) pv spines and one basal spine.

In addition to full locality / date / collector data, labels for material collected by the TIGER Project has a unique data code (prefixed 'T') which is quoted on the label and used administratively within the TIGER Project.

TAXOMOMY

Chelipoda Macquart, 1823

Diagnosis. – A characteristic genus of the Empididae subfamily Hemerodromiinae with raptorial forelegs distinctly separated from the mid legs and fore femur bearing distinct rows of setae ventrally (Figs. 25–27). *Chelipoda* is distinguished from other southeast Asian Hemerodromiinae by the combination of (1) Postpedicel longer than wide, stylus longer (2) Katatergital setae present (3) Male genitalia strongly reflexed anteriorly (4) Cell dm closed (crossvein dm-cu present) (5) Anal vein (A_2+CuA_2) present (6) Cell br usually longer than cell bm, crossveins closing them not closely aligned (Fig. 28).

Key to species of *Chelipoda* from Northern Thailand

1. Wing with strong black subterminal band commencing at apex of cell dm leaving apex of wing clear .... *C. menglunana* Grootaert, Yang & Saigusa
– Wing weakly pigmented; if darkened, never with distinct subterminal band 2
2 Legs conspicuously slender; F_1 8–9x long as wide (Fig. 26) with a single row of denticles between double rows of ventral spines ..... *C. macrosceles*, new species
– Legs stouter (Figs. 25, 27); F_1 at most 6x long as wide, usually strongly inflated (F_1 3.4 –4.8x long as wide), a double row of denticles between double rows of ventral spines (if only single row of denticles present then F_1 conspicuously inflated) .. 3
3 Ground colour of thorax yellow or brownish yellow at least on pleura; scutum sometimes darkened or with darker stripes 4
– Ground colour of thorax black, at most with propleuron contrastingly yellowish 12
4 Head yellow 5
– Head black 6
5 Upper occiput, vertex and frons darkened; scutum yellow with dark median stripe (Fig. 21) ..... *C. flavida* Brunetti
– Upper occiput, vertex and frons yellow; scutum yellow without dark median stripe ..... *C. manggawna*, new species
6 Thoracic dorsum brownish or yellowish black 7
– Thoracic dorsum yellow, sometimes with dark median stripe 9
7 Front coxa without distinct anterobasal spine. Antenna with basal segments dark reddish yellow, not contrasting strongly with dark postpedicel ..... *C. guangxiensis* Yang & Yang
– Front coxa with distinct anterobasal spine. Antenna with basal segments yellowish, contrasting with dark postpedicel 8
8 Scutum diffusely edged paler brown laterally, not distinctly contrasting with darker brown central area (Fig. 23) .... *C. nakropa*, new species (mid elevation morph)
– Scutum sharply edged yellowish lateral to line of dorsocentrals, the yellow margins contrasting with central broad, almost blackish area (Fig. 22) .... *C. nakropa*, new species (high elevation morph)
9 Scutum more or less wholly yellow 10
– Scutum yellow with dark median stripe 11
10 Front coxa with distinct anterobasal spine. F_1 with single row of denticles. Front tarsomeres 2 and 3 distinctly spinose .... *C. kameawuta*, new species
– Front coxa without distinct anteroventral spine. F_1 with double row of denticles. Front tarsomeres 2 and 3 not distinctly spinose ..... *C. thaosuranaria*, new species
11 Scutum with narrow dark median stripe (Fig. 24). A contrasting deep black mark between and behind front coxae on av margin of katepisternum ..... *C. chaiamnata*, new species
– Scutum with broader dark median stripe. Area between and behind front coxae yellow, not contrasting with surroundings ..... *Chelipoda* species D
12 Propleuron blackish (at most faintly yellowish), not contrasting with rest of pleura 13
– Propleuron yellowish or reddish, contrasting with rest of black pleura 14
13 Thoracic setae and spines on F_1 dark. Male sternites 7 & 8 with sparse black setae ..... *C. hubeiensis* Yang & Yang
– Thoracic setae and spines on F_1 yellow. Male sternites 7 & 8 with numerous yellow setae (Fig. 11) .... *C. meenamluang*, new species
14 Front coxa without distinct anterobasal spine. Posterior dc (in line with npl) about as strong as anterior dc .... *C. nakladam*, new species
– Front coxa with distinct anterobasal spine. Posterior dc (in line with npl) minute, much smaller than anterior dc 15
15 Male cercus with strong pointed ad process (Fig. 4). Female basal antennal segments yellowish ..... *C. inthawichayanona*, new species
– Male cercus with strong pointed ad process and lower less pointed lobe (Fig. 8) ..... *C. laisoma*, new species

Chelipoda chaiamnata, new species
(Figs 1, 24)

***Material examined.* – Holotype**. Male, THAILAND: Loei, Phu Ruea National Park, Nature Trail, 17°30.740'N 101°20.650'E, 1,353 m, Malaise trap, coll. N. Jaroenchai, 26 Sep.–2 Oct.2006 (QSBG, T834).

Paratypes. One male, same data as holotype (NMWC); 1 male, 19–26 Sep.2006 (QSBG, T831): Chiang Mai, Doi Inthanon National Park, Campground Pond, 18°32.657'N, 98°31.482'E, 1,200 m, Malaise trap, coll. Y. Areeluck, 2 females, 2–10 Nov.2006 (QSBG & NMWC, T831).

***Diagnosis.* –** Black head. Yellow thorax with narrow median stripe on scutum and a contrastingly deep black marking between and behind front coxae.

***Description.* – Male.** Body length 3 mm. Head black with paler dust; ocl, vtl and upper upo strong, yellowish brown; other upo blackish, small; lpo pale; a few pale hairs behind mouth. Antenna with basal segments yellow; poped black, 2.5x long as wide; stylus black, rather more than 2x long as poped. Mouthparts brownish, proboscis black.

Thorax clear yellow, narrow median stripe on scutum, broader stripe on mediotergite and base of scutellum dark brown (Fig. 24). Area between and behind front coxa on av margin of katepisternum contrastingly deep black. Setae yellow; two dc (including one level with npl) upper npl, sa and sct all strong; otherwise only minute hairs posteriorly on scutum, pospronotum and lower notopleural area.

Legs yellow, tarsomeres 4–5 obscurely darker. C_1 0.85x as long as thorax, anterior ciliation of small setulae yellow, no strong anterobasal seta. F_1 slightly longer than C_1, inflated, 3.7–3.9x as long as wide, widest 0.3–0.4 from base; femoral formula approximately 5(5–5)/20.5(20–23)/17(15–17)/5(5–6) +2–4 (Table 1); usually only one strong basal spine, others very weak and contiguous with *av* and *pv* series of spines; denticles black, spines yellow to yellowish black.

Abdomen black, yellowish ventrally; tergite 8 reduced, strongly sclerotized; sternites 7 and 8 with distinct setae on posterior margins and ventrally. Epan and Hypan fused (Fig. 1), rather hemispherical in lateral view, brownish yellow becoming darker ventrally and posteriorly, bearing distinct setae posteriorly; left and right lamellae narrowly separated by unpigmented membrane. Cercus fused with Epan, yellowish, somewhat darker basally with long anteriorly directed digitiform process bearing long erect setae above and somewhat shorter more decumbent setae below. Subepandrial process greyish yellow, a minute upturned dorsal 'tooth' apically. Phallus yellow apically, darker basally, reaching almost to apex of subepandrial process; apicolaterally with four or five minute tubercles each bearing a minute short spine-like seta.

Wing membrane faintly yellowish; veins yellowish. Squamae with dark yellow fringes. Halter whitish yellow.

Female. Similar to male; antenna with poped slightly longer, 2.8x long as wide.

Legs similar to male, F_1 slightly more inflated; femoral formula 5(5–5)/22(20–24)/16.5(15–17)/5(4–5) +1–2, usually only one strong basal spine, other very weak.

Cercus yellow, slightly elongated.

***Etymology.* –** The specific epithet derives from the Thai word, chai-am-nat (domineering), in reference to supposed fierce predatory behaviour inferred from the presence of strongly raptorial front legs in this species. Used as a noun in apposition.

***Remarks.* –** Known only from Loei and Chiang Mai provinces from rather dry seasonal forest biotopes between 1,200 and 1,353 m from September to November.

Chelipoda flavida Brunetti, 1913
(Fig. 2, 21)

Phyllodromia flavida – Brunetti, 1920: 368–369.

***Material examined.* –** THAILAND, Chiang Mai, Doi Inthanon National Park, Campground Pond, 18°32.40'N 98°31.80'E, 1,200 m, Malaise trap, coll. Y. Areeluck: 2 males, 26 Oct.–2 Nov.2006 (NMWC, T379); 5 females, 2–10 Nov.2006 (NMWC, T385); 4 males, 3 females, 10–17 Nov.2006 (NMWC, T1916); 7 males, 6 females, 17–24 Nov.2006 (NMWC, T1862); 1 male, 8–15 Dec.2006 (QSBG, T1879); 1 female, 22–29 Dec.2006 (QSBG, T1889); 1 female, 29 Dec.2006–5 Jan.2007 (QSBG, T1895); 1 male, 1 female, 5–12 Jan.2007 (QSBG, T1917): Check Point 2, 18°31.554'N 98°29.940'E, 1,700 m, Malaise trap, coll. Y. Areeluck, 1 male, 2–8 Jul.2006 (QSBG, T56); 1 male, 4 females, 15–22 Jul.2006 (QSBG, T73); 1 female, 9–16.Aug.2006 (QSBG, T180); 3 males, 9 females, 16–24.Aug.2006 (NMWC, T187); 1 male, 2 females, 24–30 Aug.2006 (QSBG, T232); 6 females, 12–19 Oct.2006 (NMWC, T371); 4 females, 19–26 Oct.2006 (QSBG, T377); 6 females, 26 Oct. –2 Nov.2006 (QSBG, T383); 3 males, 4 females, 2–10 Nov.2006 (QSBG, T389); 1 female, 17–24 Nov.2006 (QSBG, T1864); 3 males, 9 females, 24 Nov.–1 Dec.2006 (QSBG, T1870); 1 male, 7 females, 15–22 Dec.2006 (NMWC, T1886); 6 females, 22–29 Dec.2006 (QSBG, T1891); 2 males, 9 females, 29 Dec.2006–5 Jan.2007 5 females, 5–12 Jan.2007 (NMWC, T1913); 2 females, 2–9 Feb.2007 (QSBG, T1793); 1 female, 16–23 Feb.2007 (NMWC, T1805); 1 female, 23 Feb.–2 Mar.2007 (QSBG, T1775); 1 female, 29 Apr.–6 May.2007 (QSBG, T1857): Summit Marsh, 18°35.361'N, 98°29.157'E, 2,500 m, pan trap, coll. Y. Areeluck, 1 female, 28 Feb.2007 (QSBG, T1767). Trang, Khao Phu – Khao Ya National Park, 7°33.038'N 99°47.369'E, 75 m, Malaise trap, coll. M. Sharkey, 2 females, 5–7 Sep.2005 (NMWC, T1902). Loei, Phu Ruea National Park, Malaise trap, coll. N. Jaroenchai; Nature Trail, 17°30.740'N 101°20.650'E, 1,353 m, 1 male, 26 Sep. –2 Oct.2006 (NMWC, T834); Sa Sawan, 17°30.735'N 101°20.601'E, 1,352 m, 1 male, 26 Sep. –2 Oct.2006 (NMWC, T835).

***Diagnosis.* –** Yellow species with dark median stripe on scutum and rather slender legs. Head yellow, darker on upper occiput, vertex and frons.

Table 1. Femoral formula of *Chelipoda* species having four rows of setae on front femur. The median number of setae in each series is followed by the range (in parentheses) and standard deviation [in brackets]; n = number of femora sampled. Standard deviation was not calculated for values of n less than 6. Abbreviations: M, male; F, female; u., unknown.

Species	Sex	*av* spines	*av* denticles	*pv* denticles	*pv* spines	basals	n
Chelipoda menglunana	M	7(5–8) [0.90]	17(15–19) [1.12]	13(12–15) [1.07]	8(8–11) [1.01]	1–2	14
	F	5(5–6) [0.48]	19(15–21) [1.75]	14(14–22) [2.39]	5(4–6) [0.55]	1–2	10
Chelipoda flavida	M	5(5–5) [0]	22(19–26) [2.13]	14(12–18) [1.86]	4(4–4) [0]	1	13
	F	5(4–5) [0.39]	24(19–28) [2.48]	14(14–20) [1.83]	4(4–4) [0]	1	17
Chelipoda nakropa	M	5(4–6) [0.55]	20(17–25) [2.76]	14(12–19) [1.97]	5(4–5) [0.49]	1–2	17
(mid elev. morph)	F	5(5–6) [0.41]	24(21–27) [1.76]	16(14–18) [1.45]	5(4–5) [0.51]	1–2	13
Chelipoda nakropa	M	6(6–7) [0.49]	21(19–23) [1.12]	15(14–17) [1.05]	5(5–6) [0.50]	1–2	13
(high elev. morph)	F	6(5–6) [0.42]	22(19–24) [1.53]	15(13–17) [1.15]	5(5–6) [0.48]	1	13
Chelipoda manggawna	M	5(4–5) [0.42]	23(18–25) [2.18]	13(11–16) [1.58]	4(3–4) [0.48]	1	11
	F	5(5–6) [0.31]	24(21–27) [2.23]	14(11–16) [1.37]	4(4–5) [0.31]	1	11
Chelipoda chaiamnata	M	5(5–5)	20.5(20–23)	17(15–17)	5(5–6)	2–4	4
	F	5(5–5)	22(20–24)	16.5(15–17)	5(4–5)	1–2	4
Chelipoda guangxiensis	M	5(5–5) [0]	23(22–25) [1.09]	16.5(15–17) [0.82]	4(3–4) [0.41]	1	6
	F	5(5–5)	23(23–23)	16(15–17)	4(4–4)	1	3
Chelipoda inthawichayanona	M	5(5–5) [0]	20(17–22) [1.44]	13.5(11–16) [1.42]	4(4–4) [0]	1	12
	F	5(4–5) [0.32]	20(18–25) [2.45]	15(13–17) [1.32]	4(4–4) [0]	1–2	10
Chelipoda hubeiensis	M	6(6–7) [0.45]	18(15–21) [1.97]	15(12–17) [1.76]	6(5–7) [0.73]	1–2	13
	F	5(5–6) [0.27]	21.5(20–24) [1.49]	15(14–18) [1.09]	5(5–6) [0.47]	1	16
Chelipoda nakladam	M	5(5–5) [0]	20(18–23) [1.60]	12(10–13) [1.11]	5(4–5)	4–6	7
	F	5(4–5) [0.33]	22(20–26) [2.0]	14(13–16) [1.03]	5(4–5) [0.53]	2–4	12
Chelipoda laisoma	M	5(5–5) [0]	19(19–20) [0.52]	15(12–16) [1.38]	4(4–5) [0.41]	1	6
	F	4.5(4–5)	21.5(20–25)	14.5(14–16)	5(4–5)	2	4
Chelipoda meenamluang	M	5(5–6) [0.32]	16(14–18) [1.11]	13(11–15) [1.09]	5(5–7) [0.69]	2–4	12
	F	5(5–6) [0.33]	18(15–23) [2.31]	14(12–17) [1.60]	5(5–6) [0.34]	1	16
Chelipoda thaosuranaria	M	5(4–5)	18(15–18)	14(14–15)	5(506)	2–4	3
	F	u.	u.	u.	u.	u.	u.

***Description.* – Male.** Body length 3.0–3.5mm. Head yellow becoming darker dorsally on upper occiput, vertex and frons, ocellar protuberance black; setae black, similar to *C. manggawna* new species. Antenna with basal segments yellow; poped 2.5–3.0× long as wide, dark brown; stylus 2.0–2.5× long as poped, brown (yellowish white in some lights). Mouthparts yellowish but labellum black.

Thorax (Fig. 21) yellow to brownish yellow, pleura paler; postpronotal area and mediotergite often darkened; scutum with dark median stripe (usually strongest anteriorly but very variable) and indications of sublateral stripes posteriorly. Chaetotaxy similar to *C. manggawna* new species, all setae black.

Legs yellow, tarsomeres 4–5 darker. C_1 0.95–1.0× as long as thorax; rather slender, 9.5x as long as wide, anterobasal setae not distinguished from regular row of yellowish anterior setulae. F_1 slightly longer than C_1, moderately slender, 6× as long as wide, rather evenly inflated below, widest 0.4 from base; femoral formula 5(5–5)/22(19–26)/14(12–18)/4(4–4) +1 (Table 1), denticles black; spines yellowish or yellowish black, rather evenly spaced, becoming rather longer basally; basal spine distinct. T_1 short, less than 0.7× as long as F_1.

Abdomen brown, paler ventrally; tergites 7 and 8 reduced; apical abdominal segments with only short setae. Epan and Hypan fused (Fig. 2), erect, narrowly subrectangular in lateral view, yellowish brown, only small setae posteriorly, left and right lamellae very narrowly separated my unpigmented membrane (hardly visible in unmacerated specimens). Cercus fused with Epan, brownish yellow, bilobed; upper lobe elongate digitiform, covered with numerous distinct setae of which three in distal part rather stronger and more erect, apically with rather dense 'brush' of minute upswept setulae; lower lobe emerging from inner face, very slender and gradually curved, yellowish with darker broader tip. Subepandrial process and postgonite slender, inconspicuous. Phallus broad, yellowish, sharply minutely upcurved apically with a small recurved dorsal 'beak' subapically.

Wing membrane faintly greyish, veins brown. Squamae yellow. Halter pale brown.

Female. Similar to male; antenna with poped almost 3x long as wide, stylus 2.0–2.5× as long.

F_1 slightly stouter; femoral formula 5(4–5)/24(19–28)/16(14–20)/4(4–4).

Abdomen brown, yellowish ventrally with sternite 8 brown, rather elongate. Cercus elongate.

***Remarks.* –** Thai specimens agree with the description and habitus figure in Brunetti (1920) although the male genitalia have not previously been figured and it has not been possible to examine the type material. The species is known from north eastern India, the western slopes of the Tenasserim Mountains in Myanmar (Burma) and is here reported from the north (Chiang Mai), north eastern (Loei) and southern (Trang) provinces of Thailand. *C. flavida* was abundant on Doi Inthanon, mostly in mid elevation forest from 1,200–1,700 m for most of the year with a major emergence peak from October – January and a lesser peak in July and August.

Chelipoda guangxiensis Yang & Yang, 1986
(Fig. 3)

***Material examined.* –** THAILAND, Loei, Phu Kradueng National Park, Malaise and pan traps, coll. Thanongsak Srisa-ad, savannah in pine forest, 16°53.092'N 101°47.413'E, 1,257 m, 1 male, 29–30 Oct.2006 (QSBG, T1214); 1 male, 2–3 Jan.2007 (QSBG, T1218); 1 female, 9–16 Jan.2007 (QSBG, T1226). Loei, Phu Ruea National Park, pan trap, coll. P. Tumtip: Ma Kraow Ditch, 17°29.652'N 101°21.020'E, 1,167 m, 1 female, 10–11 Nov.2006 (QSBG, T1113): Pan Hin Khan Maak Ditch, 17°30.042'N 101°20.474'E, 1,219 m, pan traps, coll. P. Tumtip, 1 male, 5–6 Feb.2007 (NMWC, T1698); 1 female, 7–8 Feb.2007 (NMWC, T1700); 1 male, 9–10 Feb.2007 (NMWC, T1702). Nakhon Nayok, Khao Yai National Park, nature trail in secondary moist evergreen forest, 14°24.515'N 101°22.432'E, 750 m, Malaise trap, coll. P. Sandao, 1 female, 26 Aug.–2 Sep.2006 (NMWC, T409).

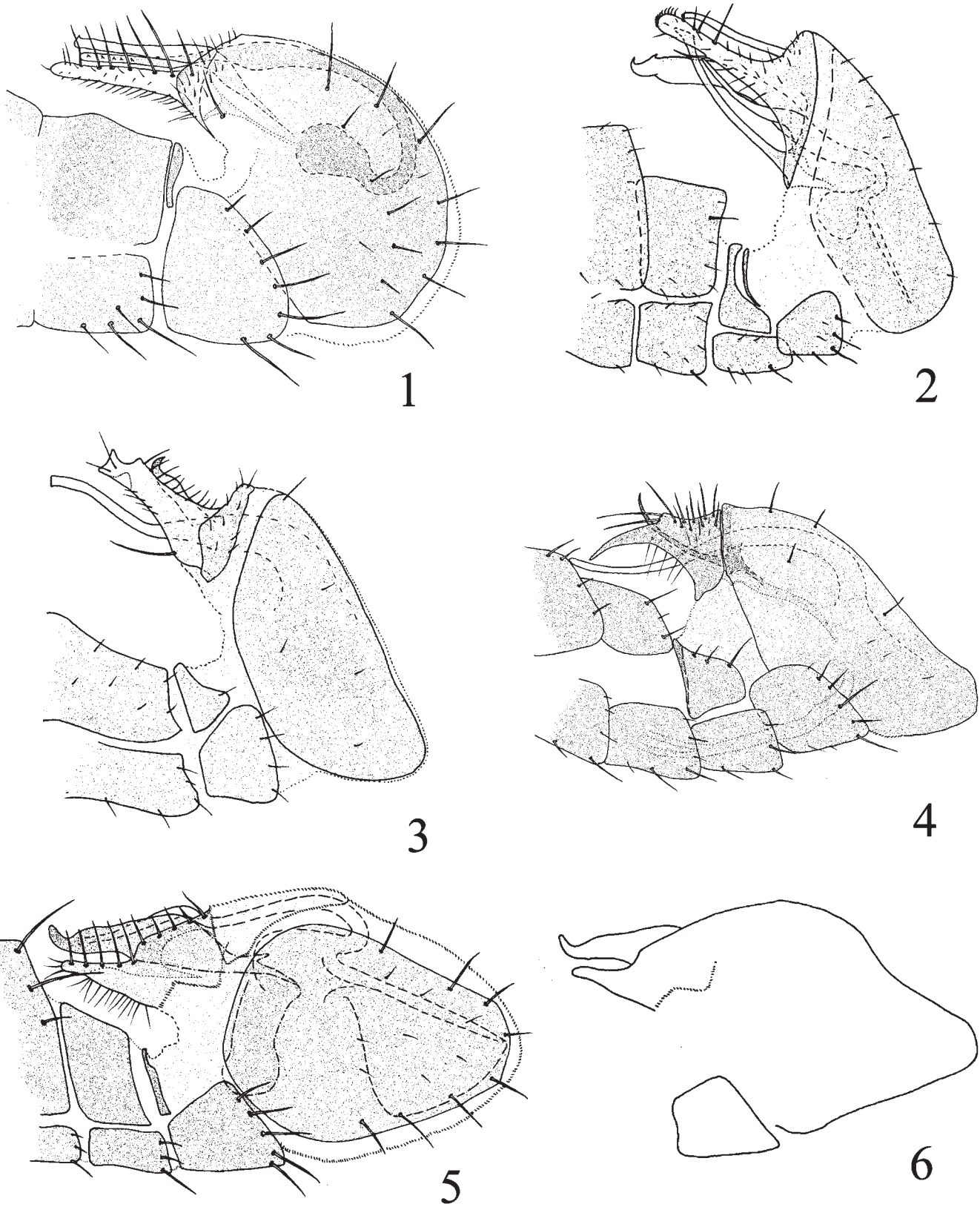
***Diagnosis.* –** Thorax dark dorsally, yellowish on pleura. Head black. C_1 without distinct anterobasal setae. Antennae with basal segments dark reddish yellow, not contrasting strongly with poped.

***Description.* – Male.** Body length 2.5 mm. Head black with paler dusting. Stronger setae black including ocl, vtl and upper upo; other upo and lpo fine and paler; a patch of fine pile behind mouth. Basal antennal segments dark reddish brown; poped greyish black, 2× long as wide; stylus brown to yellow (depending on light), 2.5–3.0× long as poped. Mouthparts yellowish with greyish labellum and darker proboscis.

Thorax with pleura yellow including most of laterotergite; scutum, scutellum and mediotergite dark yellowish black. All setae black; anterior dc and upper npl strong; mid dc (in line with npl) and posterior dc (near posterior margin of scutum) very fine; lower npl very fine, hardly stronger than scattering of fine setulae behind postpronotum; sa small.

Legs dark yellow, tarsomeres 4–5 darker, F_1 rather brownish at extreme apex. C_1 0.90–0.95× as long as thorax; rather stout, 6× as long as wide, narrowing slightly apically; no strong anterobasal seta. F_1 slightly longer than C_1, distinctly inflated, 4× as long as wide, widest 0.3 from base; femoral formula 5(5–5)/23(22–25)/16.5(15–17)/4(3–4) +1 (Table 1), spines yellow, denticles black; basal spine distinct, more or less contiguous with series of *av* spines.T_1 0.72–0.75× long as F_1.

Abdomen brown dorsally, paler ventrally; tergites 6 and 7 with posterior margin concave; tergite 8 considerably reduced, distinctly narrowed dorsally. Subterminal tergites and sternites lacking strong setae. Epan and Hypan (Fig. 3)



Figs. 1–6. Male genitalia of *Chelipoda* species in lateral view: 1. *C. chaiamnata* new species; 2. *C. flavida* Brunetti; 3. *C. guangxiensis* Yang & Yang; 4. *C. inthawichayanona* new species: 5–6 *C. hubeiensis* Yang & Yang; 5. typical form; 6. variant (outline only).

fused, brown, elongate smoothly trapezoid in lateral view, left and right lamellae narrowly separated by unpigmented membrane. Cercus fused with Epan, brown basally with single long broad yellowish lobe bearing series of fine strong setae dorsally. Subepandrial process yellowish, apically blackish, rather broad with apex narrowed and strongly upcurved. Phallus yellow, somewhat sinuous apically.

Wing membrane faintly brown, veins brown. Squamae with black fringes. Halter greyish brown.

Female. Head and thorax similar to male. Legs similar to male, femoral formula approx. 5/23/16/4 +1. Cercus elongated, yellow.

***Remarks.* –** Previously known only from Guangxi, China (Yang & Yang, 1986), this species is now reported from the sandstone mesa formations in Thailand's Loei province at Phu Kradueng and Phu Ruea and from Khao Yai in Nakhon Nayok. Adults were caught at elevations from 750–1,257 m between late October and early February and again in August.

Chelipoda hubeiensis Yang & Yang, 1990
(Figs. 5, 6, 28)

***Material examined.* –** THAILAND, Phetchabun, Nam Nao National Park, helicopter landing ground, 16°43.156'N 101°35.118'E, 890 m, pan trap, coll. N. Hongyothi: 1 male, 2 females, 4–5 Jul.2006 (QSBG, T262). Chiang Mai, Doi Inthanon National Park, coll. Y Areeluck: Kew Mae Pan, 18°33.163'N 98°28.8'E, 2,200 m, Malaise trap, 9 females, 2 females, 24–30 Aug.2006 (QSBG, T233); 1 male 13–21 Sep.2006 (NMWC,T251); 5 females, 21–27 Sep.2006 (QSBG, T344); 4 females, 27 Sep. –5 Oct.2006 (QSBG, T350); 13 females, 5–12 Oct.2006 (NMWC, T364); 12–19 Oct.2006 (NMWC, T370); 1 male, 7 females, 19–26 Oct.2006 (QSBG, T376); 4 females, 26 Oct. –2 Nov.2006 (QSBG, T382); 6 females, 2–10 Nov.2006 (NMWC, T388): Kew Mae Pan Trail, 18°33.162'N 98°28.810'E, 2,200 m, Malaise trap,1 female, 24 Nov.–1 Dec.2006 (QSBG, T1866); 1 female, 1–8 May.2007 (QSBG, T1824); 1 male, 2 females, 8–15 May.2007 (QSBG, T1829): Summit Forest, 18°35.361'N 98°29.157'E, 2,500 m Malaise trap, 1 male, 9–16 Aug.2006 (QSBG, T178); 2 males, 1 female, 16–24 Aug.2006 (QSBG, T185);3 females, 24–30 Aug.2006 (QSBG, T235); 1 female, 30 Aug. –6 Sep.2006 (QSBG, T241); 1 female 6–13 Sep.2006 (QSBG, T247); 1 male, 3 females, 13–21 Sep.2006 (NMWC & QSBG, T253); 2 females, 21–27 Sep.2006 (QSBG, T346); 5 females, 27 Sep.–5 Oct.2006 (NMWC, T352); 2 females, 15–22 Apr.2007 (QSBG, T1844); 4 females, 17–18 Apr.2007 (NMWC, T1834): Summit Marsh, 18°35.361'N 98°29.157'E, 2,500 m, Malaise trap, 1 male, 2 females, 2–9 Aug.2006 (QSBG, T124); 6 males, 3 females, 9–16 Aug.2006 (NMWC, T177); 5 males, 7 females, 16–24 Aug.2006 (NMWC, T184); 4 males, 6 females, 24–30 Aug.2006 (NMWC, T234); 1 male, 7 females, 30 Aug.–6 Sep.2006 (NMWC, T240); 5 females, 13–21 Sep.2006 (QSBG, T252); 2 females, 21–27 Sep.2006 (NMWC, T345); 1 male, 27 Sep. –5 Oct.2006 (QSBG, T351); 1 male, 16–23 Mar.2007, (QSBG, T1812); 1 male, 23 Mar.–1 May.2007 (QSBG, T1818); 1 male, 4 females, 15–22 Apr.2007 (QSBG, T1840); 2 males, 11 females, 22–29 Apr.2007 (QSBG, T1846); 6 males, 4 females, 1–8 May.2007 (NMWC, T1823); 3 males, 4 females, 8–15 May.2007 (QSBG, T1828): Vachiratharn Falls, 18°32.311'N 98°36.048'E, 700 m, Malaise trap, 2 females, 6–13 Sep.2006 (QSBG, T242). Chaiyaphum, Tat Tone National Park; dry dipterocarp forest, 15°59.037'N 102°2.103'E, 250 m, Malaise trap, coll. M. Ngoychanse, 2 females, 21–28 Jun.2006 (NMWC, T24); Phu hang sing, 15°58.723'N 102°02.231'E, 290 m, Malaise trap, coll. T. Jaruphan & O. Budsawong, 4 females (NMWC, T226).

***Diagnosis.* –** Head and thorax black including propleuron. Thoracic setae and spines on F_1 dark.

***Description.* – Male.** Body length 2.5–3.0 mm. Head black with paler dusting; vt and ocl strong, black; upper upo distinct, lower upo smaller and lpo virtually absent with very little fine pile behind mouth. Basal antennal segments yellowish; poped dirty yellow, darker apically, about 1.8x long as wide, stylus 2.5× as long. Palp pale with strong dark terminal seta.

Thorax black, extensively dusted; all setae black including two dc, one npl and one sa all strong; otherwise with only small hair like setae on humeral and posthumeral area and on scutum posteriorly

Legs yellow, tarsomeres 5 darker. C_1 0.8× as long as thorax, no distinct anterobasal seta, all setulae small becoming longer on distal half and quite long anteroapically. F_1 1.1× as long as C_1, distinctly inflated, 3.8× as long as wide, widest 0.4 from base; femoral formula 6(6–7)/18(15–21)/15(12–17)/6(5–7) +1–2 (Table 1), spines and denticles black, *av* and *pv* spines somewhat longer basally, regularly spaced with smaller basal spine contiguous with and indistinguishable from *av* series. T_1 0.75× as long as F_1.

Abdomen blackish. Tergite 6 with a few strong dark seta dorsally on posterior margin. Tergite 8 very narrow. Genitalia blackish, darker on apex of subepandrial process and with externally visible part of phallus yellow. Epan and Hypan fused, rather rounded in lateral view (Fig. 5), bearing scattered dark setae posteriorly; left and right lamellae broadly separated by unpigmented densely micropilose membrane (in many specimens the membranous and less strongly sclerotized regions partially collapse and the genitalia appear more pointed apically in lateral view (Fig. 6)). Cercus fused with Epan+ Hypan, bluntly pointed, irregularly triangular, a regular series of erect dark setae dorsally and numerous fine yellowish setae below. Subepandrial process sharply projected anteriorly, rather broad, sharply upwardly curved apically. Phallus sharply reflexed anteriorly, basal section of anterior loop lying beneath a triangular unpigmented membrane (an anterior extension of the medial membrane separating the lateral lamellae), with a distal loop emerging near base of cercus; apex tightly confined between subepandrial processes.

Wing membrane clear or faintly brownish; veins yellowish brown, paler basally (Fig. 28). Squamae with black fringes. Halter greyish white.

Female. Similar to male but antenna with stylus rather longer than in male, almost 3× long as poped. Upper upo rather stronger. Thorax with hair like setae on humeral and

posthumeral areas rather stronger though still very small.

C_1 with anterior setulae less strongly developed and F_1 slightly larger and stouter than in male, widest 0.4 from base; femoral formula 5(5–6)/21.5(20–24)/15(14–18)/5(5–6) +1, basal spine usually weaker than in male. Cercus moderately long.

***Remarks.* –** This species was described from Wudangshan Mountain, Hubei, China (Yang & Yang, 1990) and is here reported from Chiang Mai and Petchabun provinces in Thailand. The male genitalia of Thai specimens agree with Fig. 1 in Yang & Yang (1990) although the thoracic setae are black rather than yellow and in the key of Yang & Yang (2004) Thai specimens run to *C. lyneborgi* Yang & Yang, 1990 (described from a single female and hence probably unrecognizable). However, the colour of thoracic setae is rather variable in many *Chelipoda* spp. and the determination of Thai specimens as *C. hubeiensis* is strongly supported by genitalic characters. In Thailand, this species was abundant on Doi Inthanon in the upper wet forest zone from 2,200–2,500 m. There were two peaks of abundance in August to November and between April to May.

Chelipoda inthawichayanona, new species
(Fig. 4)

***Material examined.* – Holotype**. Male, THAILAND: Chiang Mai, Doi Inthanon National Park, Summit Forest, 18°35.361'N 98°29.157'E, 2,500 m, Malaise trap, coll. Y. Areeluck, 16–24 Aug.2006 (QSBG, T185).

Paratypes. Same data as holotype, 1 male, 2 females (QSBG & NMWC, T185); 2 males, 2 females, 9–16 Aug.2006 (NMWC, T178); 1 male, 3 females, 24–30 Aug.2006 (QSBG, T235); 1 male, 13–21 Sep.2006 (QSBG, T253); 1 male, 1 female, 21–27 Sep.2006 (QSBG, T346): Summit Marsh, 18°35.361'N 98°29.157'E, 2,500 m, 2 males, 2–9 Aug.2006 (QSBG, T124); 1 female, 9–16 Aug.2006 (QSBG, T177); 2 males, 16–24 Aug.2006 (NMWC, T184); 1 male, 13–21 Sep.2006 (NMWC, T252); 3 females, 5–12 Oct.2006 (NMWC, T362).

***Diagnosis.* –** Head and thorax black, propleuron contrastingly yellowish. C_1 with distinct anterobasal spine. Posterior dc (in line with npl) minute. Male cercus with distinct pointed process (Fig. 4).

***Description.* – Male.** Body length 2.0–2.5 mm. Head blackish brown; strongly dusted; larger setae black; vt, ocl and upper upo equally strong; other upo smaller; lpo small, multiserial, pale. Antenna dark brown, stylus white; poped 3× long as wide, stylus 2× as long. Palpi yellowish brown.

Thorax blackish; strongly dusted especially on scutum. Propleuron contrastingly yellowish with supraalar area and scutum posteriorly often rather yellowish brown or yellowish black. Thoracic setae black including one npl, one sa and pair of sct all strong; anterior dc strong, posterior dc (in line with npl) minute; small anterior postpronotal and posterior postpronotal setae usually present.

Legs yellow, tarsomeres 3 apically and 4–5 darker; F_2, F_3 and sometimes T_2 and T_3 obscurely infuscated. C_1 as long as thorax, 1–2 distinct short anterobasal setae clearly much stronger than anterior ciliation of minute setulae. F_1 1.2× as long as C_1, moderately inflated, 4.8× as long as wide, widest 0.3–0.4 from base; femoral formula 5(5–5)/20(17–22)/13.5(11–16)/4(4–4) +1 (Table 1), spines dark but basal spine sometimes yellowish, denticles black. T_1 0.65–0.7× as long as F_1.

Abdomen dark brown; genitalia with fused Hypan + Epan (Fig. 4) black, rather yellowish black above, slightly produced and bluntly pointed posteroapically, bearing only short dark setae; posterior mid line rather less strongly sclerotized. Cercus largely black with strong pointed *ad* process and much shorter, blunter *av* process; strong setae dorsally and on inner lower surface. Subepandrial process black, narrow, anteriorly directed, upturned distally. Phallus narrow, yellowish, sharply reflexed anteriorly.

Wing membrane faintly brownish; veins brownish, becoming yellowish at extreme base. Squamae with dark fringes. Halter grey.

Female. Similar to male but antenna with poped shorter and broader than in male, 2.5× long as wide

Legs similar to male but sometimes rather darker; F_1 slightly broader, 4.1× as long as wide, femoral formula 5(4–5)/20(18–25)/15(13–17)/4(4–4) +1–2. Cercus elongate.

***Etymology.* –** The specific epithet commemorates King Inthawichayanon, one of the last Lanna kings who was concerned for forest conservation and whose remains were placed on Doi Inthanon, the type locality of this species.

***Remarks.* –** This species is confined to moist hill evergreen forest on the summit of Doi Inthanon at 2,500 m. Adults were captured from August to October at the end of the wet season.

Chelipoda kameawuta, new species
(Fig. 7)

***Material examined.* – Holotype**. Male, THAILAND: Chiang Mai, Doi Inthanon National Park, Kew Ma Trail, 18°33.162'N 98°28.810'E, 2,200 m, Malaise trap, Y. Areeluck, 22–29 Apr.2007 (QSBG, T1847).

Paratype. 1 female, same data as holotype, 29 Apr. –6 May.2007 (QSBG, T1853).

***Diagnosis.* –** Species with black head and all yellow thorax. F_1 strongly inflated with only a single row of denticles below and front tarsomeres 2 & 3 strongly spinose (especially in female). The upper occiput is slightly concave as viewed from above.

***Description.* – Male.** Body length 3.0 mm. Head black with paler dusting; ocl, vtl and upper upo black; lpo and very

conspicuous patch of fine setulae behind mouth yellowish. Vertical seta as strong as ocl; one weak and one strong upper upo adjacent to vtl, obviously stronger than rest of upo series. Upper occiput slightly concave behind (viewed from above), vtl originating from slight lateral prominences either side of vertex. Basal antennal segments yellowish; poped yellowish brown, about 2.5× long as wide (stylus missing in holotype). Mouthparts yellow.

Thorax clear yellowish orange, all setae black. Upper npl, sa and anterior dc strong; mid dc (in line with npl) and posterior dc (near hind margin of scutum) much weaker but distinct; anterior postpronotal seta present but weak, no stronger than one or two fine setulae between it and the equally fine lower npl.

Legs yellow, tarsomeres 4–5 darker. C_1 as long as thorax, rather stout, 6.5× long as wide, 1–2 distinct short stout setae near base anteriorly. F_1 as long as C_1, distinctly inflated, 4x as long as wide, widest 0.25 from base; *pv* and *av* setae strong, black, slightly inclined anteriorly with only single row of black denticles between becoming more spine-like basally; 2–3 shorter basal spines contiguous with series of *av* spines. T_1 0.72–0.75× long as F_1. Front tarsomere 2 short, 0.3× length of tarsomere 3, bearing distinct short black apical setae; tarsomeres 3 with stout setae apically and dorsally.

Abdomen yellowish brown including genitalia, only subepandrial process black; thinly covered with rather long fine setae; tergite 8 reduced. Epan and Hypan fused (fig. 7), erect elongate oval in lateral view, left and right lamellae narrowly separated by unpigmented membrane at least dorsally. Cercus closely fused with Epan, weakly sclerotized, cluster of short setae at dorsal apex and more sparse longer finer setae elsewhere. Subepandrial process complex, clearly visible through epandrial lamellae, anterodorsal apex sharply upturned. Phallus narrow, emerging beyond tip of subepandrial process.

Wing membrane very faintly darkened, veins brown. Squamae with dark fringes. Halter light brown.

Female. Similar to male. Head with stylus 3x as long as poped; patch of yellow pile behind mouth stronger than in male with a few conspicuously longer fine setae also present.

Legs similar to male but apical and dorsal setae on front tarsomeres 2 and 3 stronger.

Abdomen with sternite 8 brown, contrasting with preceding sternites; cercus rather short, 2× long as wide, brown.

Wing membrane more distinctly brown, especially about base.

***Etymology.* –** The specific epithet is a contraction of the Thai, kaa, meaning leg and mee a-wut, meaning armed; in reference to the presence of strong spines on the front femur.

***Remarks.* –** This species is only known from hill evergreen forest at 2,200 m on Doi Inthanon from April to early May.

Chelipoda laisoma, new species

(Fig. 8)

***Material examined.* – Holotype**. Male, THAILAND: Chiang Mai, Doi Inthanon National Park, Checkpoint 2, 18°31.559'N 98°29.941'E, 1,700 m, Malaise trap, coll. Y. Areeluck, 2–10 Nov.2006 (QSBG, T389).

Paratypes. Same data as holotype, 1 male (NMWC, T383); Kew Mae Pan Trail, 18°33.162'N 98°28.810'E, 2,200 m, 1 male, 2–9 Mar.2007 (QSBG, T1777); Kew Mae Pan, 18°33.163'N 98°28.8'E, 2,200 m 2 males, 8–15 Jul.2006 (QSBG & NMWC, T66).

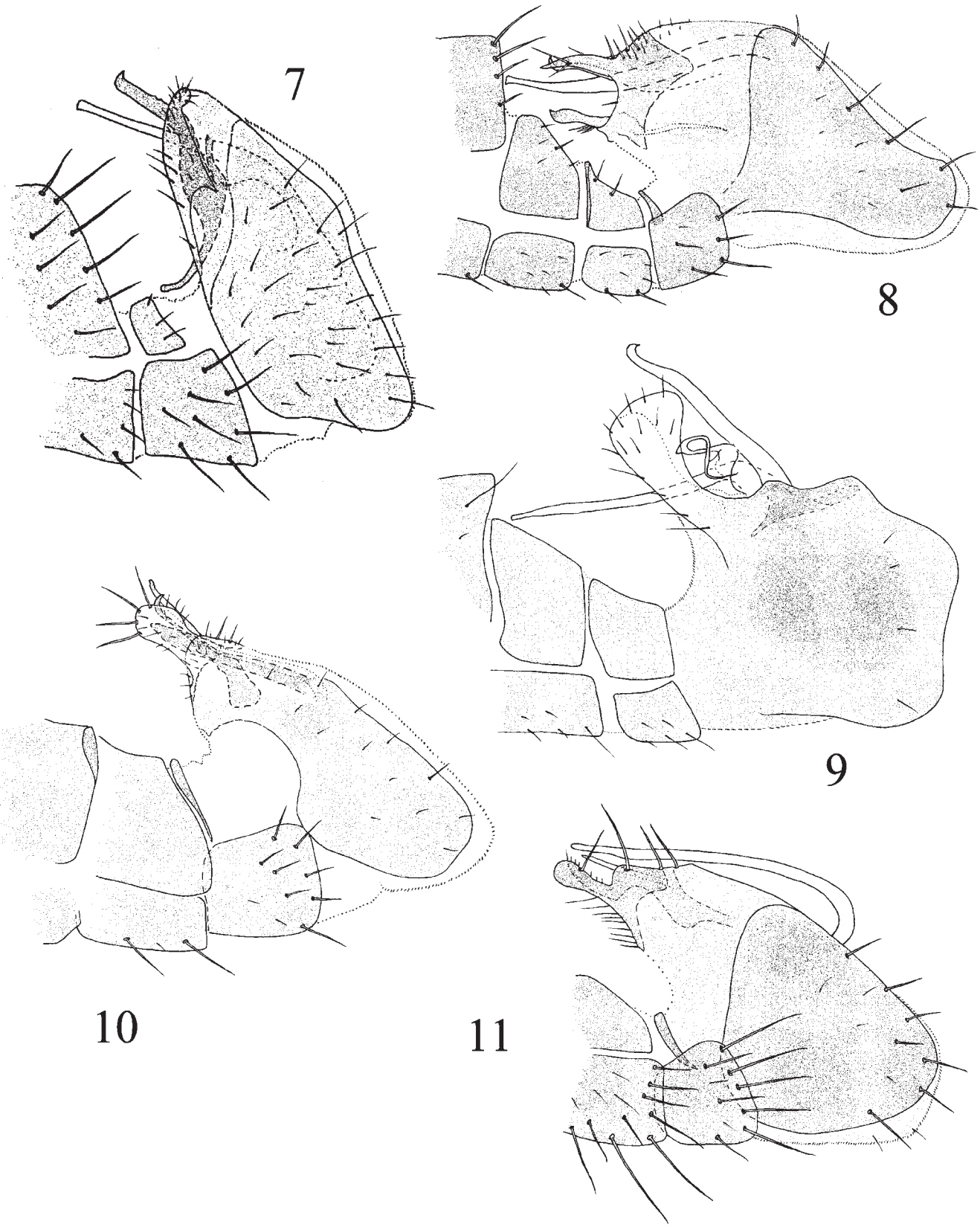
***Diagnosis.* –** Similar to *C inthawichayanona* with head and thorax black, propleuron contrastingly dark yellowish; C_1 with distinct anterobasal spine; posterior dc (in line with npl) minute. Male cercus with two pointed processes.

***Description.* – Male.** Body length 2.5 mm. Head blackish brown; strongly dusted; larger setae black; vt, ocl and upper upo equally strong; other upo smaller; lpo small, multiserial, pale. Antenna brown, stylus whitish distally; poped 2.5–2.8× long as wide, stylus 2.5× as long.

Thorax brownish black; strongly dusted especially dorsally where indications of broad darker stripe on scutum; propleuron contrastingly dark yellowish or dark orange; all setae dark including one npl, one sa and pair of sct all strong; anterior dc strong, posterior dc (in line with npl) minute; small anterior postpronotal and posterior postpronotal setae usually present

Legs yellow, often noticeably darker on F_2, F_3 and tarsomeres 4–5. C_1 0.9× as long as thorax, slightly inflated basally; a distinct short dark anterobasal seta present, clearly stronger than anterior ciliation of minute yellowish setulae. F_1 almost as long as C_1, moderately inflated, about 4x as long as wide, widest 0.4 from base. Femoral formula 5(5–5)/19(19–20)/15(12–16)/4(4–5) +1 (Table 1), spines and denticles blackish. T_1 0.7× as long as F_1.

Abdomen brown; tergite 5 with strong dark seta dorsally on posterior margin; tergite 8 very narrow, inconspicuous. Epan and Hypan fused, rather posteriorly pointed in lateral view (Fig. 8), blackish but less strongly sclerotized and yellowish immediately posterior of cercus, bearing a few dark setae posteriorly; left and right lamellae very narrowly separated by unpigmented densely micropilose membrane. Cercus dark brown, rather paler posteriorly and below; fused with Epan + hypandrium; anteriorly directed, with a cluster of small setae dorsally; bilobed; upper lobe pointed bearing a few small subterminal setae; lower lobe slightly spathulate distally with extreme apex weakly pointed upcurved, a cluster of short setulae near base below. Subepandrial process dark, closely parallel with and of similar length to



Figs. 7–11. Male genitalia of *Chelipoda* species in lateral view: 7. *C. kameawuta* new species; 8. *C. laisoma* new species; 9. *C. macrosceles* new species; 10. *C. manggawna* new species; 11. *C. meenamluang* new species.

inner surface of upper lobe of cercus, apically pointed and upcurved. Phallus apically slender, yellowish.

Wing membrane very faintly darkened, veins brown. Squamae with dark fringes. Halter with grey knob and paler stem.

Female. Similar to male. Antenna with basal segments yellowish, poped paler brown than in male, stylus apparently brownish (apical part missing). Legs similar to male but F_2 and F_3 rather lighter and all tibiae obscurely darker. Femoral formula 4.5(4–5)/21.5(20–25)/14.5(14–16)/5(4–5) +2; spines yellowish, a small *pv* basal spine present in addition to a stronger *av* spine also present in male. Wing veins and membrane slightly yellowish compared with male. Cercus moderately long.

***Etymology.* –** The specific epithet is contraction of the Thai words for shoulder, lai, and the colour orange, see som, This is in reference to the dark orange colour of the propleuron in this species.

***Remarks.* –** This species is only known from predominantly hill evergreen forest at 1,700–2,200 m on Doi Inthanon during July, November and March.

Chelipoda macrosceles, new species
(Figs. 9, 19, 20, 26)

***Material examined.* – Holotype**. Male, VIETNAM, Viet Try, Sa Pa, Sin Chay, 22°20'N 103°50'E, c1,900 m, Malaise trap, coll. R. de Vries, 21 Oct. –11 Nov.1999 (RMNH).

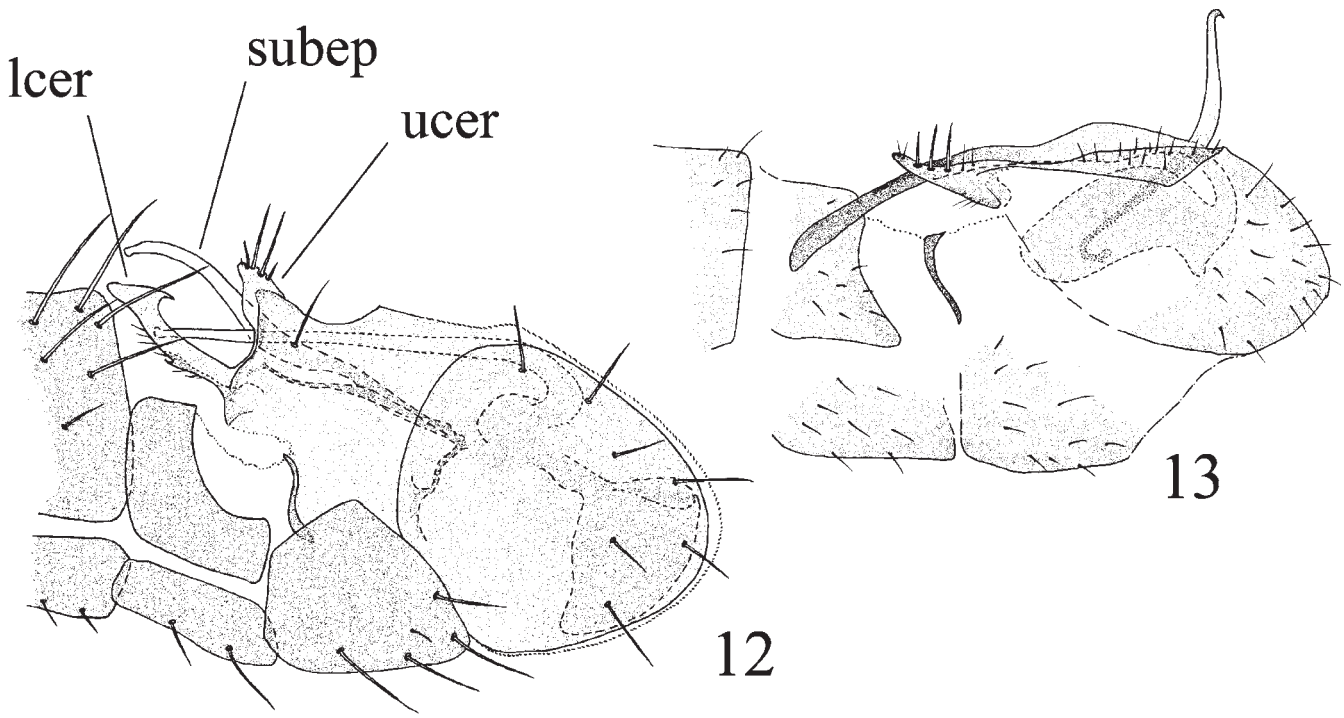
Paratypes. Same data as holotype, 14 males, 21 females (RMNH); 3 males, 3 females (IRSNB); 4 males, 3 females (NMWC).

Additional material. VIETNAM, Cat Cat, 1,550 m, Malaise trap, coll. C. Van Achterberg, 2 males, 1 female, 29 Oct.1999 (RMNH). THAILAND, Chiang Mai, Doi Inthanon National Park, Summit Marsh, 18°35.361'N 98°29.157'E, 2,500 m, Malaise trap, coll. Y. Areeluck, 1 male, 29 Apr.– 6 May.2007 (QSBG, T1852); Kew Mae Pan Trail, 18°33.162'N 98°28.810'E, 2,200 m, 1 female, 22–29 Dec.2006 (QSBG, T1888); 1 male, 16–23 Mar.2007 (NMWC, T1813); 1 female, 29 Apr. –6 May 2007 (QSBG, T1853): Kew Mae Pan, 18°33.163'N 98°28.8'E, 1 female, 2–10 Nov.2006 (NMGW, T388).

***Diagnosis.* –** Slender species with distinctive black and yellow markings on thorax and elongate front femora with only a single row of denticles beneath. The female abdomen is distinctly petiolate basally.

***Description.* – Male.** Body length 2.5–3.0 mm. Head black, lightly dusted, subshining on frons; face bright yellowish white. Eyes clearly separated (not almost touching) below antenna. All setae yellow; ocl and vtl strong; upper upo slightly shorter than vtl, other upo and lpo becoming progressively weaker ventrally; patch of pale setae behind mouth conspicuous. Antenna yellow, stylus darker apically in some lights; poped very narrow apically, 3× long as wide; stylus 2× long as poped. Mouthparts yellow.

Thorax clear yellow, thinly dusted, subshining. Scutum (Fig. 19) with somewhat variable brown markings on notopleural area, narrow median stripe widening posteriorly, scutellum, mediotergite and laterotergite (scutal stripe usually broadened at extreme anterior margin of scutum and



Figs. 12–13. Male genitalia of *Chelipoda* species in lateral view: 12. *C. nakladam* new species; 13. *C. menglunana* Grootaert, Yang & Saigusa. Abbreviations: lcer, lower lobe of cercus; subep, subepandrial process; ucer, upper lobe of cercus.

notopleural mark often extensive). Thoracic setae yellow; anterior dc and sa strong; mid dc (in line with npl) weak and usually two fine small dc immediately behind. Sct fine and rather widely spaced; anterior postpronotal very small.

Legs yellow. C_1 as long or slightly longer than thorax, slender, 9–10× long as wide, ciliated anteriorly on distal 0.5 with minute yellowish setulae. F_1 slightly longer than C_1, conspicuously slender, slightly inflated, 8–9× long as wide; a single row of 13–15 minute *av* denticles (*pv* denticles absent) with 2–3 *pv* and 3 *av* yellow spines and usually a single basal spine ventrally. T_1 0.7× as long as F_1, the row of minute denticles ventrally rather longer and more erect than usual.

Abdomen yellow with tergites 2–5 and sternites 2–3 dark brown, all setae rather short and sparse. Genitalia with fused Hypan + Epan (Fig. 9) brownish yellow, darker dorsally and with rounded blackish patch laterally; rather quadrate, bearing a few short setae; fused lobes rather widely separated dorsally, the aperture between them with greyish membrane covering in front of which is an opening through which internal organs project anterodorsally. Cercus yellow, broadly spathulate apically, bearing distinct regularly spaced setae. Subepandrial process complex, consisting of twisted yellowish structure. Phallus, pale yellow, long, projecting anteriorly.

Wing membrane clear; veins yellowish basally, blackish at level of apex of basal cells, dusky yellow distally. Squamae with pale fringes. Halter white.

Female. Antenna with poped slightly shorter than male. Thorax (Fig. 20) reddish black, subshininng; postpronotal area, thoracic 'collar', propleuron and katepisternum anteriorly yellow

Legs similar to male, perhaps even more slender and with ventral denticles on F_1 more numerous (15–19). Abdomen petiolate basally (Fig. 26); segments 2–7 subshining black, otherwise yellow; cercus very short, hardly longer than wide, yellow.

***Etymology.* –** The specific epithet derives from the Greek, macrosceles, meaning long-legged in reference to the slender front femur of this species.

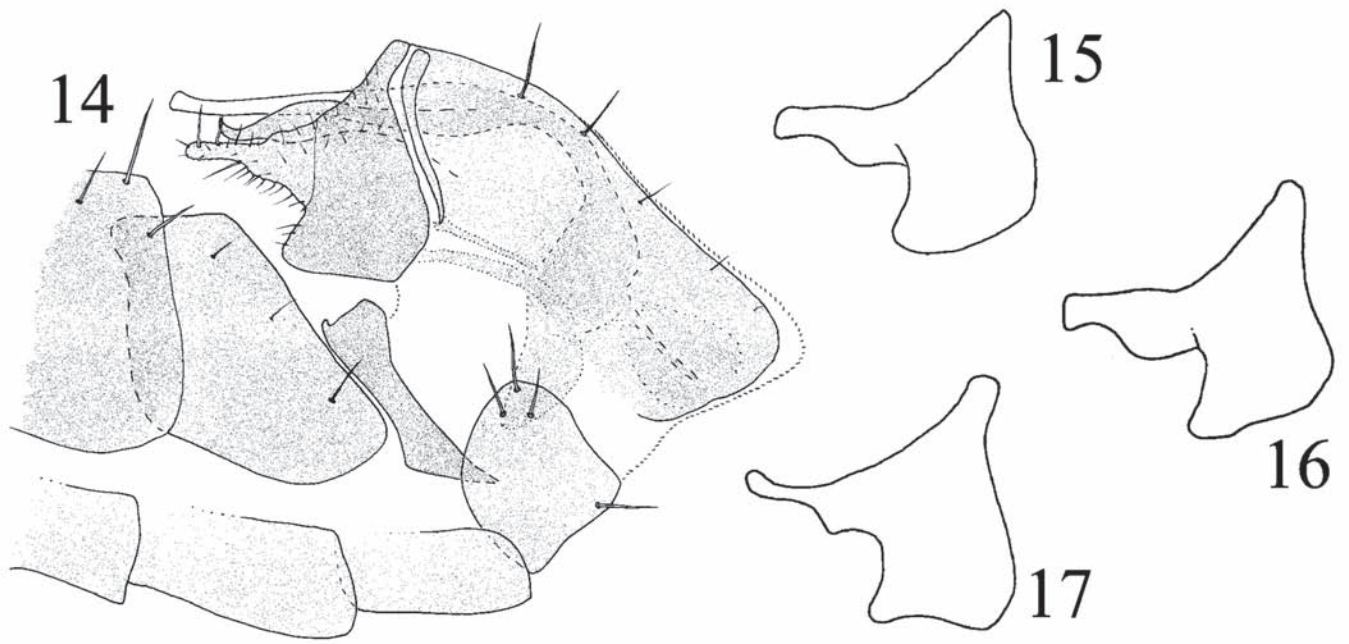
***Remarks.* –** This species is currently known from moist montane forests between 1,550 and 1,900 m in the Hoang Lien Son Mountains in northern Vietnam and from similar biotopes at 2,200–2,500 m on Doi Inthanon, Thailand. Adults were caught between October and November and again in March.

Chelipoda manggawna, new species

(Figs. 10, 25)

***Material examined.* – Holotype**. Male, THAILAND: Chiang Mai, Doi Inthanon National Park, Checkpoint 2, 18°31.554'N 98°29.940'E, 1,700 m, Malaise trap, coll. Y. Areeluck, 16–23 Mar.2007 (QSBG, T1817).

Paratypes. Same data as holotype: 1 male, 30 Aug. –6 Sep.2006 (NMWC, T238); 1 male, 6–13 Sep.2006 (QSBG, T244); 1 male, 1 female, 13–21 Sep.2006 (NMWC, T250); 1 female, 19–26 Oct.2006 (NMWC, T377); 2 females, 2–10 Nov.2006 (QSBG, T389); 1 male, 17–24 Nov.2006 (QSBG, T1846); 4 females, 24 Nov. –1 Dec.2006 (NMWC, T1870); 1 male, 2–9 Feb.2007 (QSBG, T1793); 1 female, 16–23 Feb.2007 (QSBG, T1805); 1 male, 23 Feb. –2 Mar.2007 (NMWC, T1775); 3 males, 16–23



Figs. 14–17. *Chelipoda nakropa* new species: 14. male genitalia in lateral view: 15–17: variation in form of male cercus: 15–16 high elevation morph; 17. mid elevation morph.

Mar.2007 (QSBG, T1817); 3 males, 16–23 Mar.2007 (NMWC, T1817); 2 females, 15–22 Apr.2007 (QSBG, T1845); 1 female, 29 Apr. –6 May.2007 (QSBG, T1857); 1 male, 1 female 1–8 May.2007 (NMWC, T1827): Kew Mae Pan Trail, 18°33.162'N, 98°28.810'E, 2,200 m, 1 female, 1–8 May.2007 (NMWC, T1824); 1 female, 2–9 Mar.2007 (QSBG, T1777): Campground Pond, 18°32.40'N 98°31.80'E, 1,200 m, 1 male, 5–12 Jan.2007 (QSBG, T1917): Summit Marsh, 18°35.361'N 98°29.157'E, 2,500 m, pan trap, 1 male 28 Feb.2007 (NMWC, T1767).

***Diagnosis.* –** Yellow species without dark median stripe on scutum and legs somewhat stouter than in *C. flavida*. Head yellow, only ocellar protuberance black.

***Description.* – Male.** Body length 3.0mm. Head yellow, ocellar protuberance black. Setae blackish, strong, including one ocl, one vtl and one upper upo; one or two minute upo below upper upo but occiput otherwise lacking upo and lpo and only a few minute setulae behind mouth. Antenna with basal segments yellow; poped 2× long as wide, dark brown; stylus 4× long as poped, dark brown to yellowish brown. Mouthparts yellow.

Thorax. Dorsum yellow, pleura pale yellow, lateral margins of scutum narrowly darkened. Setae blackish; anterior dc and upper npl strong, posterior dc (in line with npl) much weaker and of similar size to sa and sct. Lower npl much smaller, anterior postpronotal setulae minute with 2–4 rather longer setulae between it and notopleural area.

Legs yellow, tarsomeres 4–5 darker. C_1 as long as thorax (Fig. 25), rather slender, 9.5× as long as wide, anterobasal setae not distinguished from regular row of yellowish anterior setulae. F_1 as long as C_1, distinctly inflated, 4.6× as long as wide, widest 0.4–0.5 from base; femoral formula 5(4–5)/23(18–25)/13(11–16)/4(3–4) +1 (Table 1), spines yellowish, denticles black, *pv* spines very weak distally; basal spine rather weak, more or less contiguous with series of *av* spines.T_1 0.65× long as F_1.

Abdomen brownish yellow, paler ventrally; tergite 8 reduced; sternite 8 with distinct but short setae. Epan and Hypan (Fig. 10) similar to *C. flavida*, fused, erect, narrowly subrectangular in lateral view, yellowish, only small setae posteriorly, left and right lamellae distinctly separated by unpigmented membrane. Cercus fused with Epan; a short digitiform yellow process bearing strong yellow setae apically, apparently emerging from the inner face of a somewhat darker rounded and rather undifferentiated basal lobe which bears more numerous smaller setae. Subepandrial process blackish, short and robust, conspicuously bent at 0.5 from base, flattened above apically but convex below. Postgonite narrow, apically upturned, black, basally yellowish and broader. Phallus narrow, yellow, slightly upturned apically, reaching as far as apex of cercus.

Wing membrane faintly brownish, veins brown. Squamae with dark fringes. Halter greyish white, stems darker.

Female. Head with setae rather stronger than male. F_1 slightly more inflated, 4.3× long as wide, widest 0.3 from base; femoral formula 5(5–6)/24(21–27)/14(11–16)/4(4–5) +1 (Table 1); *av* and *pv* spines blackish or dark yellow. Abdomen brownish dorsally, whitish yellow ventrally; sternite 8 dark brown, subquadrate. Cercus elongate, yellow.

***Etymology.* –** The specific epithet derives from the Thai word for dragon, mang-gawn; a reference to supposed fierce predatory behaviour inferred by the presence of raptorial front legs.

***Remarks.* –** This species is known only from Thailand's Doi Inthanon between August and May from 1,200–2,500 m (mostly 1,700 m).

Chelipoda meenamluang, new species

(Fig. 11)

***Material examined.* – Holotype**. Male, THAILAND: Chiang Mai, Doi Inthanon National Park, Checkpoint 2, 18°31.554'N 98°29.940'E, 1,700 m, Malaise trap, coll. Y. Areeluck, 24–30 Aug.2006 (QSBG, T232).

Paratypes. Same data as holotype; 1 male, 1 female, 9–16 Aug.2006 (QSBG, T180): 2 males, 3 females, 16–24 Aug.2006 (NMWC, T187); 3 males, 1 female, 29 Dec.2006– 5 Jan.2007 (QSBG, T1897); 2 males, 2–9 Feb.2007 (NMWC, T1793); 5 males, 3 females, 23 Feb. –2 Mar.2007 (NMWC, T1775); 1 male, 2 females, 2–9 Mar.2007 (QSBG, T1781); 1 male, 15–22 Mar.2007 (QSBG, T1845); 5 females, 1–8 May.2007; Kew Ma Trail, 18°33.162'N 98°28.810'E, 2,200 m, 1 female, 16–23 Mar.2007 (QSBG, T1813); 1 male, 23 Mar. –1 May.2007 [1 Apr.2007 ?]. (QSBG, T1819): Summit Marsh, 18°35.361'N 98°29.157'E, 2,500 m, pan trap, 1 male, 24–25 feb.2007 (QSBG, T1763).

***Diagnosis.* –** Similar to *C. hubeiensis* with head and thorax black, including propleuron but thoracic setae and spines on F_1 yellow and male sternites 7 & 8 with numerous yellow setae.

***Description.* – Male.** Body length 2.5 mm. Head black, extensively dusted; vt and ocl strong, yellow; upper upo weaker, darker; other upo and lpo much smaller, latter merging into sparse patch of pale pile behind mouth. Basal antennal segments yellowish; poped dark (vaguely paler about base), slightly more than 3× long as wide; stylus dark, 2× long as poped. Palp greyish yellow with strong dark terminal seta. Proboscis dark.

Thorax black or reddish black, extensively dusted. All setae yellow including two dc, one npl and one sa all strong, sct rather weaker; a few small setae on humeral and posthumeral area and on scutum posteriorly

Legs yellow, tarsomeres 4–5 darker. C_1 0.8–0.85× as long as thorax, anterior setulae, yellow, inconspicuous, becoming slightly longer distally, no distinct anterobasal seta. F_1 distinctly inflated, 3.4× as long as wide, widest 0.35 from base; femoral formula 5(5–6)/16(14–18)/13(11–15)/5(5–7)

+2–4 (Table 1), the basal spines consisting of 1–2 smaller setae in line with and basal to both *av* and *pv* series; spines yellow, denticles black. T_1 0.7–0.75× as long as F1.

Abdomen dark brown; tergites 5 and 6 with some distinct setae dorsally on posterior margin; sternites 7 and 8 with numerous strong yellowish setae. Epan and Hypan fused, somewhat triangular in lateral view (Fig.11), brownish, less strongly sclerotized and yellowish immediately posterior of cercus, bearing dark setae posteriorly; left and right lamellae narrowly separated by unpigmented densely micropilose membrane. Cercus dark brown, rather paler posteriorly; fused with Epan + Hypan; three strong black inwardly curving dorsal setae; an anteriorly directed process rather club-shaped apically bearing a strong dorsal subapical seta. Subepandrial process dark, narrow, situated close to inner surface of cercus. Phallus yellowish, slender, distal section almost linear, reaching to end of cercus.

Wing with membrane clear and veins yellowish. Squamae dark yellow. Halter yellowish white.

Female. Antenna with poped more uniformly dark and stylus slightly longer than in male

Femoral formula 5(5–6)/18(15–23)/14(12–17)/5(5–6) +1, the small basal spine in line with *av* series and occasionally a much smaller one in line with *pv* series. Abdomen brown, paler ventrally; cercus moderately long.

***Etymology.* –** The specific epithet is a contraction of the Thai words for spiny, mee ngaam, and the colour yellow, see luang, in reference to the yellow spines on the front femur.

***Remarks.* –** The male genitalia superficially resemble *C. nigraristata* Yang, Grootaert & Horvat, 2004, from the Nanling Mountains in China, however in that species the cercus is broadly triangular (Fig. 3 in Yang et al. 2004), lacking a dorsobasal rounded swelling. *C. nigraristata* also apparently has pale rather than yellow setae on the head, three pairs of dc and only a very weak npl. *C. meenamluang* is so far known only from Doi Inthanon in Thailand with most records at 1,700 m in February–May, August and December.

Chelipoda menglunana Grootaert, Yang & Saigusa, 2000
(Fig. 13)

***Material examined.* –** THAILAND, Loei, Phu Ruea National Park, Huay Taey Ditch, 17°30.042'N 101°20.474'E, 1,233 m, Malaise trap, coll. N. Jaroenchai: 1 male, 19–26 Aug.2006 (QSBG, T532); 2 females, 5–12.Aug.2006 (NMWC, T526): Nern Wibaak Ditch, 17°29.907'N 101°20.483'E, 1,196 m, Malaise trap, 1 female, 12–19 Aug.2006 (QSBG, T527): Pan Hin Khan Maak Ditch, 17°30.042'N 101°20.474'E, 1,219 m, Malaise and pan traps, 11 males, 1 female, 5–6 Aug.2006, (NMWC, T517); 2 males, 3 females, 6–7 Aug.2006 (QSBG, T518); 5 males, 4 females, 7–8 Aug.2006 (QSBG, T519); 5 males, 8–9 Aug.2006 (QSBG, T520); 1 male, 3 females, 9–10 Aug.2006 (QSBG, T521); 3 males, 7 females, 10–11 Aug.2006 (NMWC, T522); 1 male, 2 females, 11–12 Aug.2006 (QSBG, T523); 1 female, 12–19 Aug.2006 (QSBG, T528); 3 females, 26 Aug.–2 Sep.2006 (NMWC, T534).

***Diagnosis.* –** A yellowish species with black head and distinctively a strongly marked dark subterminal band on the wing.

***Description.* – Male.** Body length 2.5 mm. Head black with pale dust. All setae yellow or whitish; ocl and vtl strong, upo and lpo becoming progressively weaker ventrally; patch of pale setae behind mouth conspicuous. Basal antennal segments yellow; poped yellowish basally, darker apically, almost 3× long as wide; stylus black, thickened, 2× long as poped. Mouthparts whitish, proboscis black.

Thorax yellow, scutellum and mediotergite brownish. Setae yellowish; two dc (including one level with npl) upper npl, sa and sct all strong; otherwise only minute hairs posteriorly on scutum, pospronotum and lower notopleural area.

Legs yellow, tarsomeres 4–5 darker, T_1 narrowly dark brown posteriorly. C_1 0.8–0.85× as long as thorax, slightly inflated, 6.1–6.2× as long as wide, widest 0.25 from base. F_1 slightly longer than C_1, distinctly inflated, 3.7× as long as wide, widest 0.3 from base; femoral formula 7(5–8)/17(15–19)/13(12–15)/8(8–11) +1–2 (Table 1), spines yellow, denticles black; *pv* spines usually rather close together basally; basal spine(s) rather weak. Mid and posterior femora and tibiae slender, lacking strong setae.

Abdomen brownish yellow; genitalia (Fig. 13) yellow with only apex of phallus and sheath blackish yellow and extreme apex of subepandrial process dark.

Epan and Hypan fused, with lateral lobes completely fused posteroapically but slightly separated posteroventrally, with scattered short setae. Cercus fused with Epan+Hypan, consisting of two roughly triangular parts connected by a narrow intermediate part along dorsum of Epan+Hypan; posterior part narrowly triangular with rather erect short setulae dorsally; anterior part free apically and bearing 2-3 stout black setae apically. Subepandrial process, erect, narrow with apical hook. Phallus strongly reflexed forward, rather broad but abruptly narrowed distally and terminating just anterior of anterior lobe of cercus; phallic sheath also broad and continuing forward beyond apex of phallus for a considerable distance.

Wing veins yellowish basally, darker distally; membrane faintly brownish yellow, a strong black subterminal band commencing at apex of cell dm leaving apex of wing clear. Squamae with pale fringes. Halter whitish yellow.

Female. Antenna with poped darker than in male.

Femoral formula (female) 5(5–6)/19(15–21)/17(14–22)/5(4–6) +1–2, *pv* spines usually more evenly spaced basally. Cercus moderately long, yellowish

Remarks. **–** Described originally from Yunnan, China (Grootaert et al., 2000), *C. menglunana* is here reported from Loei Province in north eastern Thailand. Adults were collected for a short period of the wet season in August at around 1,200 m.

Chelipoda nakladam, new species
(Fig. 12)

Material examined. **– Holotype**. Male, THAILAND: Chiang Mai, Doi Inthanon National Park, Summit Marsh, 18°35.361'N 98°29.157'E, 2,500 m, Malaise trap, coll. Y. Areeluck, 2–8 Jul.2006 (QSBG, T53).

Paratypes. Same date as holotype, 1 male, 3 females, 15–22 July.2006 (QSBG, T70); 1 male, 6 females, 2–9 Aug.2006 (NMWC, T124); 1 female, 16–24 Aug.2006 (QSBG, T184): Summit Forest, 18°35.361'N 98°29.157'E, 2,500 m, 1 male, 5 females, 9–16 Aug.2006 (QSBG, T178): Kew Mae Pan, 18°33.163'N 98°28.8'E, 2,200 m, 4 females, 29 Jun. –2 Jul.2006 (QSBG, T38): Checkpoint 2, 18°31.559'N 98°29.941'E, 1,700 m, 1 female, 21–27 Sep.2006 (NMWC, T343); 1 female, 5–12 Oct.2006 (QSBG, T365): Vachiratharn Falls, 18°32.311'N 98°36.048'E, 700 m, 1 female, 6–13 Sep.2006 (QSBG, T242).

Diagnosis. **–** Similar to *C inthawichayanona* with head and thorax black, propleuron contrastingly dark yellowish but C_1 without distinct anterobasal spine; posterior dc (in line with npl) as strong as anterior dc.

Description. **– Male.** Body length 2.5 mm. Head black with paler dusting; larger setae dark yellowish brown to black; vt, ocl and upper upo equally strong; other upo and lpo smaller, pale pile behind mouth conspicuous but short. Antenna yellowish with poped dorsoapically and stylus entirely blackish; poped about 1.7× long as wide, stylus 2.2–2.5× as long. Palp dirty white with distinct terminal seta. Proboscis black.

Thorax brownish black, propleuron contrastingly yellowish; all setae dark yellowish including two dc, one npl, one sa and pair of sct all strong; minute anterior postpronotal and posterior postpronotal setae usually present

Legs pale yellow, tarsomere 5 darker. C_1 0.75–0.8× as long as thorax, slightly inflated basally, no distinct anterobasal seta. F_1 1.2× as long as C_1, moderately and evenly inflated, widest 0.25–0.6 from base; Femoral formula 5(5–5)/20(18–23)/12(10–13)/5(4–5) +4–6 (Table 1); spines yellow, 2–3 basal spines contiguous and evenly spaced with both *av* and *pv* series of spines, continuing to base of limb; denticles black. T_1 0.75× as long as F_1.

Abdomen blackish; tergite 6 with strong dark seta dorsally on posterior margin; tergite 8 very narrow. Genitalia blackish with cerci, subepandrial process and phallus paler. Epan and Hypan fused, rather rounded in lateral view (Fig. 12), bearing a few dark setae posteriorly; left and right lamellae narrowly separated by unpigmented densely micropilose membrane (when macerated, this membrane appears much broader). Cercus fused with Epan + Hypan, anteriorly directed, bilobed; upper lobe short, bluntly pointed, bearing 2–3 strong erect setae above; lower lobe elongate, apically broadened and somewhat anvil-shaped. Subepandrial process evenly decurved, reaching apex of lower lobe of cercus. Phallus sharply reflexed anteriorly; distal section narrow, almost linear.

Wing membrane faintly yellowish; veins yellow basally becoming brownish yellow apically. Squamae with yellowish black fringes. Halter yellowish white.

Female. Antenna with poped somewhat more uniformly darkened than in male.

F_1 slightly larger and stouter than in male; femoral formula 5(4–5)/22(20–26)/14(13–16)/5(4–5) +2–4; basal spines less numerous and smaller than in male. Cercus moderately long.

Etymology. **–** The specific epithet is a contraction of the Thai words for hunter, nak-laa, and the colour black, see dam, in reference to the black colour and presumed predatory habits of this species.

Remarks. **–** This species is mostly confined to the upper slopes of Doi Inthanon, Thailand from 1,700–2,500 m with adults active during the wet season from June to October.

Chelipoda nakropa, new species
(Figs. 14–17, 22, 23, 27)

This species is known from two altitudinally segregated morphs, one from mid elevation and the other from higher elevations. The species is described from the mid elevation morph.

Mid elevation morph

Material examined. **– Holotype.** Male, mid elevation morph, THAILAND: Chiang Mai, Doi Inthanon National Park, Checkpoint 2, 18°31.554'N 98°29.940'E, 1,700 m, Malaise trap, coll. Y. Areeluck, 21–27 Sep.2006 (QSBG, T343).

Paratypes. *Mid elevation morph*. Same data as holotype: 3 males, 3 females, 15–22 Jul.2006 (NMWC, T73); 1 male, 1 female, 9–16 Aug.2006 (QSBG, T180); 4 males, 7 females, 16–24 Aug.2006 (NMWC, T187); 2 males, 1 female, 6–13 Sep.2006 (NMWC & QSBG, T244); 1 male, 2 females, 13–21 Sep.2006 (QSBG, T250); 1 male, 1 female, 21–27 Sep.2006 (QSBG, T343); 1 female, 5–12 Oct.2006 (QSBG, T365); 3 males, 11 females, 12–19 Oct.2006 (NMWG, T371) 4 males, 15 females, 19–26 Oct.2006 (NMWC & QSBG, T377); 5 females, 26 Oct. –2 Nov.2006 (NMWC, T383); 2 females, 2–10 Nov.2006 (QSBG, T389); 3 females, 24 Nov. –1 Dec.2006 (NMWC, T1870); 1 male, 22–29 Dec.2006 (QSBG, T1891); 2 females, 2–9 Feb.2007 (QSBG, T1793); 1 male, 23 Feb. –2 Mar.2007 (QSBG, T1775); 1 female, 2–9 Mar.2007 (QSBG, T1781); 2 females, 16–23 Mar.2007 (NMWC, T1817); 3 females, 15–22 Apr.2007 (QSBG, T1845): Kew Mae Pan, 18°33.163'N, 98°28.8'E, 2,200 m, 1 male, 9–16 Aug.2006 (QSBG, T179): Kew Mae Pan Trail, 18°33.162'N, 98°28.810'E, 2,200 m, 1 female, 1–8 Mat.2007 (QSBG, T1824).

Additional material. Mid elevation morph – Same data as holotype: 3 males, 1 female, 24–30 Aug.2006 (NMWC, T232); 2 females, 16–23 Feb.2007 (QSBG, T1805); 8 males, 1 female, 29 Apr. –6 May.2007 (NMWC, T1857): Summit Forest, 18°35.361'N 98°29.157'E, 2,500 m, 1 male, 15–22 Apr.2007.

High elevation morph

Paratypes. High Elevation Morph. Kew Mae Pan, 18°33.163'N 98°28.8'E, 2,200 m, 1 female, 2–10 Nov.2006 (QSBG, T388): Kew Mae Pan Trail, 18°33.162'N 98°28.810'E, 2,200 m, 5 males, 2 females, 17–24 Nov.2006 (NMWC, T1860); 30 males, 10 females, 24 Nov.–1 Dec.2006 (QSBG, T1866); 7 males, 1 female, 1–8 Dec.2006 (NMWC & QSBG, T1872); 21 males, 2 females, 8–16 Dec.2006 (NMWC, T1878); 2 males, 7 females, 15–22 Dec.2006 (QSBG, T1882); 6 males, 9 females, 22–29 Dec.2006 (QSBG, T1888); 39 males, 19 females, 29 Dec.2006 – 5 Jan.2007 (NMWG, T1893); 4 males, 1 female, 5–12 Jan.2007 (QSBG, T1928); 9 males, 14 females, 9–16 Feb.2007 (NMWC, T1795); 3 males, 6 females, 23 Feb.–2 Mar.2007 (QSBG, T1771); 15 males, 13 females, 2–9 Mar.2007 (QSBG, T1777); 7 males, 11 females, 16–23 Mar.2007 (NMWC, T1929); 5 females, 16–23 Mar.2007 (NMWC, T1813); 3 males, 2 females, 23 Mar. –1 May.2007 [1 Apr.2007 ?] (QSBG, T1819); 3 males, 2 females, 22–29 Apr.2007 (QSBG, T1847): Summit Forest, 18°35.361'N, 98°29.157'E, 2,500 m, 1 female, 19–26 Oct.2006 (QSBG, T375); 1 male, 2–10 Nov.2006 (QSBG, T387).

Additional material. High Elevation Morph – Same data as holotype: – Campground Pond, 18°32.40'N 98°31.80'E, 1,200 m, 1 female, 29 Dec.2006–5 Jan.2007 (NMWC, T1895).

***Diagnosis.* –** Head black. Thoracic dorsum extensively darkened, pleura yellowish. Somewhat resembling *C. guangxiensis* but C_1 with distinct anterobasal spine and basal antennal segments yellow. Two altitudinal forms are recognised. – a mid elevation morph in which the dark marking on the scutum is diffusely edged laterally and a high elevation form in which the scutum is darker and sharply edged yellowish lateral to line of dorsocentrals.

***Description.* –** Mid elevation morph**: Male.** Body length 2.5–3.0 mm. Head black, strongly dusted especially on upper occiput. Setae black, ocl and vtl strong, upper upo slightly shorter; other upo and lpo weak, conspicuous patch of pale pile behind mouth spreading onto lower occiput. Antenna with basal segments yellow; poped brown, 2× long as wide; stylus brown, 3× long as poped. Mouthparts yellowish.

Thorax with pleura yellow; scutum, scutellum, mediotergite and laterotergite brownish yellow; scutum diffusely edged paler brown laterally (Fig. 23), not distinctly contrasting with darker central area. All setae black; upper npl and anterior dc strong, mid dc (in line with npl) very weak, posterior dc (near posterior margin of scutum) fine but usually distinct; sct weak and sa weaker still; a few minute setulae about and behind postpronotum; lower npl very weak.

Legs yellow, tarsomeres 4–5 darker; F_2 and F_3 dorsoapically, T_2 and mid basal tarsomeres sometimes also brownish. C_1 0.95× as long as thorax; rather stout, slightly narrowed distally, 6x as long as wide; 1–2 anterobasal setae, yellowish, stout, not as long as C_1 is deep, clearly differentiated from series of regularly spaced minute anterior setulae. F_1 slightly longer than C_1, distinctly inflated (Fig. 27), 4x as long as wide, widest 0.3–0.4 from base; femoral formula 5(4–6)/20(17–25)/14(12–19)/5(4–5) +1–2 (Table 1), spines yellowish often becoming darker on distal part of limb; denticles black; basal spine(s) distinct, more or less contiguous with series of *av* spines.T_1 0.70–0.74× long as F_1.

Abdomen brownish yellow, paler ventrally; tergite 8 reduced, very narrow dorsally, broader laterally, strongly sclerotized. Epan and Hypan (Fig. 14) fused, rather pointed posteroventrally, brownish yellow, a few distinct but small setae posteriorly; left and right lamellae narrowly separated by unpigmented membrane. Cercus fused with Epan, broad and brownish basally; a short digitiform yellow upper process bearing distinct yellowish setae (length and breadth of process rather variable between individuals and even between left and right side; apically rather more pointed than in Figs. 14 & 17) in some individuals, sometimes broader); lower process more rounded and shorter. Subepandrial process blackish, broad in dorsal view, narrower with apex upcurved in lateral view. Phallus yellow apically, darker basally, reaching to just beyond tip of upper process of cercus.

Wing membrane faintly darkened; veins brown, slightly yellowish basally. Squamae with black fringes. Halter greyish.

Female. Similar to male but antenna with stylus yellowish white; upo and lpo rather stronger.

F_1 with spines often darker yellowish, femoral formula 5(5–6)/24(21–27)/16(14–18)/5(4–5) +1–2 (Table 1). Abdomen dark above, paler below; sternite 8 dark brown, bluntly pointed apically; cercus elongate, yellow.

High elevation morph

Scutum sharply edged yellowish lateral to line of dorsocentrals (Fig. 22), the yellow margins contrasting with central broad almost blackish area. Katepisternum and meron more obscurely darkened ventrally. F_1 with av and pv spines tending to be slightly stronger, more numerous and darker. Male femoral formula 6(6–7)/21(19–23)/15(14–17)/5(5–6) +1–2; female 6(5–6)/22(19–24)/15(13–17)/5(5–6) +1 (Table 1). Abdomen generally darker.

Male cercus with digitiform process broader (Figs. 15, 16); subepandrial process less distinctly upturned apically

***Etymology.* –** The specific epithet derives from the Thai word, nakrop, meaning warrior, in reference to presumed fierce predatory behaviour suggested by the raptorial front legs.

***Remarks.* –** Morphological differences between the high and low elevation morphs were not judged sufficient to warrant specific status for the two forms, both of which are confined to forests on Doi Inthanon. The high elevation morph was mostly found at 2,200 m with peak adult activity from November – March. The mid elevation morph was abundant lower down the mountain at 1,700 m with peak adult activity from July–November and again from March – May (Fig. 29). The two morphs may prove to be sibling species with allotopic populations isolated by altitudinal and phenological factors.

Chelipoda thaosuranaria, new species
(Fig. 18)

***Material examined.* – Holotype**. Male, THAILAND: Loei, Phu Ruea National Park, Nature Trail, 17°30.740'N 101°20.650'E, 1,353 m, Malaise trap, coll. N. Jaroenchai, 26 Sep.–2 Oct.2006 (QSBG, T834).

Paratype. One male, same data as holotype (NMWC).

***Diagnosis.* –** Superficially resembling *C. thaosuranaria* with head black and all yellow thorax but F_1 with usual double row of denticles beneath, front tarsomeres 2 & 3 not distinctly spinose and C_3 with strong black anteroapical seta.

***Description.* – Male.** Body length 2.0–2.5 mm. Head black with paler dusting; ocl, vtl and upper upo strong, black; other upo and lpo minute or absent; only a few pale setulae behind mouth. Antenna yellowish with poped obscurely darker, especially apically and stylus blackish; poped 2.2× long as wide, stylus 2× as long. Mouthparts yellowish brown, proboscis darker.

Thorax clear yellow, mediotergite medially and scutum sublaterally obscurely darkened. Setae black; two dc (including one level with npl) upper npl, sa and sct all strong; otherwise only minute hairs posteriorly on scutum, pospronotum and lower notopleural area.

Legs yellow, tarsomeres 4–5 and T_1 obscurely darker. C_1 0.8× as long as thorax, 5.0–5.2× as long as wide, slightly broader basally; anterior ciliation of fine yellowish setae distinct and almost as long as limb is deep on distal 0.6, no stronger anterobasal seta. C_3 with strong black anteroapical seta as long as limb is wide and 2–3 weaker dark setae anteriorly. Mid trochanter with short pointed prominence in inner face basally. F_1 1.2× as long as C_1, 4x as long as wide, widest 0.3 from base; femoral formula approximately 5(4–5)/18(15–18)/14(14–15)/5(5–6) +2–4 (Table 1), spines yellow, denticles black; basal spines small, contiguous with and forming basal extension of both *av* and *pv* spines.

Abdomen dark yellow; tergite 8 reduced, slightly more strongly sclerotized than preceding tergites; sternite 7 with long yellowish setae posteroventrally. Epan and Hypan fused (Fig. 18), subspherical in lateral view, brownish yellow with distinct setae posteriorly; left and right lamellae broadly separated by unpigmented membrane. Cercus fused with Epan, yellowish, bilobed; upper lobe short, bluntly pointed, dorsally with numerous closely set long setae curving anteriorly and inwardly; lower lobe longer, narrowly digitiform with a few short setulae distally and more numerous and longer setae below basally. Subepandrial process brownish yellow, narrow, broadened and anvil-shaped apically. Phallus yellowish, narrow, gradually tapered apically. Postgonite (?) closely apposed with phallus, apically broader with lateral twisted ribbon-like process extending laterally to inner face of lower lobe of cercus.

Wing membrane faintly greyish yellow, veins brownish yellow. Squamae with dark fringes. Halter pale yellow.

Female unknown.

***Etymology.* –** The specific name commemorates Mo Mo, a woman from Korat who was honoured with the epithet Thao Suranari ('brave woman') by Thailand's King Rama III in recognition of her bravery during a nineteenth century Laotian invasion of Thailand.

***Remarks.* –** This species is only known from 1,353 m on the sandstone mesa formations at Phu Ruea, Thailand in late September – early October.

Chelipoda species D

***Material examined.* –** THAILAND: Chiang Mai, Doi Inthanon National Park, Checkpoint 2, 18°31.554'N 98°29.940'E, 1,700 m, Malaise trap, coll. Y. Areeluck, 3 females , 2–8 July.2006 (NMWC, T56) 7 females, 15–22 Jul.2006 (NMWG, T73); Loei, Phu Ruea National Park, Ma Kraow Ditch, 17°29.652'N 101°21.020'E, 1,167 m, pan trap, coll. P. Tumtip, 1 female, 10–11 Noc.2006 (NMWC, T1113); Khonkaen, Nam Pong National Park Office, 16°37.341'N 102°34.467'E, 324 m, Malaise trap, coll. K. Jaidee, 1 female, 19–26 Jul.2006 (NMWC, T109).

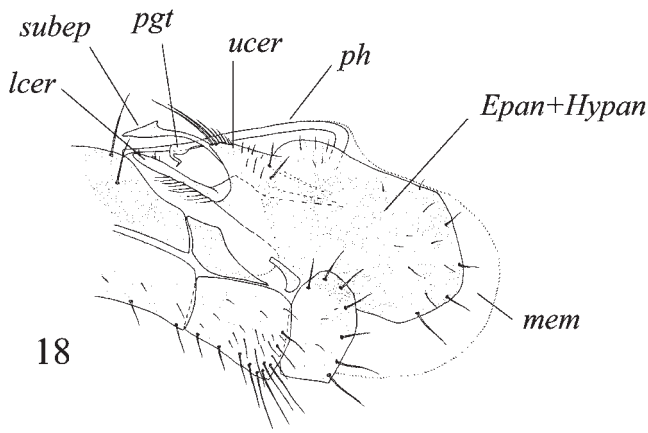
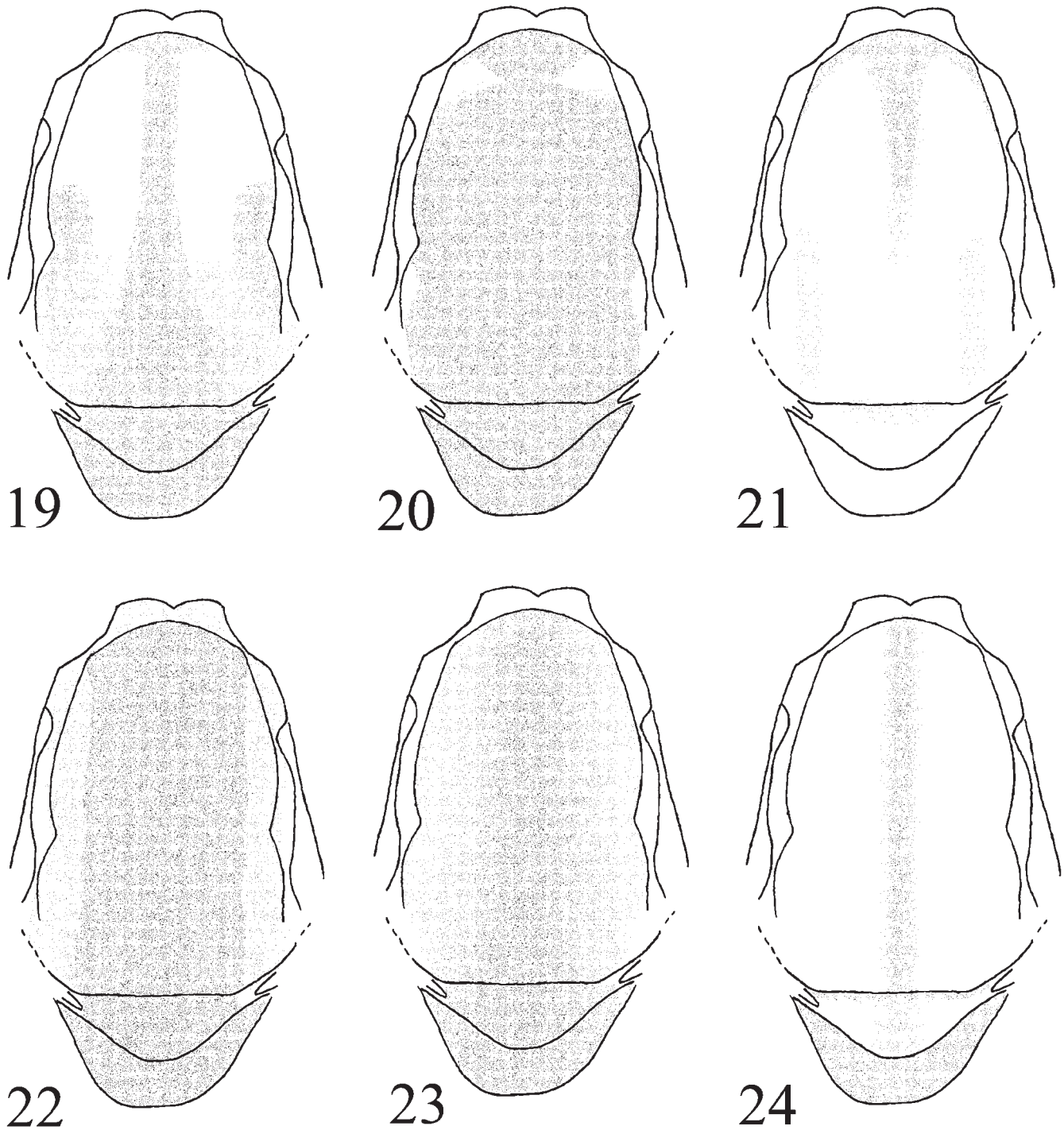


Fig. 18. *Chelipoda thaosuranaria* new species, male genitalia. Abbreviations: Epan+Hypan, fused epandrium and hypandrium; lcer, lower lobe of cercus; mem, median membrane separating left and right lobes of fused epandrium + hypandrium; ph, phallus; pgt, postgonite; subep, subepandrial process; ucer, upper lobe of cercus.

***Diagnosis.* –** In the absence of male specimens, this species will not be formally described in the present work and it is included in the key and mentioned here only to prevent confusion with other species. Variation in antennal colour and intensity of markings on the scutum may indicate that more than one species is involved.

Head black with paler dusting and antenna yellow to brown, poped 2.5× long as wide. Thorax yellow including area between and behind front coxae; scutum with strong rather broad median stripe (0.3× width of scutum), sometimes more diffuse and fading in prescutellar depression; anterior dc strong, three pairs of much smaller postior dc; sa minute; postalar present, minute. F_1 strongly inflated, spines yellow, double row of denticles black. Abdomen dark above, whitish yellow below.



Figs. 19–24. Thoracic dorsum of *Chelipoda* spp. showing schematic pattern of ground colour. 19–20. *C. macrosceles* new species: 19. male; 20. female: 21. *C. flavida* Brunneti, male: 22–23. *C. nakropa* new species, male: 22. high elevation morph; 23. mid elevation morph: 24. *C. chaiamnata* new species, male.

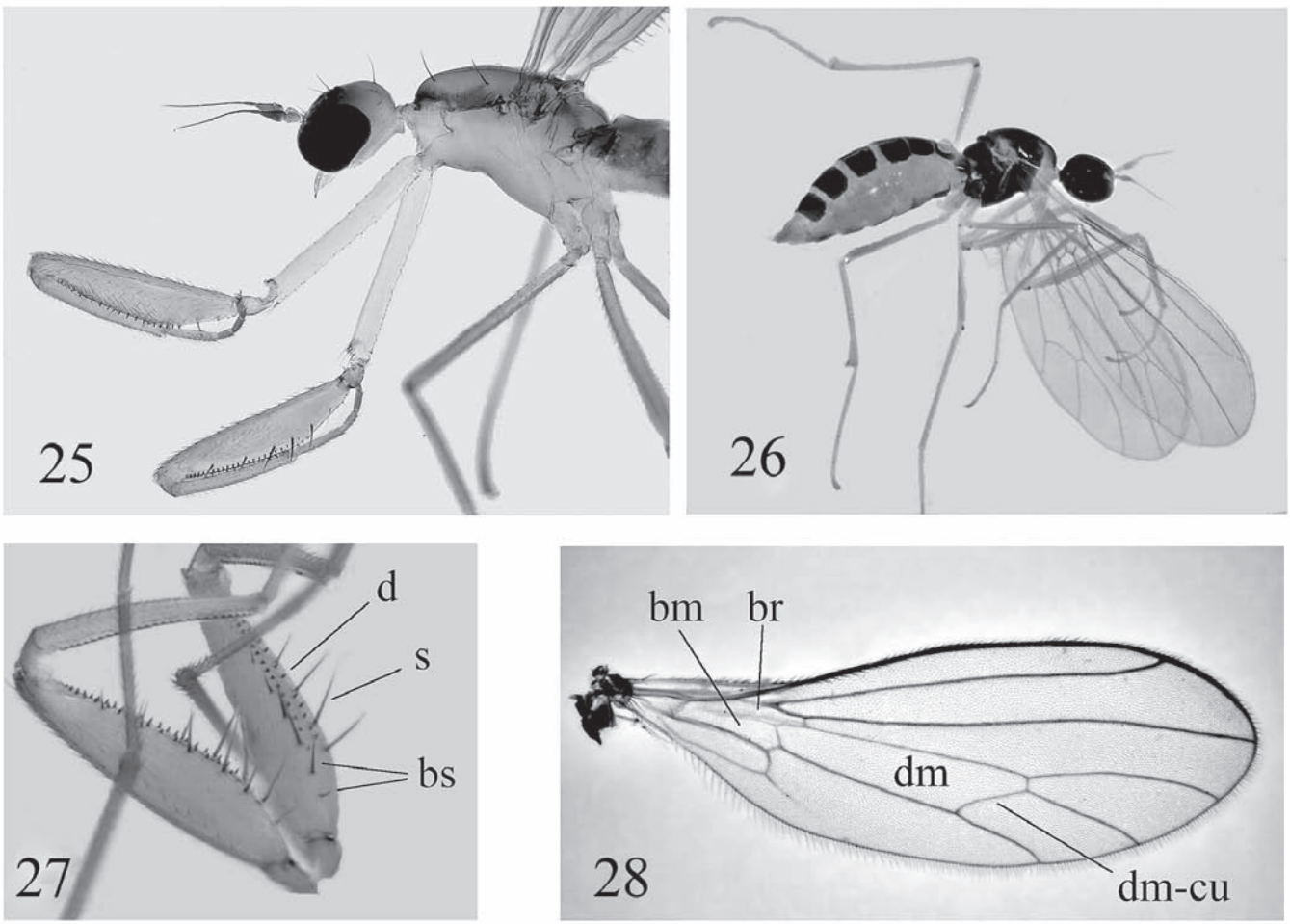
DISCUSSION

Systematics

The genus *Chelipoda* contains 92 described species distributed across all faunal realms except the Afrotropical. The genus is rather structurally diverse and some included species from the Neotropical (Plant, 2009a) and Australasian (Plant, 2007) realms for example exhibit potentially important morphological differences from those in the Palaearctic. However, all species treated in this work share a keel-like fusion of the epandrium and hypandrium, an important synapomorphy in a major clade of *Chelipoda* sensu lato, which includes all known species from the Indo-Malayan (Oriental) and Palaearctic realms and most species from the Nearctic (Plant, 2007; 2009b). Further work is ongoing to resolve the systematic relationships within *Chelipoda* sensu lato.

Distribution

The faunistics of *Chelipoda* species in Asia is very imperfectly understood and only southern China (Yang & Yang, 2004) and now northern Thailand have been recently studied. Despite this, a few provisional comments are appropriate. Of the 14 species reported here from Thailand, seven were apparently confined to Doi Inthanon (2,565 m), the highest peak of the Thanon Thongchai Range. An additional species was found in Thailand only on Doi Inthanon but also occurred on high mountains in northern Vietnam. Five species were restricted to Loei Province with three of these also occurring at other sites elsewhere, especially along the western margins of the Isaan Plateau in Thailand and southern provinces of China. It is possible that this group of species provides evidence of a biogeographic division separating the eastern mountains from those in the west (the N–S axial Tenasserim mountains and their offshoot, the Thanon Thongchai) although ecological factors could equally well be determinant as many of the Loei localities were highly seasonal *Pinus* / savannah biotopes, much dryer than the higher elevation evergreen forest biotopes of Doi Inthanon. *Chelipoda flava* is apparently widely distributed in Asia ranging from India, the western slopes of the Tenasserim in Myanmar and their eastern slopes in Chaing Mai, the peninsular mountains in Trang as well as in Loei.



Figs. 25–28. *Chelipoda* species: 25. *C. manggawna* new species, male; 26. *C. macrosceles* new species, female habitus; 27. *C. nakropa* new species, male, front femora showing chaetotaxy; 28. *C. hubeiensis* Yang & Yang, female, wing. Abbreviations: bm, cell bm; br, cell br; bs, basal spines; d, denticles; dm, cell dm; dm-cu, crossvein dm-cu; s, spines.

Table 2. Variation in species richness with altitude on Doi Inthanon. Species Richness = number of species; Abundance = no of individuals of all species / sample; n = number of samples in which *Chelipoda* were found (note- The total number of samples at each altitude is unknown).

Altitude (m)	Species Richness	Abundance	n
0 – 500	n/a	n/a	0
501 – 1,000	2	1.5	2
1,001 – 1,500	4	3	12
1,501 – 2,000	7	3.5	80
2,001 – 2,500	10	5.3	99

Diversity and phenology on Doi Inthanon

Of 911 specimens named in this study 833 (91%) representing 11 species, were collected on Doi Inthanon allowing meaningful analysis of distributions on the mountain. Species richness and abundance increased with altitude (Table 2) and were particularly high in the hill evergreen forest zone above 1,700 m with pronounced altitudinal zonation in some species (Figs, 29, 30). Three species (*C. hubeiensis*, Yang & Yang, *C. inthawichayanona* new species & *C. macrosceles* new species) were entirely restricted to the upper moist hill evergreen (cloud forest) zone. Below 1,200 m mixed deciduous forest predominates becoming progressively wetter with increasing altitude and merging into hill evergreen forest above 1,500 m where Fagaceae (e.g. *Castanopsis, Lithocarpus* & *Quercus*) are prominent in the canopy. Above 2,000 m Fagaceae are increasingly replaced by Magnoliaceae, Theaceae and Ericaceae and the forest becomes extremely moist with ombrogenic (rain-inducing) conditions ensuring a moist, humid environment under the canopy throughout the year.

An analysis of seasonal phenology at different altitudes (Fig. 31) indicated declines in species richness at the start of the wet season and at the end of the cool dry season. Above 1,700 m, species richness was slightly greater during the dry season compared with the wet season but the pattern was reversed at lower altitudes. Although little is known of the immature stages of *Chelipoda*, they are probably associated with moist soils in shaded, humid biotopes (Plant, 2007). It is hypothesized that outside the wet season, the seasonal drought experienced by the lower slopes of Doi Inthanon results in conditions which are less suitable for *Chelipoda* but that seasonality is relaxed on the upper slopes which maintain a suitable moist environment even in the dry season. Interestingly, Grootaert & Kiatsoonthorn (2003) also provided some evidence for increased activity of adult Empididae during the beginning of the wet season in a strongly seasonal secondary mixed deciduous forest at Na Haeo, north east Thailand.

The Doi Inthanon biodiversity 'hotspot'

The mountains of northern Thailand are situated within the Indo-Burma biodiversity hotspot identified by Myers et al. (2000) as being of global significance. Furthermore, there are indications from groups as diverse as mammals, birds, reptiles and plants (Birdlife International, 2007) that Doi Inthanon is a key biodiversity site within this area. This study identified a rich *Chelipoda* fauna from Doi Inthanon

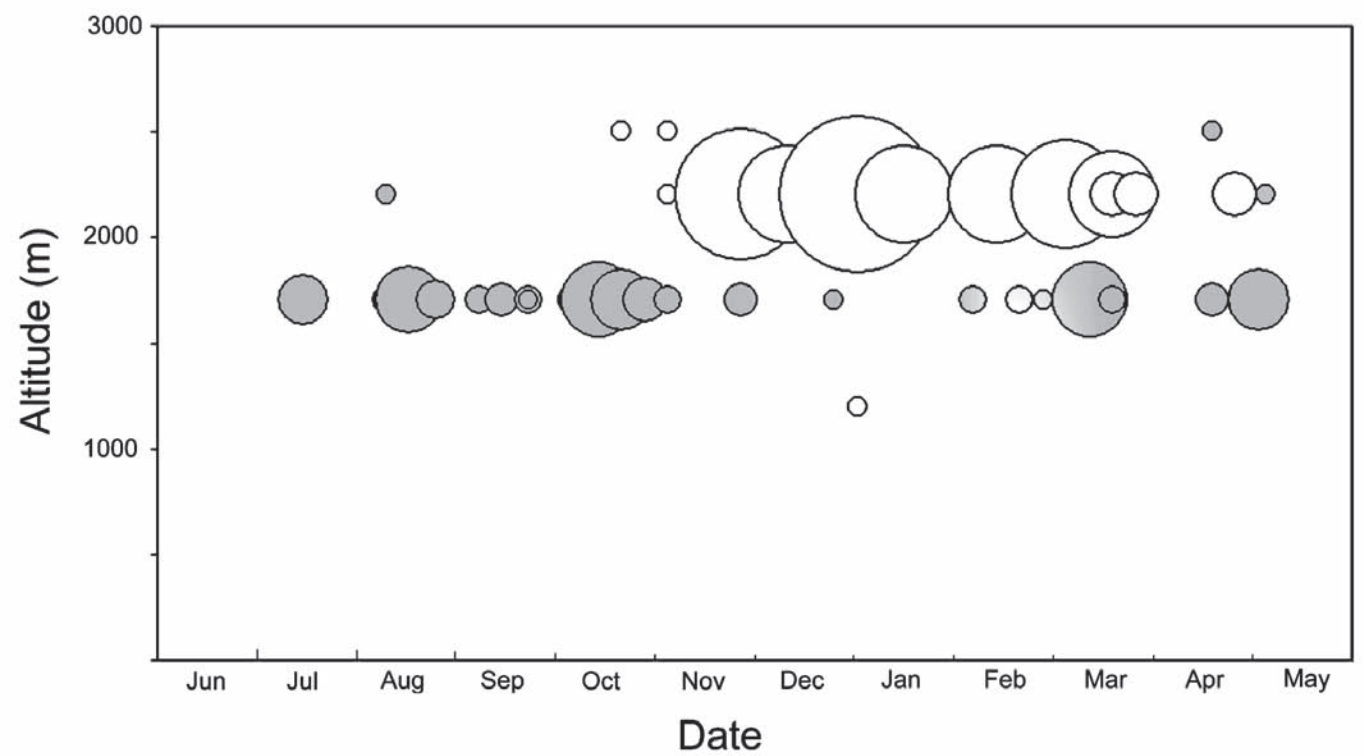


Fig. 29. Altitudinal zonation of *Chelipoda nakropa* new species on Doi Inthanon. The abundance at each elevation and date is proportional to the area of the circles; high elevation morph (open circles); mid elevation morph (shaded circles).

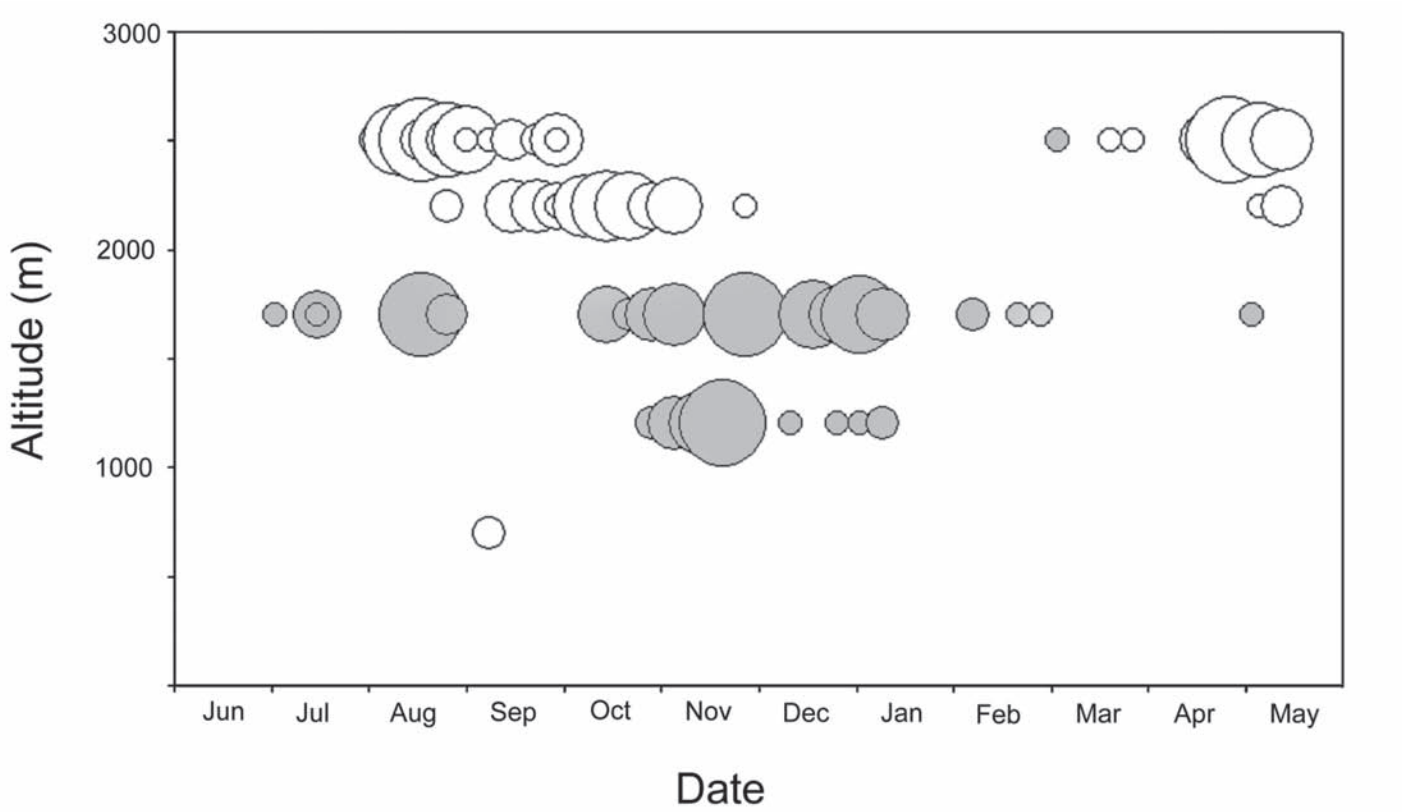


Fig. 30. Altitudinal zonation of *Chelipoda* species on Doi Inthanon. The abundance at each elevation and date is proportional to the area of the circles; *C. hubeiensis* Yang & Yang (open circles); *C. flavida* Brunetti (shaded circles).

with 91% of individuals representing 78% of the Thai *Chelipoda* species (including seven apparently endemic species) being found on the mountain. It is likely that the apparent importance of Doi Inthanon for *Chelipoda* may have been inflated by under sampling of comparable high elevation evergreen forests at other sites in Thailand but the richness of the mountain's fauna demands further explanation.

Doi Inthanon is a metamorphic core complex bounded by low-angle faults which has been uplifted (MacDonald et al., 1993; Dunning et al., 1995; Searle & Morley, 2009; M. Searle, pers. com.) and is now considerably higher than the surrounding mountains. Its large altitudinal variation supports a greater range of altitudinal succession zones than elsewhere in northern Thailand and present day availability of multiple moist forest biotopes at higher elevations may at least partially explain the richness of the *Chelipoda* fauna.

Orogenesis of Thailand's N-S axial mountains occurred at varying rates during the Cenozoic following the collision of India with Eurasia c 50 MYA (Royden et al., 2008). Elevation of the Tibetan Plateau resulted in the onset of a seasonal monsoon climate, perhaps as early as 15-20 MYA (Harris, 2006) with profound biotic consequences. Southeast Asia's climate was probably warmer during the Miocene (10–23 MYA) than at present with less seasonally dependant rainfall patterns and supported more extensive tropical rain forests extending as far north as southern China (Heaney, 1991; Zhu, 2008). In the Pleistocene, tropical forests retreated southwards in response to

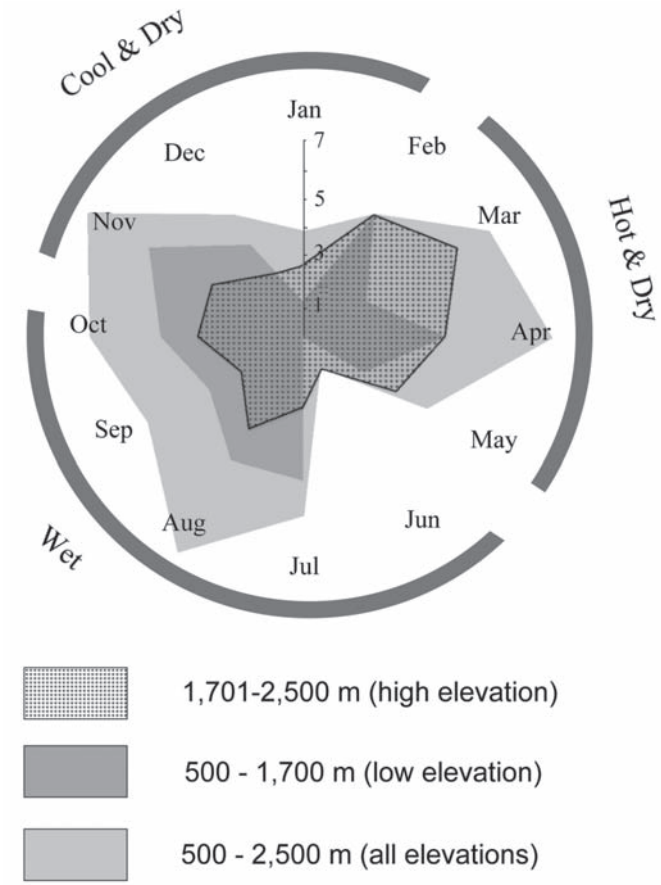


Fig. 31. Influence of altitude on seasonal abundance of *Chelipoda* spp. on Doi Inthanon. Radial plot of species richness (number of species) throughout the year. Approximate limits of the major seasons are indicated.

progressive general cooling and modified rainfall patterns and during the glacial maximum (18,000 BP) montane vegetation and savannah were more frequent (Heaney, 1991). Fossil evidence from large mammals (Tougard, 2001) and coniferous trees (Werner, 1997), a palynological analysis from peat bogs (Penny, 2005) and a molecular phylogeographic reconstruction of the population history of *Simulium tani* Takaoka & Davies (Diptera, Simuliidae) (Pramual et al., 2005) for example, provide evidence for migration of southeast Asian biota in response to climatic fluctuations during this period.

It is hypothesised that exceptional biodiversity on Doi Inthanon might have resulted from altitudinal migration in response to climatic fluctuations. A range of altitudinal succession zones in close approximation on the mountains' slopes would have facilitated dynamic vertical dispersal into montane refugia as environmental and vegetation patterns changed, with populations subsequently becoming isolated on the mountain as orogenesis and climatic change continued. Furthermore, uplifting of Doi Inthanon probably began 20 MYA (MacDonald et al., 1993; Dunning et al., 1995; Searle & Morley, 2009; M. Searle, pers. com.) coincident with the development of a seasonal monsoon. Although a pronounced dry season developed at lower altitudes it is likely that, as at the present time, seasonality was relaxed at higher altitudes which probably experienced more even annual precipitation levels. Seasonal relaxation at higher altitudes would have provided buffering refugia for ombrophilous fauna such as *Chelipoda* which were unable to tolerate seasonal dry conditions at lower elevations.

The summit slopes of Doi Inthanon share at least some affinities with the Palaearctic Realm admixed with tropical Indo-Malayan influences. For example, Hara et al. (2002) found 60% of tree species in one study plot common with the eastern Himalaya. Plant (2009c) described two species of *Trichopeza* Rondani (Diptera, Brachystomatidae) apparently endemic to the summit area of Doi Inthanon and considered this essentially Palaearctic genus of possible Himalayan origin had penetrated the Indo-Malayan along 'corridors' of suitable cool moist forest on the easternmost mountain folds of the Himalaya. As yet no phylogeographic resolution of Palaearctic and Indo-Malayan elements has been demonstrated in *Chelipoda* but the spread of Palaearctic elements along building mountain chains can not be discounted. The subsequent uplifting of Doi Inthanon's basement well above the surrounding area would have isolated these elements and promoted speciation.

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