

TAXONOMIC TREATMENT



Classification and species list :

The present study was undertaken chiefly to determine the species of Culicoides present in several areas of Thailand and their relative abundance. No large scale taxonomic work was done. Several new species were found, and these will be described fully at a later date. The classification of the genus Culicoides and related genera in the Ceratopogonidae is still in a state of rapid change, and the total world fauna is very incompletely known, especially in the tropical regions. It is anticipated that the subgeneric classification in Culicoides will undergo additional changes before it is stabilized. In the discussion of the Thailand species which follows the known species are listed in alphabetical order, without respect to subgeneric position. The new species follow the named species in numerical order.

The systematic position of the genus Culicoides and its subgenera is as follows:

Phylum - Arthropoda

Class- Insecta

Order- Diptera

Suborder- Orthorapha

Series- Neantocera

Family- Ceratopogonidae

Subfamily- Ceratopogoninae

Tribe- Culicoidini Kieffer, 1911

Genus- Culicoides

Subgenus- Haemophoructus

Meijerschela

Culicoides

Trithecoides

Hoffmania

Avaritia

Oecacta

Beltranmyia

Monoculicoides

Selfia

Macfiella



Not all of these subgenera have been reported from Thailand, and in fact some of them are known thus far only from the Western Hemisphere. Members of the following subgenera have been found in Thailand during this study- Haemophoructus, Meijerschela, Culicoides and Trithecoides.

Description and discussion of species:

In the following description and discussion of species enough details have been included under the various species to permit identification of the adult males and females wherever possible. In some cases either the male or female was not available for study, and this fact is noted under the species in question. Extended synonymies have not been included, since this is not primarily a taxonomic study, and since much of the world literature was not available for examination.

1. Culicoides (Culicoides) actoni Smith, 1929

(Wing Photograph 1 )

Culicoides actoni Smith, 1929 Ind, Jour. Med. Res. 225

Female - length of wing .817 mm. (n = 3). Head : dark brown. Antenna flagellar segments in the proportion : 27-21-20-21-21-21-22-27-38-39-40-41-65, ratio .807 (n = 3), distal sensory tufts on segments III, XI-XV Palpi brown, segment 3 moderately broad, (twice as long as greatest width) with broad sensory pit on distal portion, segments in proportion-13-43-46-23-16. Mandible with 10-16 small even teeth (n = 3) Thorax\* - scutum, \* scutellum\* and postscutellum\* dark brown; pleuron\* dark brown. Hind tibia with indistinct sub-basal\* pale band, claw single, tibial comb with 5 spines. Wing-General pattern intermediate between Trithecooides species and C. orientalis; dark area over half of first and second radial cells, this area bounded on each side by a light area roughly circular in outline; dark area over transverse center of cell R5, proximal half of M<sub>1</sub> and M<sub>2</sub>, along M<sub>3</sub>-M<sub>4</sub> Cul, in anal cell and from near base of costa to vein R. Wing tip broadly pale. Costa .58 of wing length Walter\* knob pale. Abdomen- dark brown, Two spermathecae, pyriform\*, with short sclerotized neck, opening to duct small, spermathecae .039 by .096 mm.

Male- Not availableDistribution Outside Thailand - IndiaThailand Distribution - Bang Phra, Khao Yai, Petchburi.Discussion- Smith (1929) reported that this species fed on man in India,

\* discussed in Torre - Bueno (1937)

and it was taken while biting man in the present study, at Khao Yai. No males were available for examination or description. At Bang Phra this species was most abundant during July.

Characteristic of female mandibles, spermathecae and palpi the same as C. schultzei.

Culicoides (Trithecoides) albibasis Wirth & Hubert 1959

(Figure 1, Wing Photograph 2)

Culicoides albibasis Wirth & Hubert 1959 Pacific Insects 1 : 31

Female : length of wing .879 m.m. (n = 4). Head : dark brown; eye contiguous; antenna with lengths of flagellar segments in proportion of 36-53-34-36-37-36-36-37-51-49-59-63-91-; antenna ratio.91 (n = 2), distal sensory tufts present on segments XI-XV., Palpi pale brown, segment 3 moderately, sensory pit on distal surface. Palpal segments with lengths in proportion of 10-33-37-17-19, third segment 1.417 times (n = 4) as long as greatest breadth. Mandible teeth 10 (10-11, n = 4), small triangular teeth of subequal lengths. Thorax : scutum yellow, scutellum and postscutellum dark brown; pleuron yellow above, pale brown on lower half. Legs brown, all knees pale with broad pale bands on each side; hind tibia also pale at apex; claws simple. Hind tibial comb with 4 spines. Wing: with 2 pale brown areas on costal margin, one between tip of first and half of second radial cell, other larger area just past end of second radial cell in series brown into tip of wing; dark area along apical half of veins; pale areas over r-m crossvein\* and second radial cell about subequal size; former spot

---

\* discussed in Torre - Bueno (1957).

nearly covering first radial cell and latter covering centered on tip of cell; pale area on proximal half of wing and one pale spot in cubital cell; apex of wing not pale. Costa extending to .70 (n = 4) of distance of wing tip. Halter knob infuscated. Abdomen: yellow, 3 spermathecae, unequal, all of them broader than long, oval, with large unsclerotized entrances to ducts. Large one measuring .026 by .029 mm., and two small ones measuring .016 by .019 mm.

Male - Not available

Distribution outside Thailand: Malaysia, Philippines.

Thailand Distribution: Bang Phra

Discussion: This species was found in February at Bang Phra, in small numbers. Male was not available for description.

Culicoides (Culicoides) amamiensis Tokunaga. 1937

(Figure 2, Wing photograph 3)

Culicoides amamiensis Tokunaga, 1937, Tenthredo 1 (3):325

Culicoides kagiensis Tokunaga 1961, Wirth W.W. & Hubert, Pacific Insects 3 (1):11

Female: length of wing 1.087 mm. (n = 16) Head: dark brown, eye contiguous dorsally; antenna dark brown with lengths of flagellar segments in proportion of 36-34-34-38-40-39-40-43-56-53-63-63-103; antennal ratio .987 (n = 6); distal sensory tufts present on segments III, XI-XV. Palpi dark brown, Segment 3 swollen centrally, distinct sensory pore. Palpal segments with length in proportion of 19-48-72-31-28, third segment 2.769 X (n = 11) as long as greatest breadth. Mandible with 17 (13-21, n = 14) teeth, small, even, triangular teeth.

Thorax: Scutum entirely dark brown with dotted, scutellum and postscutellum dark brown; pleuron dark brown. Legs dark, hind femur dark to apex, tibia with distinct sub-basal and subapical white band; first pairs with sub-basal pale band on tibia and second pairs with knee pale. Wing: with macrotrichia spread over only distal and marginal area, dark area on first and second radial cells slightly darker than rest of wing, white spot at base of wing, over crossvein reaching costa, over half of second radial cell, but third white costal spot separated from costal margin (differ from C. peregrinus Kieffer white spot middle of cell  $M_1$ , near tip of cell  $M_1$ , beneath center of cell  $M_2$ , tip of cell  $M_2$ , nearly almost cell M, above cubital fork, base, middle and tip of anal cell, tip of cell Cu. Costa extending to .67 (n = 16) of distance of wing tip. Halter knob pale. Abdomen: dark brown, 2 spermathecae, pyriform with short sclerotized neck, opening to duct small, measuring .058 by .046 (n = 8) 1.26 as long as greatest breadth.

Male: Not available

Distribution outside Thailand: Ryukyu Island, Japan, Manchuria, Taiwan to India, Indonesia, New Guinea.

Thailand Distribution: Bang Phra, Rajburi, Karnchanaburi, Khao Yai (Nakorn Nayok), Petchburi, Chiangmai.

Discussion: This species has been reported to feed on man and also was collected while biting man to Khao Yai. It was the most abundant species at Bang Phra during June and predominated in the limited catches from Khao Yai and Karnchanaburi.

Culicoides (Trithecooides) anophelis Edwards, 1922

(Figure 4, Wing Photograph 4 )

Culicoides anophelis Edwards, 1922. Bull Ent. Res 13: 161 - 167

Female : Length of wing 1.035 mm. (n = 6). Head : dark brown, eye contiguous dorsally, antenna dark with lengths of flagellar segments in proportion of 34-34-36-36-37-34-34-36-47-44-59-61-97; antenna ratio. 912 (n = 2); distal sensory tufts present on segments III, XI-XV. Palpi dark brown, segment 3 very stout, with sensoria scattered on surface of apical half of segment. Palpal segments with lengths in proportion of 22-23-42-20-25, third segment 1.68 X (n = 6) as long as greatest breadth. Mandible with 15 (13-17, n = 14) teeth, curved teeth, proximal ones largest. Thorax : Scutum, scutellum and postscutellum dark brown; pleurae pale brown. Legs pale brown, fore and mid legs with knee pale and broad apical band on femora and basal band on tibia pale; hind legs with knee dark, tibia with base broadly pale. Tarsal claw bifid on female. Wing : generally with dark streak along veins and moderately pale areas in cells; 2 large very pale yellow spots, one centering on r-m crossvein and other apex of second radial cell, apex of wing narrowly pale. Costa extending to .69 (n=6) of distance of wing tip. Halter knob infuscated. Abdomen : Dark brown, terga poorly sclerotized. 3 spermathecae, sub. equal, measuring .038 by .032 mm., pyriform with short sclerotized neck, entrances to duct small.

Male : Not available.

Distribution Outside Thailand: Malaya, India, Sumatra, Burma, Ceylon, Hong Kong, Indochina, Taiwan, Tonkin, as far as New Britain.

---

\* discussed in Torre - Beuro 1937

Thailand distribution : Bang Phra, Bangkok, Chiangmai.

Discussion : This species is remarkable for its habit of obtaining a second-hand meal of blood by engorging through the stomach wall of Anopheles mosquitoes which are in the act of feeding, or have recently feed on a warm blooded host. C. anophelis was collected in this study while attached to Anopheles splendidus and A. jeyvoriensis candidiensis. It was previously reported attached to A. annulalis, A. nigerinus, A. barbirostris, A. subpictus, A. vagus, A. aconitus, A. maculatus and may attack Culex pipiens fatigans and Mansonioid (Mansonioides) annulifera (Theo.). It was a maximum number at Bang Phra in February and had one of the most common species among Trithecoides Group of Thailand.

Culicoides (Mieforecheles) arakawai (Arakawa), 1943

(Figure 3, Wing Photograph 5)

Culicoides arakawai (Arakawa), 1943. Tokunaga, 1957. Zenthrudo 1 (3):290

Culicoides sugimotoi Shiraki, 1915, Taiwan Sotokufu Moji Shikenjo Tokubetsu Hokoku 3 : 239 (Formosa).

Culicoides daloki Smith and Swaminath, 1932, Ind. Med. Res. Mem. 25:185

Female- Length of wing 1.055 mm. (n = 16). Head : dark brown, eye separated, Antenna dark brown with lengths of flagellar segments in proportion of 33-28-25-29-29-26-28-32-58-63-70-72-94, antenna ratio .649 (n = 6), distal sensory tufts present on segments I-XIV. Palpi dark brown, segment 3 long and moderately swollen, distally with a very broad, shallow, sensory pit. Palpal segments with lengths in proportion of 19-23-71-23-24, third segment 2.37 times (n = 9) as long as greatest breadth. Mandible with 12-14, small, even, triangular teeth.



Thorax : scutum brown, scutellus and postscutellum dark brown, pleuron light brown. Legs dark brown, knee spot dark, pale band at apex of femur and subapical of tibiae. Hind tibial comb with 5 spines. Wing: with distinct circular spots, macrotrichia spread over almost entire surface of wing, small dark area on first and second radial cell, first white costal spot narrow extending from costa over r-m crossvein, 3 round pale spots in cell  $R_5$ , one at extreme wing tip and two just beyond second radial cell, the posterior one separate from vein M1 on distal corner of cell  $R_5$ . Cell  $M_1$ ,  $M_2$  each with two distinct circular spots; anal cell with a double circular spot on distal part and one on proximal part; suffused spots below vein  $M_{1-2}$ , behind arculus and in anal cell. Cubital cell with a distinct circular spot along wing margin. Seven peripheral spots all touching on or at margin of wing; five isolated white spots nearly arranged in a transverse line which extends from costal margin distad of second radial cell to anal margin between ends of cubital cell. Costa extending to .60 (n = 16) of distance of wing tip. Halter knob dark. Abdomen: dark brown, 1 spermatheca, sclerotized, large elongate, measuring .138 by .0678 mm. (n = 10), entrance to duct small.

Male- Head with eye contiguous, wing long and narrow, less fumose than in female, second double costal spot smaller, other white spots larger than in female. Male genitalia with apicolateral process not very broadly separated, rather short and blunt; aedeagus with blunt, flaring enlarged tip, heavily chitinized throughout; parameres fused, with laterally directed basal arm, slender stem and rather stout, simple, laterally bent tip.

Distribution outside Thailand :- Japan to Manchuria, China, Taiwan, Siberia, Indonesia, New Guinea, India.

Thailand distribution :- Bang Phra, Udornthani, Rajburi, Petchburi, Bangkok, Chiangmai.

Discussion This species commonly feeds on domestic fowl and may transmit a varioloid disease of them (Tokunaga 1937). Species predominated in the catches from Udorn and Rajburi. The maximum number occurred at Bang Phra in February.

Culicoides (Culicoides) distinctus Sen. & Das Gupta, 1959

(Figure 5, Wing Photograph 6,7)

Culicoides distinctus Sen. & Das Gupta, 1959. Ann. ent. Soc. Amer. 52:618

Female: Length of wing 1.6777 mm.

Head: dark brown, eye separated; antennae dark brown with lengths of flagellar segments in proportion of 23-23-26-26-26-26-33-43-43-43-39-49; antennae ratio .965 distal sensory tufts present on segments VII, VIII, IX, X. Palpi dark brown, segment 3 swollen above, with a very broad, sensory pit near apex. Palpal segments with lengths in proportion of 16-36-49-16-19, third segment 2.13 X as long as greatest breadth. Mandible with 10 teeth, small, even, triangular teeth.

Thorax : scutum, scutellus and postscutellus dark brown; pleurae dark brown. Legs dark brown, femur with indistinct sub-basal pale band, tibia with sub-basal and subapical pale bands. Wing: with distinct circular spot, macrotrichia spread over most apical half of wing, distinct circular white spot on crossvein, at extreme apex of cell R<sub>5</sub>,

cell M1, M2, in cubital cell, above cubital fork, middle of cell M, 2 transverse white band in anal cell and just beyond second radial cell. Costa extending to .59 of distance of wing tip. Halter knob dark. Abdomen : brown, 2 spermathecae, large one measuring .066 by .043 mm., small one measuring .043 by .029 mm. pyriform with long sclerotized neck, opening to duct small.

Male- Head with eye separated; wing small, no macrotrichia, male hypopygium with ninth tergite very narrow, apicolateral process long and pointed tip; caudomedian margin between them transverse; aedeagus Y-shaped, slender with flaring at tip; paramere slender with bent tip.

Distribution outside Thailand : India

Thailand distribution : Bang Phra.

Discussion This species was known previously only from India. This is a new record for Thailand and was found at Bang Phra in July.

Culicoides (Trithecoides) flavescens Macfie, 1937

(Figure 6, Wing photograph 8 )

Culicoides flavescens Macfie, 1937. Am. Trop. Med. Parasit 1937

51 (4) : 469 - 472.

Female : length of wing 1.393 mm. Head : dark brown, eye contiguous; antennae dark brown with lengths of flagellar segments in proportion of X-39-43-43-46-46-43-46-63-66-73-83-106; distal sensory tufts present on segments XI-XV. Palpi light brown, segment 3 very slender, with sensoria scattered on surface. Palpal segments with lengths in proportion of 13-36-66-23-29, third segment 3.47 X as long as greatest breadth.

Mandible with 20 teeth, apical tooth distinctly larger than teeth in middle of series small and even, triangular, 5-6 proximal teeth in series very sharp and directed distad. Thorax : Scutum entirely pale yellow; scutellum pale brown, postscutellum dark brown; pleuron yellow above, dark brown lower. Legs pale brown, fore and mid legs with knees, distal  $\frac{1}{2}$  of femora and basal  $\frac{1}{2}$  of tibiae pale yellow; hind femur brown with broad subapical pale band; knee dark; hind tibia entirely pale. Hind tibia comb with 4 spines. Wing : with macrotrichia scattered at the margin; 2 dark areas, one between first and second radial cell and another behind the second radial cell in cell  $R_5$ , dark area along vein, pale areas over r-m crossvein and second radial cell very large, latter spot covering second radial cell nearly to base and scarcely extending past apex of cell into cell  $R_5$ ; apex of wing not pale. Costa extending to .75 distance of wing tip. Halter knob pale. Abdomen : yellow, 3 spermathecae, subequal, pyriform, entrances to ducts small and sclerotized a short distance, each measuring .036 by .029 mm. (1.24 as long as greatest breadth)

Male : Not available.

Distribution Outside Thailand: Malaya, North Borneo, Philippines, Sarawak

Thailand distribution : Bang Phra, Bangkok, Chiangmai,

Discussion This species reported to feed on man and cattle. It was first confused with C. anophelis Edwards and was the basis for some erroneous records of C. anophelis biting vertebrates. Macfie recognized it as different in 1937, but called it a variety of C. anophelis.

However, C. flavescens is quite different and is readily recognized

by its distinctive mandibular teeth and entirely yellow scutum.

Only one specimen was found at Bang Phra in February.

Culicoides (Trithecoides) flaviscutatus Wirth & Hubert, 1959

(Figure 7, Wing Photograph 9)

Culicoides flaviscutatus Wirth & Hubert, 1959. Pacific Insects 1 : 34  
Female : Length of wing .662 mm. (n = 3) Head : dark brown, antenna brown with lengths of flagellar segments in proportion of 29-36-43-36-33-33-33-43-46-56-56-73-X; distal sensory tufts present on segments XI-XV. Palpi brown, segment 3 moderate, with scattered sensoria on distal area. Palpal segments with lengths in proportion of 10-33-36-16-20, third segment 2X(n = 3) as long as greatest breadth. Mandible with 12 teeth, (12-13, n = 3), even, triangular teeth. Thorax : Scutum entirely yellow, scutellum and postscutellum dark brown; pleuron pale brown. Legs dark brown, fore legs with knees spot blackish, femur with subapical and tibia with sub-basal broad, pale bands; mid leg with knee pale, apex of femur and base of tibia broadly pale; hind leg with femur all dark, tibia usually with narrow basal and apical pale bands. Claw simple. Hind tibial comb with 5 spines. Wing: anterior margin dark brown with 2 pale spots, one centering over r-m crossvein and other over end of second radial cell; less distinct pale spots also present on tip of wing, base of cell M<sub>1</sub>, in anal cell and in cubital cell, in cell M. Costa extending to .67 of distance of wing tip. Halter knob infuscated. Abdomen : dark brown, 3 spermathecae, large one measuring .036 by .029 mm. and two small ones .021 by .018 mm. unequal with broad, unsclerotized entrances to ducts large one oval.

Male: Not available.

Distribution outside Thailand: North Borneo, Ceylon, India, Malaysia, Philippines, Salawak, Sumatra.

Thailand distribution: Bang Phra, Ban Na Muang, Dansai, Loei, Paiao, Chiengrai, Bangkok, Palau Panjang, Phangnga, Chiengmai.

Discussion: This species is reported to feed on man and deer (Wirth & Hubert 1959) it was confused with C. anophelis Edwards and C. raripalpis Smith in the early literature, but the combination of even mandibular teeth, entirely pale scutum, pale halter and entirely dark hind femur serve to distinguish them from other similar species. Very small number were found in February at Bang Phra.

Culicoides (Culicoides) geminus Macfie, 1937

(Wing Photograph 10)

Culicoides geminus Macfie, 1937. Ann. Trop. Med. Parasit., 31(4):472

Female: length of wing .878 mm. (n = 14). Head: dark brown, eye separated; antenna pale brown with lengths of flagellar segments in proportion of 29-19-19-19-26-23-23-26-33-39-43-46-66; antenna ratio .665 (n = 10), distal sensory tufts present on segments II, III, XI-XV. Palpi pale brown, segment 3 long, swollen centrally; distally with a very broad, shallow sensory pit. Palpal segments with lengths in proportion of 14-36-46-19-20, third segment 1.34 X (n = 9) as long as greatest breadth. Mandible teeth 10 (9-11, n = 9), small, even, triangular teeth, Thorax: Scutum dark brown; scutellum brown, postscutellum dark brown; pleuron light brown. Legs brown, all tibial with indistinct subapical and sub-basal pale bands, claws simple. Hind tibiae comb with 4 spines.

Wing : with macrotrichia spread overmost entire surface of wing, pattern very closely C. arakawai but all pale spots larger. Dark band over second radial cell, base of wing and anal cell pale; with small dark spot on vein  $Cu_1$  and medial cell. First white spot which envelops the cross-vein is rather larger and covers almost the whole of the first radial cell, two pale circular spots just beyond second radial cell, the posterior one at extreme wing tip in cell  $R_5$ ; cell  $M_2$ , and  $M_1$  each with 2 circular pale spots; another spot in cubital cell. Costa extending to .60 (n = 14) of distance of wing tip. Halter knob infuscated. Abdomen : dark brown, 2 spermathecae, ovate with short sclerotized neck; opening to duct small; measuring .042 by .093 mm. (n = 5, 1.27 as long as greatest breadth).

Male : Head with eye separated, with long and narrow, less fumose than in female, second radial cell smaller. Male genitalia with apicolateral processes not very broadly separated rather blunt and long, shallow posterior median cleft; aedeagus with blunt, flaring tip, slender shape; paramere with laterally directed basal arm, slender stem with bent tip.

Distribution outside Thailand : Malaya

Thailand distribution : Bang Phra

Discussion This species has a wing pattern resembling very closely C. arakawai, but it has two spermathecae while C. arakawai has only one. It reached a maximum number from November to February in Bang Phra. Characteristic of female mandibles, spermathecae, and palpi the same as C. schultzei.

Culicoides (Meijereholer) guttifer de Meijere, 1922

(Figure 8, Wing Photograph 11)

Culicoides guttifer de Meijere, Edwards, 1922. Bull. Ent. Res 13 : 163

Culicoides leucostictus Kieffer, Edwards : 1922, Bull. Ent. Res 13 : 163

Female : length of wing 1.057 mm (n = 8) Head : dark brown, eyes very narrowly separated, antenna pale brown with lengths of flagellar segments in proportion of 36-31-51-31-31-31-31-32-61-66-73-72-91; antenna

ratio .699 (n = 4) distal sensory tufts present on segments I-XIV.

Palpi dark brown, segment 3 long and swollen centrally, distally with

a very broad, shallow, sensory pit. Palpal segments with lengths

in proportion of 23-59-64-24-24, third segment 2.064 X (n = 8) as

long as greatest breadth. Mandible with 12(11-14, n = 7) teeth,

small, even, triangular teeth. Thorax: scutum brown, scutellum brown;

postscutellum dark brown. Pleuron as brown as scutum. Legs mainly

dark, first pair with subapical white band on femur and sub-basal

white band on tibia, second pair similarly marked but the femoral

band is less distinct; hind legs all dark except for sub-basal light

band on the tibia. Hind tibial comb with 4 spines, one longest.

Wing : wing with macrotrichia dense over most of wing, dark area over

first and second radial cell; first white costal spot extending from

costa over r-m crossvein and become narrower at crossvein, second

double spots just beyond second radial cell, third costal spot on distal

corner of cell R<sub>5</sub>, another spot just beneath first radial cell; cell

M<sub>1</sub> and cell M<sub>2</sub>, each with two distinct circular spots, anal cell with

small double circular spots; cubital cell with a distinct circular spot

along wing margin,



diffused spots below vein M12, between Cu vein into anal cell, just behind arculus. Costa extending to .62 (n = 8) of distance of wing tip. Halter knob dark. Abdomen : brown, 1 spermatheca, sclerotized, ovate with a very long duct, measuring .11 by .056 mm. (n = 3, 1.26 as long as greatest breadth), opening to duct small.

Male : Head with eyes separated, wing long and narrow; macrotrichia fewer; second double costal spot and white spot beneath first radial cell smaller but others larger than in female. Male genitalia, hypopygium with ninth tergite narrow, straight sides, and deep posterior medial cleft, well developed apicolateral process, very broadly separated; aedeagus lightly chitinized with fairly stout basal arms, distal stem stout and flaring at tip; parameres with large basal knob directed laterad, rather stout and simple, the bent tip without distal fringing spines.

Distribution outside Thailand : Serwang, Malaya, Sumatra.

Thailand distribution: Bang Phra, Bangkok, Rajburi, Chiangmai.

Discussion Wing pattern very close to *C. arakawai* except for one more white spot just beneath first radial cell, which is present only in *guttifer*. It had a new number in January in Bang Phra.

Culicoides (Culicoides) huffi Causey, 1938

(Wing Photograph 12)

Culicoides huffi Causey, 1938. Amer. J. Hyg. 27 : 406

Female : Length of wing .846 mm. Head : dark brown, eye contiguous, antenna pale brown with lengths of flagellar segments in proportion of 23-19-23-23-23-23-29-46-46-46-56-79; antenna ratio .6813,

distal sensory tufts present on segments III, V, VII-X. Palpi dark brown, segment 3 moderately swollen with a very broad, shallow sensory pit on distal end. Palpal segments with lengths in proportion of 9-33-46-13-19, third segment 2 X as long as greatest breadth. Mandible with 10 teeth, small, even, triangular teeth. Thorax : Scutum, scutellum pale brown, postscutellum dark brown. Pleuron light brown. Legs light brown, first and second pairs with subapical pale band on femur and sub-basal pale band on tibiae. Hind legs with femurs dark, indistinct pale band on sub-basal part, tibia with both subbasal and subapical pale bands. Wing : pattern very close to C. geminus, macrotrichia fewer; dark band over second radial cell. White spots at base of wing, base of cell  $R_5$ , tip of cell  $R_5$ , tip of second radial cell, just above mid portion of vein  $M_1$ , near tip of cell  $M_1$ , center of  $M_1$ , tip of  $M_2$ , posterior to base of vein  $M_2$ , above cubital fork and two in anal cell. Coste extending to .56 of distance of wing tip. Abdomen : light brown, 2 spermathecae, pyriform.

Male : Not available.

Thailand distribution : Bang Phra, Bangkok, Chiangmai, Karnchanaburi, Rajburi.

Discussion This species resembles C. similis but differs in having a distinct white spot just above mid portion of vein  $M_1$  and having fewer macrotrichia on wing. A single specimen was found at Bang Phra in December.

Characteristics of female mandibles, spermathecae and palpi the same as C. schultzei

Culicoides (Trithecoides) humeralis Okada, 1941

(Figure 11, Wing Photograph 13)

Culicoides humeralis Okada, 1941. Tokyo Imp. Univ., Jour Coll. gr.

15 : 20

Culicoides raripalpis Smith, var. no. 1, Tokunaga 1940, Tenthredo

3 : 147. Okada, 1942, Nat. Hist. Soc. Formosa, Trans. 32 : 143

Female : Length of wing .884 mm. (n = 2). Head : dark brown, eye contiguous dorsally, antenna brown with lengths of flagellar segments in proportion of 33-39-36-43-46-43-43-49-63-63-66-69-93-; antennal ratio .937; distal sensory tufts present on segments III, XI-XV. Palpi brown, segment 3 moderately swollen, sensoria distally. Palpal segments with lengths in proportion of 19-46-39-16-16, third segment 2.052 as long as greatest breadth. Mandible with 6 (6-7, n = 3), curved teeth, distal one largest. Thorax : Scutum bright yellow with dark brown area on anterior margin, scutellum and postscutellum dark brown; pleuron yellow above, dark brown below. Legs dark brown, base of femur narrowly pale; fore legs with knee dark and broad pale subapical femoral and sub-basal tibial bands; mid leg with distal  $\frac{1}{3}$  of femur and  $\frac{1}{3}$  of tibia yellow, hind femur dark to tip, hind tibia yellow with broad dark band in the middle part. Claws single. Wing : 3 very dark costal areas, second radial cell pale on distal half, wing tip broadly pale. Costa extending to .80 of distance of wing tip. Halter knob pale. Abdomen : Light brown, 3 spermathecae, unequal, with large entrance to ducts; large one measuring .033 by .036 mm., broader than long; 2 small ones each measuring .023 by .026 mm. also broader than long.

Male : Not available.

Distribution outside Thailand: Japan, Malaya, Taiwan, Eastern Siberia.

Thailand distribution : Bang Phra, Ban No Muang, Dansai, Loei, Palau Panjang, Phangnga, Chiangmai, Koo Yai.

Discussion This species was reported to bite man in India and was collected during the study while biting man at Koo Yai. Small number was found in December at Bang Phra.

Culicoides (Culicoides) gedwelfi self., 1961

(Figure 12, Wing Photograph 14 )

Female : Length of wing .929 mm. (n = 13)

Head : dark brown, eye separated; antenna dark brown with lengths of flagellar segments in proportion of 33-27-27-29-29-28-29-31-45-47-51-51-69; antenna ratio .889 (n = 10), distal sensory tufts present on segments II-XV. Palpi dark brown, segment 3 long and swollen, distally with shallow sensory pit. Palpal segments with lengths in proportion of 16-46-57-20-22, third segment 2.035 X (n = 11) as long as greatest breadth. Mandible with 16 (12-16, n = 13) teeth, small, even, triangular teeth. Thorax : Scutum, scutellum and postscutellum dark brown; pleuron brown. Legs dark brown with indistinct sub-basal pale band on all tibia. Claw simple, hind tibia with 4 spines.

Wing : macrotrichia spread over almost entire surface of wing, dark area over second radial cell and half of first radial cell; dark band along veins, middle of cell R<sub>5</sub>, M<sub>1</sub>, M<sub>2</sub>, and anal cell. Other dark band extend from anterior of costa cell to cell R, protuberance in cell M. Costa extending to .62 (n = 13) of distance of wing tip. Halter knob pale.

Abdomen : dark brown, 2 spermathecae, oval with short sclerotized neck, measuring .077 by .051 mm., subequal size, entrance to duct small.

Male- Not available.

Thailand distribution; Bang Phra, Chiengrai.

Discussion This species was first reported in Philippine Islands.

This is the first record of this species of Culicoides for Thailand.

It reached a maximum number in February at Bang Phra.

Culicoides (Culicoides) orientalis Macfie,

(Wing Photograph 15)

Culicoides orientalis Macfie,

Female : Length of wing .909 mm. (n = 7). Head : dark brown, eye contiguous above, antenna dark brown with length of flagellar segments in proportion of 28-24-23-25-25-25-25-27-38-38-42-45-71; antenna ratio .865 (n = 3), distal sensory tufts present on segments III, XI-KV. Palpi dark brown, with lengths of palpal segments in proportion of 41-41-43-26-25, third segment 2.388 X (n = 5) as long as greatest breadth. Mandible with 13 (10-16, n = 8) teeth, small, even, triangular teeth. Thorax : Scutum, scutellum and postscutellum entirely dark brown. Pleuron dark brown. All legs dark brown. Wing : grayish, dark spots over first and second radial cells, and middle of cell R<sub>5</sub>. Confluent light spots at base of wing, on crossvein, over most of second radial cell, large white band at extreme apex of cell R<sub>5</sub> (tip of cell), throughout cell M, M<sub>1</sub>, M<sub>2</sub> and anal cell and in cell Cu. Costa extending to .56 (n = 7) of distance of wing tip. Halter knob pale.

Abdomen : dark brown, 2 spermathecae pyriform, highly chitinized, with short sclerotized neck, opening to duct small; measuring .046 by .037 (n = 2, 1.243 as long as greatest breadth).

Male : Not available.

Thailand distribution : Bang Phra, Bangkok, Trang, Rajburi, Karnchanaburi Petchburi, Chiangmai.

Discussion This species has a wing pattern resembling C. actoni but differ in having area of cell M1 & M2 nearly pale white. No males were available for examination or description. At Bang Phra this species reached maximum numbers in January and February.

Characteristic of female mandibles, spermathecae and palpi the same as C. schultzei.

Culicoides (Trithoeoides) palpifer Das Gupta & Ghosh, 1956

(Figure 15, Wing Photograph 16 )

Culicoides palpifer Das Gupta & Ghosh, 1956. Calcutta Sch. Trop. Med; Bull. 4 : 122

Female : Length of wing .703 mm. (n = 9). Head : dark brown, eyes contiguous dorsally; antenna dark with lengths of flagellar segments in proportion of 28-28-30-34-38-38-36-38-51-49-56-55-82; antennal ratio .9215 (n = 4); distal sensory tufts present on segments III, XI-XV. Palpi dark brown, segment 3 slender, distally with shallow sensory pit. Palpal segments with lengths in proportion of 14-37-57-21-19, third segment 2.59 X (n = 2) as long as greatest breadth. Mandible with 7 (6-8, n = 9), curved teeth, distal ones larger.

Thorax : Scutum yellow, scutellum and postscutellum dark brown; pleuron brown. Legs dark brown, fore-legs with knee spot dark, broad subapical band on femur and sub-basal band on tibia; mid legs with pale knees, broad band at apex of femur and basal of tibia, hind femur dark to apex, tibia with broad dark band in middle, ends pale, Claws simple. Wing: Marked dark area on costal margin, disc quite dark along veins and indistinctly pale areas in cells; 2 very pale spots on costal margin, one centering over r-m crossvein, other on apex of second radial cell, latter variable in size; apex of wing broadly pale. Costa extending to .81 ( n = 9) of distance of wing tip. Halter knob infuscated. Abdomen : Dark brown, 3 spermathecae, unequal, with large entrance to ducts; large one measuring .027 by .027 mm., 2 small ones each measuring .023 by .023 mm.

Male : Not available.

Distribution Outside Thailand : India, Malaya, North Borneo, Philippines, Sarawak, Sumatra, Taiwan.

Thailand distribution : Bang Phra, Bangkok, Chiangmai, Palau Panjang, Phangnga, Koksato, Donsai, Joci, DanWa Kuang, Karnchanaburi.

Discussion This species was one of the most common species among Trithecoides Group of Thailand and has a maximum number during February at Bang Phra.

Calicoides (Trithecoides) paraflavescens Wirth & Hubert, 1959

(Figure 16, Wing Photograph 17 )

Calicoides paraflavescens Wirth & Hubert, 1959. Pacific insects: 1 : 15

Female : length of wing 1.051 mm. (n = 9) Head : dark brown, eyes separated; antenna pale brown with lengths of flagellar segments in proportion of 39-40-42-44-45-44-44-45-62-61-76-51-121; antennal ratio .855 (n = 6), distal sensory tufts present on segments III, XI-XV. Palpi pale brown, segment slender with sensoria scattered on surface of apical half. Palpal segments with lengths in proportion of 20-43-48-20-24, third segment 2.28 x (n = 4) as long greatest breadth. Mandible teeth 24, apical tooth distinctly larger and separated from second, distal teeth of series large, decreasing in size to smaller, even, triangular teeth, 4-5 proximal teeth in series very sharp and directed distad. Thorax : scutum yellow, with dark brown area on anterior margin; scutellum and postscutellum dark brown; pleuron yellow above, dark brown on lower  $\frac{1}{2}$ ; Legs pale brown, fore and mid legs with knees, distal  $\frac{1}{2}$  of femur and basal  $\frac{1}{2}$  of tibia pale yellow, hind femur brown with broad subapical pale band, knee dark, hind tibia entirely pale; claws simple. Hind tibial comb with 4 spines. Wing : with 2 dark brown areas on costal margin, one between first and second radial cell; another larger area just past end of second radial cell, cell R5 posterior to the latter distinctly infuscated across to vein M1; dark area along entire veins; pale areas over r-m crossvein and second radial cell moderately large, former spot covering about  $\frac{1}{2}$  of first radial cell and latter covering second radial cell nearly to base; pale area in anal, in cubital and median cell. Costa extending to .70 (n = 9) of distance of wing tip. Halter knob pale. Abdomen : yellow, 3 spermathecae, subequal, pyriform with short sclerotized neck, entrance to duct small, each measuring .036 by .026 mm. (1.33 as long as greatest breadth).



Male : Not available.

Distribution Outside Thailand: Ceylon.

Thailand distribution: Bang Phra.

Discussion Similar to C. anopalis and C. palpifer, it was one of the most common species among the Trithacoidea group of Thailand Culicoides. It resembles C. flavescens, but differs in having dark brown area on the anterior margin of scutum while flavescens has scutum entirely yellow. This species has a maximum number in February, with C. anopalis and C. palpifer, at Bang Phra.

Culicoides (Culicoides) poliliuensis Tokunaga, 1937

(Wing Photograph 18 )

Culicoides poliliuensis Tokunaga, 1937. Tenthredo 1(3) : 305

Female : Length of wing .982 mm. (n = 9) Head : dark brown, eyes narrowly separated; antenna with lengths of flagellar segments in proportion of 25-26-25-26-26-26-27-42-44-47-48-69; antennal ratio .854 (n = 8), distal sensory tufts present on segments II-XV. Palpi pale brown, segment 3 moderately; sensoria small on distal part; palpal segments with lengths in proportion of 20-49-60-22-26-, third segment 2.40 X (n = 10) as long as greatest breadth. Mandible with 12(10-14, n = 8) teeth, small, triangular teeth of subequal size. Thorax : Scutum, scutellum and postscutellum dark brown; pleuron brown. Legs dark brown, first pairs with indistinct sub-basal and subapical pale band on tibia; hind femur dark, tibia with broad indistinct subapical and subdistal pale band, claw simple. Hind tibial comb with 4 spines

Wing : with macrotrichia spread over more than half of apical tip of wing; white spots very large; all dark bands nearly arranged in a transverse line, which include; dark band in the middle of cell R and in anal cell; dark band between first and second radial cell, joined with the one at base of pedicel fork and along vein Cu 1 ; dark band in the middle of cell R<sub>5</sub>, middle of cell M<sub>1</sub>, middle of cell M<sub>2</sub> and along vein R<sub>3-4</sub>, another dark band near base of vein Cu<sub>1</sub> . Apex of wing broadly pale. Costa extending to .61 (n = 9) of distance of wing tip. Halter knob pale. Abdomen : brown, 2 spermathecae, unequal, pyriform with sclerotized neck, entrances to ducts small, measuring .046 by .039 (n = 5, 1.179 as long as greatest breadth)

Male : Not available.

Distribution Outside Thailand: Japan, Micronesia, Palau.

Thailand distribution : Bang Phra, Prachuabkirikarn.

Discussion : This species was first reported from Japan, and the present record is the first for Thailand. The species bites man, and reached its maximum numbers at Bang Phra in July.

Characteristic of female mandibles, spermathecae and palpi the same as C. mcDowelli.

Culicoides (Culicoides) peregrinus Kieffer, 1910

(Figure 17, Wing Photograph 19 )

Culicoides peregrinus Kieffer, 1910. Mem. Ind. Mus. 2; no.4, 186 - 194

Culicoides philippinensis Kieffer, 1921, Philippine Jour. Sci. 13 :564.

Female : Length of wing 1.095 mm. (n = 13). Head : dark brown, eye

contiguous dorsally, antenna dark brown with length of flagellar segments in proportion of 34-30-31-32-34-34-33-35-34-54-58-68-96; antenna ratio .806 (n = 4), distal sensory tufts present on segments III, XI-XV. Palpi dark brown, third segment slightly swollen posterior to sensory pit. Palpal segments with lengths in proportion of 16-54-67-24-29, third segment 2.576 X (n = 11 as long as greatest breadth) Mandible with 13 (11-15, n = 11) small and equal teeth. Thorax: scutum, scutellum and postscutellum entirely dark brown; pleuron dark brown. Legs dark, knee pale, hind tibiae with subapical pale band. Wing: dark area on first and second radial cells slightly darker than rest of wing, white spots at base of wing, over crossvein reaching costa, over most of second radial cell, near tip of cell  $R_5$ , middle of cell  $M_1$ , near tip of cell  $M_1$ , tip of cell  $M_2$ , beneath center of vein  $M_2$ , above cubital fork, posterior to base of vein  $M_2$ , base of cell Cu, tip of cell Cu, base, middle and tip of anal cell. Costa extending to .63 (n = 13) of distance of wing tip. Halter knob infuscated. Abdomen: dark brown, 2 spermathecae, heavily chitinized, pyriform, measuring .055 by .04 (n = 9), 1.375 as long as greatest breadth.

Male: Coloration as in female, wing with some pale spots broader than wing of female. Male hypopygium with terminal portion of the aedeagus long and tapering. Verges stout, with basal spine, tip with tuft of hairs near apex.

Distribution outside Thailand: Japan, Malaya, Sumatra, Assam, India to New Guinea, Indonesia, Taiwan.

Thailand Distribution: This species occurs in greater abundance and is more widely distributed than any other species of Culicoides of

Siam. Found in Bang Phra, Udonthani, Rajburi, Petchburi, Bangkok, Chienghai,

Discussion This was the most abundant species through most of the year at Bang Phra except during June. The writer noticed that there were no G. peregrinus in the light traps from Prachubkirikarn and Karnchanaburi; while it was very rare at Udonthani.

Dr. N. Annandale reported that this species bit human beings at Balugon in Orissa.

Culicoides (Culicoides) recurvus Deffinals, 1961

(Wing Photograph 20)

Female : Length of wing 1.006 mm. (n = 11). Head : dark brown, eye separated; antenna pale brown with lengths of flagellar segments in proportion of 31-26-29-30-32-30-32-35-48-50-54-63-90; antennal ratio .924 (n = 5), distal sensory tufts present on segments III, V, IX, XI-XV. Palpi dark brown, segment 3 long and moderately swollen, distally with a very broad, sensory pit. Palpal segments with length in proportion of 18-45-58-24-22, third segment 2.416 X (n = 10) as long as greatest breadth. Mandible teeth 13(10-15, n = 9), small, even, triangular teeth. Thorax; Scutum, scutellum and postscutellum dark brown; pleurae brown. Legs mainly dark; first and second pairs with sub-basal pale band on tibiae and hind tibiae with both sub-basal and subapical pale bands. Hind tibial comb with 6 spines; one longest. Wing: with dark area on first and second radial cell and middle of cell  $R_5$  slightly darker than rest of wing; wing base white with an obscure dark spot on Cul in this white area; first white spot covering

r-m crossvein, elongated, constricted at middle at radial vein; second spot covering distal half of second radial cell, convex on outer margin; third spot rarely separated from costal margin; white stripes along vein  $M_1$ . Cell  $M_1$ , and  $M_2$ , each with 2 white spots, the first two at tip of cell separated but others very closely just separated by vein  $M_2$ ; another white spot in front of median fork, above cubital fork, circular spot in cubital cell and two in anal cell. Costa extending to .62 (n = 11) of distance of wing tip. Halter knob pale. Abdomen: dark brown, 2 spermathecae, pyriform with short sclerotized neck, and with a rudimentary; each measuring .046 by .035 (n = 4, ratio 1.31 as long as greatest breadth), opening to duct small.

Male: Not available.

Distribution outside Thailand: Philippines.

Thailand distribution: Bang Phra, Bangkok.

Discussion: This species also is a new record for Thailand Culicoides. It was first described from the Philippines. It resembles C. peregrinus but differs in having only one white spot in the Cubital cell while C. peregrinus has two. It was at maximum number in December at Bang Phra.

Characteristic of female mandibles, spermathecae and palpi the same as C. mcdowelli.

Culicoides (Culicoides) schultzei Enderlein, 1908

(Figure 13, Wing Photograph 21)

Culicoides schultzei Enderlein, 1908. Denkschr. Med.-naturw. Ver. Jena 13:459

Culicoides oxystoma Kieffer, 1910, Ind. Mus., Res. 2:193 (Calcutta)

Female: length of wing .906 (n = 12) Head: dark brown, eyes narrowly

separated; antenna pale with lengths of flagellar segments in proportion of 30-26-25-25-25-26-26-28-36-36-39-45-66; antennal ratio .9 (n = 6); distal sensory tufts present on segments III, VIII-X. Palpi pale; second and third segment of about equal length, third segment swollen centrally. Palpal segments with length in proportion of 13-45-46-21-22, third segment 1.916 (n = 4) as long as greatest breadth, Mandible with 12 (11-13, n = 8) teeth, small, even triangular teeth. Thorax : Scutum, scutellum and postscutellum dark brown; pleurae dark brown. Legs dark brown, femora with indistinct sub-basal pale bands first and second pairs with also subapical pale band. Tibia with sub-basal, hind tibia with very broad subapical pale band. Wing : with numerous distinct pale spots, including in cell  $R_5$ , a double, transverse distal one and a small round one between this and poststigmatic pale spot, wing without pale spot at extreme apex of cell  $R_5$ , white spots at middle of cell R, middle of cell M, near tip of cell M1, tip of cell M2, above cubital fork, transverse cell Cu, tip of anal cell and middle of anal cell. Costa extending to .54 of distance of wing tip. Halter knob infuscated. Abdomen : dark brown, 2 spermathecae plus a rudimentary; measuring .048 by .08 (n = 4, 1.2 as long as greatest breadth.)

Male : wing with some white spots larger than in female; aedeagus with broad tip, paramere slender with sinuate stem and tip with very fine fringing hairs, apicolateral processes long and closely approximated.

Distribution outside Thailand : Africa, Asia to Iraq, W. Pakistan, Ussuri Land, Japan, Ceylon, Indonesia, New Guinea, Taiwan.



Thailand distribution : Bang Phra, Nakhon Phanburi, Rajburi, Bangkok, Chiangmai.

Discussion This species had a maximum number in August, at Bang Phra.

Culicoides (Culicoides) shortti Smith & Swaminath, 1932

(Wing Photograph 22 )

Culicoides shortti Smith & Swaminath, 1932. Indian Med. Res. Mem. 25 : 182 - 186.

Female : Length of wing .824 mm. (n = 6) Head : Light brown, eye separated, antenna light brown with lengths of flagellus segments in proportion of 28-24-25-26-25-26-26-26-36-35-38-43-62; antennal ratio .962 (n = 3), distal sensory tufts present on segments III, VIII-X. Palpi very dark brown, third segment swollen centrally. Palpal segments with length in proportion of 11-39-54-17-19, third segment 2.571 X (n = 2) as long as greatest breadth. Mandible with 13 (12-15, n = 5), teeth, small, even, triangular teeth. Thorax : Scutum, scutellum and postscutellum entirely dark brown; pleuron dark brown. Legs pale, femur and tibiae with sub-basal and subapical pale band except hind femur with only sub-basal pale band, tibiae with very broad subapical pale band. Hind tibial comb with 5 spines. Wing : with dark area over second radial cell, white spots at base of wing, over crossvein, tip and below second radial cell, central and tip of cell R<sub>5</sub>, two spots in cell M<sub>1</sub>, two in cell M<sub>2</sub>, two in cell K, one in cell Cu and three in anal cell. Costa extending to .56 (n = 6) of distance of wing tip. Halter knob dark. Abdomen : pale brown, 2 spermathecae, pyriform with short sclerotized neck, opening to duct small, measuring .037 by .031 (n = 2, 1.193 as long as greatest breadth).

Male: Most available.

Distribution outside Thailand: Assam, India.

Thailand distribution: Bang Phra, Chiangmai, Bangkok, Rajburi, Karnchanaburi, Petchburi, Chiangmai.

Discussion: This man biting species was first described from India. It was found small numbers at Bang Phra on December and predominated in the catches from Petchburi.

Characteristics of female mandibles, spermathecae and palpi the same as C. schultzei.

Culicoides (Culicoides) similis Macfie, 1932

(Figure 19, Wing Photograph 23)

Culicoides similis Macfie, 1932. Ann. and Mag. of Nat. Hist., Series 10, 9: 485-499

Female: length of wing .949 mm. Head: dark brown, eyes narrowly separated, antenna dark with lengths of flagella segments in proportion of X-X-19-23-26-23-23-26-46-43-49-53-83; distal sensory tufts present on segments V, VII-XIII. Palpi dark brown, segment 3 with deep sensory pit. Palpal segments with lengths in proportion of 16-23-49-16-26, third segment 1.807 as long as greatest breadth. Mandible with 10 teeth, small, even, triangular teeth. Thorax: Scutum entirely dark brown with dotted, scutellum and postscutellum brown; pleuron light brown. Legs brown, knee black, tibia with sub-basal light bands, first pairs, femur with subapical and tibia with sub-basal pale band. Wing: with macrotrichia spread over most of wing, distinct dark area on first and second radial cells. White spots over crossvein, at tip



of second radial cell, small round one beneath the latter and center of cell R<sub>5</sub>, extreme apex of cell R<sub>5</sub>, tip of cell M<sub>2</sub>, on mid point of vein M<sub>2</sub>, in cell Cu, above cubital fork, 2 in anal cell, and 2 in cell X. Costa extending to .55 of distance of wing tip. Halter knob infuscated. Abdomen : Light brown, 2 spermathecae, pyriform with short sclerotized neck, entranced to duct cell, spermathecae measuring .066 by .036 (1.855 as long as greatest breadth).

Male : Not available.

Distribution Outside Thailand: This species was originally described from the Gold Coast, Africa and later found in India.

Thailand Distribution : Bangkok, Chiangmai.

Discussion This species was first described from India, It was reported to feed on cattle

Culicoides sp.1 (Hemiotherectus)

(Figure 9 & 10, Jing Photograph 24, 25 )

Female : Length of wing 1.285 mm. (n = 15) Head : dark brown, eyes contiguous dorsally, antenna dark brown with length of flagellar segments in proportion of 44-46-46-47-47-46-45-46-75-82-89-99-133, antennal ratio .770 (n = 6), distal sensory tufts present on segments III-XV. Palpi dark and long, third segment longest and not swollen, with sensory tuft. Palpal segments with lengths in proportion of 19-72-102-38-50, third segment 4.08 X (n = 10) as long as greatest breadth. Mandible with 14 (12-17, n = 13) teeth, large and equal. Thorax : scutum, scutellus and postscutellus entirely very dark brown;

pleuron pale brown. Legs dark brown; first pair with sub-basal pale band on femur and tibia, second and hind pairs with sub-basal and subapical pale band, hind femur dark to apex. Wings with dark area over half of radial cell (only one radial cell present), middle of cell  $R_5$ . White spot at base of wing, on crossvein, half of radial cell, transverse distal white spot near tip of cell  $R_5$  but not extending to near apex of cell  $R_5$ , throughout cell  $M$ , middle of cell  $M_1$  throughout middle of cell  $M_2$ , tip of cell  $M_1$ , tip of cell  $M_2$ , almost throughout anal cell (two white spots in anal cell), throughout cell  $Cu$ . Costa extending to  $.74$  ( $n = 15$ ) of distance of wing tip. Halter knob pale. Abdomen : dark brown, 2 spermathecae, pyriform, highly chitinized measuring  $.051$  by  $.041$  mm. ( $n = 11$ ,  $1.243$  as long as greatest breadth).

Male : Head : dark brown, eye narrowly separated; antennae brown with lengths of flagellar segments in proportion of 103-49-49-49-49-49-49-49-49-139-133-139; distal sensory tufts present on segments II-XIII, Palpi dark brown, segment 3 moderate, sensory scattered on distal surface. Palpal segments with lengths in proportion of 16-49-73-29-36; third segment  $4.562$  as long as greatest breadth. Thorax : Scutum, scutellum and postscutellum dark brown; pleuron pale brown. Legs mainly dark brown with indistinct sub-basal pale bands on tibiae, Hind tibial comb with 5 spines. Wing : very long and narrow, with two radial cells which differs from females of some species in this group: distinct venation. Dark band arranged in 4 stripes across wing which include ; dark band at wing tip; at apex of second radial cell and middle of cell  $M_1$  and  $M_2$ ; dark band between first and second radial cell to cell  $R_5$ ,

at median fork to cubital fork; dark band at middle of costal cell to middle of anal cell. Costa extending to .70 of distance of wing tip. Abdomen : dark brown. Male hypopygium with ninth tergite broad, slope sides and deep posterior medial cleft; aedeagus heavily chitinized, slender with laterally basal arm, stem stout with bent tip.

Thailand distribution : Bang Phra.

Discussion : This species is a new record of Thailand with a remarkable pattern of wing, all females have only one radial cell while there are two in male. The maximum number occurred in October at Bang Phra.

Culicoides.sp. 2 (Culicoides)

(Figure 13, Wing Photograph 26 )

Male : Length of wing .963 mm. Head : dark brown, eyes separated; antenna pale brown with lengths of flagellar segments in proportion of 66-39-33-36-39-59-36-36-36-56-99-79-56. Palpi pale brown and very small, segment 3 slender, with a very broad, sensory pit, near apex. Palpal segments with lengths in proportion of 9-49-29-19-29. Wing : pattern like C. orientalis but dark band between first and second radial cell, and second radial cell smaller than C. orientalis; dark band over first and second radial cells, middle of cell R5. Confluent light spots at base of wing, on cross vein, over costae second radial cell to middle of cell R5, behind dark band to apex of cell R5; throughout cell R, R<sub>1</sub>, R<sub>2</sub>, anal cell and in cell Cu. Costa extending to .54 of distance of wing tip. Abdomen : Light brown, male hypopygium with ninth tergite short and broad, apicolateral process well developed with posterior curved side;

aedeagus Y-shaped, chitinized at base, curved tip; paramere with large basal knob pointed laterad, stout with nearly straight, unchitinized pointed tip.

Female : Not available.

Thailand distribution : Bang Phra

Discussion : only single male specimen was found at Bang Phra in September.

Culicoides sp. 3 (Culicoides)

(Figure 14, Wing Photograph 27 )

Male : length of wing .361 mm. Head : dark brown, eye separated; palpi dark brown, segment 3 slender, distally with shallow sensory pit. antenna pale brown. Thorax : Scutum, scutellum and postellum dark brown; pleuron pale brown. Legs pale brown, all knees dark, tibiae with indistinct sub-basal pale band. Wing : pattern like C. McDowellii Delf. but no macrotrichia over surface of wing, dark area over second radial cell and half of first radial cell; dark band along veins, middle of cell  $R_5$ ,  $M_1$ ,  $M_2$  and anal cell and other dark band extends from anterior of costa cell to cell 2, protuberance in cell 11. Costa extending to .97 distance of wing tip. Halter knob pale.

Abdomen : dark brown; male hypopygium with ninth tergite narrow, curved sides with deep posterior medial cleft and well developed apicolateral process; aedeagus lightly chitinized at base, V-shaped very stout with large blunt tip; parameres with large basal knob directed laterad, stout with unchitinized tip.

Female : Not available.

Thailand Distribution : Bang Phra

Discussion Only a single male specimen was found at Bang Phra in January.



9. White costal spot separated from costal margin... C. anamiensis.  
 With whole white area at costal margin..... 10
10. White spot behind second radial cell emerge beneath the  
 second radial cell ..... 13  
 No emerge of white spot under the second  
 radial cell ..... 11
11. Second radial cell much reduced ..... Culicoides sp. 2  
 Second radial cell simple ..... 12
12. Area of cell  $M_1$  &  $M_2$  nearly pale white ..... C. orientalis.  
 Area of cell  $M_1$  &  $M_2$  dark with white spot  
 at apex ..... C. actoni.
13. 3 white spots in cell  $R_5$  ..... 14  
 2 white spots in cell  $R_5$  ..... 15
14. One white spot at apex of cell  $R_5$ ..... C. shortti.  
 Not as above..... C. schultzei.
15. No macrotrichia on wing ..... Culicoides sp. 3  
 With numerous macrotrichia spread over the wing..16
16. With dark bands along the side of vein  $M_1$  &  $M_2$ .. C. redwelli.  
 No dark band along the side of vein  $M_1$  &  $M_2$ ... C. pellicouensis.
17. Scutum uniform yellow ..... 20  
 Scutum yellow with dark brown at anterior margin..18
18. Mandible with 7 teeth only ..... C. hugaralis.  
 Mandible with more than 10. teeth ..... 19
19. Mandible with 19 - 23 teeth, apical teeth larger.. C. paraflavescens.  
 Mandible with 12 - 15 teeth, proximal teeth larger  
 ..... C. anophelis.

20. Mandible with more than 20 teeth..... C. flavescens.  
 Mandible with 15 teeth or fewer ..... 21
21. Mandible with only 7 curved teeth..... C. palpifer.  
 Mandible with more than 7 teeth (mostly 10)..22
22. Hind femur entirely dark..... C. flaviscutatus.  
 Hind femur with distal pale band..... C. albibasis.

Remarks

1. The two species of the C. gymnortus group are new species of uncertain status. All female have only one radial cell while there are two radial cells in the male.

2. C. geninus will run in this key to C. arakawai. The white spots on the wing are a little larger in C. geninus than in C. arakawai.