Zootaxa 5357 (1): 139–143
https://www.mapress.com/zt/

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ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)
https://doi.org/10.11646/zootaxa.5357.1.7
http://zoobank.org/urn:lsid:zoobank.org:pub:D294ECD4-7EFC-4A3B-BE39-203AB404AF3E

Problematic placement of species in subgenera of the genus *Topomyia* (Diptera: Culicidae: Sabethini) based on the length of foretarsomeres 2 and 3

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Topomyia Leicester, 1908 (Culicidae: Culicinae: Sabethini) includes 68 species – two without subgeneric placement and the others divided between three subgenera: *Miyagiella* Harbach, 2014 (in Harbach & Culverwell 2014) (1 species), *Suaymyia* Thurman, 1959 (21 species) and *Topomyia sensu stricto* (44 species) (Harbach 2023). Adults of the genus have a median longitudinal stripe of broad white or silver (occasionally brownish) scales on the scutum. This character is also present in species of two other genera of Sabethini, *i.e. Kimia* Vu Duc Huong & Harbach, 2007 (in Harbach *et al*. 2007) and *Malaya* Leicester, 1908. Species of *Topomyia* are mainly recorded from southeastern and southern areas of the Oriental Region. Two species (one described and one undescribed) are known from the Australasian Region (New Guinea) (Lee *et al*. 1988) and one species is found in the Palaearctic Region (Ryukyu Archipelago) (Tanaka *et al*. 1979).

The separation of *Topomyia* into subgenera is based primarily on features of the genitalia and forelegs of males (Thurman 1959): males of the subgenus *Topomyia* have foretarsomere 2 (Ta-I_2) equally long or shorter than foretarsomere 3 (Ta-I_3), whereas males of the subgenera *Miyagiella* and *Suaymyia* have Ta-I_2 longer than Ta-I_3 (Harbach & Culverwell 2014). Although Thurman (1959) determined that the foretarsomeres were only useful for separating males, Rattanarithikul *et al*. (2007) separated "adults" of the genera *Kimia* and *Topomyia*, and the subgenera *Topomyia* and *Suaymyia*, based on the relative lengths of Ta-I_2 and Ta-I_3: species of the subgenus *Topomyia* with Ta-I_2 shorter than Ta-I_3 and those of species of *Kimia* and *Suaymyia* with Ta-I_2 as long or longer than Ta-I_3. To determine whether the use of the length of Ta-I_2 relative to the length of Ta-I_3 is a reliable subgeneric character for both males and females, we collected and analyzed information about the foretarsomeres of species of the subgenera *Topomyia* and *Suaymyia* and the genus *Kimia* from published descriptions, including specimens of *To. inclinata* Thurman, 1959 and *To. lindsayi* Thurman, 1959, which we collected on Doi Inthanon (mountain) in Chiang Mai Province of Thailand during the present study. The accumulated data showed that in nine of the 21 species of *Suaymyia*, *To. apsarae* Klein, 1977, *To. argenteoventralis* Leicester, 1908, *To. auriceps* Brug, 1939, *To. cristata* Thurman, 1959, *To. houghtoni* Feng, 1941, *To. leucotarsis* Thurman, 1959, *To. pseudoleucotarsis* Thurman, 1959, *To. puehensis* Miyagi, Toma & Okazawa, 2022 (in Miyagi *et al*. 2022) and *To. spinophallus* Zhou, Zhu & Lu, 1999, as well as females of *To. apsarae* and *To. puehensis*, have Ta-I_2 longer than Ta-I_3. Unfortunately, the length of the two foretarsomeres is not known or described for males of the other 12 species nor the females of the other 19 species. Males of two of the five species of *Kimia*, *Km. decorabilis* (Leicester, 1908) and *Km. imitata* (Baisas, 1946), have Ta-I_2 longer than Ta-I_3, but this is not known or described in the females of the genus. Therefore, there is no reason at this stage to discount that adults of *Suaymyia* and *Kimia* have Ta-I_2 longer than Ta-I_3 until the relative lengths of the foretarsomeres of the other species are known. However, of the 44 species of the subgenus *Topomyia* (Table 1), only four species, *To. aliyusopi* Miyagi & Toma, 2014 (in Miyagi *et al*. 2014), *To. longisetosa* Gong, 1994, *To. vijayae* Ramalingam, 1975 and *To. zhangi* Gong, 1991 have Ta-I_2 shorter than Ta-I_3 in both sexes, whereas 19 species have Ta-I_2 shorter than Ta-I_3 in males (females unknown); thus, there is no disagreement with Thurman (1959) and Rattanarithikul *et al*. (2007) so far. Both sexes of one species, *To. aenea* Thurman,1959, have Ta-I_2 as long as Ta-I_3, and one species, *To. chaii*, 2012 (in Miyagi *et al*. 2012), has Ta-I_2 as long as or shorter than Ta-I_3. Thurman (1959) placed species with Ta-I_2 and Ta-I_3 of equal length in the subgenus *Topomyia* whereas Rattanarithikul *et al*. (2007) placed species with these tarsomeres of equal length in either the subgenus *Suaymyia* or the genus *Kimia.* More importantly, five species, *To. angkoris* Klein, 1977, *To.*

Accepted by K. Moulton: 21 Sept. 2023; published: 17 Oct. 2023

baolini Gong, 1989b, *To. bifurcata* Dong, Wang & Lu, 1995, *To. nicksoni* Miyagi & Toma, 2012 (in Miyagi *et al*. 2012) and *To. sylvatica* Lu, Dong & Wang, 1986 have Ta-I_2 longer than Ta-I_3 in males; the females of three of these species, *To. angkoris*, *To. baolini* and *To. nicksoni*, have Ta-I_2 longer than Ta-I_3 as in the males, disagreeing with both Thurman (1959) and Rattanarithikul *et al*. (2007). Five species, *To. inclinata*, *To. lindsayi*, *To. margina* Gong & Lu, 1995, *To. murudensis* Miyagi, Toma & Okazawa, 2021 (in Miyagi *et al*. 2021a) and *To. sarawakensis* Miyagi, Toma & Okazawa, 2021 (in Miyagi *et al*. 2021b) have Ta-I_2 shorter than Ta-I_3 in males, but this is the opposite in females, disagreeing with Rattanarithikul *et al*. (2007). The lengths of the foretarsomeres are not known in eight species of the subgenus *Topomyia*. It should be noted that Rattanarithikul *et al*. (2007) described the adults of *To. angkoris* as having Ta-I_2 shorter than Ta-I_3, contrary to Klein (1977), who originally described this species as having Ta-I_2 longer than Ta-I_3 in both sexes.

TABLE 1. Length of foretarsomere 2 (Ta-I_2) relative to the length of foretarsomere 3 (Ta-I_3) of males and females of species of the subgenus *Topomyia* of the genus *Topomyia.* For dates of authorship of the species, see the references listed in the table. < = shorter than; > = longer than; ? = information not available.

Species	Male	Female	Reference
aenea Thurman	Ta-I_2 = Ta-I_3	Ta2 = Ta-I_3	Thurman (1959)
aliyusopi Miyagi & Toma	Ta-I_2 < Ta-I_3	Ta-I_2 < Ta-I_3	Miyagi *et al*. (2014)
angkoris Klein	Ta-I_2 > Ta-I_3	Ta-I_2 > Ta-I_3	Klein (1977)
argyropalpis Leicester	Ta-I_2 < Ta-I_3	?	Leicester (1908)
aureoventer (Theobald)	?	?	Theobald (1910)
baolini Gong	Ta-I_2 > Ta-I_3	Ta-I_2 > Ta-I_3	Gong (1989b)
barbus Baisas	Ta-I_2 < Ta-I_3	?	Baisas (1946)
bifurcata Dong, Wang & Lu	Ta-I_2 > Ta-I_3	?	Dong *et al*. (1995)
cabrerai Miyagi, Toma & Rivera	?	?	Miyagi *et al*. (1983)
chaii Miyagi & Toma	Ta-I_2 = Ta-I_3 or Ta-I_2 < Ta-I_3	Ta-I_2 = Ta-I_3 or Ta-I_2 < Ta-I_3	Miyagi *et al*. (2012)
danaraji Ramalingam	?	?	Ramalingam (1988)
dejesusi Baisas & Feliciano	Ta-I_2 < Ta-I_3	?	Baisas & Feliciano (1953)
dubitans Leicester	Ta-I_2 < Ta-I_3	?	Leicester (1908)
gracilis Leicester	Ta-I_2 < Ta-I_3	?	Leicester (1908)
hardini Miyagi, Toma & Ramalingam	?	?	Miyagi *et al*. (1989)
hernandoi Baisas & Feliciano	Ta-I_2 < Ta-I_3	?	Baisas & Feliciano (1953)
hirtusa Gong	Ta-I_2 < Ta-I_3	?	Gong (1989a)
inclinata Thurman	Ta-I_2 < Ta-I_3	Ta-I_2 > Ta-I_3	Thurman (1959) and present study
irianensis Miyagi & Toma	?	?	Miyagi & Toma (1997)
javaensis Miyagi & Toma	?	?	Miyagi & Toma (1995)
katibasensis Miyagi & Toma	Ta-I_2 < Ta-I_3	?	Miyagi *et al*. (2012)
lindsayi Thurman	Ta-I_2 < Ta-I_3	Ta-I_2 > Ta-I_3	Thurman (1959) and present study
longisetosa Gong	Ta-I_2 < Ta-I_3	Ta-I_2 < Ta-I_3	Gong (1994)
malaysiensis Ramalingam & Banu	?	?	Ramalingam & Banu (1987)
margina Gong & Lu	Ta-I_2 < Ta-I_3	Ta-I_2 > Ta-I_3	Gong & Lu (1995)
minor Leicester	Ta-I_2 < Ta-I_3	NA	Leicester (1908)
murudensis Miyagi, Toma & Okazawa	Ta-I_2 < Ta-I_3	Ta-I_2 > Ta-I_3	Miyagi *et al*. (2021a)
nicksoni Miyagi & Toma	Ta-I_2 > Ta-I_3	Ta-I_2 > Ta-I_3	Miyagi *et al*. (2012)
nigra Leicester	Ta-I_2 < Ta-I_3	?	Leicester (1908)
pilosa Brug	Ta-I_2 < Ta-I_3	?	Brug (1931)
pseudobarbus Baisas	Ta-I_2 < Ta-I_3	?	Baisas (1946)

...Continued on the next page

TABLE 1. (Continued)

Species	Male	Female	Reference
rubithoracis Leicester, 1908	Ta-I_2 < Ta-I_3	?	Leicester (1908)
sabahensis Ramalingam & Ramakrishna	?	?	Ramalingam & Ramakrishna, (1988)
sarawakensis Miyagi, Toma & Okazawa	Ta-I_2 < Ta-I_3	Ta-I_2 > Ta-I_3	Miyagi *et al*. (2021b)
svastii Thurman	Ta-I_2 < Ta-I_3	?	Thurman (1959)
sylvatica Lu, Dong & Wang	Ta-I_2 > Ta-I_3	?	Lu *et al*. (1986)
tenuis Edwards	Ta-I_2 < Ta-I_3	?	Edwards (1922)
tipuliformis Leicester	Ta-I_2 < Ta-I_3	?	Leicester (1908)
trifida Edwards	Ta-I_2 < Ta-I_3	?	Edwards (1922)
unispinosa Thurman	Ta-I_2 < Ta-I_3	?	Thurman (1959)
vijayae Ramalingam	Ta-I_2 < Ta-I_3	Ta-I_2 < Ta-I_3	Ramalingam (1975)
winter Dong, Wu & Mao	Ta-I_2 < Ta-I_3	?	Dong *et al*. (2006)
yongi Miyagi, Toma & Ramalingam	?	?	Miyagi *et al*. (1991)
zhangi Gong	Ta-I_2 < Ta-I_3	Ta-I_2 < Ta-I_3	Gong (1991)

In conclusion, it is obvious the length of Ta-I_2 relative to the length of Ta-I_3 cannot be used as a diagnostic character of the subgenus *Topomyia* and whether it is diagnostic for the subgenus *Suaymyia* is not definitely known. Identification of adults should be made in association with the immature stages, which are commonly found in the leaf axils of a variety of plants (*e.g. Alocasia*, *Ananas*, *Colocasia*, *Cordyline*, wild banana, bracts of *Zingibes* plants (ginger), *Nepenthes* pitchers and perforated bamboo internodes). As noted by Lee *et al*. (1988), the Australasian species of *Topomyia* cannot be placed with certainty in either subgenus *Suaymyia* or *Topomyia* based on the characters of the forelegs and male genitalia described by Thurman (1959). Mosquitoes in the genus *Topomyia* are poorly known. Adults of many species of the genera *Kimia* and *Topomyia* have overlapping morphological features or share common characters that cause difficulty for identification. Larvae of many species include variant forms which may be unidentifiable to species (Rattanarithikul *et al.* 2007). Further studies of *Topomyia* using integrated morphological and molecular approaches are essential to establish a natural classification of the genus.

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