

VARIATION IN TARSAL CLAW MORPHOLOGY AND THE IDENTIFICATION OF *Aedes (Stegomyia) Demeilloni/Segermanae* AND *Aedes (Stegomyia) Simpsoni/Bromeliae* (DIPTERA: CULICIDAE) IN SOUTH AFRICA

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ABSTRACT. Individuals in families of *Aedes (Stegomyia)* mosquitoes reared from females collected at Kloof, KwaZulu-Natal, were identified as *Aedes demeilloni* or *Aedes segermanae* or were indeterminate because tarsal claw morphology, the distinguishing character, varied. Similarly, *Aedes (Stegomyia) simpsoni* and *Aedes (Stegomyia) bromeliae* reared from ovitraps exposed at Ndumu, northern KwaZulu-Natal, showed variation in tarsal claw morphology. Variation existed between tarsal claws on individual specimens, which made identification difficult at Ndumu, indicating that tarsal claws may not be taxonomically significant.

KEY WORDS *Aedes demeilloni/segermanae*, *Aedes simpsoni/bromeliae*, identification, tarsal claws

In attempting to identify certain *Aedes (Stegomyia)* species, we found their tarsal claw morphology varied. The species were *Aedes demeilloni* Edwards and *Aedes segermanae* Huang that belong to the *dendrophilus* group and *Aedes simpsoni* (Theobald) and *Aedes bromeliae* (Theobald) that belong to the *simpsoni* group. This variation presented a problem because the most recent keys rely heavily on claws (unguis) to identify these species (Huang 1979, 1997). The *Aedes simpsoni* group includes the vector of yellow fever virus elsewhere in Africa (Mahaffy et al. 1942, Serie et al. 1964) so accurate identification of these mosquitoes is particularly important. We report the results of a morphological study on the tarsal claws of *Aedes demeilloni/segermanae* from Kloof, KwaZulu-Natal, and on the *Aedes simpsoni* group from various localities that addresses this question. The anatomical terminology of Harbach and Knight (1980) is used with the exception of "tarsal claw" for "unguis."

Female mosquitoes were collected while biting humans during the daytime in a suburban garden at Kloof, about 25 km northwest of Durban in KwaZulu-Natal. Subsequently, eggs were obtained and 3 small progeny broods (families) were reared. The mosquitoes in these families were all pinned shortly after emergence to minimize damage to their diagnostic features, especially tarsomeres. Examination of each of the specimens under the stereomicroscope led to their identification as *Ae. demeilloni*, *Ae. segermanae*, or *Ae. demeilloni/segermanae* on the basis of the key and descriptions recently published by Huang (1997). All 6 tarsi from each individual were then mounted on slides and examined under the compound microscope so that claw morphology could be examined in detail. It was necessary to determine whether one or both claws of each pair of claws on a leg were "armed" (bearing a tooth) or simple (without a tooth). Each

leg on each side of the insect was assessed. In every case, the hind legs of both males and females possessed claws that were equal and simple, but males always had unequal claws on the fore- and midlegs. The results for the fore- and midlegs are presented in Table 1. As can be seen, diagnoses varied within the families except within the 3rd family, where only 3 individuals were available for examination. In family A 150-3, 1 female was identified as *Ae. demeilloni* (all claws armed), 1 male and 1 female as *Ae. segermanae* (all claws simple), whereas 1 female was indeterminate, with claws armed on the right legs but simple on the left legs. In family A150-5, 6 females and 1 male had the characters that identified them as *Ae. demeilloni*, whereas 1 female was identified as *Ae. segermanae*. It is clear from these results that the armed/simple nature of the claws of the fore- and midlegs is not consistent within a family, which negates the applicability and validity of this morphological character for diagnosis of the female and probably also the male. This character varies intraspecifically.

Ovitraps collections, which included the *Aedes simpsoni/bromeliae* group, were made in a survey of tree hole-breeding mosquitoes from Tzaneen and Skukuza (Kruger National Park) in the Northern Province, the Ndumu Game Reserve in northern KwaZulu-Natal, and the port of Durban. Eggs collected in the field were reared to adults and were examined as soon as possible after emergence. The morphology of the tarsal claws on the fore- and midlegs appeared to be the single most useful character in the taxonomic key based on adult female morphology prepared by Huang (1979). The tarsal claws on these legs are simple in *Ae. simpsoni* and armed in *Ae. bromeliae*. The collections from Tzaneen included 32 female specimens of *Ae. simpsoni* and 1 of *Ae. bromeliae*. Samples from 2 ovitraps from Durban were entirely homogeneous for *Ae.*

Table 1. Detailed morphology of the tarsal claws in families of *Aedes demeilloni/segermanae* from Kloof.¹

Family no.	No. specimens and sex	Forelegs		Midlegs		Identity
		Left	Right	Left	Right	
A 150-3	1 ♀	aa	??	aa	aa	<i>demeilloni</i>
	1 ♀	ss	ss	ss	ss	<i>segermanae</i>
	1 ♂	ss	ss	ss	ss	<i>segermanae</i>
	1 ♀	ss	aa	ss	aa	<i>demeilloni/segermanae</i>
A 150-5	5 ♀	aa	aa	aa	aa	<i>demeilloni</i>
	1 ♀	aa	aa	??	aa	<i>demeilloni</i>
	1 ♀	ss	ss	ss	ss	<i>segermanae</i>
	1 ♂	as	as	as	a?	<i>demeilloni</i>
A 150-9	2 ♀	aa	aa	aa	aa	<i>demeilloni</i>
	1 ♂	as	as	as	as	<i>demeilloni</i>

¹ a = armed, s = simple, ? = claw broken off and missing.

simpsoni. From Skukuza, we reared 31 typical *Ae. simpsoni* and 2 unusual females that had armed tarsal claws on the forelegs and simple ones on the midlegs. Collections from Ndumu were even more complex, the results of which are given in Table 2. There were 9 female specimens each of *Ae. bromeliae* and *Ae. simpsoni* and 11 that shared characters of both species on either the fore- or midlegs or both. Table 3 gives full details of the variation in tarsal claw morphology present in the Ndumu collections. Combinations varied from differences between fore- and midlegs, through differences between legs in each category, to differences between the claws on a single leg. This variation within an individual either between the left and right leg or between the 2 claws of the same leg shows the unreliability of the claw character for diagnosis of *Ae. simpsoni* and *Ae. bromeliae* and strongly suggests that there would also be variation within families in the *Ae. simpsoni* group of mosquitoes. However, our attempts to collect adult females in biting catches at Ndumu were unsuccessful, either because the mosquitoes of this group were too low in density at the time of collecting or because the Ndumu populations of the group were nonanthropophilic. Thus, we were unable to rear families for

study as we had done with *Ae. demeilloni/segermanae*. We also failed to sample adult females in traps set at Ndumu to collect gravid females.

We conclude that the separation of *Ae. demeilloni* from *Ae. segermanae* females and males, using the tarsal claw characters of Huang (1997), failed on South African specimens because of intrafamilial and intraspecific variation of this character. Similarly, the distinction between *Ae. simpsoni* and *Ae. bromeliae* females according to Huang's characters (Huang 1979) failed in the case of the population sampled at Ndumu, KwaZulu Natal, because of variation in claw structure on individual mosquitoes. Sample sizes were of necessity small in the *Ae. demeilloni/segermanae* study because only a small number of eggs were deposited in each family. In the *Ae. simpsoni/bromeliae* study, sample sizes were small because these "species" were difficult to collect in large numbers, even by several different sampling methods over 2 seasons. However, variation between only 2 siblings in a family or between tarsal claws on legs from the same individual constitutes conclusive evidence of intraspecific variation no matter what the sample size. It is possible that mosquitoes of the *Ae. simpsoni* group sampled at Ndumu included hybrids between the 2 species, which could account for the incon-

Table 2. Identity of female mosquitoes of the *Aedes simpsoni* group, reared from ovitraps exposed at Ndumu, based on tarsal claw morphology.

No. specimens	Identity	
	Forelegs	Midlegs
9	<i>simpsoni</i>	<i>simpsoni</i>
9	<i>bromeliae</i>	<i>bromeliae</i>
4 ¹	Indeterminate ²	<i>simpsoni</i>
3 ¹	<i>bromeliae</i>	Indeterminate
2 ¹	Indeterminate	<i>bromeliae</i>
2 ¹	Indeterminate	Indeterminate

¹ Identity uncertain (see Table 3).

² The members of a pair of claws were heterogeneous, i.e., 1 claw armed, the other claw simple.

Table 3. Detailed morphology of the tarsal claws in atypical unidentifiable females of the *Aedes simpsoni* group from Ndumu.¹

No. females	Forelegs		Midlegs	
	Left	Right	Left	Right
4	aa	ss	ss	ss
2	aa	aa	aa	ss
1	aa	aa	as	ss
1	aa	ss	aa	aa
1	as	ss	aa	aa
1	as	ss	as	ss
1	as	as	as	as

¹ a = armed, s = simple.

sistent claw structure; according to Huang (1986), the 2 species are sympatric at Ndumu. However, such a high proportion of intermediates or "hybrids" would not normally be expected between 2 species in a region of sympatry. Instead, the data appear to indicate 2 morphologically divergent subspecies sharing a limited region of sympatry and interbreeding to produce a range of morphological intermediates.

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