ANOPHELES (AN.) REIDI, A NEW SPECIES OF THE BARBIROSTRIS SPECIES COMPLEX FROM SRI LANKA (DIPTERA: CULICIDAE)1

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ABSTRACT—The female of Anopheles (Anopheles) reidi n. sp. from Sri Lanka is described, illustrated and compared morphologically with the other members of the barbirostris species complex, and the members of the bancrofti species complex. Variations in the adult habitus of An. barbirostris Van der Wulp, and An. barbumbrosus Strickland and Choudhury are also discussed.

Carter (1925, 1950) discussed a species of Anopheles in the Ceylon fauna which he considered conspecific with Anopheles pseudobarbirostris Ludlow 1902. Reid (1962) examined two specimens seen by Carter and decided on the basis of morphological and zoogeographic differences that they were not conspecific with pseudobarbirostris, and probably represented a new species. However, since the two specimens were in poor condition, he chose not to describe them as new, but called them the “Ceylon species”.

Recently, Smithsonian Institution personnel working under Smithsonian Research Foundation Grant SFG-0-2854, Biosystematic Studies of the Insects of Ceylon, collected a near perfect female specimen in Sri Lanka that I consider the same species as the specimens seen and discussed by Carter and Reid. I have been unable to borrow the two original specimens for comparison or those seen by Reid, but I am convinced of this association because this female has all of the characters described by Reid (1962) for the “Ceylon species”. A comparison of this specimen with the lectotype and original description (Ludlow 1902) of An. pseudobarbirostris quickly confirmed Reid’s opinion. This new species is very distinct from the other known species of the barbirostris and bancrofti complexes.

Anopheles (Anopheles) reidi, n. sp.

fig. 1

Anopheles (Anopheles) pseudobarbirostris of Carter 1925, Ceylon J. Sci. (D) 1: 69 (2); Baisas 1931, Philippine J. Sci. 44: 429 (in part); Christophers 1933, Fauna of British India. Diptera, 4: 162 (in part); D’Abrera 1944, J.

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Fig. 1. Anopheles (An.) reidi, n. sp., holotype ♀: A, right wing; B, abdominal sterna V-VIII; C, head; D, fore, mid and hind legs, lateral view. Anopheles (An.) pseudobarbirostris Ludlow, lectotype ♀: E, abdominal sterna I-VIII, and distal half of right wing. Anopheles (An.) barbumbrosus Strickland and Choudhury, (Sri Lanka ♀): F, abdominal sterna V-VIII, and distal half of right wing.


**FEMALE** (Fig. 1). *Head*. Palpus with very dense, erect black scales, most distal scales more decumbent; palpus slightly shorter than proboscis; proboscis with black scales, most distal scales more decumbent, labellum nearly bare; fore femur/proboscis ratio 1.01; clypeus without scales; vertex with erect broad dark brown-black scales except several broad white scales just above the interocular space; interocular space with short narrow white scales and long brown setae forming dark frontal tuft; antennal pedicel with small dark scales on upper and outer aspects; first antennal flagellomere with short black scales, remaining flagellomeres without scales. *Thorax*. Scutal integument frosty gray-brown, with dark longitudinal lines on the dorsocentral and supraalar bare areas; anterior promontory with narrow erect pale scales mesally, darker and broader scales laterally; scutum with short fine, pale curved scales, especially dense on acrostichal and prescutellar areas; scutal setae tan to dark brown, in anterior promontory, acrostichal, dorsocentral, lateral prescutal, fossal, antealar and supraalar groups; scutellum with long brown setae and narrow pale curved scales; anterior pronotum with dark erect scales on cephalic half, pale short setae on caudal half; pleuron generally dark brown, with 1 pale scale on left propleuron, 1–4 pale scales on lower sternopleuron just cephalad of lower sternopleural setae, and 3–9 pale scales in median patch on mesepimeron; pleural setae number, 4–5 propleural, 6–7 spiracular, 3–4 upper and 6–8 lower sternopleural, 15–19 prealar, 10–12 upper and 0 lower mesepimeral. *Wing*. Costa mainly dark scaled, with small humeral pale spot, several scattered individual pale scales on basal ½, small subcostal pale spot and small preapical pale spot; subcosta with several pale scales adjacent to sector spot on vein R₁ and 1–2 pale scales at apex adjacent to subcostal pale spot on costa; preapical pale spot involves fringe scales and tip of vein R₁; remigium with dark scales except small central pale spot; humeral cross vein with 3–4 large dark scales; R₁–R₅ mostly dark scaled, with 3–4 small groups of pale scales proximal to more distinct pale sector spot, 15–20 scattered pale scales beyond sector spot out to level of subcostal pale spot on the costa, only 1–2 pale scales in preapical dark area beyond level of subcostal pale spot; tip of R₁ with pale scales; R₂ with dark scales; R₃+₄ with dark scales to fork; R₅ with dark scales except pale scales on tip; R₆ with dark scales except small pale spot on basal half and slightly larger preapical pale spot, tip with dark scales; R₇ with distinct dark basal spot, distinct pale preapical spot and tip with dark scales, remainder with mixed pale and dark scales; M with dark scales to fork; M₃+₄ base and tip with dark scales, mixed pale and dark scales in between; M₅, base and tip with dark scales, mixed pale and dark scales in between; extreme base of Cu with pale scales and 1–2 dark scales, followed by distinct dark patch of scales, remainder to fork with mixed pale and dark scales; Cu, with small dark spots at base, M-Cu crossvein and
tip, distinct pale spot between dark spots at base and M-Cu crossvein, remainder mixed pale and dark scales; CuA with pale scales mixed with infrequent dark scales on basal ¾, apical ¼ with dark scales; 1A with mixed pale and dark scales on basal ½, distinct dark mark at midpoint followed by large preapical pale area, tip with dark scales; apical dark mark on CuA longer than apical dark mark on 1A; primary, secondary and tertiary fringe scales dark except preapical pale fringe spot immediately above and down to level of R, small accessory pale apical fringe spot adjacent to R, long apical pale fringe spot from R₂₃ caudally to slightly beyond M₁₂₃, and small pale fringe spot on caudal margin of wing adjacent to tip of CuA; Halter. With dark scales. Legs. Fore and mid coxae with upper and lower patches of pale scales, hind coxa with only lower scale patch; mid coxa with 1 upper coxal seta; hind coxa with 2 large caudo-mesally projecting setae. Fore leg: femur swollen on basal half and dark scaled except narrow basal band of pale scales, anterior and posterior apical pale spots and scattered, often grouped, pale scales along anterior and posterior surfaces; tibia with dark scales, without pale basal or apical band, with scattered, often grouped, pale scales along entire length of anterior and posterior surfaces; tarsomeres 1 and 2 with pale apical bands approximately equal to segment width and scattered, usually grouped pale scales; tarsomeres 3–5 with only dark scales. Mid leg: femur with dark scales except small basal pale band, anterior and posterior apical pale spots and scattered pale scales that nearly form continuous line on posterior surface; tibia with dark scales except scattered pale individual or groups of scales that form broken lines on anterior and posterior surfaces; tarsomere 1 with dark scales, apical pale band approximately equal width of segment, and scattered pale individual or groups of scales mostly on anterior and posterior surfaces; tarsomere 2 with dark scales, a small dorso-apical pale spot and several mostly anterior and posterior patches of scattered pale scales; tarsomeres 3–5 with dark scales. Hind leg: femur with dark scales except small basal pale band, anterior apical pale spot and scattered pale individual or groups of scales that form broken lines on anterior and posterior surfaces; tibia with dark scales except dorso-apical pale spot and scattered pale individual or groups of scales that form broken lines on anterior and posterior aspects; tarsomeres 1–5 with dark scales except tarsomere 1 with scattered individual or groups of scales on anterior and posterior surfaces, tarsomeres 1–4 with apical pale band approximately equal segment width, and tarsomeres 2–5 with basal pale band approximately equal or smaller than segment width. Abdomen. Integument light to dark brown, without tergal scales, but with numerous long dark setae; sterna without scales except 3 median black scales near caudal margin of sternum VI, and sternum VII with 15 median white scales on cephalic half and more than 20 median black scales on caudal half.

MALE, PUPA AND LARVA. Not known.

TYPE DATA. Holotype female, SRI LANKA (Ceylon): Central Province, Kandy District, Peradeniya Botanical Gardens, January 1971, Piyadasa & Somapala collectors. The holotype is deposited in the Smithsonian Institution, U.S. National Museum (Natural History), Washington, D.C., and is in excellent condition with all body parts present and only minor rubbing damage evident on the wings and legs.
DISTRIBUTION. SRI LANKA. Examined: Female holotype from Central Province, Kandy District, Peradeniya Botanical Gardens. Carter (1925) listed two females collected in Western Province, Colombo District, Colombo and Ganemulla, and Reid (1962) examined a female collected in 1936 in the Province of Uva, Badulla District. All previous records of pseudobarbirostris from the Indian subregion (Sri Lanka) probably apply to reidi. Accordingly, pseudobarbirostris Ludlow now has its western most extension in the Philippines and the Celebes.

BIOLOGY. No data.

TAXONOMIC DISCUSSION. Carter's (1925) association of specimens of this species with pseudobarbirostris was apparently based on both having spotted legs and a pale fringe spot adjacent to the tip of wing vein R₂. These similarities are superficial, for reidi belongs to the barbirostris species complex, while pseudobarbirostris is a member of the bancrofti species complex (Reid 1962). Adult members of the barbirostris complex have the following characters that will differentiate them from the bancrofti complex: wing with an apical pale fringe spot at vein R₄₊₅ and often from R₄₊₅ to M₁₊₂; wing without a prehumeral pale spot on the costa; wing with scattered pale scales on the basal half of the costa; and abdominal sternum VIII without pale scales. These two complexes also have distinct zoogeographical distributions, with only a small area of overlap. The bancrofti complex has basically an Australasian distribution with records from Australia, Celebes, Ceram, the Moluccas, New Guinea and the Philippines. The barbirostris complex has a distinct Oriental distribution that extends from India east to the Philippines, Ambon, Celebes, Ceram and the western tip of New Guinea. Only 4 of the 11 species in the latter complex are known to be sympatric with members of the bancrofti complex.

Besides the above species complex differences, reidi can be differentiated from pseudobarbirostris by having the following additional characters: pale spots on the legs formed by groups of scales; hind tarsomere 2 with a distinct basal pale band; and abdominal sternum II-VI without pale scales.

Anopheles reidi can be separated from all the other members of the barbirostris species complex by possessing the following primary characters: (1) spotted legs; (2) a pale basal band on hind tarsomere 2; and (3) pale bands crossing all 4 of the hind tarsal joints. Additional characters on reidi that have secondary value are: (1) wing with an accessory apical pale fringe spot at vein R₂; (2) wing with an apical pale fringe spot from vein R₄₊₅ to M₁₊₂; and (3) abdominal sternum II-VI without pale scales. The possession of the two latter characters places reidi in Reid's (1962) oanus subgroup of the barbirostris complex, along with ahomi Choudhury (Assam), barbum-
brosus (Oriental), manalangi Mendoza (Philippines) and vanus Walker (Philippines, Borneo, Celebes and Moluccas).

Besides reidi, there are two other members of the barbirostris complex known from Sri Lanka. The first, barbirostris (barbirostris subgroup), possesses none of the primary or secondary characters listed for reidi. The second, barbumbrosus (vanus subgroup), lacks the accessory pale fringe spot at R₂ listed under the secondary characters, and all of the primary characters listed for reidi. Both barbirostris and barbumbrosus from Sri Lanka have adult characters that differ from barbirostris and barbumbrosus specimens from Southeast Asia, but these differences apparently reflect infraspecific geographical variation. Adult barbirostris from Sri Lanka typically have dark wings and numerous pale scales on the abdominal sterna, characters that are usually found on An. campestris Reid, in Malaysia and Thailand. Adults of barbumbrosus from Sri Lanka have only narrow apical pale bands on hind tarsomeres 3 and 4, and do not have an accessory pale fringe spot on the wing at R₂ (Fig. 1), while those from Indonesia (topotypic), Malaysia and Thailand have basal and apical pale bands on hind tarsomeres 3 and 4 and have a distinct accessory pale fringe spot at R₂. However, the larvae, pupae and male genitalia of barbirostris and barbumbrosus from Sri Lanka are essentially identical with Southeast Asian barbirostris and barbumbrosus specimens. Such disjunct adult and larval character associations and leg and wing variations have been previously noted by Reid (1963 and 1968) in barbirostris and other species.

The only other species in the barbirostris complex currently known from the Indian subregion is ahomi from Assam. This poorly known species does not have speckled legs, but does have a wide pale wing fringe spot from R₄+₅ to M₁+₂ and the abdominal sterna without pale scales, making it a member of the vanus subgroup. Currently, there is confusion regarding the presence or absence of an accessory pale wing fringe spot on ahomi. Wattal, Kalra and Gopal (1962) indicate ahomi has this pale spot, while Reid indicates it is absent. Reid (1962, p. 38 and personal communication) based his description of the ahomi wing on an excellent wing illustration drawn by Wattal who examined the wing of ahomi at Reid's request and sent him the illustration.

Anopheles vanus of Wattal, Kalra and Gopal (1962) reported from India, does not agree with the definition of vanus assigned by Reid (1962), after he examined Walker's type specimen. Reid (1968) considers the specimens seen by the above authors as variants of barbirostris sensu stricto.

The adult female of reidi is one of the most easily recognized members of the barbirostris complex. Hopefully, this will help in the discovery of other specimens, particularly the male and immatures.
The importance of the immature stages cannot be over stressed for Reid's (1962) revision of the *barbirostris* complex was based primarily on larval and pupal characters. The *barbirostris* complex in the Indian subregion needs re-evaluation in light of Reid's revision. The limited Indian material available for study consists almost entirely of adults without associated immature skins.

*Anopheles reidi* is named in honor of Dr. John A. Reid in recognition of his outstanding contributions to our understanding of anopheline systematics and human malaria and filarial epidemiology. His many faceted approach to anopheline taxonomy has been a major demonstration of the value of the biological species concept in taxonomy and medical entomology.

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