

DESCRIPTION OF *ANOPHELES (CELLIA) SERETSEI* SP. NOV. FROM KASANE, BOTSWANA

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ABSTRACT. *Anopheles (Cellia) seretsei*, a new mosquito species from Kasane, northern Botswana, is described on the basis of the examination of a type series of 37 females and 18 males. Diagnostic features of the egg, larva, and pupa are presented. Comparisons of the new species with close relatives (*Anopheles listeri* and *Anopheles azevedoi*) are made.

KEY WORDS *Anopheles seretsei*, new species, description, Botswana, *Anopheles listeri*, *Anopheles azevedoi*

INTRODUCTION

During a mosquito survey carried out in 1995 in Kasane, Chobe District, northeastern Botswana (Abdulla-Khan et al. 1998), specimens of an anopheline mosquito belonging to a new, undescribed species were collected biting humans indoors and feeding on cattle in enclosures.

Wild females were returned to the laboratory and isolated for ovipositing, and the progeny were reared to adults as individual families (Hunt and Coetzee 1986). Each pinned adult had associated larval and pupal skins mounted on slides. Eggs were stored in 70% alcohol for scanning electron microscopy.

The descriptive terminology used is that of Harbach and Knight (1980). Diagnostic characters for separation of *Anopheles listeri* De Meillon, *Anopheles azevedoi* Ribeiro, and the new species are provided.

TAXONOMIC TREATMENT

Anopheles (Cellia) seretsei, new species
(Figs. 1-4 and Tables 1 and 2)

Female. Wing length 3.16-3.60 mm. *Wing:* Largely pale, with pale and dark areas well contrasted (Fig. 1a). Median dark areas of costa and subcosta separate, approximately equal in length.

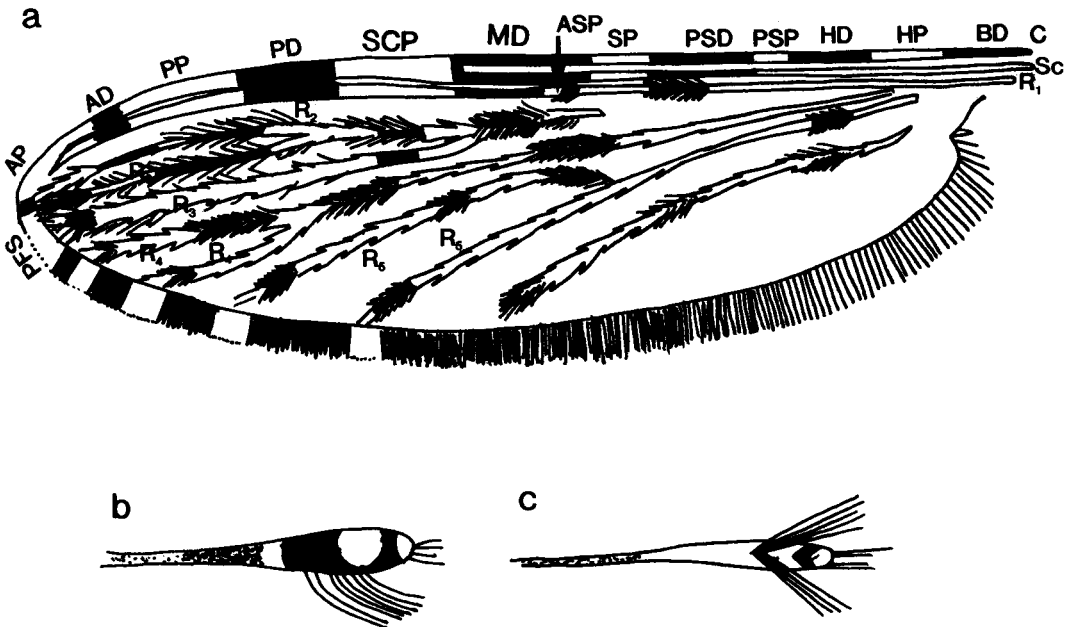


Fig. 1. a. *Anopheles seretsei*. Female wing (from right to left): C, costa; Sc, subcosta; BD, basal dark; HP, humeral pale; HD, humeral dark; PSP, presector pale; PSD, presector dark; SP, sector pale; ASP, accessory sector pale; MD, median dark; SCP, subcostal pale; PD, preapical dark; PP, preapical pale; AD, apical dark; AP, apical pale; PFS, pale fringe spot; veins, R₁, R₂, R₃, R₄, R₅. b. *Anopheles listeri* male palp (also seen in some *Anopheles seretsei* specimens) c. Male palp seen in *An. seretsei* only.

Table 1. Full setal counts for pupal specimens of *Anopheles seretsei* sp. nov. (n = 54).

Seta	Range	Seta	Range	Seta	Range	Seta	Range
Cephalothorax		Abdomen III		Abdomen V		Abdomen VII	
10	1-4	0	Simple	0	Simple	0	Simple
11	2-4	1	6-7	1	Simple	1	Simple
12	1-3	2	5-8	2	5-6	2	3-4
Abdomen I		3	1-3	3	1-3	3	1-2
1	Fan	4	3-4	4	1-2	4	Simple
2	4-6	5	6-7	5	4-5	5	2-3
3	2	6	3-4	6	3-4	6	1-4
4	5-6	7	2-4	7	2-4	7	2-3
5	1-3	8	Simple	8	3-5	8	Simple
6	Simple	9	1-3	9	Simple	9	Simple
7	7-10	10	Simple	10	Simple	10	1-3
9	Simple	11	Simple	11	Simple	11	1-2
		14	Simple	14	Simple	14	Simple
Abdomen II		Abdomen IV		Abdomen VI		Abdomen VIII	
0	Simple	0	Simple	0	Simple	0	Simple
1	7-8	1	Simple	1	Simple	4	Simple
2	6-8	2	4-5	2	5-6	9	3-8
3	2-3	3	3-7	3	Simple	14	Simple
4	4	4	1-3	4	1-2	1	Simple
5	2-3	5	4-6	5	3-4		
6	Simple	6	1-3	6	2-3	Paddle	
7	3-6	7	4	7	1-4	1	Simple
8	2	8	3-4	8	1-3	2	1-2
9	Simple	9	Simple	9	Simple		
10	1-2	10	Simple	10	Simple		
		11	Simple	11	Simple		
		14	Simple	14	Simple		

Apex of vein R₃ with dark scales extending to the fringe spot. *Palps*: Identical to those of *An. listeri*. *Legs*: Femora dark; hind tibiae narrowly pale at base and apex, fore- and mid-tibiae pale at apex only; all tarsomeres dark.

Male. Wings and legs as in female. *Genitalia*: As in *An. listeri* (De Meillon 1931, Gillies and De Meillon 1968). *Palps*: of 2 types, one identical to *An. listeri* (Fig. 1b) and the other with a paler overall appearance (Fig. 1c); shaft dark proximally, followed by a long pale area; club widely pale at apex followed by a narrow dark region preceding a wide pale area medianly; pale base of club contiguous with pale area on shaft.

Pupa. Full setal counts are provided in Table 1. The following are diagnostic for *An. seretsei*. *Ab-*

domen: Seta 1-II, 7-8 branches; 1-III, 6-7 branches; 1-VII, simple, same length as segment (Fig. 2); 5-III to 5-VII with 6-7, 4-6, 4-5, 3-4, and 2-3 branches, respectively; 9-VI to 9-VII simple, equal to or less than one half the segment length.

Larva. Full setal counts are provided in Table 2. The following are diagnostic for *An. seretsei*. *Prothorax*: Setae P₁ and P₂ branched, on small separate tubercles (Fig. 3a); P₁, 9-10 branches; P₂, 8-10 branches. *Abdomen*: 1-I and 1-II rudimentary, leaflets lanceolate and undifferentiated with 16 branches (Fig. 3b); 1-III to 1-VII fully developed with 16 moderately broad leaflets, well-defined shoulders and short, blunt-tipped filaments varying in length (Fig. 3c).

Egg. Shiny, silver-grey, boat-shaped egg with broad dorsal surface (deck) (Fig. 4a). The undivided deck is surrounded by a well-developed, narrow, striated frill, interrupted in the middle on each side by well-developed floats consisting of 16 float chambers. Under light microscopy, 2 dark, irregular patches occur across the deck on each side of the mid-center of the deck. This coloration is not apparent on scanning electron micrographs (Fig. 4a). The exochorion in these patches consists of relatively broad, irregular bosses when compared with the remainder of the upper surface of the deck, which comprises finer, smaller bosses. Numerous, large, lobed tubercles are located at both anterior

Pupa

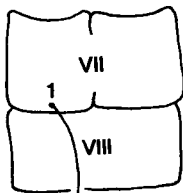
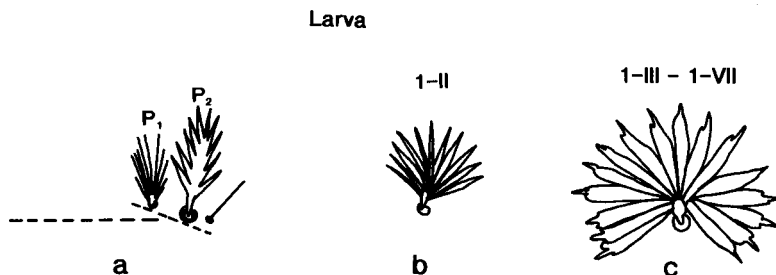


Fig. 2. Pupa of *Anopheles seretsei*: seta 1-VII equal in length to abdominal segment VIII.

Table 2. Full setal counts for larval specimens of *Anopheles seretsei* sp. nov. (n = 42).

Seta	Range	Seta	Range	Seta	Range	Seta	Range
Cranium		Metathorax		Abdomen III		10	2
0	Simple	1	Simple	0	Simple	11	1-2
1	Simple	2	Simple	1	16	12	Simple
2	Simple	3	Simple	2	1-2	13	1-3
3	Simple	4	Simple	3	2-4	Abdomen VI	
4	Simple	5	5-8	4	2-4	0	Simple
5	7-9	6	2-4	5	Simple	1	16
6	3	7	5-8	6	3-5	2	1-2
7	3-4	8	4-9	8	1-3	3	Simple
8	5-8	9	5-11	9	Simple	4	Simple
9	9-12	10	4-8	10	2	5	Simple
10	14-17	11	4-9	11	1-2	6	1-2
11	14-18	12	5-10	12	Simple	7	3-8
12	1-3	13	3-4	13	1-3	8	1-2
13	3-5	Abdomen I		Abdomen IV		9	Simple
14	3-4	1	16	0	Simple	10	1-2
Antenna		2	Simple	1	16	11	Simple
2	Simple	3	Simple	2	1-2	12	3-4
3	Simple	4	3-4	3	2-4	13	1-3
4	3-5	5	1-3	4	2-4	Abdomen VII	
Prothorax		6	3-6	5	Simple	0	Simple
1	9-10	7	4-9	6	Simple	1	16
2	8-10	8	Simple	8	2-3	2	1-2
3	Simple	9	Simple	9	Simple	3	Simple
8	2-3	10	1-2	10	2	4	Simple
14	2	11	Simple	11	Simple	5	Simple
Mesothorax		12	Simple	12	Simple	6	1-2
1	2-3	13	2-4	13	1-2	7	3-8
2	Simple	Abdomen II		Abdomen V		8	1-2
3	Simple	1	16	0	Simple	9	Simple
4	Simple	2	Simple	1	16	10	1-2
5	Simple	3	3	2	1-2	11	1-2
6	Simple	4	Simple	3	2-4	12	2
7	Simple	5	2-3	4	Simple	13	1-2
8	2-3	6	4-7	5	Simple	Abdomen VIII	
9	Simple	7	4-9	6	1-2	0	Simple
10	2-4	8	2-3	7	3-8	1	Simple
13	4-5	9	2-4	8	2-3	2	3-6
14	5-6	10	1-2	9	Simple	3	Simple
		11	Simple			4	Simple
		12	Simple			5	1-2
		13	1-2				

Fig. 3. Larva of *Anopheles seretsei*. a. Prothoracic setae 1-2. b. Abdominal palmate setae 1-II underdeveloped. c. Fully developed palmate seta 1 on segments III-VII.

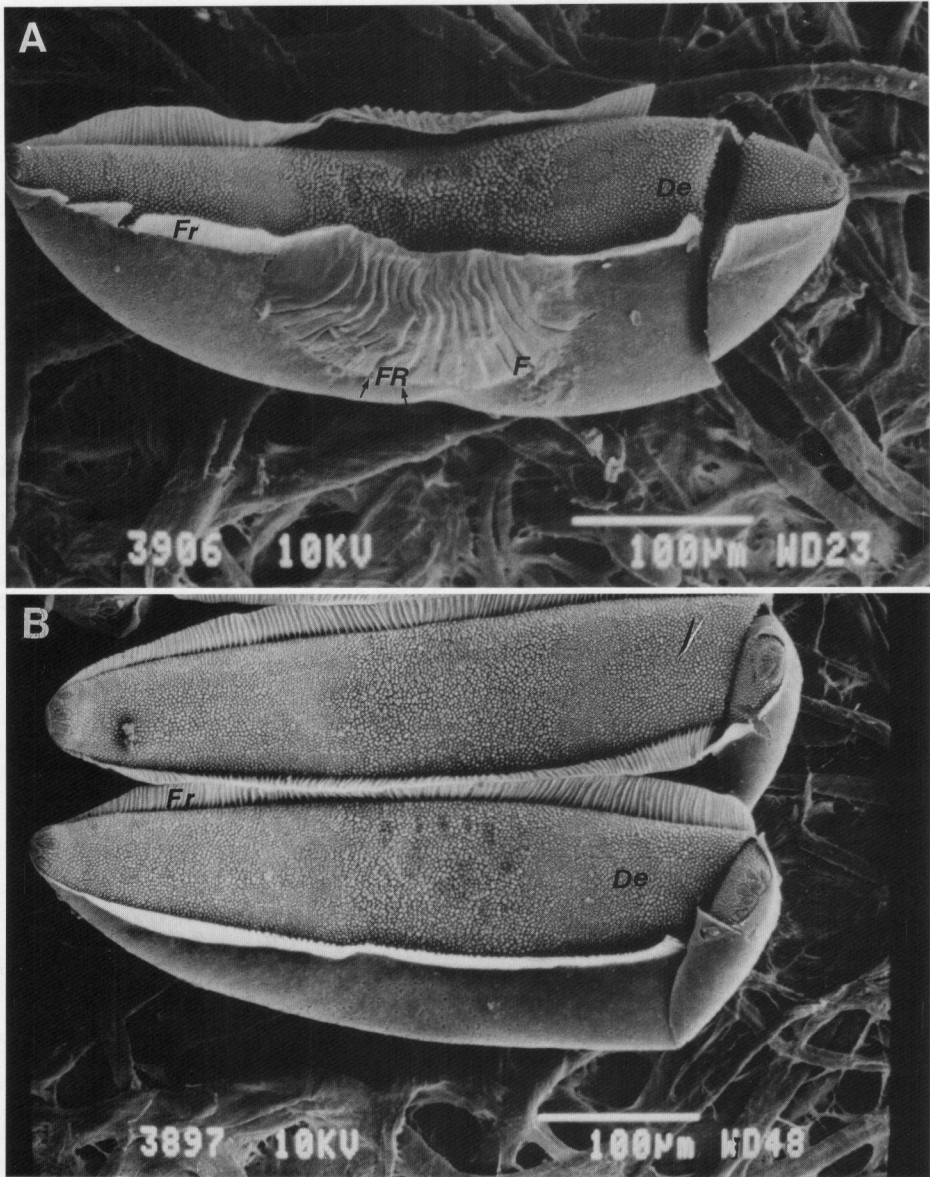


Fig. 4. a. Egg with floats, *Anopheles seretsei*. b. Egg without floats, *Anopheles listeri*. Fr, frill; De, deck; FR, float ridge; F, float.

and posterior ends of the deck. The micropylar apparatus is small, covered by a thin, unornamented layer of exochorion. The micropylar channel is flat, with a cone-shaped micropylar process. The base of the micropylar apparatus is smooth. The under-surface has a fine, reticular pattern.

Type data. *Holotype*: Female: Kasane, Botswana (17°48'S, 25°09'E), February 1995; BOT 169.10. Associated larval and pupal skins mounted on slide with same data and identification number. *Paratypes*: Five females (BOT 169.1, 2, 3, 6, and 7) and 4 males (BOT 169.4, 5, 8, and 9) with as-

sociated immature skins with same data and identification number. All specimens reared from eggs obtained from a single wild female, collected in a cattle enclosure by R. Hunt and R. A. Khan. Deposited in the collection of the South African Institute for Medical Research (SAIMR). Eggs of type family subjected to electron microscopy and photographed (Fig. 4a).

Material examined. In addition to the type material, other specimens examined were progeny from 10 wild females (BOT 116, 135, 147, 148, 166, 168, 170, 171, 172, and 195) collected from

Table 3. Characters used to distinguish *Anopheles seretsei* sp. nov., *Anopheles listeri*, and *Anopheles azevedoi*.

Character	<i>An. seretsei</i>	<i>An. listeri</i>	<i>An. azevedoi</i>
Adult	None	None	None
Pupae			
Seta 1-VII	Simple, as long as segment VIII	1.5 length of segment VIII	0.6 length of segment VIII
Seta 9-VII	0.5 length of segment VIII	0.5 length of segment VIII	Equal to length of segment VIII
Larvae			
Mesothorax seta M-9	Simple	Simple	Branched (De Meillon and Van Eeden 1976) Simple (Ribeiro 1969)
Egg	With floats	No floats	No floats

either a cattle enclosure (22 females, 9 males) or indoors biting humans (9 females, 5 males), February 1995. Deposited in the SAIMR.

Etymology. The new species is named in honor of Sir Seretse Khama, the late president of Botswana, 1966–1980.

DISCUSSION

Anopheles seretsei sp.nov. belongs to the *An. listeri* group sharing most morphological features in the adult, pupal, and larval stages. Notable differences between *An. seretsei*, *An. listeri* and *An. azevedoi* (Ribeiro 1969), a 3rd member of the group, are presented in Table 3. Adults of all 3 species key out to section VII number 12 of the key to female *Anopheles* in Gillies and Coetzee (1987). Larvae key out to section IX of the larval key but are easily separated by the characters in Table 3. The eggs of *An. seretsei* with floats (Fig. 4a) differ from those of *An. azevedoi* and *An. listeri*, which have no floats (Fig. 4b and Gillies and Coetzee 1987).

The bionomic and cytogenetic characteristics are given in Abdulla-Khan et al. (1998).

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