

## The diurnal activity of *Culicoides kingi* in northern Sudan

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### RÉSUMÉ

EL SINNARY (K. A.), MULLER (R.), ATTA EL MANNAN (A.) et HUSSEIN (S. H.). — L'activité diurne de *Culicoides kingi* dans le nord du Soudan. *Rev. Elev. Méd. vét. Pays trop.*, 1985, 38 (3) : 270-275.

L'activité diurne du vol de *Culicoides kingi* Austen, 1922 (*Diptera, Ceratopogonidae*) a été étudiée à Shambat, région de Khartoum, au Soudan, au moyen d'un piège lumineux. L'activité de piqure a été évaluée sur des vaches utilisées comme piège. Deux sommets ont été notés, l'un le matin et l'autre en fin d'après-midi. L'activité était nulle la nuit. Elle était à son minimum le jour, au début de l'après-midi alors que la température et l'intensité de la lumière étaient à leur maximum, le vent modéré et l'humidité relative assez basse. Dans toutes les captures, les femelles étaient plus nombreuses que les mâles.

Des variations saisonnières du nombre de mouches ont été notées avec des pointes de population en février et juillet.

*Mots clés* : *Culicoides kingi* - Comportement - Soudan.

### SUMMARY

EL SINNARY (K. A.), MULLER (R.), ATTA EL MANNAN (A.) et HUSSEIN (S. H.). — The diurnal activity of *Culicoides kingi* in northern Sudan. *Rev. Elev. Méd. vét. Pays trop.*, 1985, 38 (3) : 270-275.

The diurnal flight activity of *Culicoides kingi s.l.* Austen, 1922 (*Diptera, Ceratopogonidae*) was determined at Shambat, Khartoum, by means of a light source and the biting activity by means of a cow bait. Two peaks of activity were noted, one in the morning and the other late in the afternoon, with no activity at night.

Diurnal activity was lowest in the early afternoon, when the temperature and light intensity were highest, wind speed was moderate, and relative humidity was low. Females outnumbered males in all catches. Seasonal variations in numbers of flies were recorded with population peaks in February and July.

*Key words* : *Culicoides kingi* - Behaviour - Sudan.

### INTRODUCTION

*Culicoides* are proven or suspected vectors of a number of human and animal filariae (12, 13). MACFIE (11) listed the species of *Culicoides* known in the Sudan but did not include *C. kingi*; nor did KIRK (10), who gave an account of filarial disease in the Sudan transmitted by *Culicoides*. However, BOORMAN and MELLOR (3) recorded 11 species from Sudan and stated that *C. kingi* was by far the most abundant in the Khartoum area. Re-

examination of specimens from the Sudan by BOORMAN (personal communication) suggests that the species found in the Khartoum area may not be *C. kingi sensu stricto* but a closely related species and in the absence of a definitive taxonomic revision should be more accurately referred to as belonging to the *C. schultzei/kingi* group. Thus the designation in this paper as *C. kingi* should be regarded as provisional. EL SINNARY and HUSSEIN (7) showed that this species is well adapted to transmit *O. gutturosa* in Sudan, and provided

the incentive to study it in more detail. Apart from reports by EL BIHARI and HUSSEIN (6) and EL SINNARY and HUSSEIN (7), very little is known about the flight and biting activities of this insect. Hence, in the present study, an attempt has been made to investigate the flight and biting patterns of *C. kingi* (*s.l.*) and to determine the effect of climatic factors on such activities.

## MATERIALS AND METHODS

This work was carried out at the University of Khartoum, Veterinary Laboratory at Shambat, north of Khartoum.

Adult *Culicoides* were collected periodically during the course of this investigation which commenced in 1979 and continued throughout 1980. The biting activity of the female flies was assessed by means of cow baits, and the diurnal flight patterns of flies by means of catches of flies near the light in the animal house.

### 1. Recoveries from cow bait

The bait cow was kept in a shelter a few metres away from a dung heap (a favoured midge breeding site) during the month of July and regular *Culicoides* catches were made every day. Midge collections started before 5.00am and midges were collected regularly each half-hour throughout the day until 7.00pm (a few collections were made later but no midges were caught feeding on the cow). All insects caught were transferred to waxed cardboard boxes (10 × 7.5 cm) which were closed with nylon sandfly nets, and the cages were kept at room temperature (27 °C) to await identification.

### 2. Recoveries from neon light source

The light was a neon electric light, one metre long, situated 120 cm above the back of the animal, inside the shed roof. The best time for collection was found to be from sunset at 6.00pm to 7.00pm, when the number of flies was very high. Because at this time of day the flies were attracted to the nearest source of light, it was easy to see them move towards the light in groups. The same two persons were involved in collecting flies, either from the cow

or from the light, throughout the year, using a sucking tube method, alternating each day.

All flies were kept overnight in boxes at room temperature and on each box was a label with the date of collection and source of flies (either from bait animal or from the light). The next morning the flies in each cage were immobilized with carbon dioxide, sorted out under a dissecting microscope and the number of flies entered in the main record.

## RESULTS

### 1. Time of biting

The present observations were made while the bait animal was in an open shed. They were made throughout the day in order to ascertain at what hours the flies were prepared to feed in the farm, and whether any particular hours were preferred; it was found that flies were not biting earlier than 5.00am and that only a few stragglers were biting as late as 7.00pm. Before attacking the bait animal, most female flies were seen to be moving in groups near to the floor of the stables, especially in wet places near heaps of animal waste.

The results showed that there were morning and evening peaks of *Culicoides kingi* biting activity (Fig. 1). The evening peak occurred just before sunset (which was at 5.45pm in July) and was about twice as great as the morning peak, just after sunrise (which was at 5.45am in July). The collections on the bait cow were stopped at 7.00pm, partly because of the difficulty of seeing the midges in the dark, but also because it had been noticed that very few midges were present in the animal shed at night even near to the light and none was ever found biting after this hour. Although a few flies were attracted to the light source later in the evening (Fig. 2), none were ever found to fly from the light to the cow. The great majority were also not blood-fed. The light intensity near the cow was probably not enough to stimulate biting behaviour.

*C. kingi* was found to prefer the dorsal area of the bait cow and landed either on the hump or on the face. Few midges were seen to land on the chest, back, or ears, while none were found feeding or biting on the ventral surface.

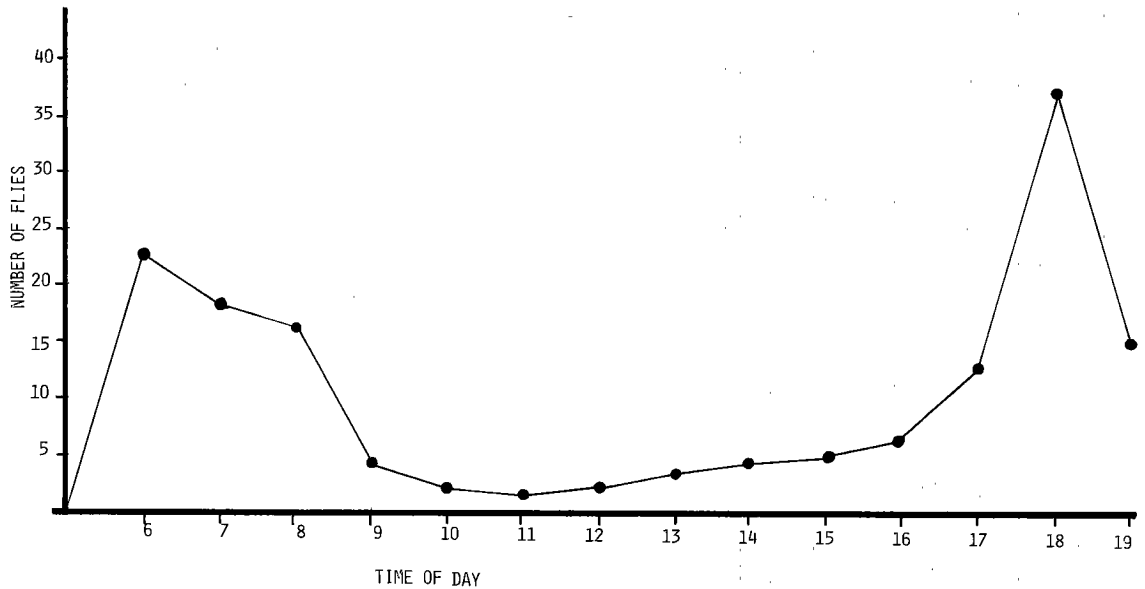


Fig. 1. — Hourly catch of *Culicoides kingi* biting bait cow throughout the day. (Mean figures for catches over 9 consecutive days in July 1980. Total flies caught = 968.)

## 2. Seasonal factors governing populations

*C. kingi* was the only species caught either from the animal bait or from the light in the animal house during the period of the investigation.

In view of the abundance of *C. kingi* in the animal sheds, adult midges were collected

regularly twice a week during the afternoons from around the light using a suction tube. Observations were made each 30 minutes, starting 1 hour before sunset and ending 2 hours after sunset, in order to ascertain what was the best time for collection from the light during the afternoon peak. It was found that flies were most abundant 30 minutes after sunset

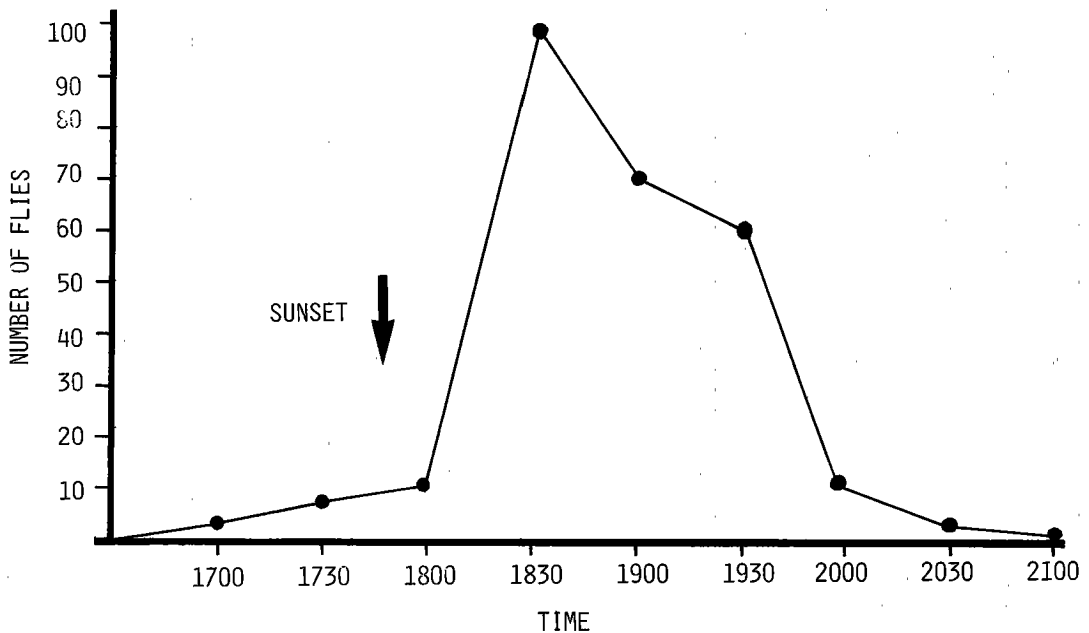


Fig. 2. — Catch of *C. kingi* every half-hour from neon light source in cattle shed throughout afternoon. (Mean figures for each day of July 1980.)

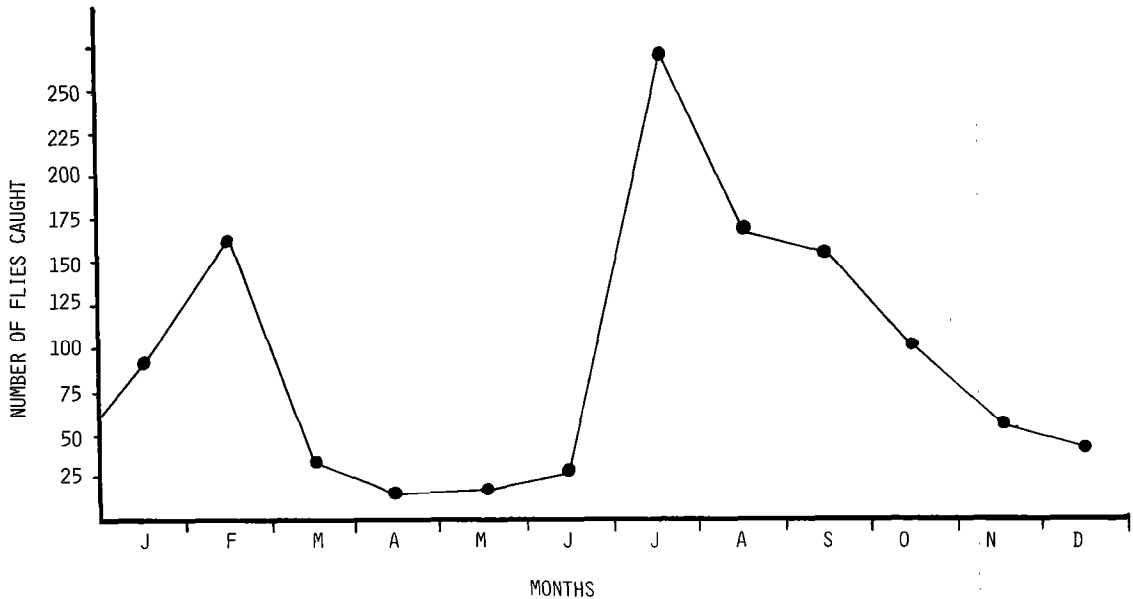


Fig. 3. — Mean numbers of *C. kingi* caught per day from light in shed from sunset to one hour later each month. (Each figure represents the mean of 4 weekly readings taken each month during 1980.)

(at about 5.45pm in July) and that they had virtually disappeared two hours after sunset (Fig. 2).

The numbers of flies caught near the light source during the daily peak activity period

(from sunset to one hour later) varied seasonally (Fig. 3), with the highest numbers during late July (the wettest period of the year and when temperatures are falling), with low numbers in late April and May when tempera-

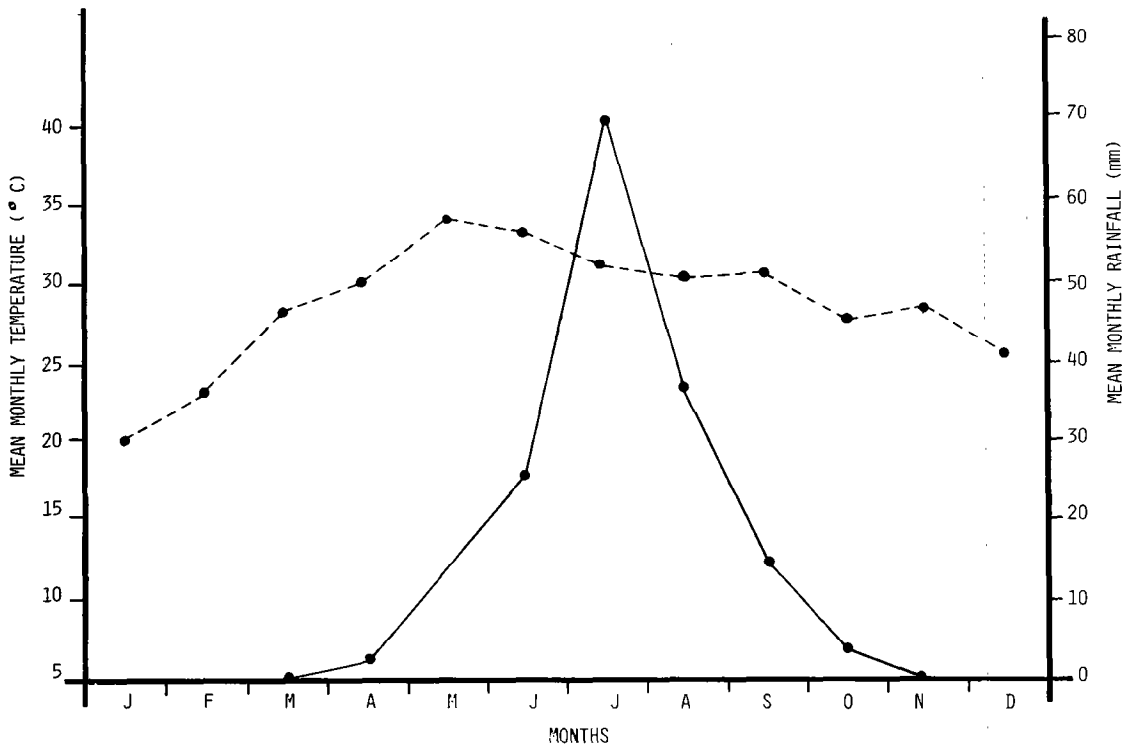


Fig. 4. — Mean monthly temperature (dotted line) and mean monthly rainfall in mm (solid line); figures for 1980.

tures were at a maximum. There was also greater abundance in January and February when temperatures were low (compare Figs 3 and 4). Monthly mean temperatures vary between 20 °C and 33 °C throughout the year and are highest from April to June (Fig. 4).

No clear correlation was observed between the daily weather conditions and the abundance of flies. As a general rule, rain during the night was followed by a good collection the next day, while rain or windy conditions during the day greatly reduced the number of flies collected.

## DISCUSSION

Many factors are known to influence the flight activity of *Culicoides* species but temperature, light intensity, wind speed and rainfall are probably the most important physical factors (8, 9).

As is usually the case under tropical conditions (8), some adults of *C. kingi* could be found throughout the year, although the population peak was during the rainy season. BRAVERMAN and GALUN (4) found that *Culicoides* species (including *C. schultzei-kingi*) were found throughout the year in Israel but with the main population peak in October and a small peak in spring. Rainfall was restricted to a short period in winter and — since this was also the time when average temperatures were much lower than is ever found around Khartoum — had no immediate effect on *Culicoides* density. DIPEOLU and OGUNRI-NADE (5) found that, in southern Nigeria, all species of *Culicoides* encountered emerged principally during the rainy season when the relative humidity was high while the temperature was lower (23–27 °C optimum).

The daily flight and biting activities of females were depressed by higher temperatures and by an increase in wind speed. When bait animals were confined to sheds, flies could be found biting at all hours, except while it was raining, after a heavy storm, or during the hours of darkness.

*Culicoides* spp. commonly have activity peaks at sunrise and sunset, with variable nocturnal activity (8). Some species (e.g. *C. brevis-*

*tensis* and *C. kingi* in the present study) have little activity at night, while others (including *C. marksii*, *C. australopalpalis*, *C. furens* and *C. barbosai*) show continuous night-time activity. The peak activity periods of the females of *C. kingi* (and also the peak biting periods) were found to correlate with 2 peak periods of swarming by males. Most female flies caught at the light source during the day contained only small ovaries with undeveloped oocytes and with no evidence of a blood meal. As was shown by SERVICE (14) for 4 British species, the main peak activity for *C. kingi* was at dusk. AURIAULT (1) has described the daily rhythm of *C. grahami* biting man in Gabon. This species has a marked biting peak in the morning (about 2 hours after sunrise), with a small evening peak about an hour before sunset. Biting was affected principally by light intensity but was depressed by high temperatures and low humidity. In a later study in a dense forest area (2), populations showed similar sensitivity to micro-climatic factors but with a higher evening peak.

Various methods of trapping *Culicoides* can be employed, such as bait animals, sticky traps, different types of light traps and suction traps, and these may give differing results (14). However, in the present study there was a good correlation in the number of female flies caught at the evening peak either from the light source or by cow bait. The simple type of light source used in the present study was probably not as efficient as Monks Wood type traps, and this may account for the fact that *C. Imicola*, reported from the locality in much smaller numbers than *C. kingi* by BOORMAN and MELLOR (3), was not recovered.

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## RESUMEN

EL SINNARY (K. A.), MULLER (R.), ATTA EL MAN-NAN (A.), HUSSEIN (S. H.). — La actividad diurna de *Culicoides kingi* en el norte del Sudán. *Rev. Elev. Méd. vét. Pays trop.*, 1985 **38** (3) : 270-275.

Se estudió la actividad diurna del vuelo de *Culicoides kingi* Austen, 1922 (*Diptera, Ceratopogonidae*) mediante una trapa luminosa y la actividad de picadura con vacas utilizadas como cebo, en Shambat región de khartum, en Sudán.

Se notaron dos máximos de actividad, uno por la

mañana y el otro a fines de la tarde. La actividad era nula por la noche. Era mínima al principio de la tarde cuando la temperatura y la intensidad luminosa eran máximas, el viento moderado y la humedad relativa bastante baja. En todas las capturas, las hembras estaban más numerosas que los machos.

Se notaron variaciones estacionales del número de las moscas con máximos durante febrero y julio.

*Palabras claves* : *Culicoides kingi* - Comportamiento - Sudán.

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