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DRAGONFLY DISTRIBUTION ALONG NEW CALABAR RIVER, NEAR PORT HARCOURT, NIGERIA (ANISOPTERA)

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Abstract – During 13 months larvae were collected bimonthly at 6 sample sites and then reared to the adults. Chloride and Biochemical Oxygen Demand (BOD) were measured monthly at each sample site during 12 months in order to assess the influence of these factors on odon. distribution along the river. A total of 11 spp. were collected (1-8 spp. per site). Regression analysis indicated that odon. distribution was significantly affected by Chloride and BOD, accounting for 32.4 and 48.3%, resp. of the variation in distribution. As each variable increased, the number of spp. per site decreased.

Introduction

In the Afrotropical region, dragonfly studies fall into two major areas: those restricted to one or two species (e.g. GAMBLES, 1966, 1970, 1971, 1972; LINDLEY, 1970; PARR & PARR, 1972, 1974; PARR, 1974) and those restricted to taxonomy, collection and identification of adults (PINHEY, 1961a, 1961b, 1962, 1971; DUMONT, 1977, 1978). Such studies contribute immensely to the understanding of regional fauna, but some other aspects of interest are neglected. For example, studies concerned with the collection and identification of adults do not provide information on larvae, breeding sites and breeding periods of adults. Studies restricted to one or two species are of limited application because the diversity of dragonflies in Africa is enormous.

Within the Afrotropical region, published information on dragonflies is unevenly distributed. For example, there is no information on the lower Niger delta. Yet this delta is a complex ecological area, located in the tropical rainforest and provides a gradual transition from fresh to salt water. It has a high diversity of aquatic insects. This study was therefore undertaken to determine the odonate larvae distribution along the New Calabar River, near Port Harcourt. The study is also intended to provide some baseline information on dragonfly species found in the area.

Material and methods

Dragonfly distribution along the New Calabar River, near Port Harcourt was investigated for 13 months (November 1989-November 1990) by bimonthly collecting larvae from 6 sample sites along the river (Fig. 1), and rearing them to adults. Also, two variables, Chloride and Biochemical Oxygen Demand (BOD) (an index of pollution), were measured monthly at each sample site for a period of 12 months (December 1989-November 1990) and related to dragonfly distribution along the river. These two factors were chosen because transition from fresh to salt water is gradual in the area, and water pollution, especially from petroleum products, is fairly common.

The collection of larvae was restricted to the lotic margin and was done from a canoe using a dip net. During collection, the net was submerged in water under aquatic weeds, and, while holding the handle of the net with one hand, the weeds were held and shaken with the other hand in order to dislodge larvae clinging to the roots of weeds into the net. This process was repeated 50 times per sample site per sample period. The larvae were taken to the University of Port Harcourt campus for rearing.

For each sample site, only representative larvae were reared after each sample period for the more common species; all the less common larvae were reared. Rearing was done in a small open-air house. Larvae from each sample site were reared separately using water collected from the sample sites. The purpose of the rearing was for easier identification of the species, most of which are only known in the adult or final larval stage. Rearing involved placing 3-5 larvae in a clear plastic container (11 cm long, 6 cm wide, 16 cm deep) half-filled with water. A 17 cm long by 2 cm wide flat stick was placed diagonally within each container for the insects to crawl out and emerge. The open end of the container was covered with nylon-screen, held in place with a rubber band. Water in the container was changed daily. The larvae were fed chironomid larvae collected from gutters within the University Campus. Upon emergence, the adults were killed with ethyl acetate and dried in a desiccator containing anhydrous calcium chloride pellets. These adults were later identified by S.J. Brooks (British Museum, Natural History) and R.W. Garrison (Asuza, California, USA).

Water samples for the determination of Chloride and BOD were collected from each sample site during high tides. These are the periods when salt water flows into coastal inlet waters. The Argentometric Method was used to measure Chloride (APHA, 1985). The Azide Modification Method was used to determine the initial and final Dissolved Oxygen (DO) (APHA, 1985). The final DO was determined after 5 days of incubation. BOD was computed from the difference between initial and final DO. Regression analysis was used to test whether Chloride and BOD significantly affected dragonfly distribution along the river. Both variables were treated as independent variables, while the number of dragonfly species per sample site was the dependent variable.

Results and discussion

A total of 11 species was collected. The number of species per sample site ranged from 1 to 8 (Tab. I). Regression analysis indicated that dragonfly distribution along the river was significantly affected by Chloride and BOD. Based on Rsquare (Tab. I), Chloride and BOD accounted for 32.4 and 48.3 percent of the variation in distribution, respectively. The slope of the regression equation (β) (Tab. I) indicated that there was a negative relationship between each variable and the number of species per sample site. In other words, as each variable increased, the number of species per sample site decreased.

Species collected per sample site are listed in Table II. The highest number of species was collected from Elele Alimini, followed by Rumuji and then Oduoha, while only one species was collected from Rumuoparani (Tab. II, Fig. 1).

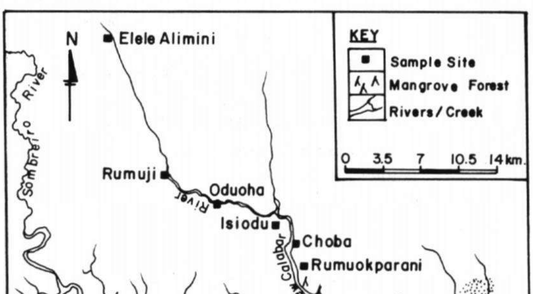

Fig. 1. Map of a section of the lower Niger delta, showing New Calabar River and the six sample sites.

Rumuoparani is the transition zone between fresh and mixohaline (brackish) water as indicated by the mangrove forest; mangrove thrives in mixohaline and salt water environments (Fig. 1). Three species, *Chalcostephia flavifrons*, *Gomphus* sp., and *Urothemis edwardsi*, are limited in distribution from Elele Alimini to Oduoha (Tab. II, Fig. 1). *Trithemis stictica* was collected throughout the year from Elele Alimini to Oduoha and from Isiodu and Choba only in January 1990 (Tab. II, Fig. 1). This indicates that the

Table I - Effect of Chloride and Biochemical Oxygen Demand (BOD) on dragonfly distribution along New Calabar River, near Port Harcourt, Nigeria

Sample site:	Elele Alimini	Rumuji	Oduoha	Isiodu	Choba	Rumuoparani	Regression analysis (Slope $R^2[\beta]$)
No. of species/ sample site	8	7	5	2	2	1	
Mean Chloride (mg/l)/ sample site	2.43	2.55	2.58	5.56	11.06	66.07	-0.569 0.324
Mean BOD (mg/l)/ sample site	1.43	0.82	1.13	1.68	2.60	2.35	-0.695 0.483

Table II - Distribution of dragonflies along New Calabar River, near Port Harcourt, Nigeria

Site	Species	Period
Elele Alimini	*Gomphus* sp.	–
	Chalcostephia flavifrons	throughout the year
	Hadrothemis infesta	–
	Olpogastra lugubris	–
	Orthetrum sp.	–
	Oxythemis gamblesi	–
	Trithemis stictica	throughout the year
	Urothemis edwardsi	throughout the year
Rumuji	*Gomphus* sp.	–
	Macromia sp.	–
	Chalcostephia flavifrons	throughout the year
	Cyanothemis simpsoni	Nov. 1989, Nov. 1990
	Sympetrum navasi	Sept. & Nov. 1990
	Trithemis stictica	throughout the year
	Urothemis edwardsi	throughout the year
Oduoha	*Gomphus* sp.	–
	Chalcostephia flavifrons	throughout the year
	Sympetrum navasi	throughout the year
	Trithemis stictica	throughout the year
	Urothemis edwardsi	throughout the year
Isiodu	*Sympetrum navasi*	throughout the year
	Trithemis stictica	Jan. 1990
Choba	*Sympetrum navasi*	throughout the year
	Trithemis stictica	Jan. 1990
Rumuoparani	*Macromia* sp.	Nov. 1989, Nov. 1990

main breeding site of this species extends from Elele Alimini to Oduoha. *Sympetrum navasi* was collected throughout the year from Oduoha to Choba and only in September and November 1990 from Rumuji (Tab. II) indicating that the main breeding site of this species extends from

Oduoha to Choba (Fig. 1). Thus, Oduoha appears to be the transition site between Elele Alimini - Rumuji and Isiodu - Choba sample sites.

Some species collected during this study, such as *Chalcostephia flavifrons*, *Sympetrum navasi*, *Trithemis stictica*, and *Urothemis edwardsi*, breed throughout the year because their larvae were collected throughout the period of this study. Others, such as *Macromia* sp. and *Cyanothemis simpsoni* breed only once a year; their larvae were collected in November 1989 and November 1990 (Tab. II). GAMBLES (1960) stated that in Nigeria, there is nothing to prevent dragonflies from breeding continuously throughout the year, provided that water is available. Also, HYNES (1970) stated that in view of the unvarying temperature and light conditions in the tropics it may be that reproduction and growth are continuous, with all stages present at all times. The observations in this study indicate that these hypotheses are partially true; while some species breed throughout the year, others breed only once a year.

Some dragonflies collected during this study have been reported elsewhere. For instance, *Chalcostephia flavifrons* has been reported from Gabon and Cameroons (PINHEY, 1962). DUMONT (1977, 1978) reported *Urothemis edwardsi* from Niger and Mali. *Hadrothemis infesta* has been reported from Cameroons (PINHEY, 1962).

Our knowledge of Afrotropical dragonflies has been enhanced by the information gained from this study. The scope of the distribution of the species which have been reported elsewhere is widened by the knowledge that such species also occur in this part of the world. Equally interesting is the fact that larvae distribution along the river is significantly affected by Chloride and BOD. Thus, unlike aerial distribution of adults, larval distribution can be greatly influenced by a series of chemical factors. This study also revealed that some dragonflies are multivoltine while others are univoltine contrary to the hypothesis that all are multivoltine in the tropics.

In spite of what is already known and the information gained from this study, our knowledge of Afrotropical dragonflies is still very deficient especially in the area of biology. Afrotropical dragonfly larvae are very poorly known and there has been very little association between larvae and adults of the same species. Without studying this aspect, our knowledge of dragonflies in the area, or in any other part of the world, will still be deficient even if all the adults are collected and identified.

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References – AMERICAN PUBLIC HEALTH ORGANISATION [AFHA], 1985, *Standard methods for the examination of water and wastewater*, 16th ed., Washington DC; – DUMONT, H.J., 1977, *Revue Zool. afr.* 91: 573-586; – 1978, *ibid.* 92: 303-315; – GAMBLES, R.M., 1960, *Jl. W. Afr. Sci. Ass.* 6: 18-26; – 1966, *Entomologist* 99: 161-173; – 1970, *ibid.* 103: 53-61; – 1971, *ibid.* 104: 177-189; – 1972, *Odonatologica* 1: 245-247; – HYNES, H.B.N., 1970, *The ecology of running waters*, Liverpool. Univ. Press, Liverpool; – LINDLEY, R.P., 1970. *Entomologist* 103: 77-83; – PARR, M.J., 1974, *Odonatologica* 3: 187-189; – PARR, M.J. & M. PARR, 1972, *ibid.* 1: 257-261; – 1974, *ibid.* 3: 21-47; – PINHEY, E., 1967a, *Ent. mon. Mag.* 96: 256-271; – 1961b, *ibid.* 97: 101-114: – 1962, *J. ent. Soc. sth. Afr.* 25: 20-50; – 1971, *ibid.* 34: 215-230.

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