

## OBSERVATIONS ON BUTTERFLY MIGRATION AT ENTEBBE, UGANDA

By

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### INTRODUCTION

Bird migration has been recognized as a to-and-fro movement for a long time, but this type of movement is recorded for relatively few species of butterflies. The best known of these are the Monarch (*Danaus plexippus* L.) of North America and the Red Admiral (*Vanessa atalanta* L.) and Painted Lady (*V. cardui* L.) of the Old World.

Records of migratory movements in these and many others, amounting to a total of 214 species, are summarized by Williams (1930) who defines insect migration as follows:

"It is a periodic, more or less unidirectional continued movement assisted by the efforts of the animal and in a direction over which it exerts a control, which results in the animal passing away from its previous daily field of activity."

It should be noted that Williams' definition does not state that migration is necessarily a two-way movement, although he also discusses the importance of observations on return flights which, in contrast to gregarious outgoing flights, are often very thinly spread and therefore likely to be overlooked.

The butterfly movements reported below at Entebbe were largely unidirectional, the insects flying consistently against the wind. They represent examples of transmigration. (Williams, *ibid.*)

### OBSERVATIONS

*Sites:* All observations were made in the area of Entebbe town and its surroundings within a distance of five to ten miles north of the equator.

*Period of observations:* Observations during the time of migration were conducted from the beginning of June to the end of the first week of July, 1967. Daily casual observations were made up to the end of the year and throughout 1968.\*

The detailed counts were all made on the compound of the East African Virus Research Institute on an extensive open area of mown lawn. Other occasional observations were made on the golf course, the airstrip, Kigungu beach which faces south into the open lake and on the lake about three hundred yards from the shore at Kigungu.

*Methods:* At the principal site a front of 35 yards running East-West was established, and insects flying across this line were counted and their direction noted. This front lay more or less at right angles to the main direction of flight.

### RESULTS

#### *Species represented:*

Specimens were taken of the following migrating species:—

*Belenois creona* Cr. (Pieridae)

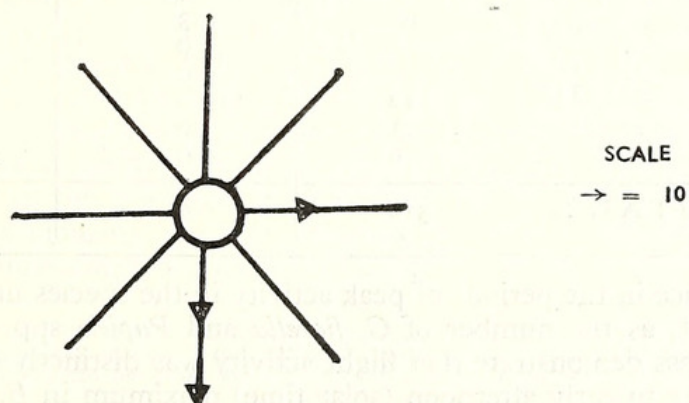
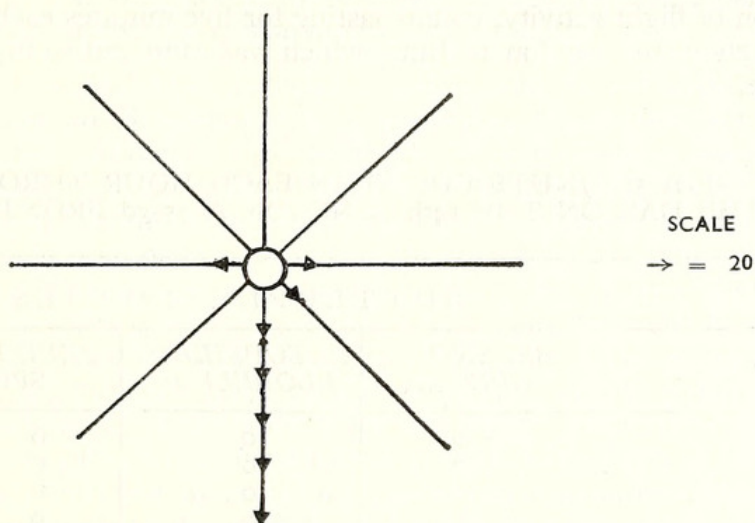
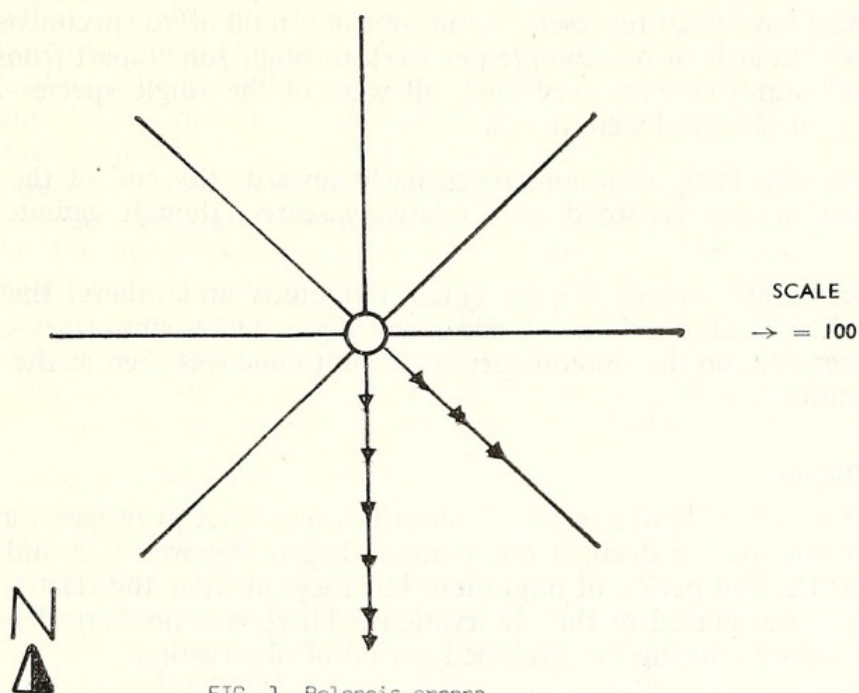
*Catopsilia florella* Fab. (Pieridae)

*Papilio demodocus* Esper (Papilionidae)

\*No further migration has been apparent at Entebbe up to July 1970.



FIGURES 1 - 3 Show the relative intensities and direction of migration of B. creona, C. florella and Papilio spp. respectively. The scales are different. The time during which counting was done totalled 270 minutes spread out during the entire course of observation.





Records of these and of the conspicuous *Papilio bromius/nireus* group were made. Towards the end of June and in early July some large yellow Pierids were evidently migrating, but as these flew high and evaded identification, records are not given.

*B. creona* was by far the commonest migrant. It is possible that closely similar *Belenois* species may have been represented, but out of a total of 70 specimens collected over six occasions with at least one sample per week through June (apart from the third week when overall numbers were very low), all were of the single species *B. creona*. Well over 50 per cent observed were males.

*C. florella* was also fairly common, particularly towards the end of the period of observations. Other species recorded were relatively scarce, though definitely on the move.

Resident species of *Eurema*, *Neptis*, small Lycaenids and others, though quite commonly seen, showed no consistently directional flight. Other butterflies could have been migrating elsewhere on the Entebbe peninsula, but none was seen at the sites used for regular observations.

### Migratory movements:

*Overall period:* Considerable migration of butterflies had been in progress at Entebbe for at least two weeks before detailed observations began. Figures 1, 2 and 3 do not therefore represent the full period of migration, but they do show the relative intensity of migration during the period of the observations. There was no butterfly migration across Entebbe peninsula during the extended period of observation.

*Time of day of flight:* In order to obtain an indication of the period of commencement, peak and cessation of flight activity, counts lasting for five minutes each were conducted every hour throughout the day (on 14 June) which was calm and sunny. The results are given in the table.

TABLE  
RESULTS OF A 5-MINUTE COUNT IN EACH HOUR THROUGHOUT  
THE DAY ON THE 14th JUNE (ON A 35-yd FRONT)

TIME (Solar time)	BUTTERFLY SPECIES			TOTAL
	<i>BELENOIS CREONA</i>	<i>CATOPSILIA FLORELLA</i>	<i>PAPILIO SPP.</i>	
0700—0705	0	0	0	0
0800—0805	0	0	0	0
0900—0905	0	0	0	0
1000—1005	9	0	0	9
1100—1105	13	2	2	17
1200—1205	17	4	1	22
1300—1305	67	3	1	71
1400—1405	128	0	0	128
1500—1505	63	0	0	63
1600—1605	12	0	0	12
1700—1705	1	0	0	1
1800—1805	0	0	0	0
TOTAL	310	9	4	323

The difference in the periods of peak activity in the species under consideration are hardly significant, as the number of *C. florella* and *Papilio* spp. were too small. The results nevertheless demonstrate that flight activity was distinctly diurnal leading up to, and from, midday to early afternoon (solar time) maximum in *B. creona*.



## DISCUSSION

It is noteworthy that all species of migrating butterflies observed showed a marked southerly bias in flight direction which would have taken them out into the open lake. However, the method of choosing a front which lies more or less at right angles to the main direction of flight, and then counting butterflies flying across this line is likely to yield quantitatively biased results. This was not realized at the time and the results given here should be viewed accordingly. When movement is entirely unidirectional it would seem obvious that to assess flight activity one would follow the above method. On the other hand, for insects which diverge from the main directional axis, the real front is reduced as their direction of flight approaches that of the front. Thus, if one considers insects flying at random across an East-West line, then none of those flying due East or West would be recorded at all, and the resultant directional chart would be shaped like a figure-of-eight. To eliminate such bias it is suggested that an area should be staked which subtends  $60^\circ$  of a circle. The observer should stand at the centre of the circle, and insects counted and their direction noted at the points at which they enter the area. Such a method would be feasible when conspicuous butterflies are under observation. The radius of the area may be varied depending on observability.

If the tendency to migrate southwards is genetically determined, then one might assume that migration must be of considerable advantage to persist in such a spectacular form as indicated by the numbers observed. These butterflies were migrating not only at Entebbe during this period; on 27 and 28 May *Belenois* butterflies were seen in very great numbers flying across the Kampala to Mbarara road, a distance of 165 miles, in a south and south-eastwards direction (J. Kingdon, *pers. comm.*) and the same movement was observed on 3 June and it was estimated that more than 95 per cent were flying towards the lake (A. W. R. McCrae, *pers. comm.*) By 11 June numbers appeared to be much fewer and direction less consistent (*idem*).

The observation that flight activity was distinctly diurnal with a midday to early afternoon maximum in *B. creona* raises the question of whether the butterflies would rest or attempt to rest while over the lake. There are numerous examples of butterflies and other insects being seen at great distances out to sea. R. H. Carcasson (*pers. comm.*) has personally seen swarms of *V. cardui* in the Mediterranean and *C. florella* in the Arabian sea, some five hundred miles from the nearest land. This suggests either that they are capable of resting on and taking off from the sea\* or that over open water they do not cease flying. This may be a question of assistance by winds and by endurance in terms of energy reserves. Hocking (1953) calculated that owing to the high efficiency of a food reserve in the form of fat, many lepidoptera are capable of flying several hundred miles without feeding. A proportion of the butterflies which head over the lake from Entebbe and other places may nevertheless perish before they reach land, and such migrations could be suicidal. It would be of great interest to have observations from the southern and south-eastern shores of Lake Victoria, e.g. from Mwanza.

The causes and objectives of such migrations still remain a matter for speculation. *B. creona* is a very widespread and highly mobile species inhabiting dry country, as numerous records of migratory flights show (Williams, 1930). The food plant of this species include *Capparis* and *Maerua* (Williams, 1930; R. H. Carcasson, *pers. comm.*), plants which occur in Uganda largely in dry thicket country along the Western rift and in the north-west of the country. Pitman (1928, in Williams, 1930) believed that these migrations originate in the lowlands of West Nile district where he remarked: "One can only describe as amazing the vast breeding grounds encountered. I have never before seen such countless myriads of butterflies, as far as the eye could see there was a

\*Urquhart, in a monograph on the "Monarch Butterfly" of North America, proves by experiment that it can rest on the surface of water and also can rise from the surface when released from below the surface. Published by the Toronto University. M.C.



shimmer of white just above the surface of the ground . . . ."; he did not observe directional movements at the time. It was clear that this population was extremely crowded and food for the ensuing larvae would have been limited, therefore necessitating either very high mortality or dispersal. Food supply in such dry areas is seasonal, and such locally abundant species may only survive periods of food shortage either by a period of dormancy or by migration.

A closer study of the biology of migratory *Belenois* should illuminate these extremely interesting problems.

#### SUMMARY

Observations on migrant butterflies at Entebbe are described. *B. creona*, *C. florella*, *P. demodocus* and the *Papilio bromius/nireus* group were the species represented during the course of migration and they all showed a marked southerly bias in flight direction.

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