

MIGRATIONS OF BUTTERFLIES IN SIAM, WITH SOME REMARKS ON
MIGRATIONS IN GENERAL.

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Reports of an unusual migration of butterflies in Bangkok, which appeared in the local press on April 30th 1927, aroused some interest amongst those readers interested in Natural History.

Records are given below of this and of other migrations which have been observed in Siam. The migrations, five in number, are as follows:—

<i>Date.</i>	<i>Locality.</i>	<i>Observer.</i>
April 4th-5th, 1912.	Pechaburi River, W. Siam.	E. J. Godfrey.
April 12th-13th, 1914.	Sriracha, S. E. Siam.	E. J. Godfrey.
May 23rd, 1926.	Huey Sak, Chumporn, P. Siam.	J. H. Hee.
April 12th-16th, 1927.	Kaw Tao, P. Siam.	A. F. G. Kerr.
April 28th-29th, 1927.	Bangkok, C. Siam.	A. F. G. Kerr.
		and W. R. S. Ladell.

It is highly probable that butterfly migrations in Siam are of far more frequent occurrence than is generally supposed. Dr. Kerr has witnessed more than the one recorded above, and on several occasions I have heard reports from villagers of unusual swarms of fighting butterflies, especially in the neighbourhood of Muak Lek and Pak Jong, E. Siam. Near the latter village I witnessed, on January 2nd 1914, an extraordinary assemblage of butterflies of the allied species *Euplaea modesta*, *E. harrisi*, *E. mulciber* and *E. midanus chloë*.

I recorded this in the Journal of the Natural History Society of Siam* and part of the record reads as follows:—"Not only were the butterflies massed on the trunks of the trees, but they were on almost every branch and twig. They hung in long rows from the lower bushes and even the lowest undergrowth swarmed with them. On some trees they seemed to form part of the foliage..... Males preponderated. Numerous pairs were *in copula*. Individuals on the bushes could be taken quite easily with the fingers, in fact, the Siamese bark-collector who conducted me to the hill embarrassed me somewhat by bringing me living specimens in handfuls."

* The Butterflies of Siam. Vol. ii, No. 2, p. 119 (1916).

When I left Pak Jong, two days later, the butterflies were still there. Whether or not this extraordinary assemblage was connected with the beginning or end of a migratory flight, I could not tell, but it was evidently no normal occurrence. I visited the hill-side on almost the same date in the following year, but not a single *Euploeid* was to be seen there.

The Pechaburi River Migration.

This flight consisted of swarms of *Catopsilia crocale* Cram., *Catopsilia pomona* Fabr. and *Appias albina darada* Feld., interspersed with a small proportion of *Papilio antiphates pompilius* Fabr.

The butterflies were not in "cloud" formation, but in what has been called "diffuse" order. They appeared at irregular intervals, sometimes singly, but more frequently in straggling groups of from three to six. They were flying down stream close under the right bank of the river at a height of from two to six feet above the water and followed every twist and turn of the bank, never advancing into mid-stream. The flight, which lasted for two days, commenced at about 9 a. m. and continued until quite late in the afternoon. The butterflies were flying at moderate speed against a slight breeze, but at no point did they stop to rest, although everywhere on the left bank, wherever there were moist places, huge crowds of the species represented in the flight were assembled. The vast assemblages, which are so frequently recorded, of butterflies at moist places in roads, or on river banks, are generally accounted for as being associated with migrations, the butterflies being either resting or assembling preparatory to flight. From my own observations, however, I am certain that this is not always the case. I have seen these vast assemblages of butterflies in many parts of Siam, but have never found them associated with migrations.

The Sriracha Migration.

This was also of the "diffuse" type and was made up entirely of males and females of *Appias albina darada* Feld. The butterflies were flying very fast and were difficult to capture. Those obtained were in very good condition and evidently had only recently emerged from their chrysalides. Males preponderated. Such breeze as there was, was against the butterflies. The flight lasted for two days and,

although the density was never great, the migration was always distinctly conspicuous. One remarkable feature of this flight is, I think, worthy of record. At a point about a mile from Sriracha village the jungle path in which the butterflies were flying crossed another path almost at right angles.

At this point the butterflies had the choice of three paths; the one in which they were travelling would have taken them straight through the main street of the village, that to the left led to the sea. The path to the right after a short distance turned sharply to the left again and led eventually to the outskirts of the Sriracha forest. All the butterflies, without exception, took the path to the right. Some of them seemed to hesitate at the junction of the paths and a few passed on towards the village, but these soon returned to join the main stream.

It would almost seem that, in this case, the butterflies were able to discriminate between the path to the sea which would have led them to destruction and that to the right which held out the possibility of leading to suitable feeding grounds. As far as I could see, there was nothing which accounted for the divergence from the original path.

The Huey Sak Migration.

This was of the "cloud" type and five species were included in it, viz. *Papilio polytes* Linn., *Catopsilia crocale* Cram., *Danaïda similis persimilis* Moore, *Euplaea mulciber* Cram., and *Cynthia erota* Fabr.

According to the observer, Mr. J. H. Hee, the flight started at about 8.30 a.m. and continued until noon by which time, in his opinion, millions of butterflies must have passed. The day was bright and pleasant, with a fresh westerly breeze, and the butterflies were flying almost due south. They passed at height of 1 to 8 yards on a front of about 100 yards. During the afternoon a few straggling lines were seen returning due north, and for some days afterwards there were unusually large numbers of butterflies around the bungalow and in the garden.

The Kaw Tao Migration.

Kaw Tao is a small island about 50 kilometres from the mainland of Peninsular Siam and 30-40 kilometres from Kaw Pa-

Ngan, the nearest island.

On landing on the island at about 8 a.m. on April 12th, Dr. Kerr observed vast crowds of the Pierid *Appias albina darada* Feld. and the Nymphalid *Cyrestis cocles* Fabr. The Pierids were hovering about the vegetation along the beach and visiting the flowers of *Euphorbia Atoto*; the Nymphalids were assembled on damp patches of sand.

At about noon the Pierids were moving northwards along the beach in straggling strings, but at about 4 p.m. some of them were flying south, whilst the flight of others was irregular.

On April 13th, they (the Pierids) were flying north, most of them along the beach but considerable numbers over the sea, up to 50-100 yards from the shore. On April 14th, they were in full flight north, quite as many travelling over the sea as long the beach.

On April 14th, Dr. Kerr visited one of the peaks of the island. From the top of this peak clouds of butterflies could be seen everywhere flying over the tops of the trees. The moving clouds appeared to consist of the two species mentioned above, and the direction of flight of the majority was north.

On April 16th at 9 a.m. the Pierids were travelling south, many hundreds of them flying over the sea about 20-50 yards from the shore, fewer numbers proceeding along the the beach.

Dr. Kerr made no butterfly notes on the 17th and 18th, the remaining days of his stay on the island, but he noticed that the Pierids were still very plentiful.

He was not able to make observations at the north or south ends of the island and so could not determine whether the butterflies came across the sea to the island, or left it by that route.

He concluded that the millions of butterflies which were everywhere on this small isolated island could not have been bred there.

The above records are the more interesting as the swarms on the island occurred about a fortnight before the Bangkok migration which is dealt with below.

The Bangkok Migration.

As stated above, this migration took place on April 28th and 29th. It was first observed at Nondaburi, where vast crowds of

white butterflies were seen flying down the river Chow Praya towards Bangkok and the sea. In Bangkok, according to Major W. R. S. Ladell, Chief of the Bureau of Agricultural Science, the butterflies distributed themselves in millions in the gardens and fields, vast numbers settling on Pradoo trees. At Bangkolem they appeared "like a veritable snowstorm." The flight consisted entirely of the males and females of the pierid *Appias albina darada* Feld. Of 40 specimens captured, 24 belonged to the former sex, and 16 to the latter. Dr. Kerr observed large numbers of the butterflies flying about the tops of the trees in Luang Sunthorn Kosa's Road at about 5.30 p.m. on the 28th and on the following afternoon he noticed swarms flying across Wireless Road and going nearly due east.

The subject of the migration of butterflies is one which has received much attention in recent years but, although many interesting facts have come to light, the whole problem is still very obscure.

Migrations are most frequent in the Pieridae, records in this family being known from all parts of the world.

C. B. Williams, M.A., F.E.S., Department of Agriculture, Trinidad, in a series of four papers,* which were read before the Entomological Society of London, deals with migrations in British Guiana, Trinidad, Tropical America, and other parts of the world.

He finds it possible to distinguish between three types of migration, viz.

- (i) The "cloud" or "snowstorm" migration.

Migrations of this type attract the attention of even the most casual observer and are consequently the ones most frequently recorded.

- (ii) The "diffuse" migration.

In this type of migration the butterflies may be flying in such numbers as to be distinctly noticeable, or they may be in such attenuated formation as to escape the notice of all but the close observer. It will be understood, of course, that there is no fixed line of demarcation between this and the "cloud" type. A "cloud" mi-

* Trans. Ent. Soc. London, 1917, p. 154; 1919, p. 76; 1920, p. 146; 1923, p. 207.

gration may be conceived as merging, on its edge, into a diffuse one.

(iii) The "ribbon" or "procession" migration.

Williams defines this type as one in which "a narrow band of butterflies a few feet or a few yards wide flies across country in the direction of its length."

Williams gives many striking examples of "cloud" or "snow-storm" migrations, two of which I quote.

Of a remarkable migration in British Guiana referred to by Rodway ("In the Guiana Forest") he says (quoting Moore):—".....it was observed by Sir Robert Schomburgk on the 18th of October 1838, when going up the Essequibo, and it continued crossing the river for nine hours and a half, during which time his boat ascended nine miles. A thousand million is not too high an estimate for the number of individuals in the swarm."

Of a migration which he himself witnessed in Trinidad in 1918 he writes:—".....the numbers passing varied from two or three occasional specimens to a cloud so dense as to interfere with the progress of a motor-car. Perhaps an even better idea of their occasional abundance is obtained from one record in which they were stated to be passing over a house in the country in such immense numbers that the turkeys in the garden looked up at them and gobbled in consternation!"

A fourth and very interesting type of migration is that known as the "return" migration. Flights of this type were witnessed by A. R. Sanderson and T. R. Harvey at Bukit Kutu, about 35 miles N. N. E. of Kuala Lumpur, in March 1920. The flights, which took place from one valley to another, lasted from the 5th to the 13th, the outward migration taking place in the evenings at about 5.30 p.m. to 6.45 p.m., and the return migration in the early mornings from 6.30 a.m. to 8 a.m. A striking feature of these migrations, and one which aroused much interest at the time, was that the flights were made up of both butterflies and moths. Two Pierids, *Delias ninus* Wall. and *Delias aglaia parthenope* Wall., were represented; these were accompanied by their moth mimics *Dysphania (Euschema) glaucescens* Walk., *Dysphania militaris selangora* Swin, and *Dysphania excubitor* Moore, and these again by their moth mimic *Psap-*

his camadeva Dbl. At a meeting of the Entomological Society of London in October 1920, at which the writer was present, Professor Poulton exhibited nineteen captured examples of these migrations and pointed out the extraordinary mimetic resemblance between the butterflies and moths.

Daily migrations of a similar nature were witnessed by W. C. M. Pendlebury in April 1917 on the edge of cultivated land that lay between the British trenches round Gaza and the Turkish lines but, in this case, the flights were made up of one butterfly, *Papilio cardui*, only.

Professor Poulton has discussed* these and other migrations and the following are some of the conclusions at which he has arrived on migrations in general:—

- (i) The migratory instinct must be liberated before migration can take place.
- (ii) This instinct is probably evoked by the exhaustion of the larval food-plant.
- (iii) The instinct to migrate may be liberated every year, or only in exceptional years.
- (iv) There must be some stimulus which determines and keeps the direction of flight.
- (v) The most usual stimulus is probably the wind-current.
- (vi) The reaction to the stimulus probably differs in different species and in different countries.
- (vii) As flights against the wind are more frequent than flights with it, the stimulus in the former case is probably greater than in the latter.
- (viii) A species which reacts to the wind-current will reverse its direction with each reversal of the wind. (This would explain the Kuala Lumpur and other "return" migrations).

Williams in the last of the four papers referred to above discusses the immediate internal and external factors which he thinks may possibly influence migration and which he considers should be studied more carefully. He tabulates these as follows:—

* *Vide* Trans. Ent. Soc. Lond., pp. xii-xxvi (1921).

	<i>External.</i>	<i>Internal.</i>
<i>Start.</i>	Overcrowding.	Hunger.
	Shortage of food.	Sex impulse.
	Moisture (shortage or surplus).	Periodicity or habit.
	Temperature.	Imitation.
	Electrical state of atmosphere.	
	Wind.	
	Light (Sun and moon).	
<i>Course.</i>	Wind.	Instinct (? habit).
	Sun and (?) moon.	Imitation.
	Pressure.	
	Temperature gradient.	
	Moisture gradient.	
	Contour of land.	
<i>Finish.</i>	Arrival at required conditions,	Fatigue,
	or	End of reserve energy supply.
	Failure of previous stimulus.	Development of sex organs or other physiological state.

He points out that in all cases "both external stimulus and internal response will be necessary as every insect does not migrate in spite of the most favourable circumstances, and even the best known migrants require certain conditions before they will move."

Of the most important of these factors — the wind — he says in his final conclusions:—"The question of the determination of direction still remains unsettled. An external factor, such as wind, cannot be said to be the real determining cause unless — other things being equal — migration takes place in all directions in the same proportions as the frequency of the prevailing winds and in the same relation to them."

He can find no explanation for "the blind influence of forced movements.....indicated by the case of large flocks of butterflies flying straight out to sea, or by the almost annual spread of *Pyrameis cardui* into large areas of Europe where it cannot survive the winter, and from where we have no evidence of any return."