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Desert locust forecasting manual (Volume 2 of 2)

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**DESERT LOCUST
FORECASTING MANUAL**



VOLUME II

DESERT LOCUST FORECASTING MANUAL

edited by

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Centre for Overseas Pest Research
London, W8 5SJ
UK

VOLUME II

1980
HMSO

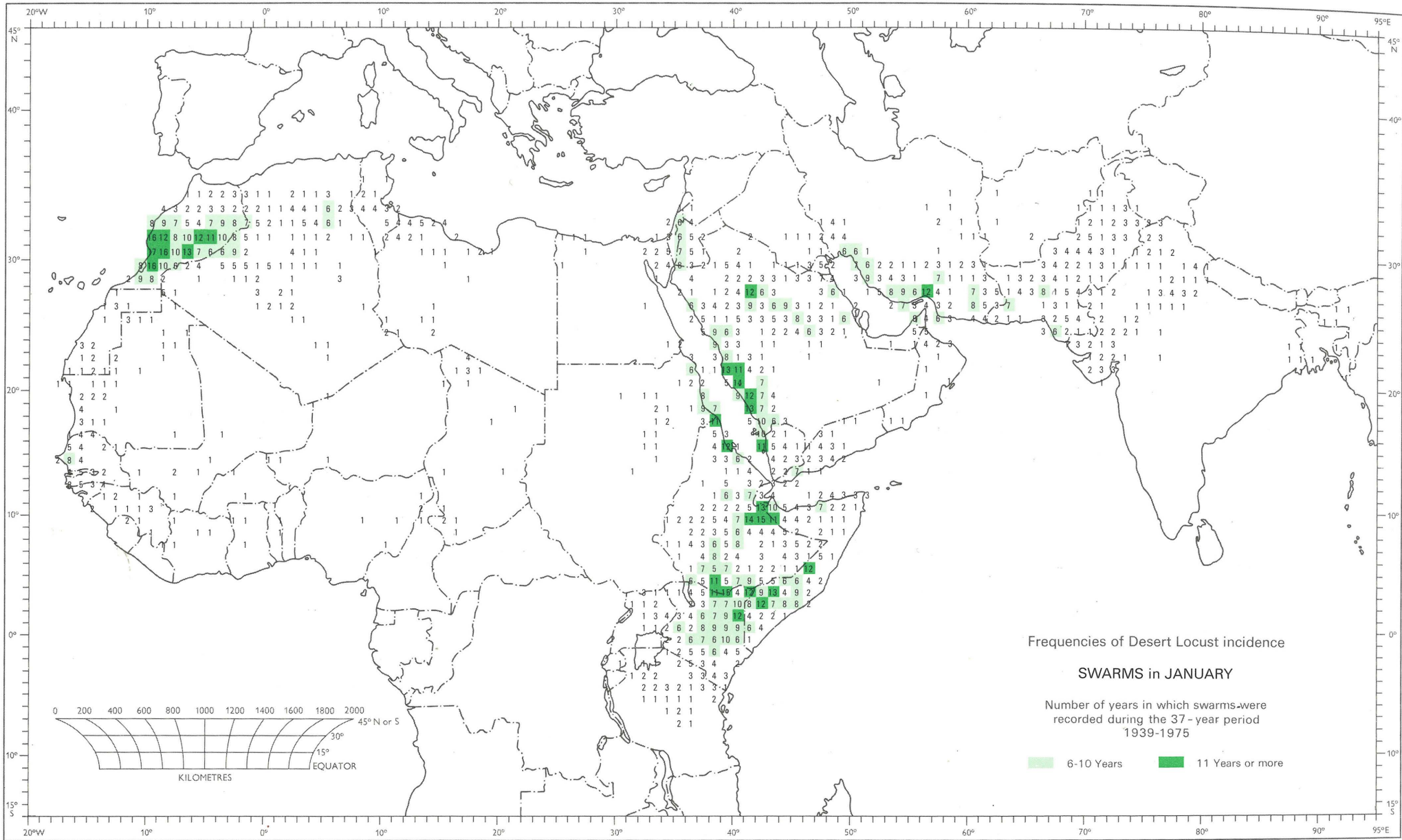
ISBN 0 85135 121 2

Printed in England for Her Majesty's Stationery Office by Ordnance Survey, Southampton.

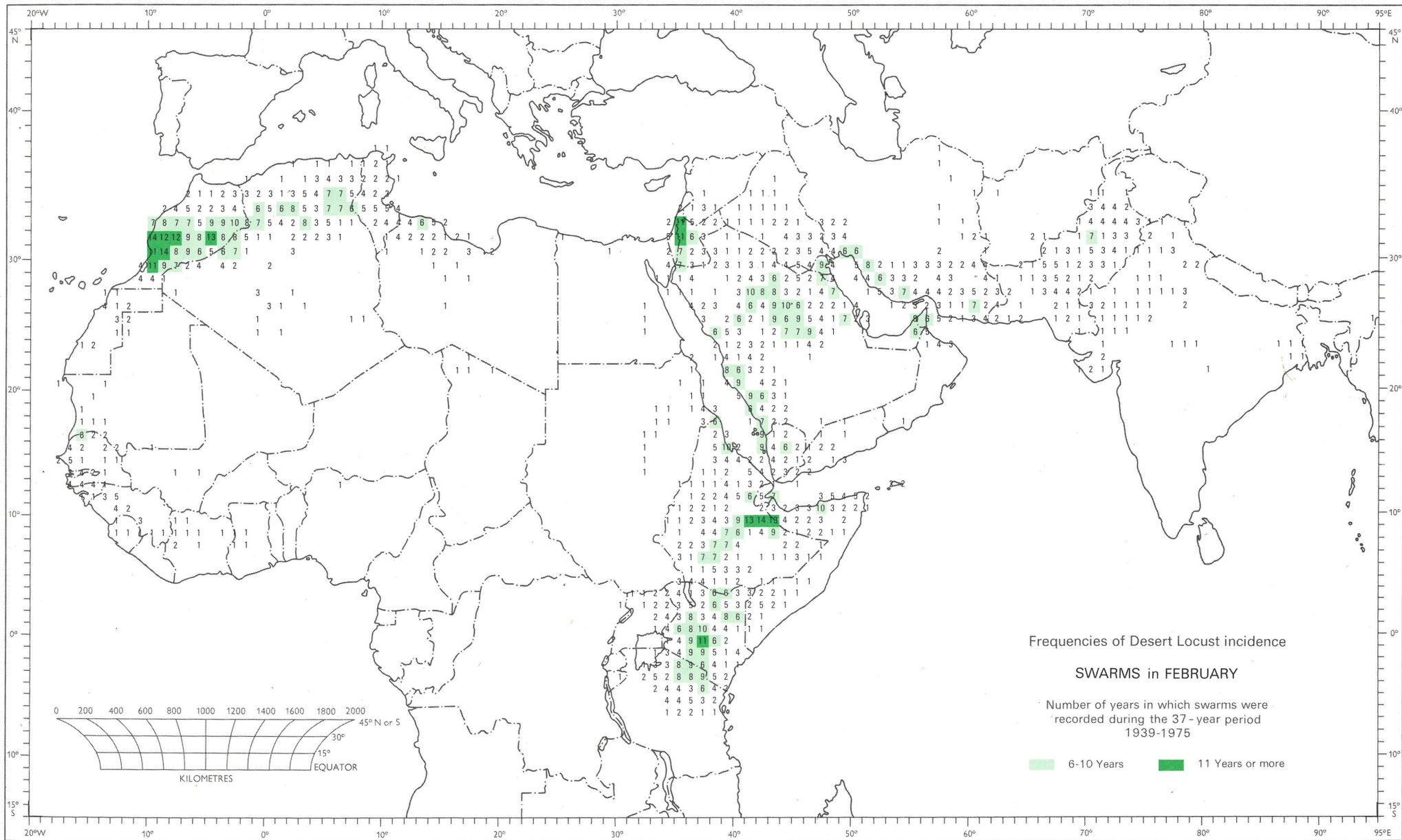
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MAPS OF FREQUENCIES OF DESERT LOCUST INCIDENCE

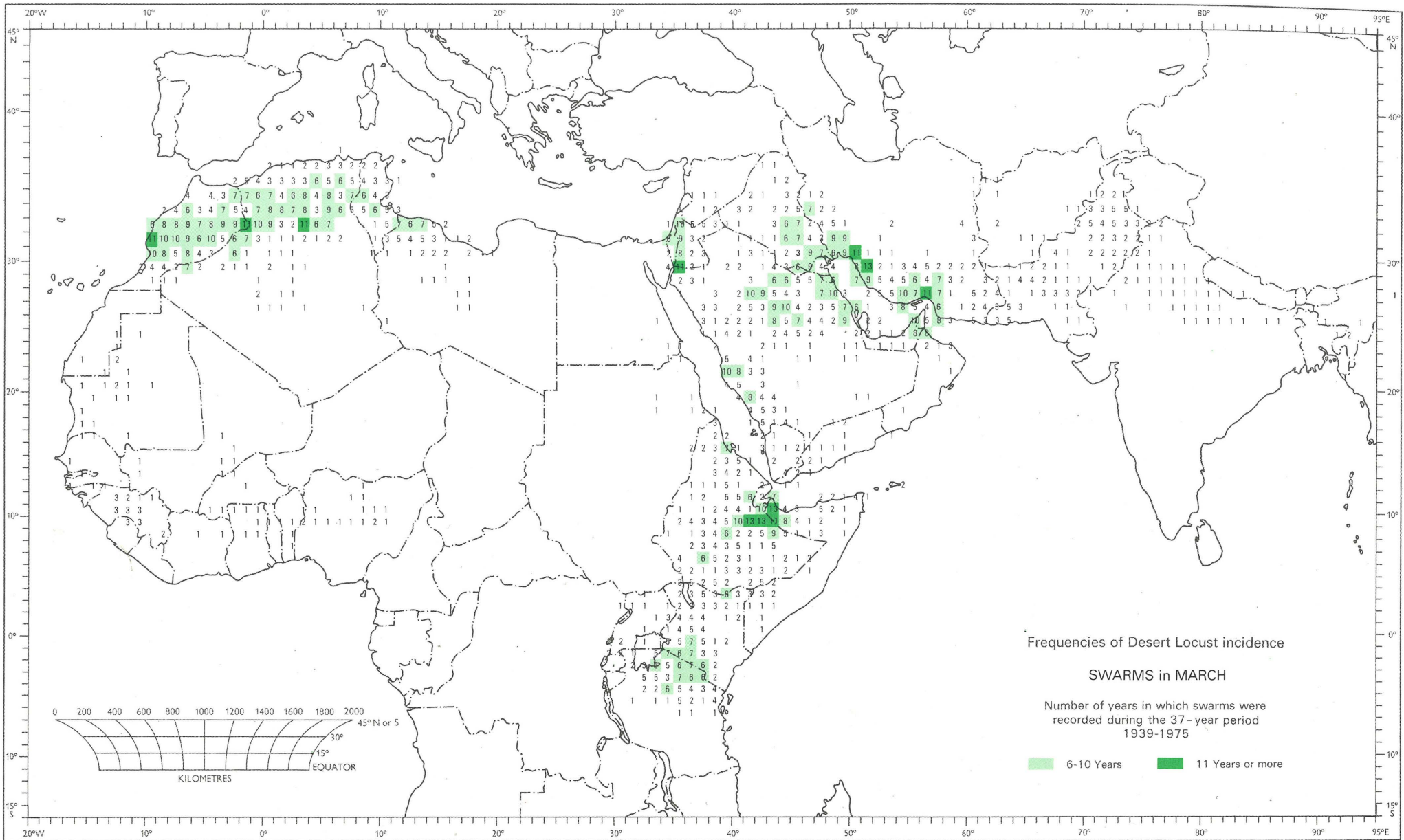
The following 24 maps show, for each calendar month, the number of years in which swarms and hopper bands were recorded during the 37-year period 1939-1975. Records are grouped into 'squares' of one degree latitude and one degree longitude, and colour shading has been used to aid recognition of areas where records were most frequent. For a discussion of the compilation and usefulness of these maps see Section 2.4.1.



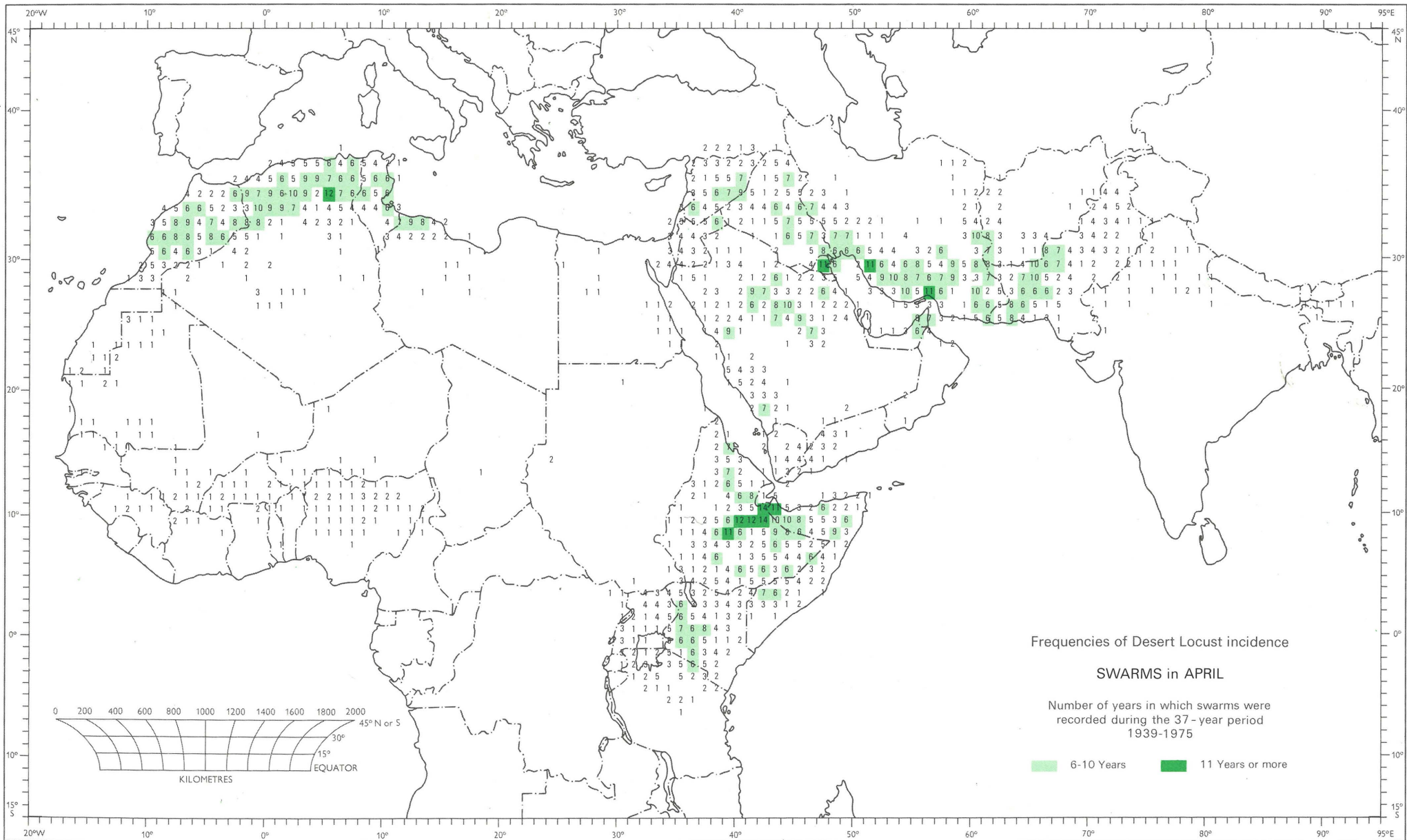
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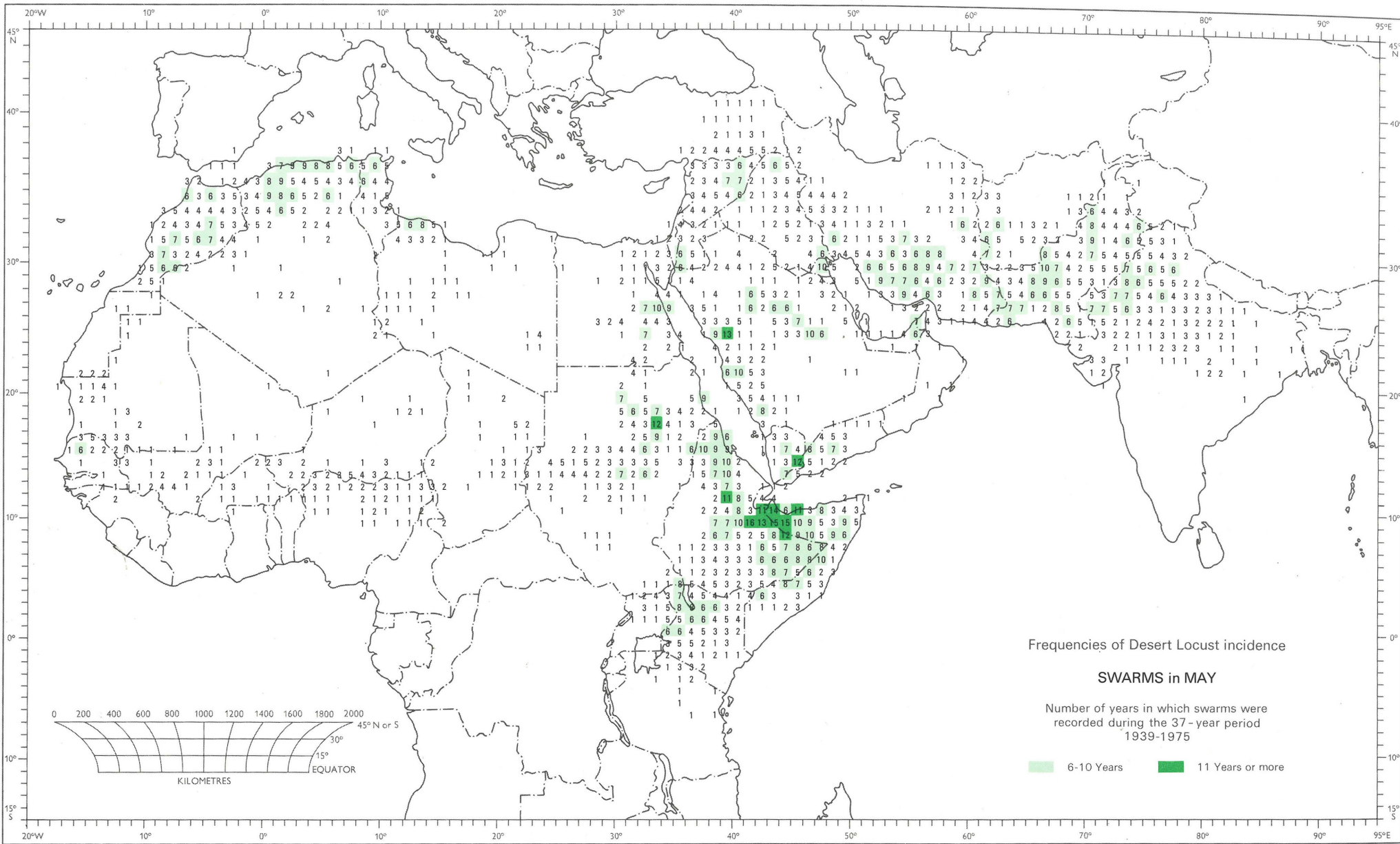
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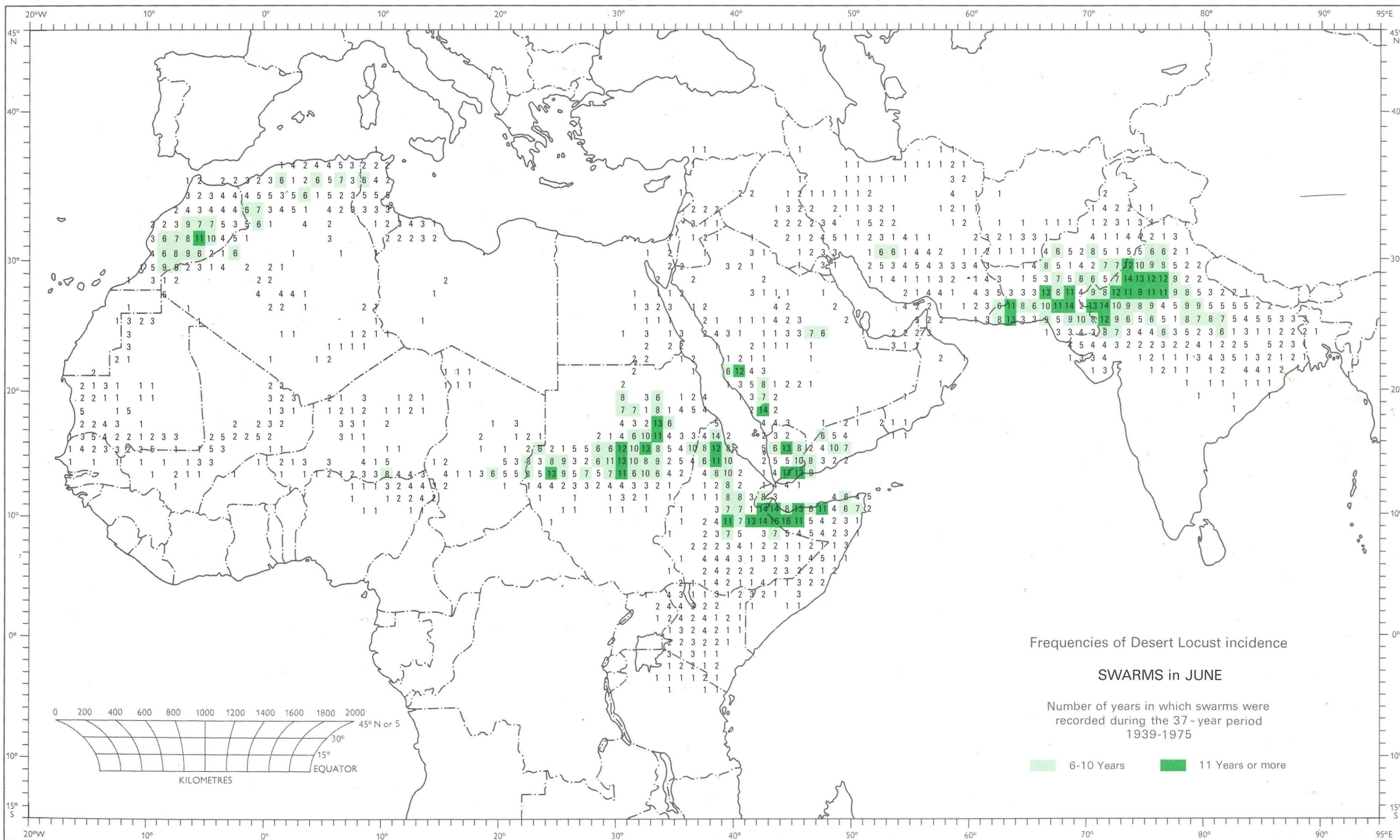
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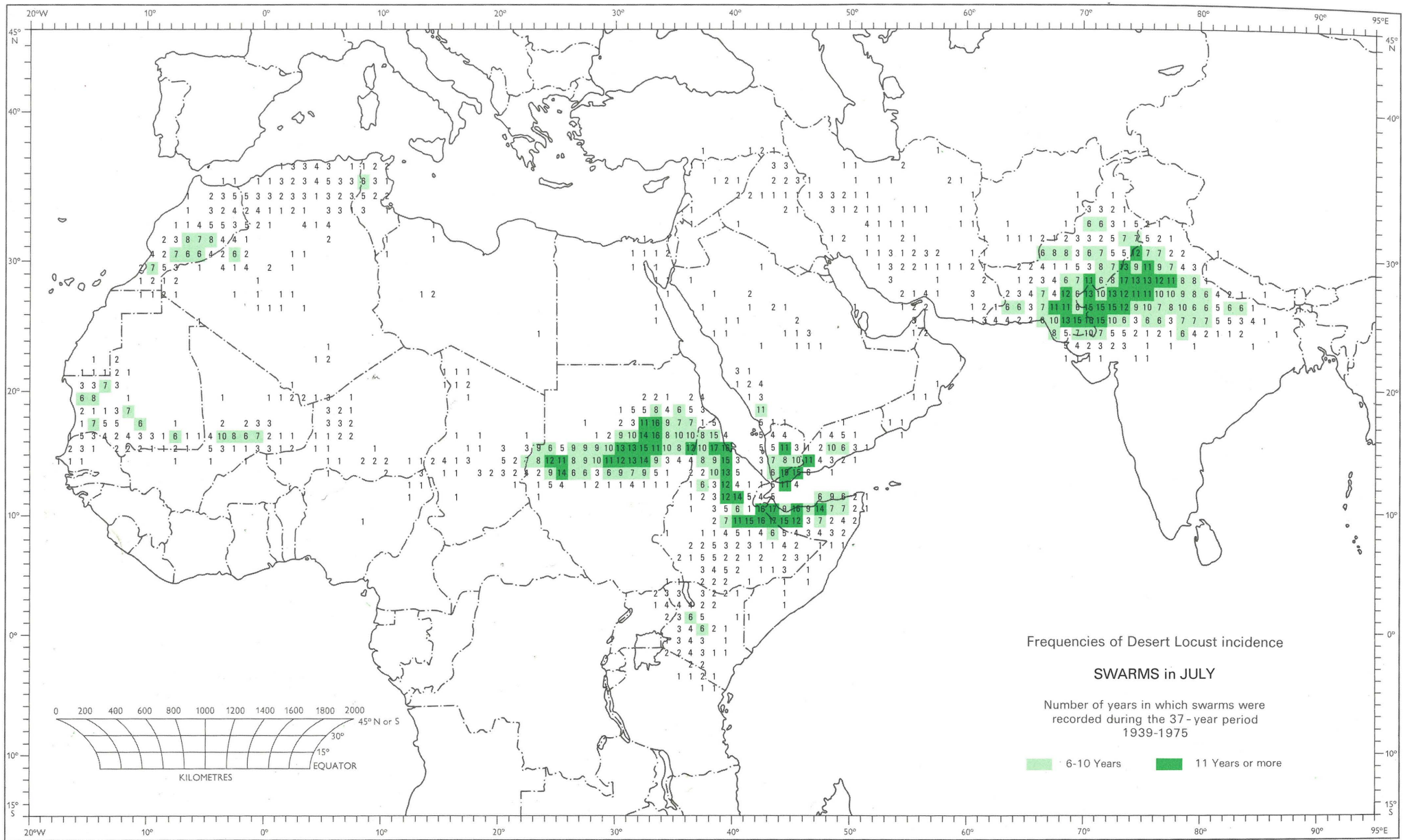
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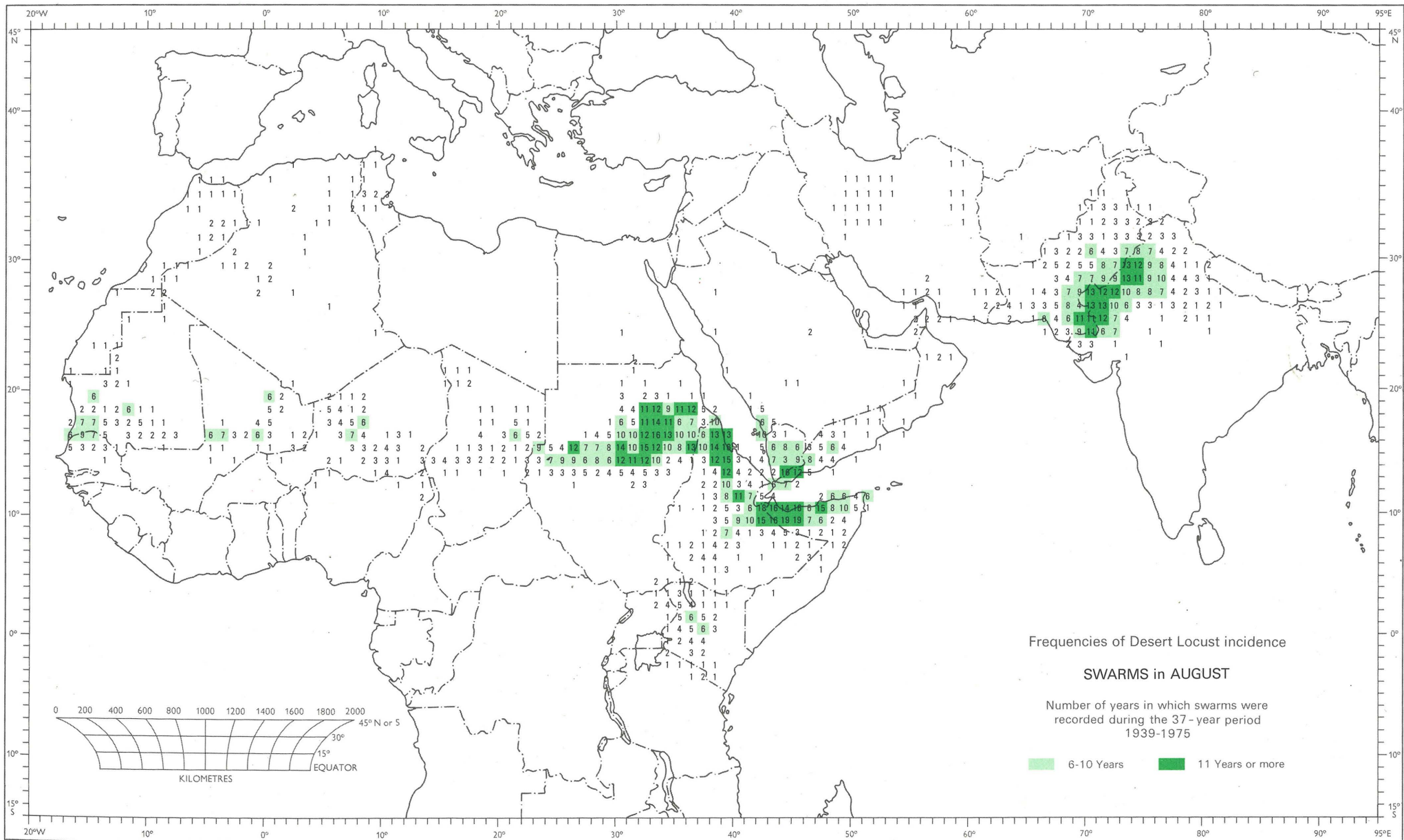


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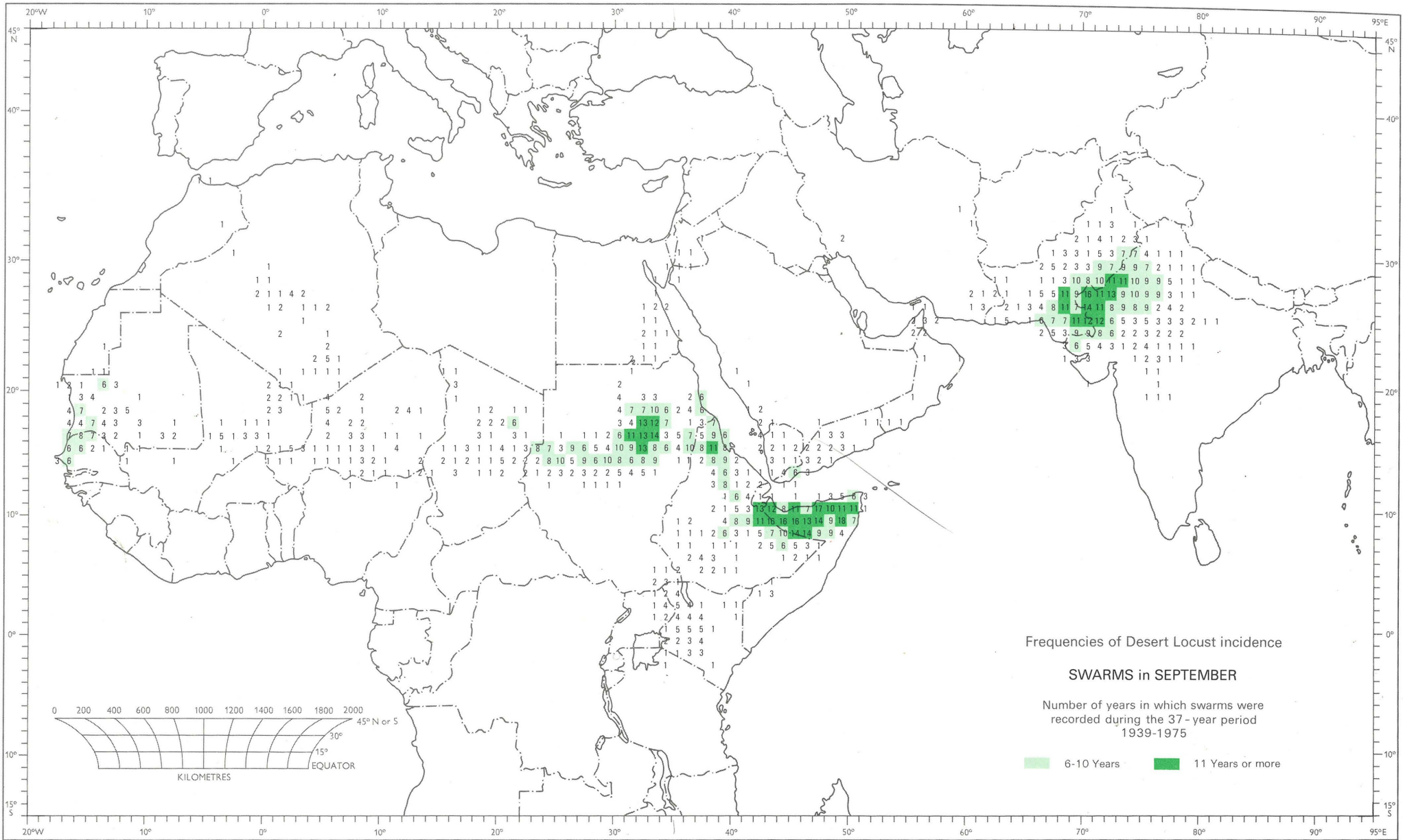


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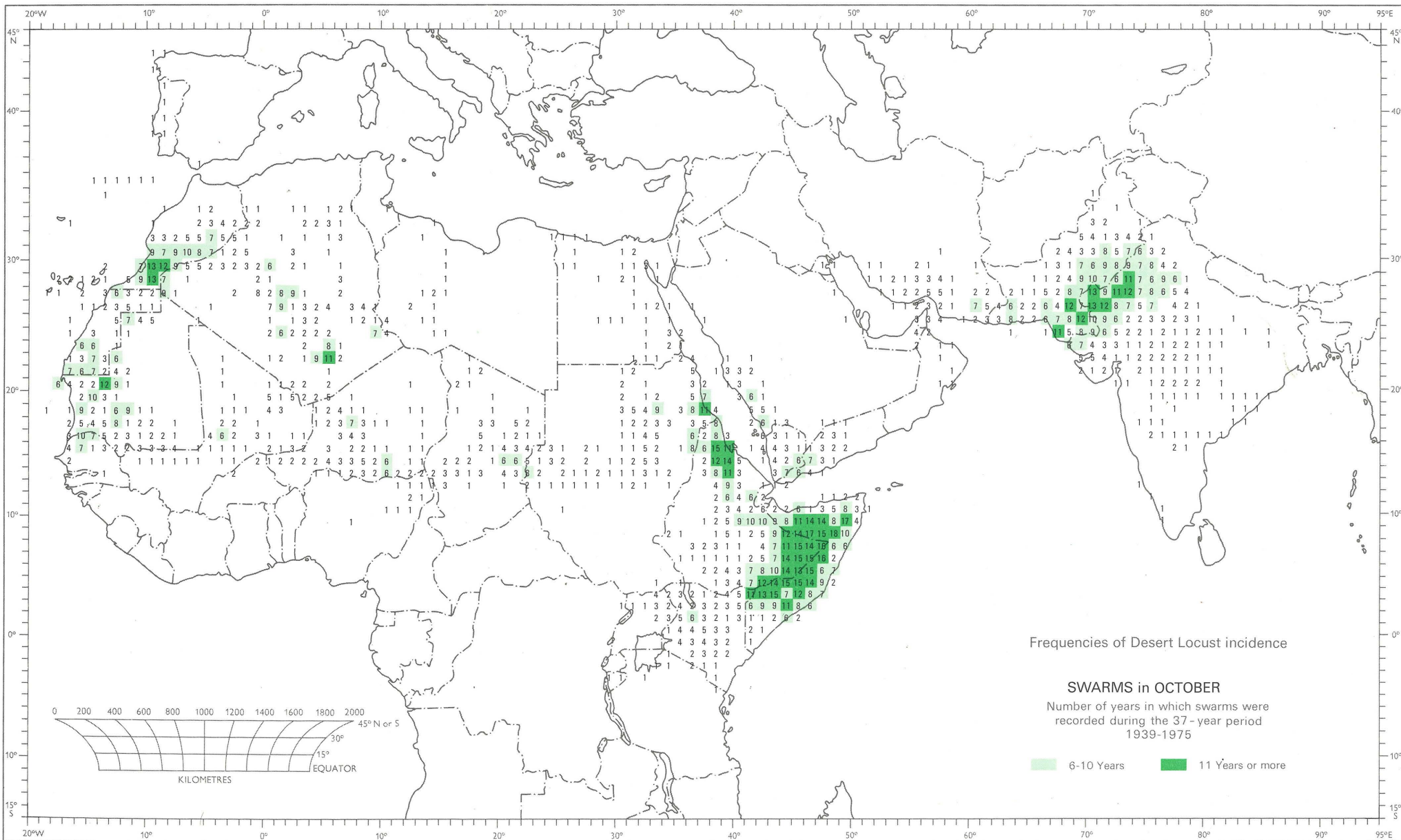




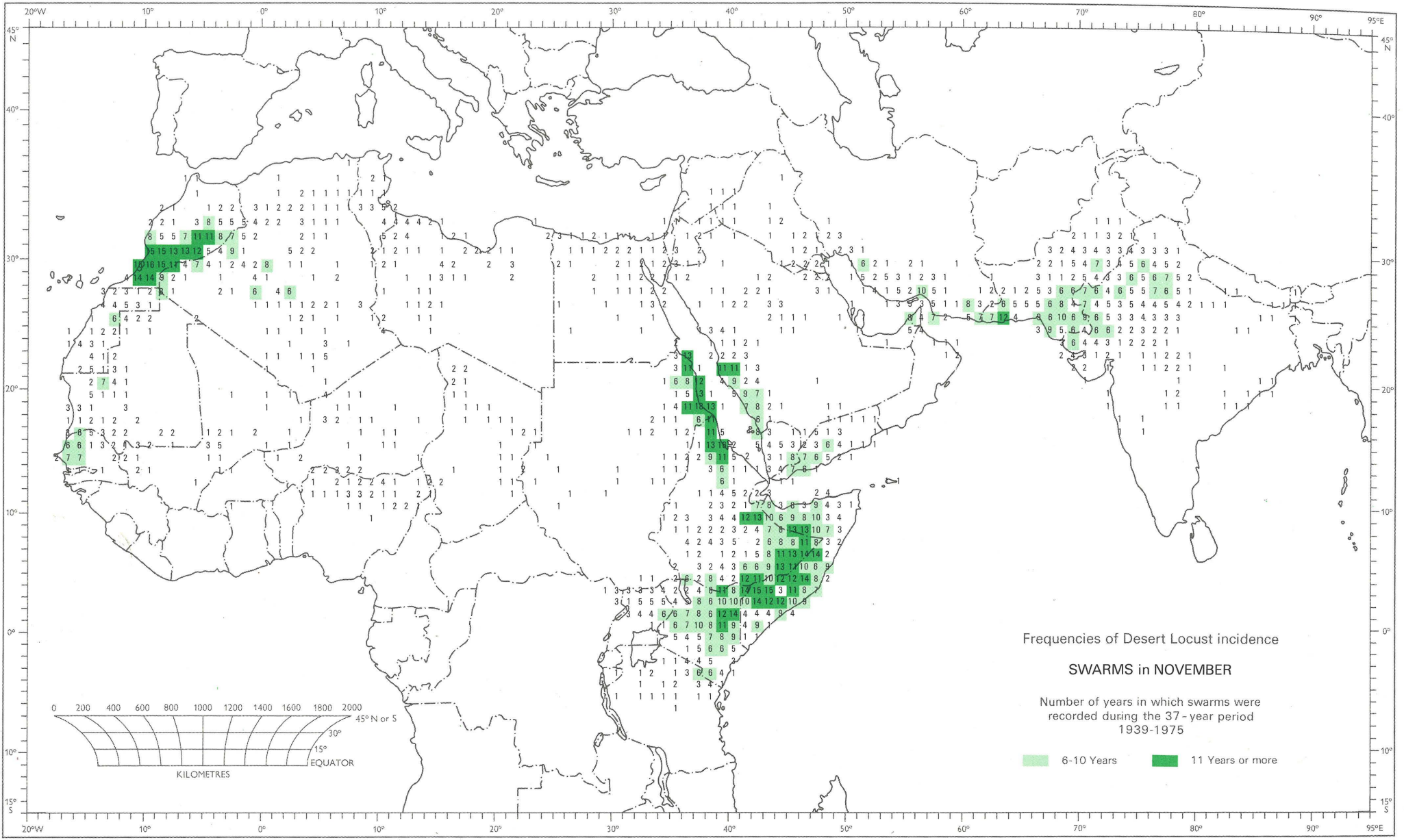
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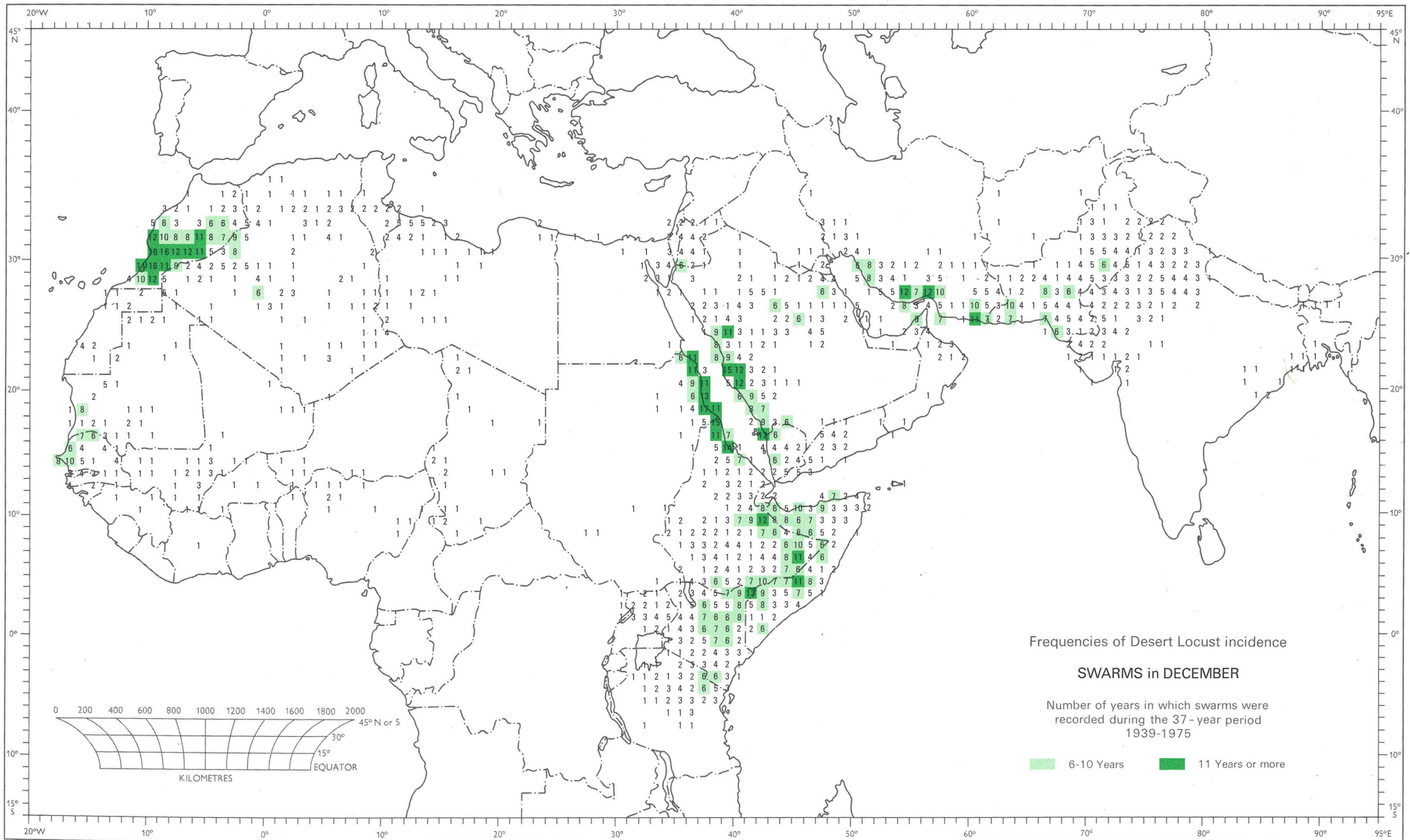
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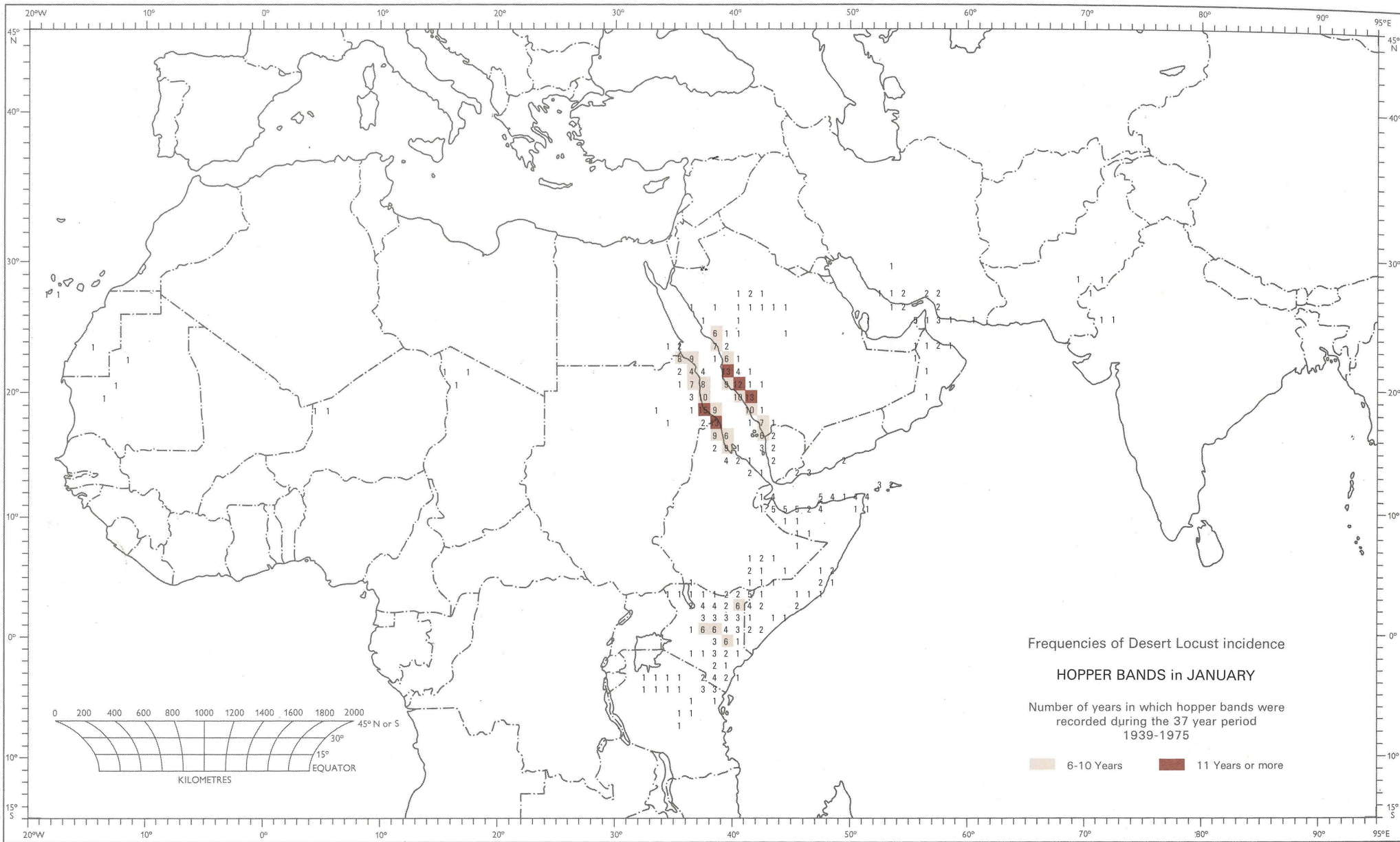
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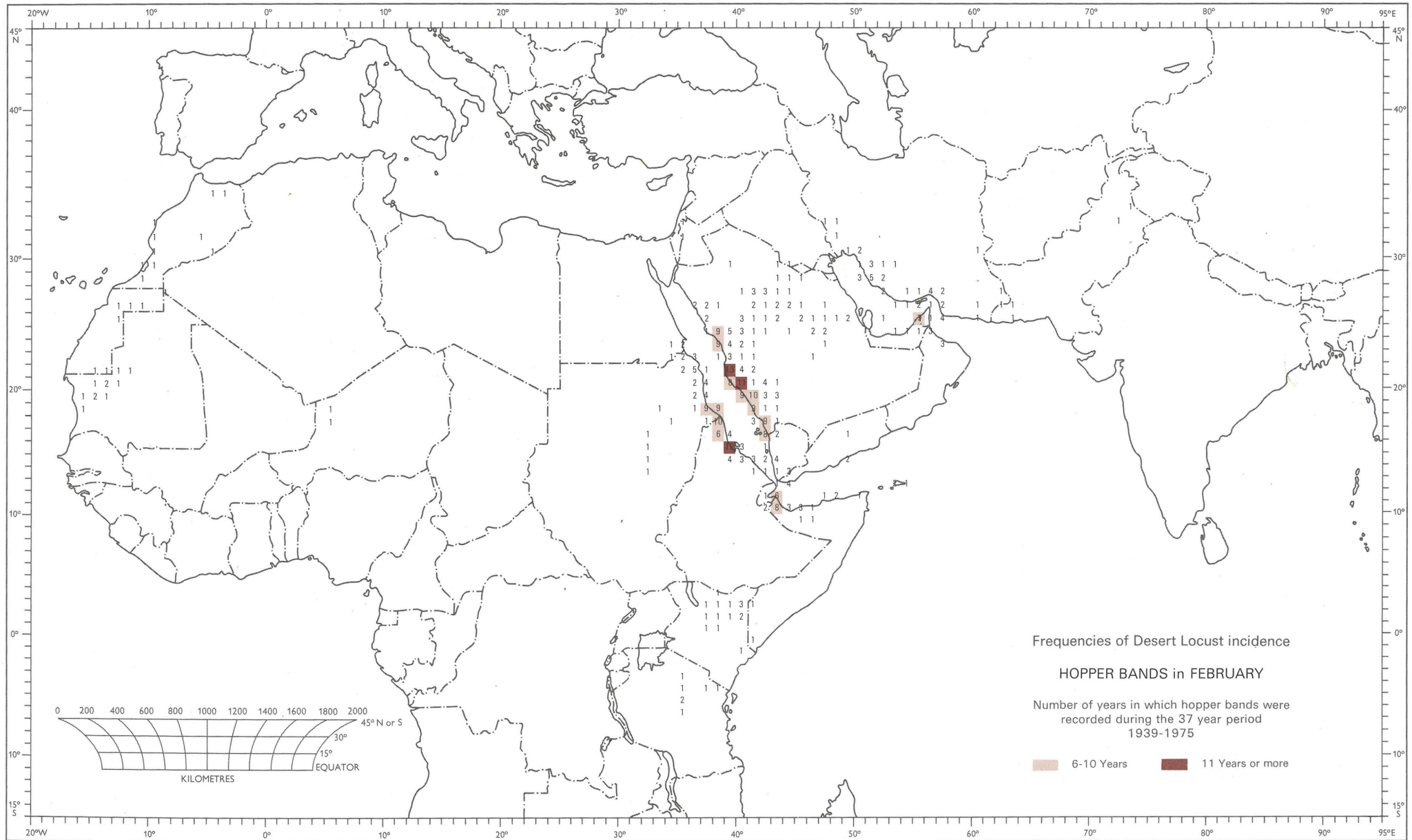
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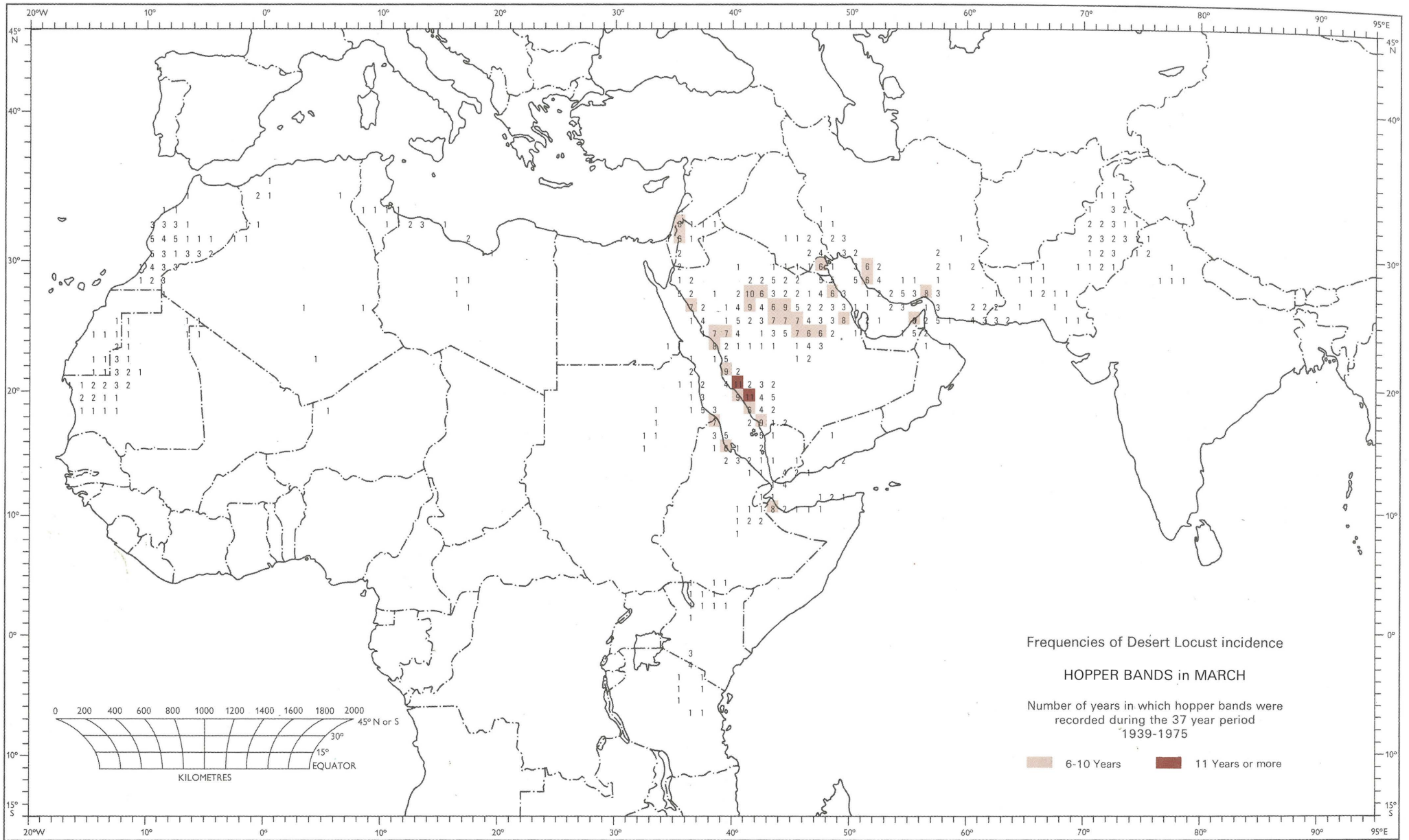
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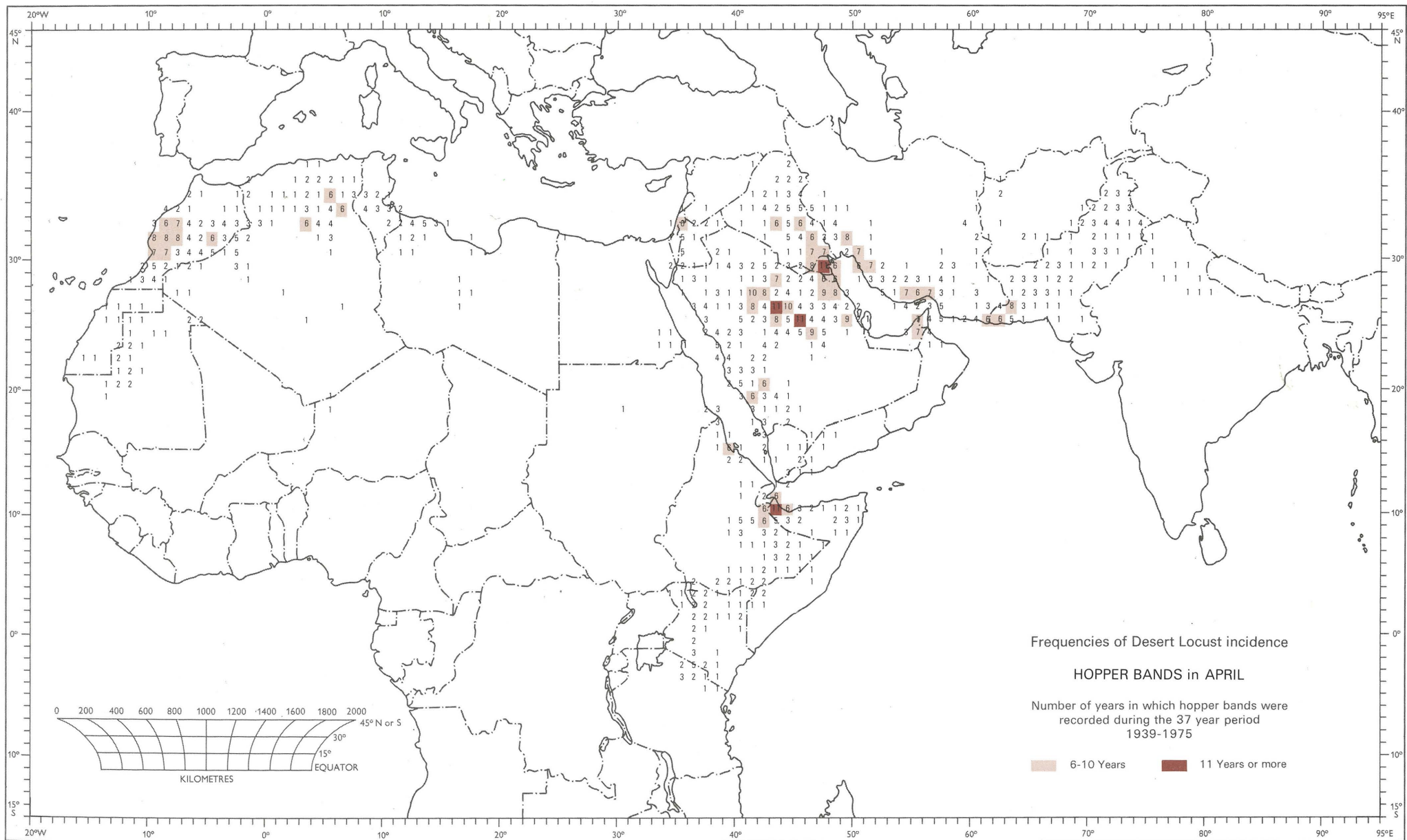
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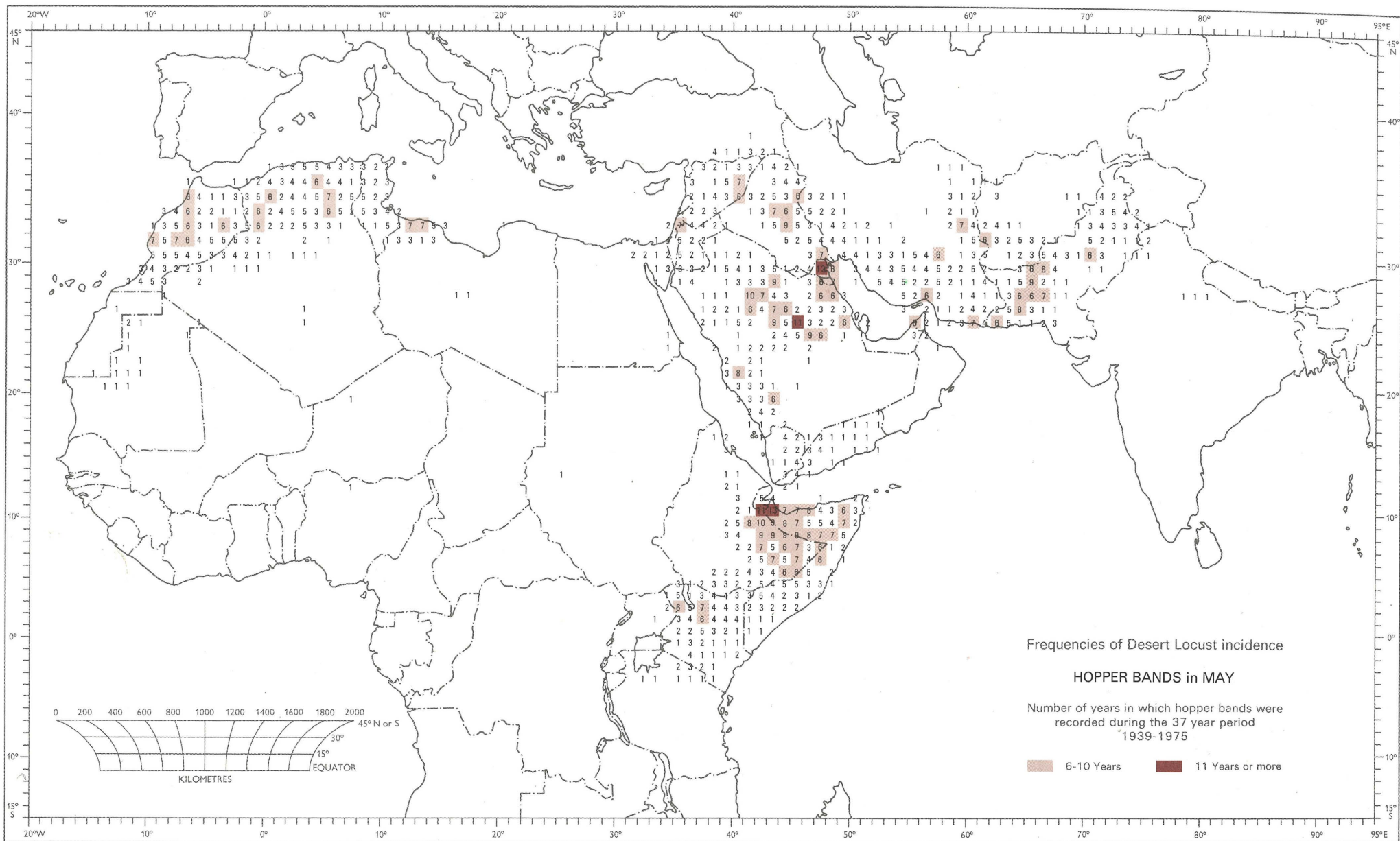
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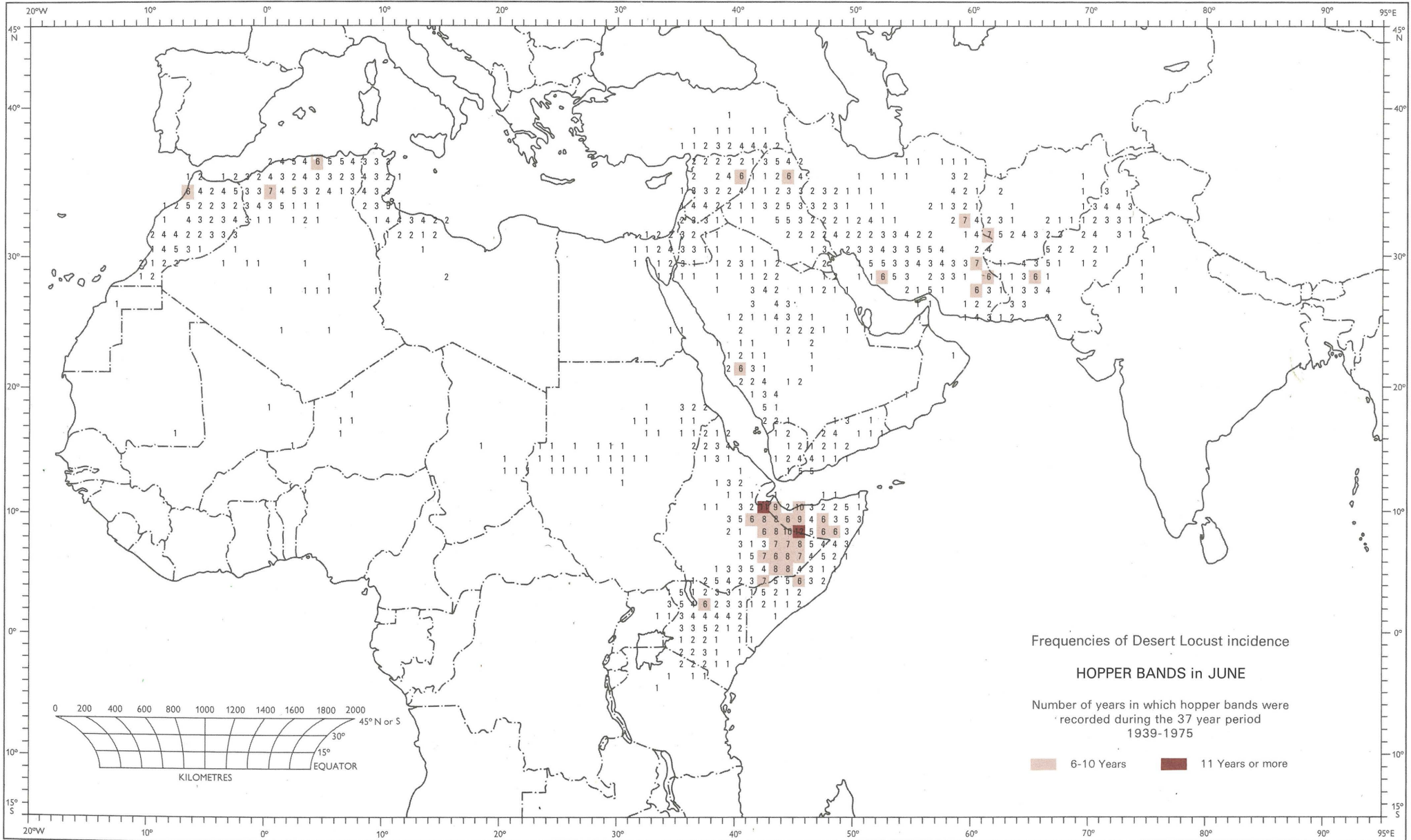
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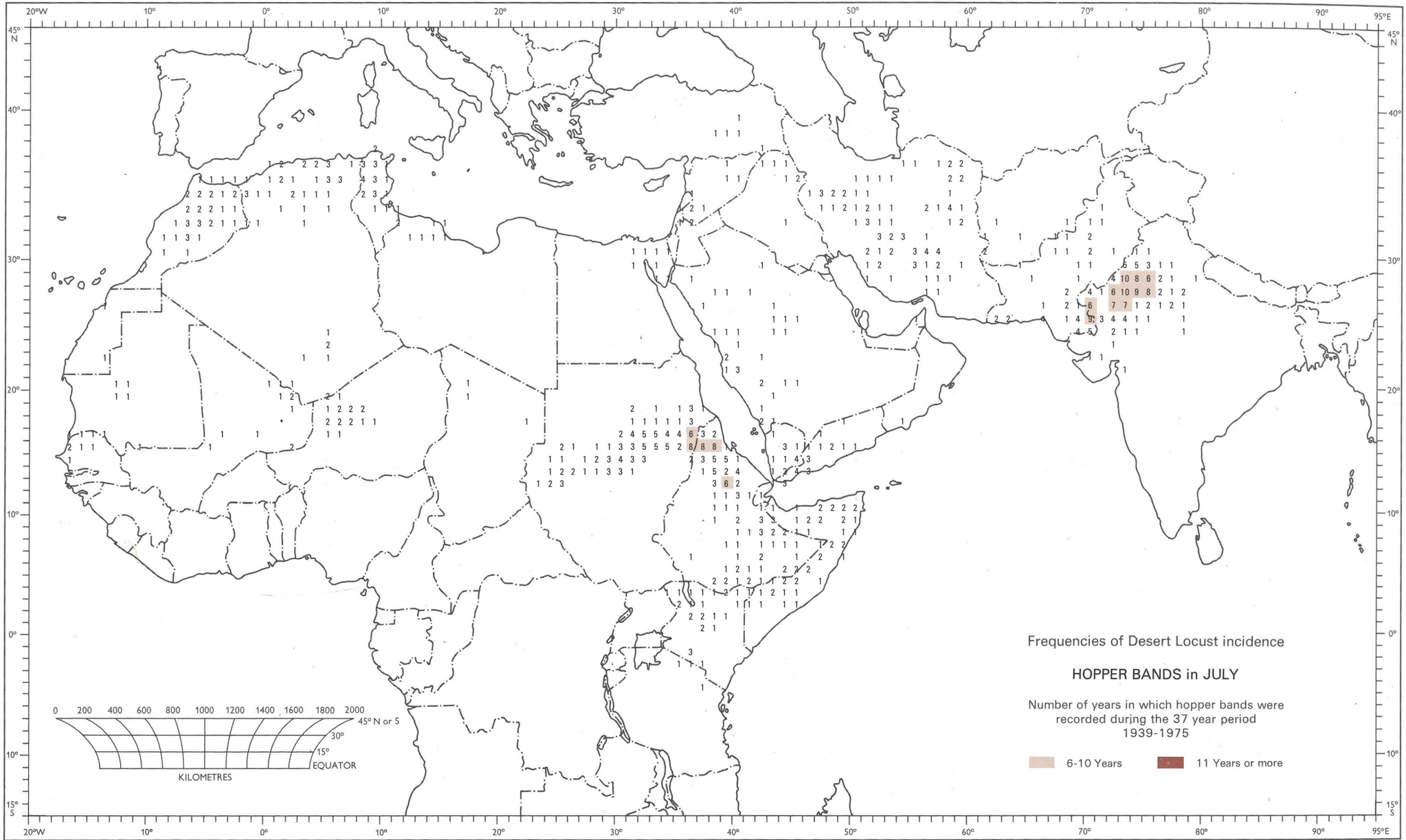
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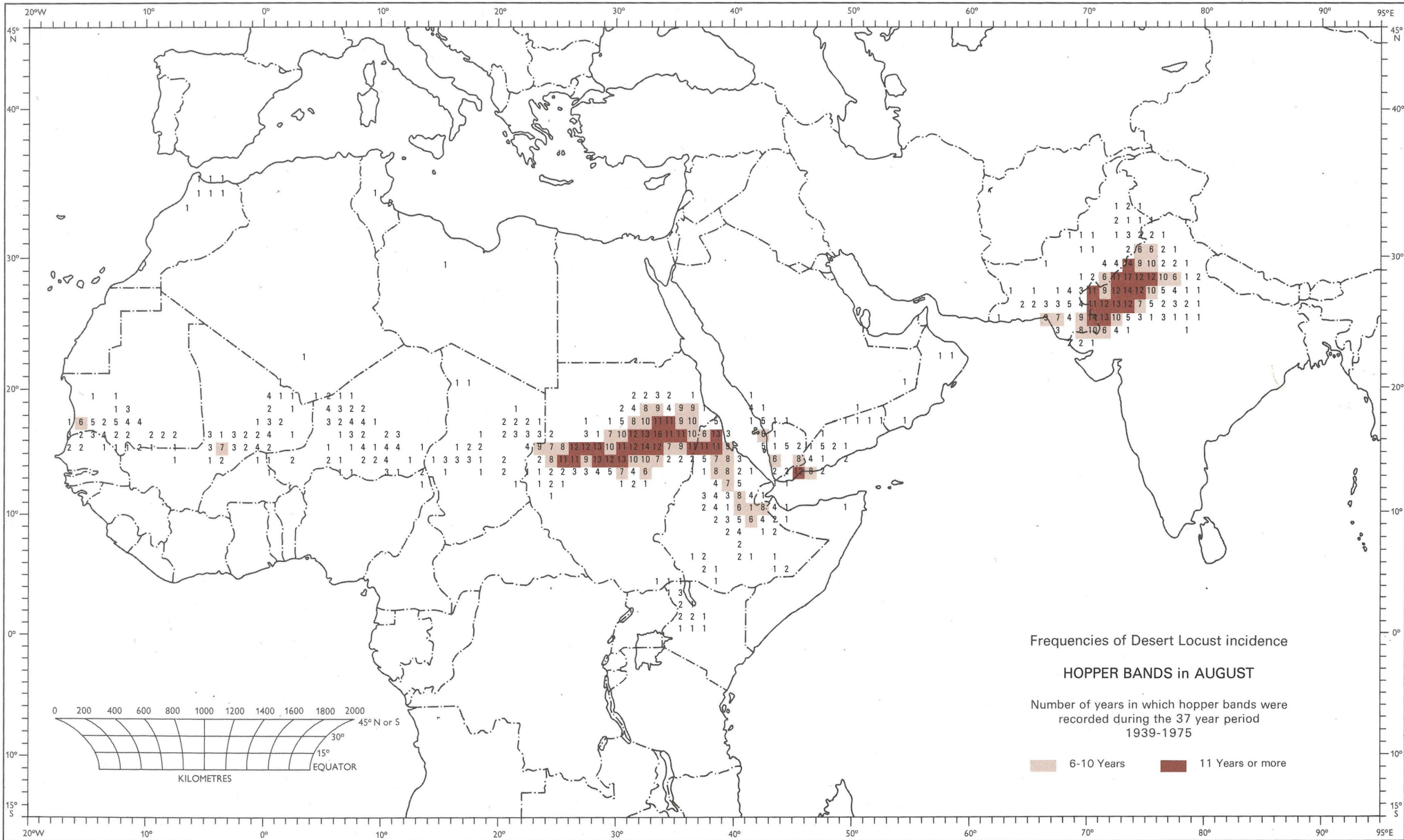
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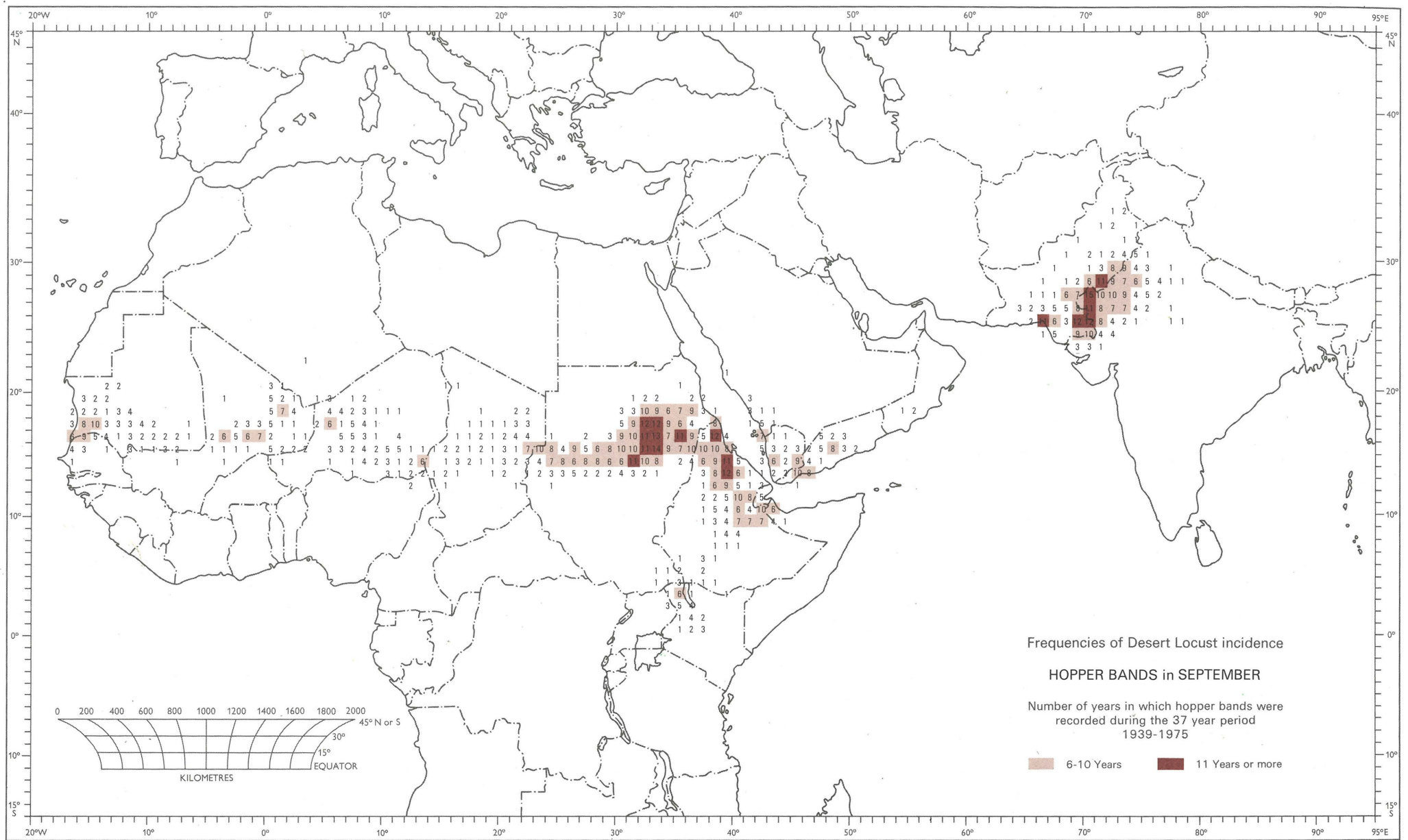
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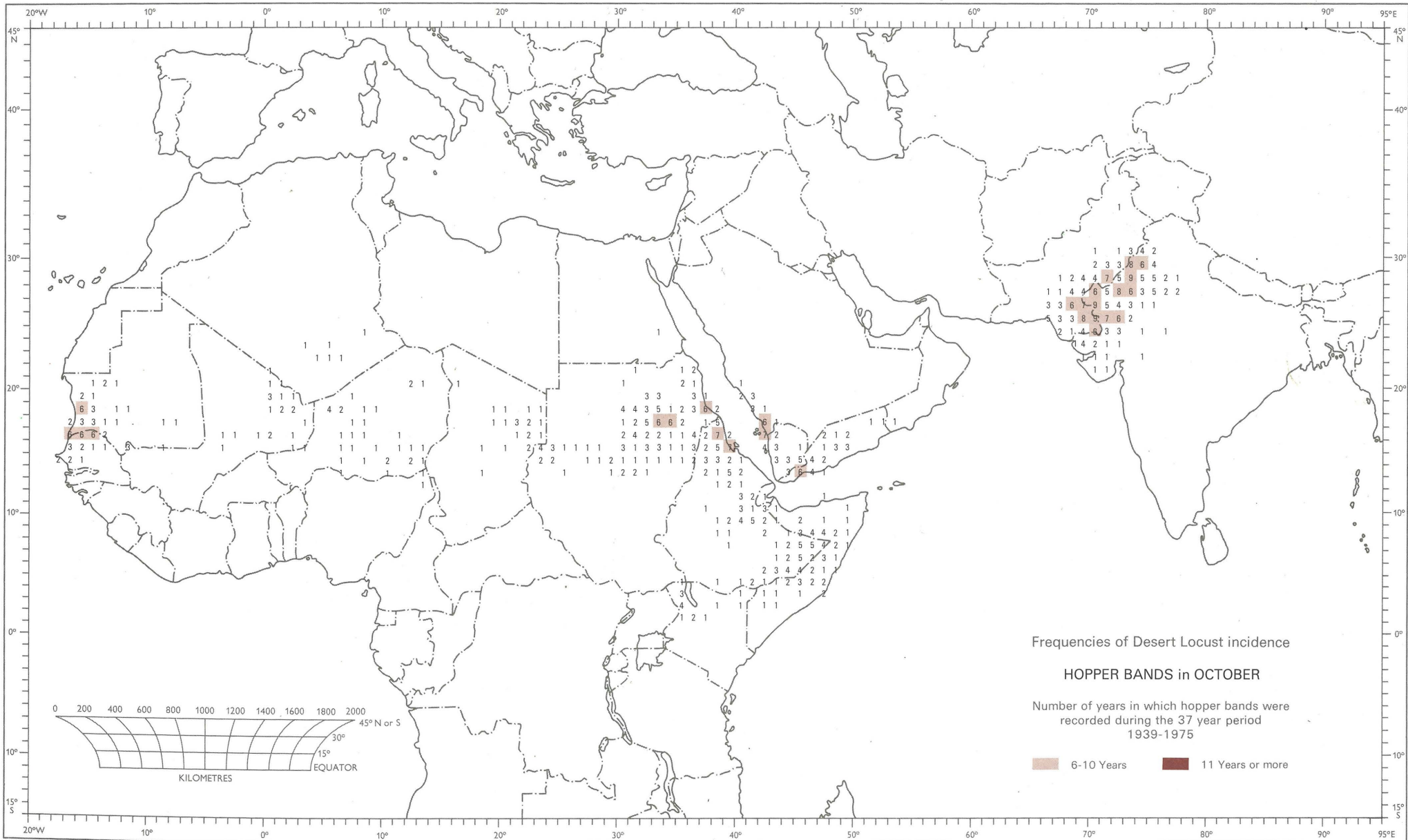
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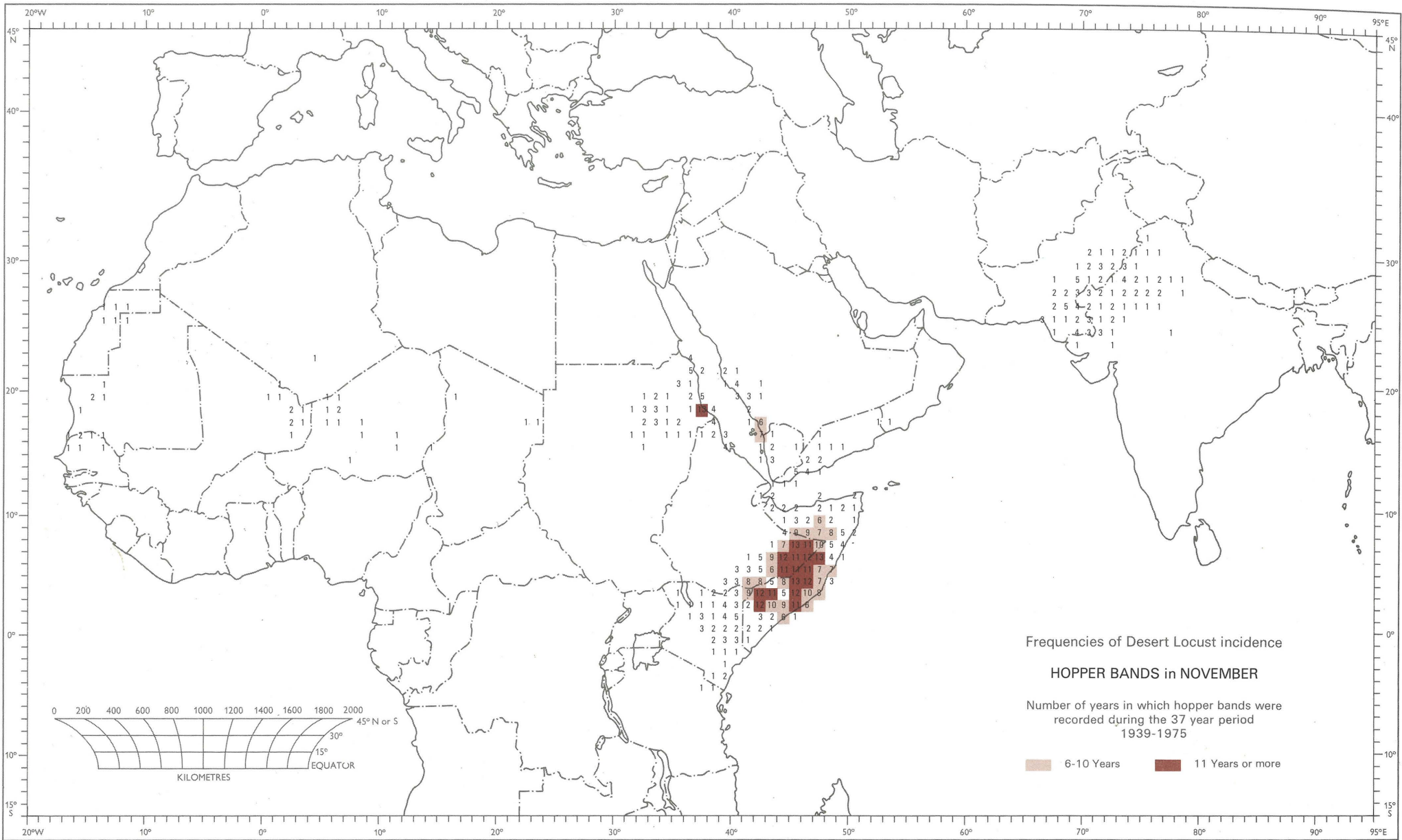
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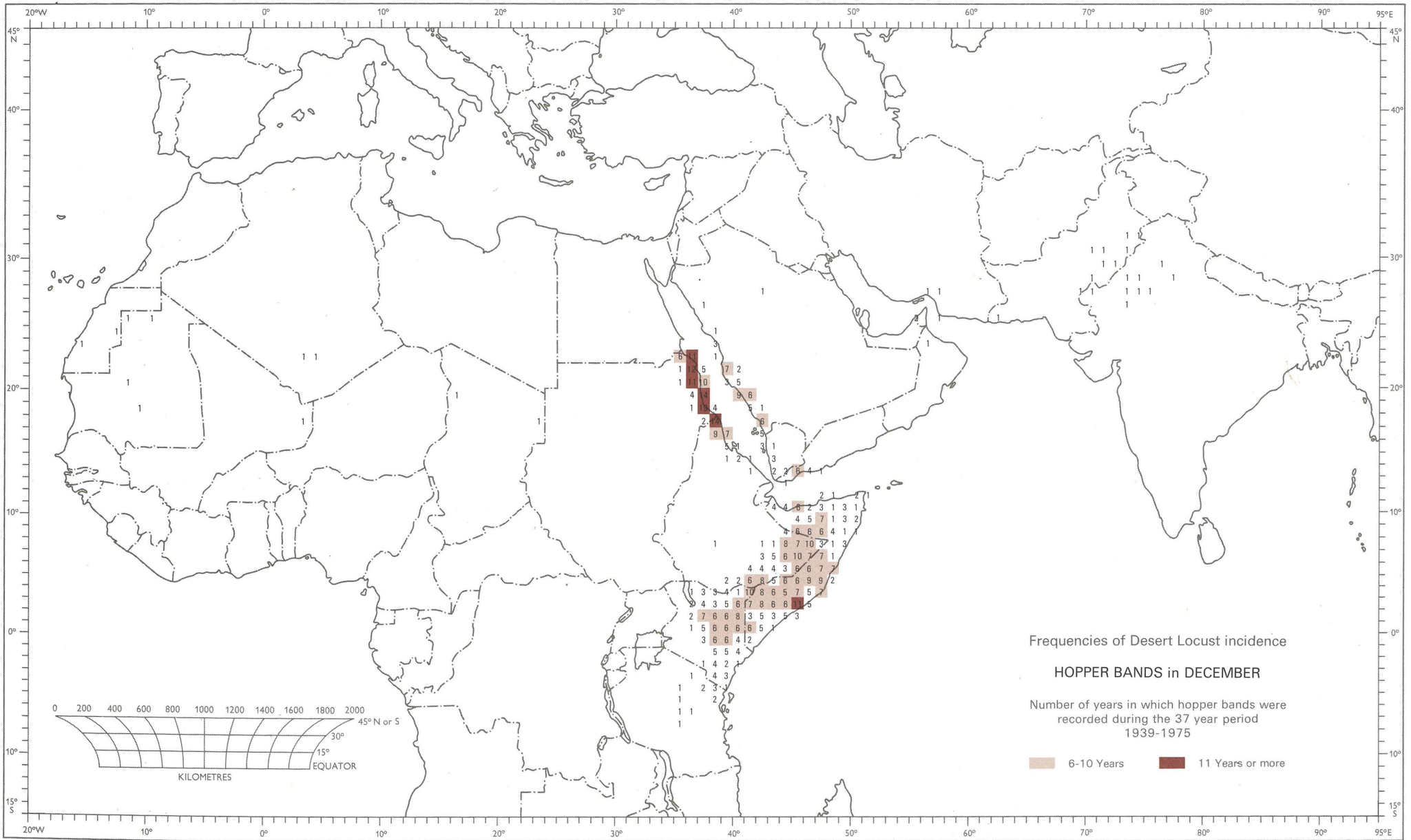
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MAPS TO ACCOMPANY THE SUMMARIES AND CASE STUDIES

Summaries and Case Studies are placed at the end of Part 2 of this Manual (see Volume I). Maps to accompany them are gathered here for ease of reference. *Summary* map reference numbers (1-19) are preceded by the letter S. *Case Study* map reference numbers (1-19) correspond to the Summaries and are preceded by the letter C. For example, Figs. C.2.1 to C.2.4 accompany Case Studies 2.1 to 2.4, and all four Case Studies refer to Summary 2.

Symbols used on Summary maps are explained on individual maps. Symbols used on Case Study maps are as follows.

Locust maps

▽	mature swarm	} reports of locusts, with dates (? if unknown), discussed in the Case Study
▼	immature swarm	
▽	swarm of mixed maturity	
□	swarm of unspecified maturity	
▽	locusts not in a swarm	
■	locusts reported during stated period	} before that being discussed
□	locusts reported during stated period	

Other symbols are explained on individual maps. For some maps there may have been reports from the areas shown, but they are not relevant to the discussions in the Case Studies and they are therefore not shown (although their existence is mentioned in the text).

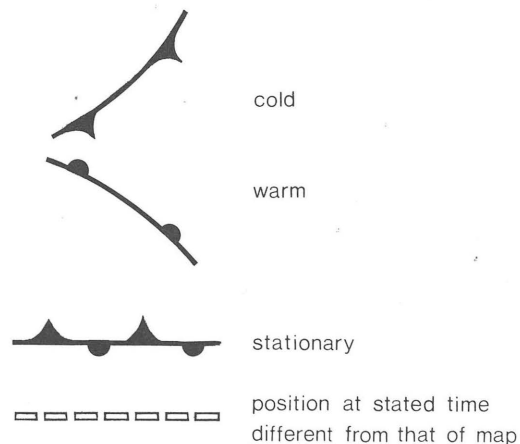
Weather maps

Plots at positions of weather observing stations show temperatures (°C) and winds (see Fig. 3.12 for international symbols). Analyses consist of:

schematic streamlines, shown by bold arrows, representing the large-scale wind flow;

isobars, shown by continuous lines at 2-mbar intervals, with centres of low and high pressure marked L and H (for a discussion of wind flow patterns and their relation to isobars see Section 3.3);

atmospheric fronts (usually also windshift lines), shown by the following symbols



ITCZ refers to the Inter-tropical Convergence Zone, and RSCZ to the Red Sea Convergence Zone (see Section 3.3.4).

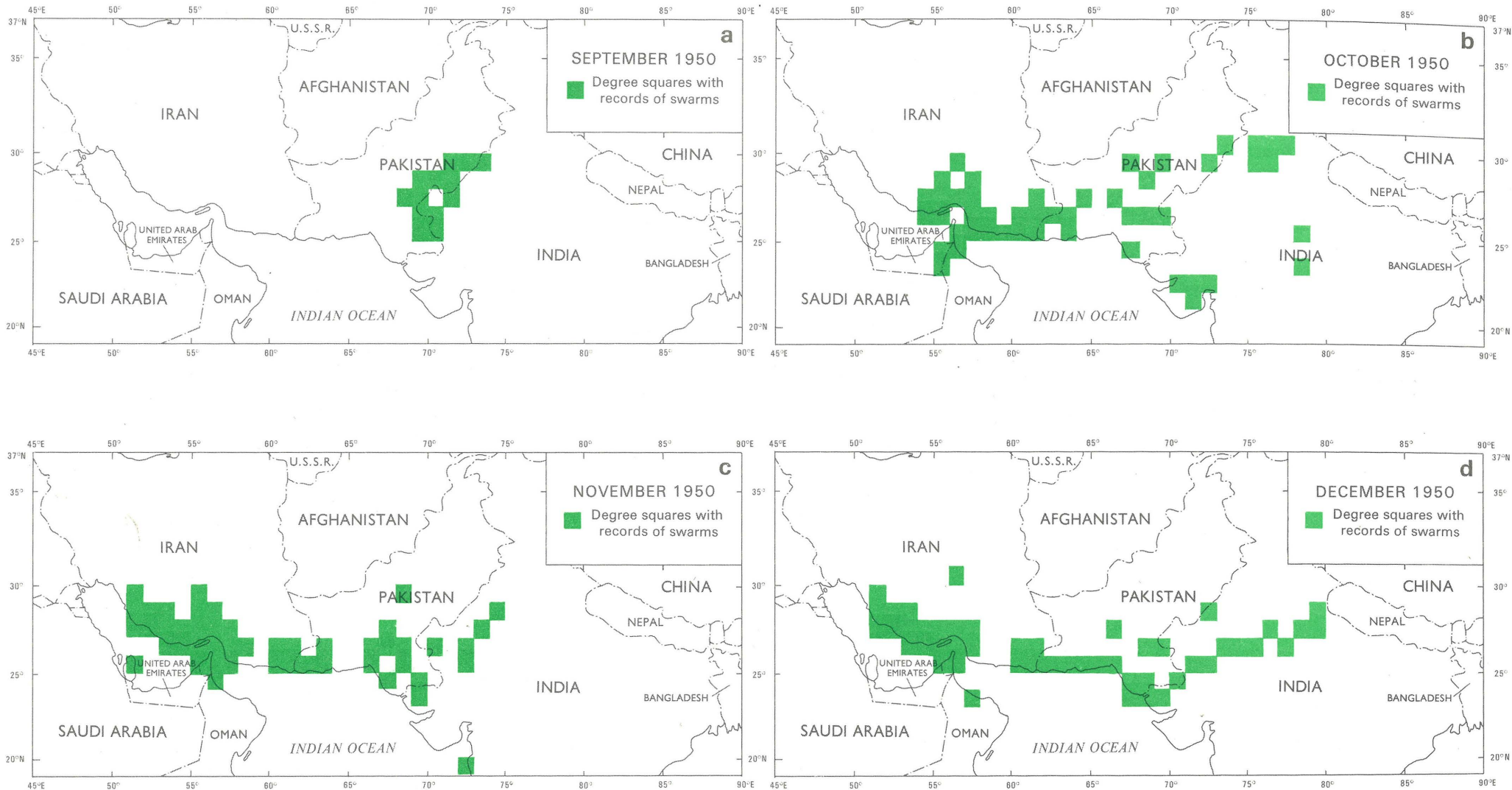


Fig. S1 (see opposite page)

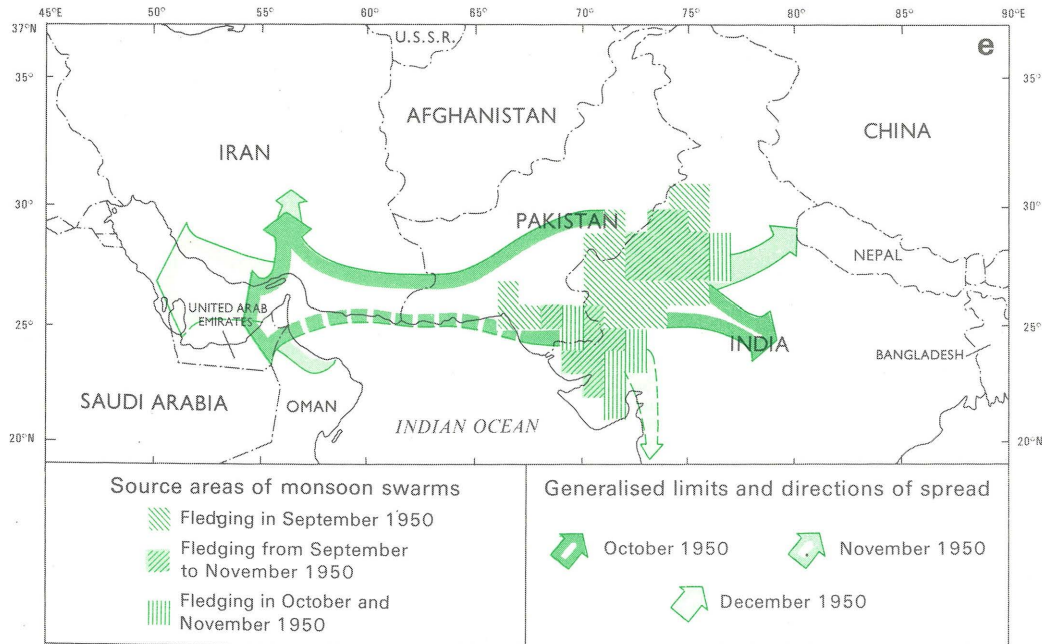


Fig. S1 a-m. 1950 MONSOON AND 1951 EARLY SPRING GENERATIONS SWARMS IN THE EASTERN REGION

Figs. a,b,c,d,f,g,h,j,k and l show the monthly distribution of monsoon generations swarms by degree squares. Figs j,k and l also show swarms of the early spring generation.

Arrows on Figs e,i, and m show schematically the spread of swarms (see p 27)

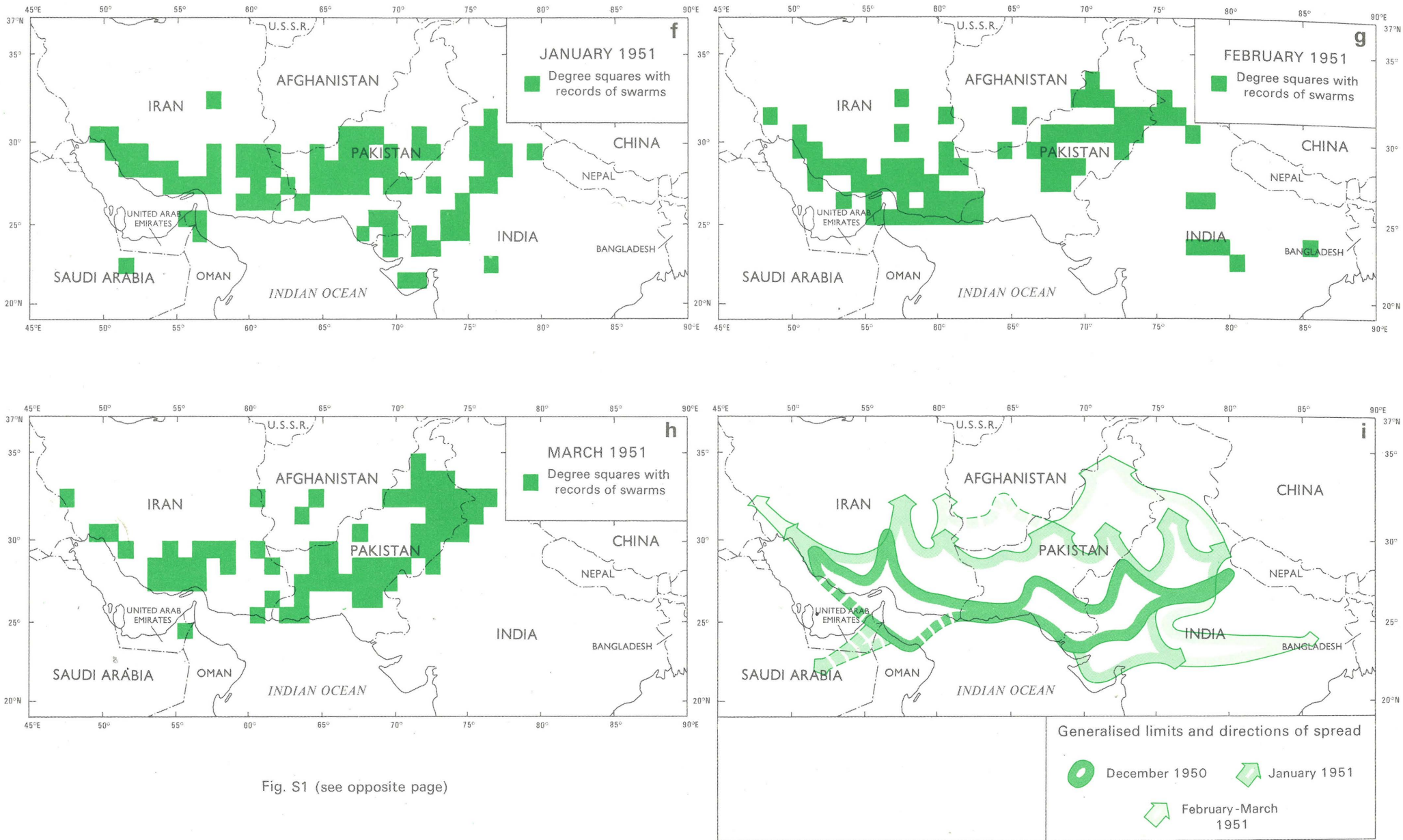


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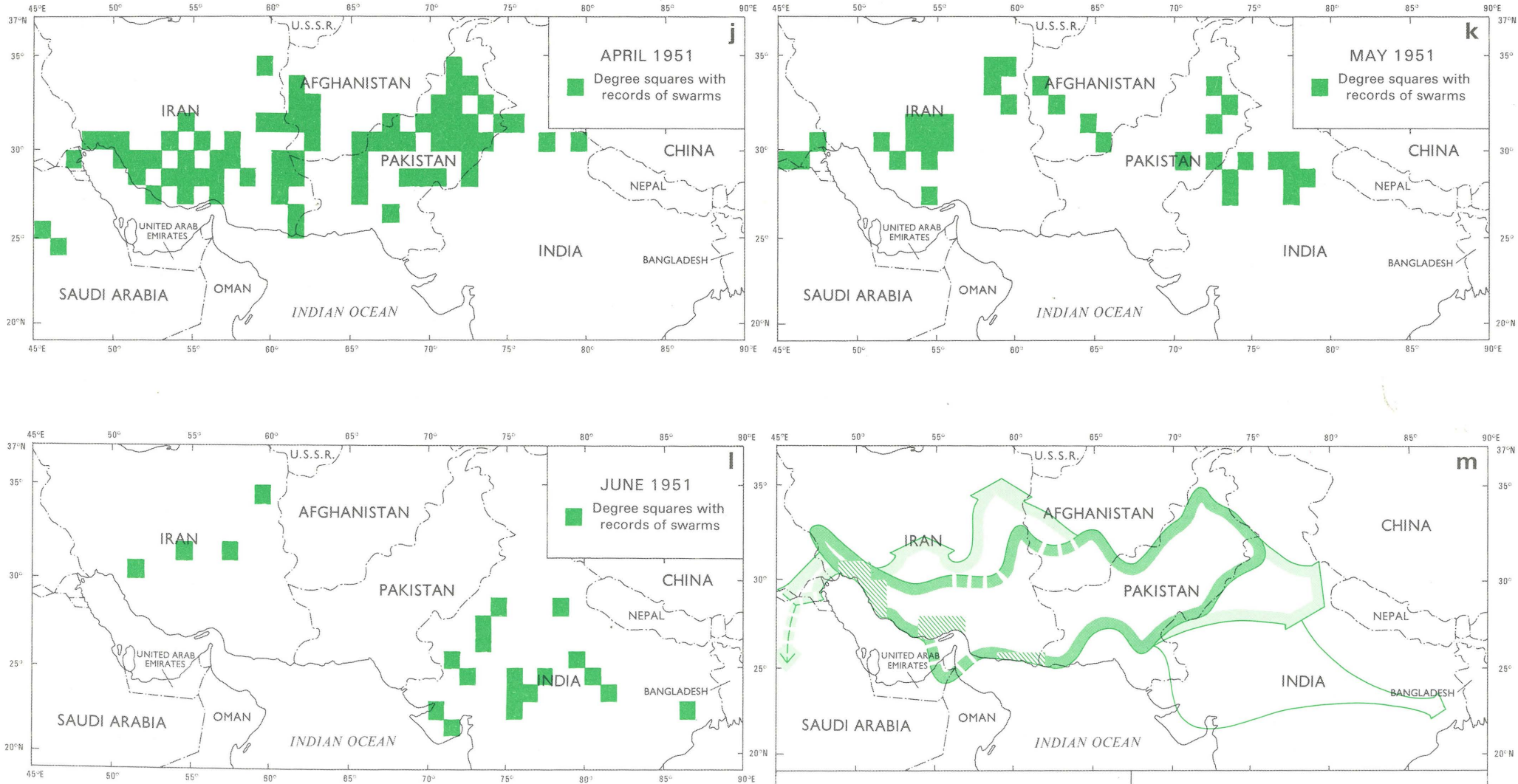
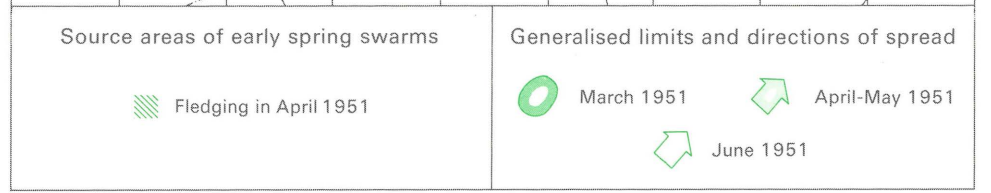


Fig. S1 a-m. 1950 MONSOON AND 1951 EARLY SPRING GENERATIONS SWARMS IN THE EASTERN REGION

Figs. a,b,c,d,f,g,h,j,k, and l show the monthly distribution of monsoon generations swarms by degree squares. Figs j,k, and l also show swarms of the early spring generation. Arrows on Figs. e,i, and m show schematically the spread of swarms (see p 27)



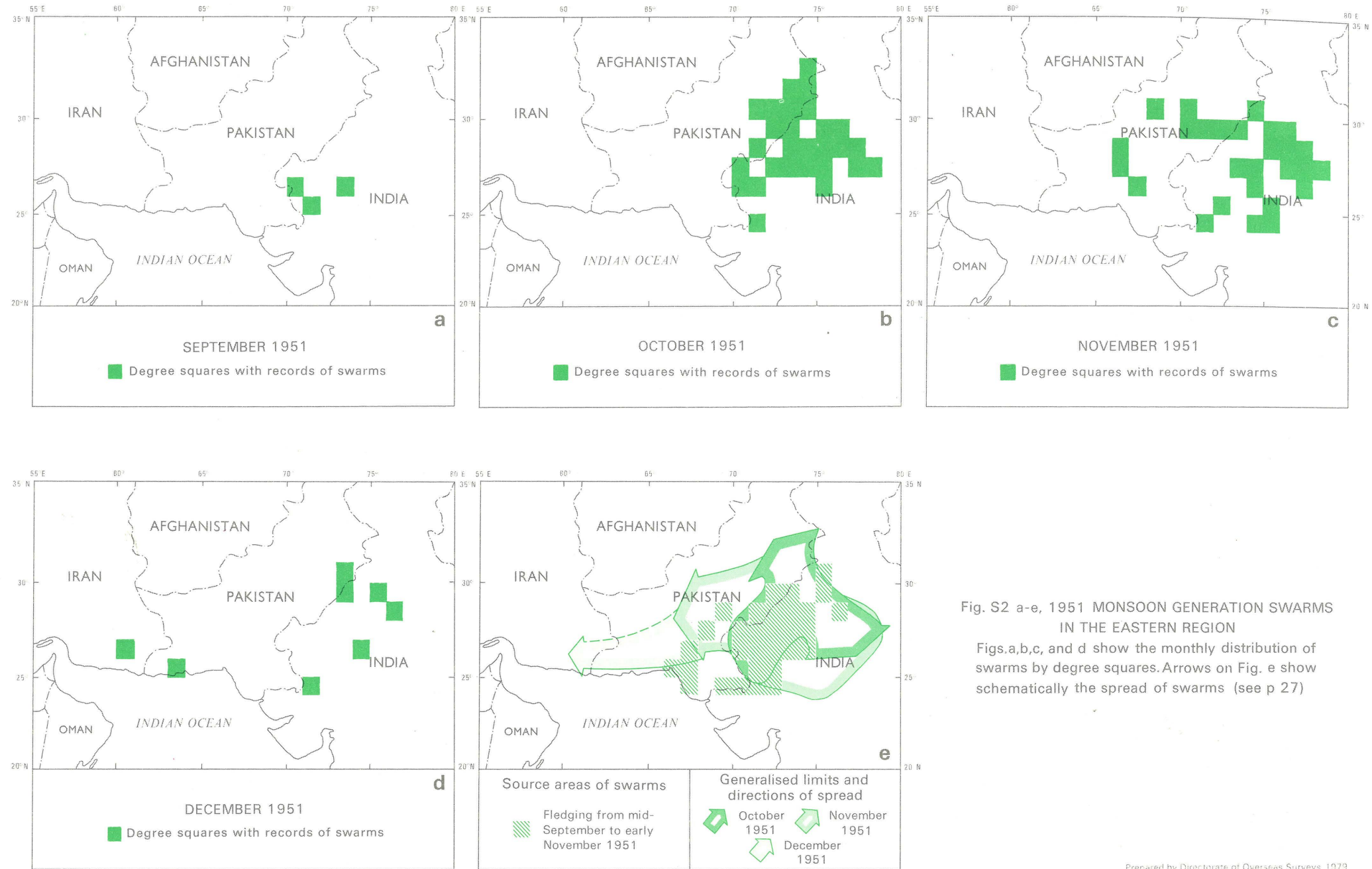


Fig. S2 a-e, 1951 MONSOON GENERATION SWARMS IN THE EASTERN REGION

Figs.a,b,c, and d show the monthly distribution of swarms by degree squares. Arrows on Fig. e show schematically the spread of swarms (see p 27)

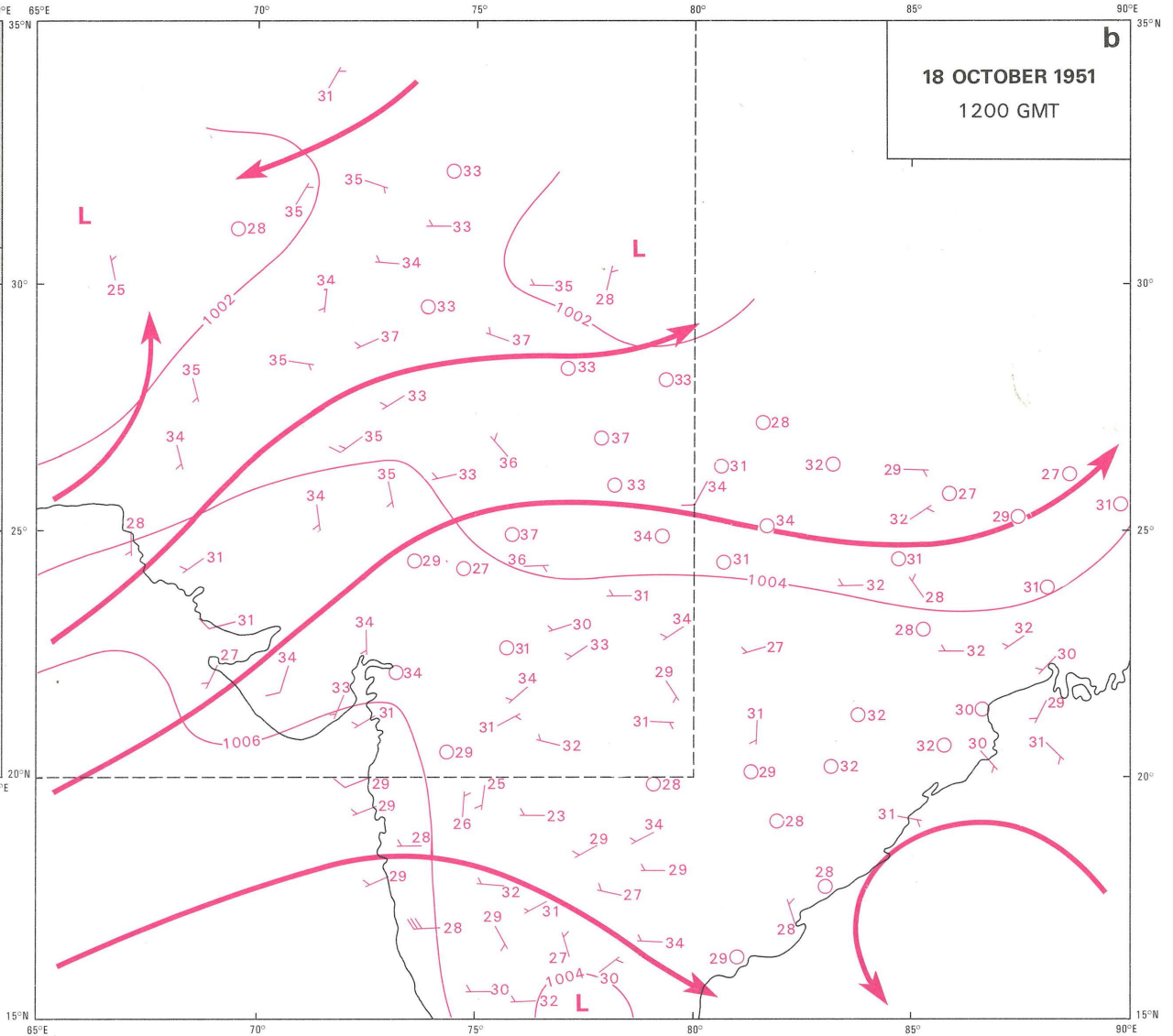
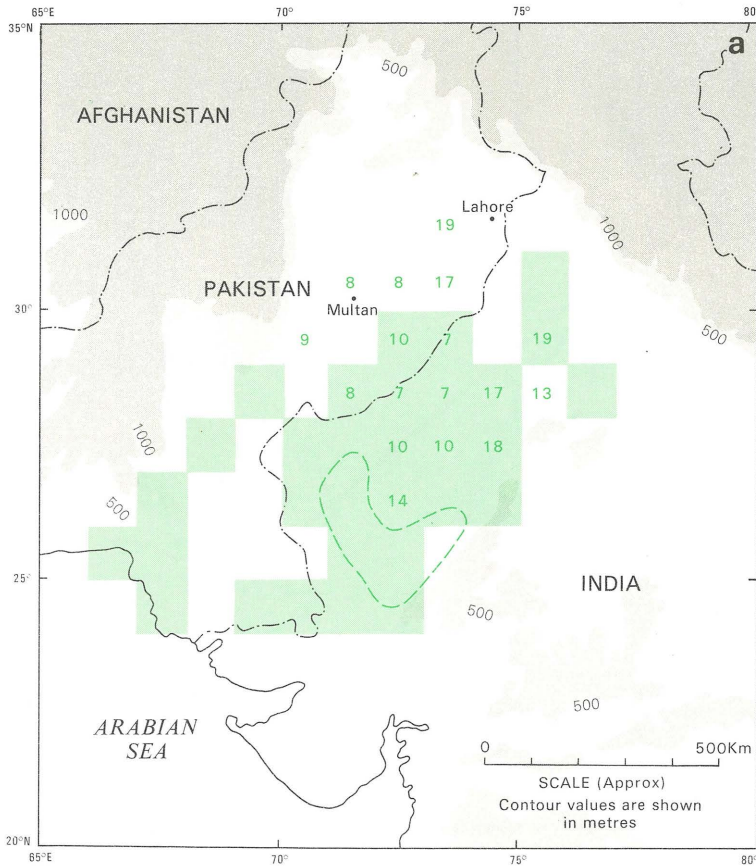
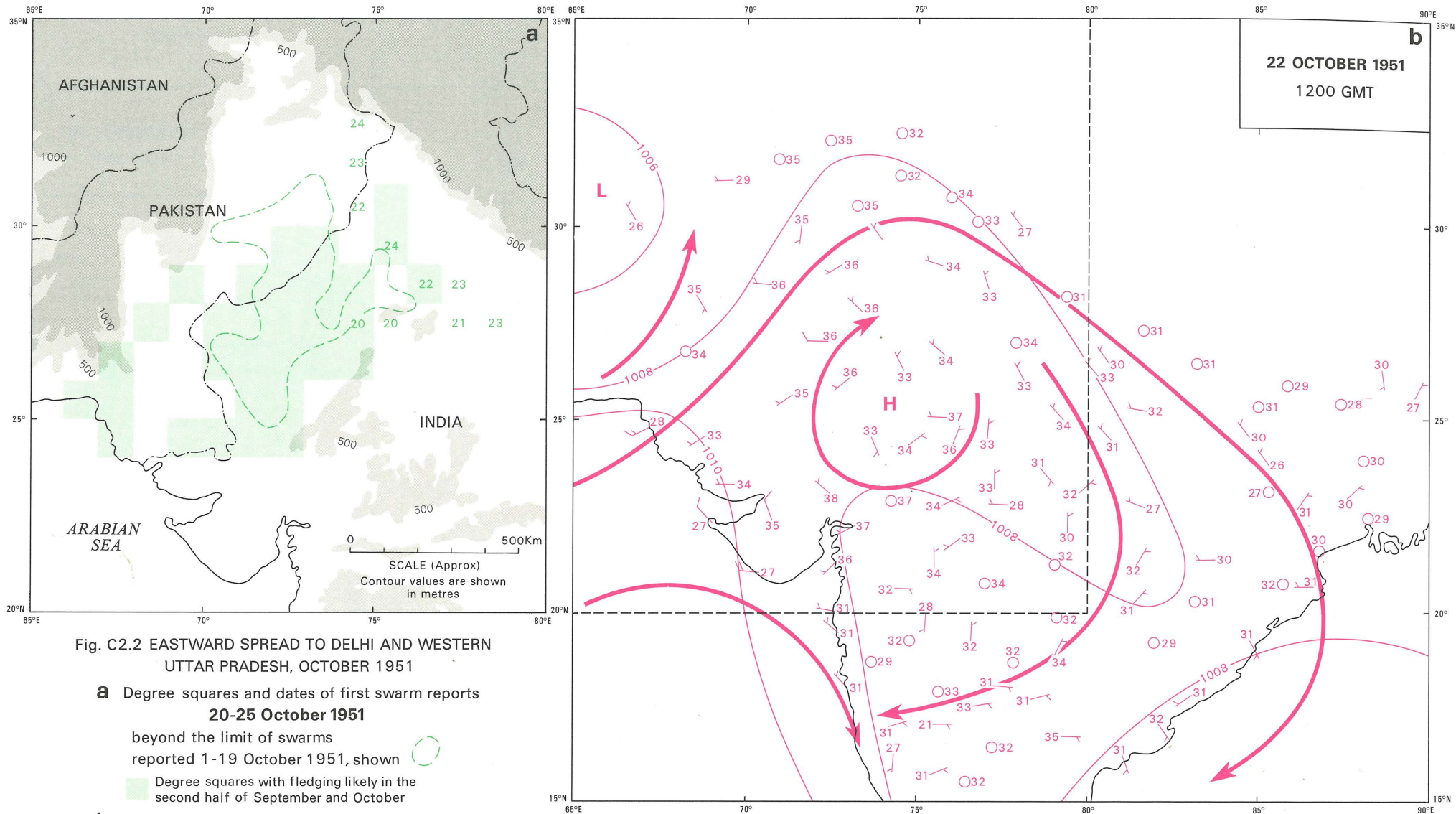


Fig. C2.1 NORTHWARD SPREAD OF IMMATURE SWARMS IN PAKISTAN, OCTOBER 1951

- a** Degree squares and dates of first swarm reports 1-19 October 1951 beyond the limit of swarms reported in September 1951, shown
- Degree squares with fledging likely in the second half of September and October

b Weather map for 18 October 1951 at 1200 GMT

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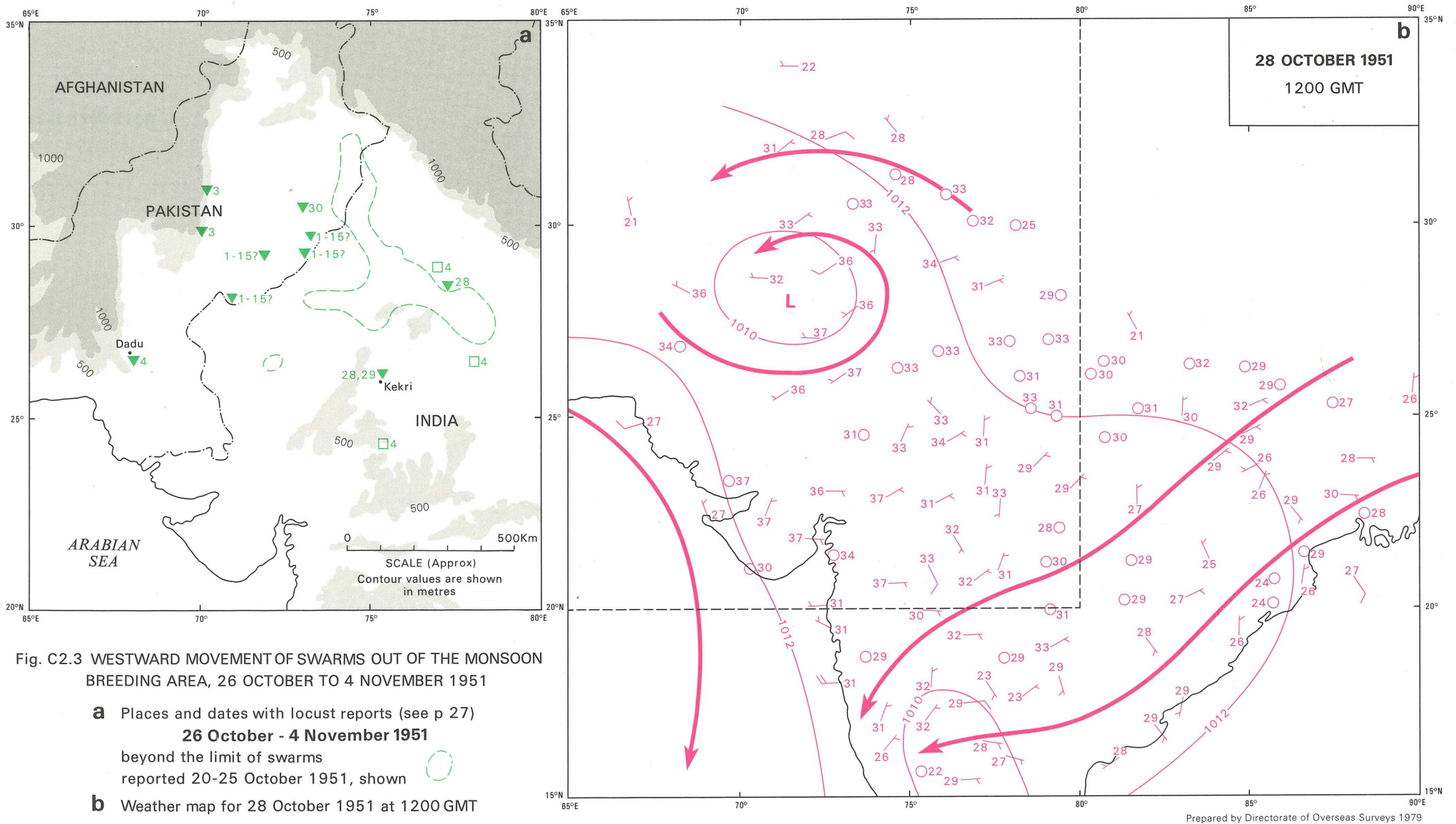
Fig. C2.2 EASTWARD SPREAD TO DELHI AND WESTERN UTTAR PRADESH, OCTOBER 1951

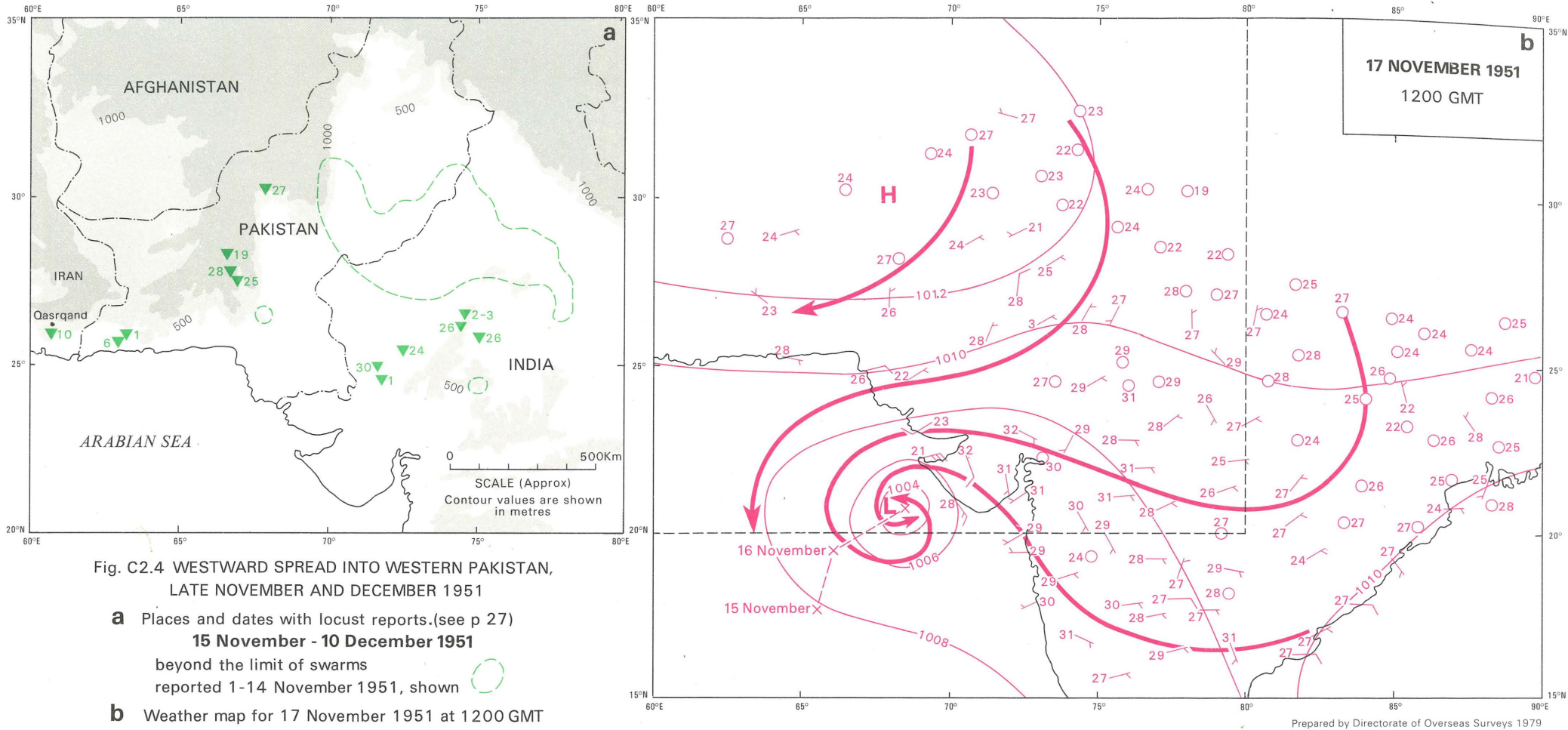
a Degree squares and dates of first swarm reports
20-25 October 1951

beyond the limit of swarms
reported 1-19 October 1951, shown

Degree squares with fledging likely in
the second half of September and October

b Weather map for 22 October 1951 at 1200 GMT





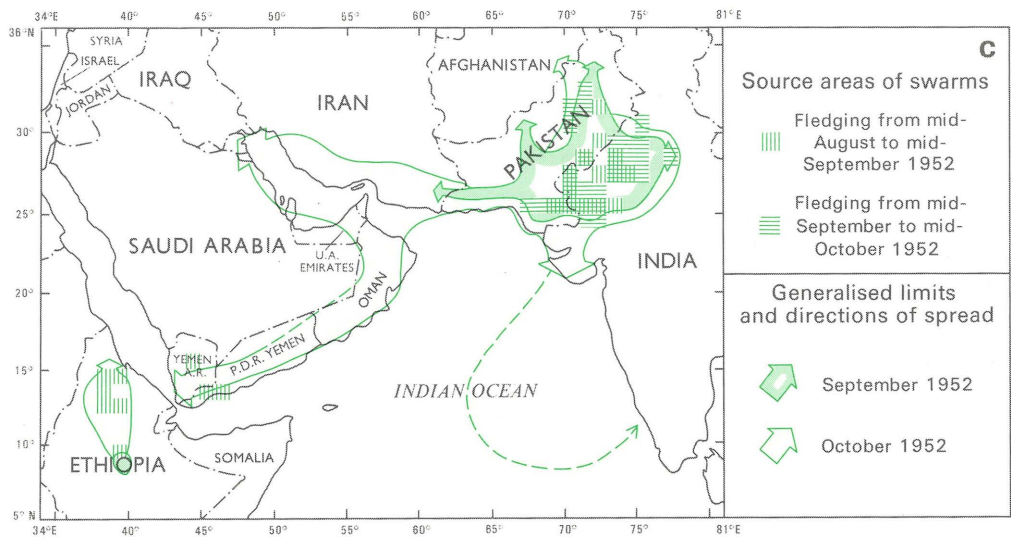
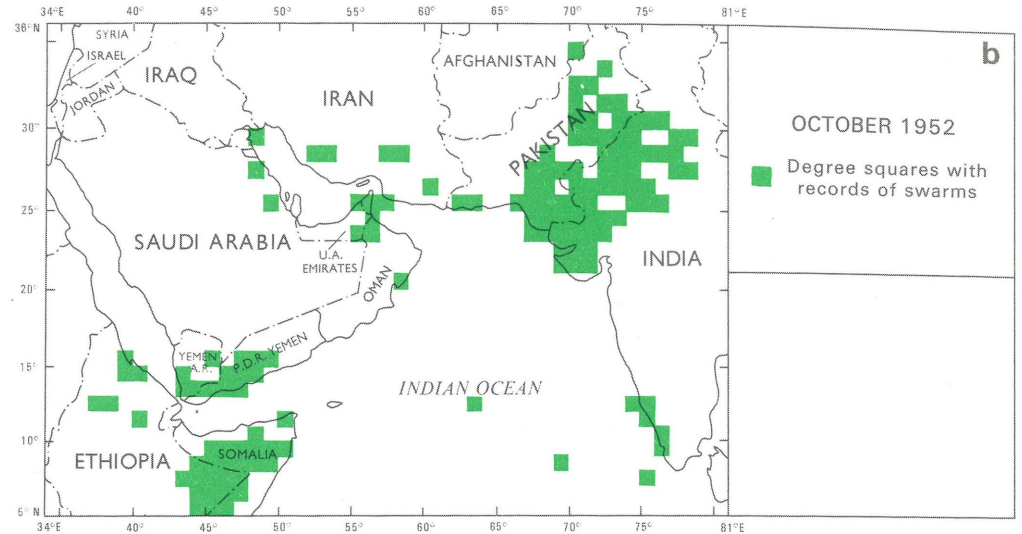
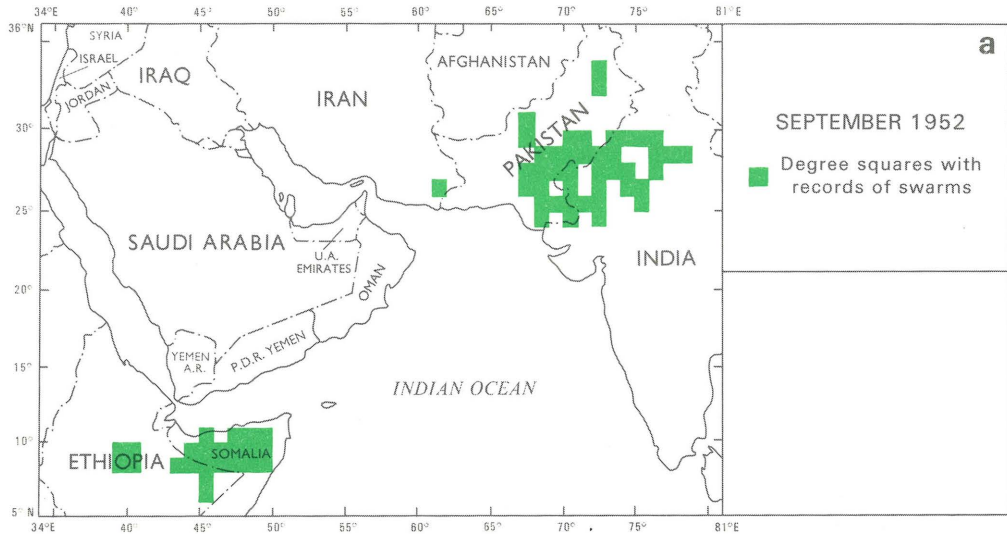


Fig. S3 (see opposite page)

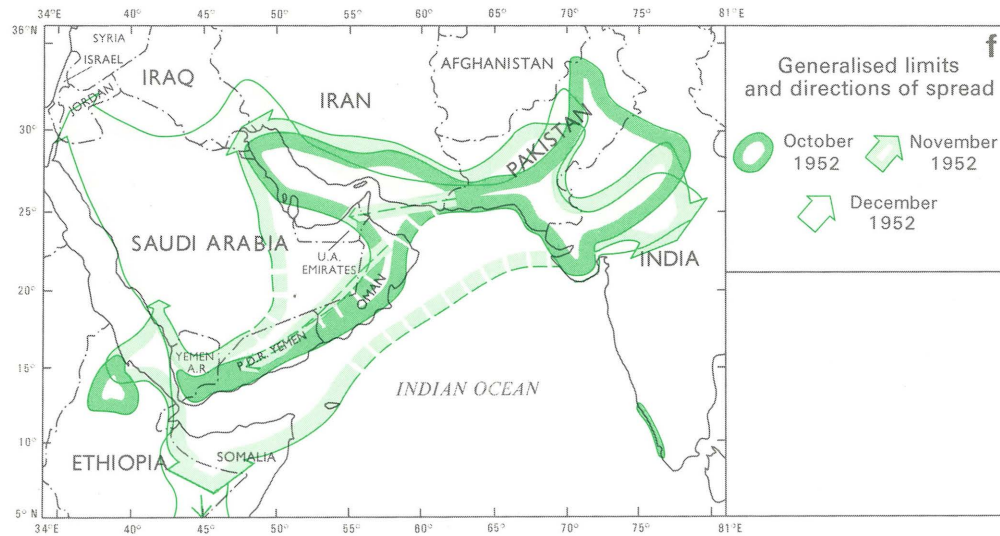
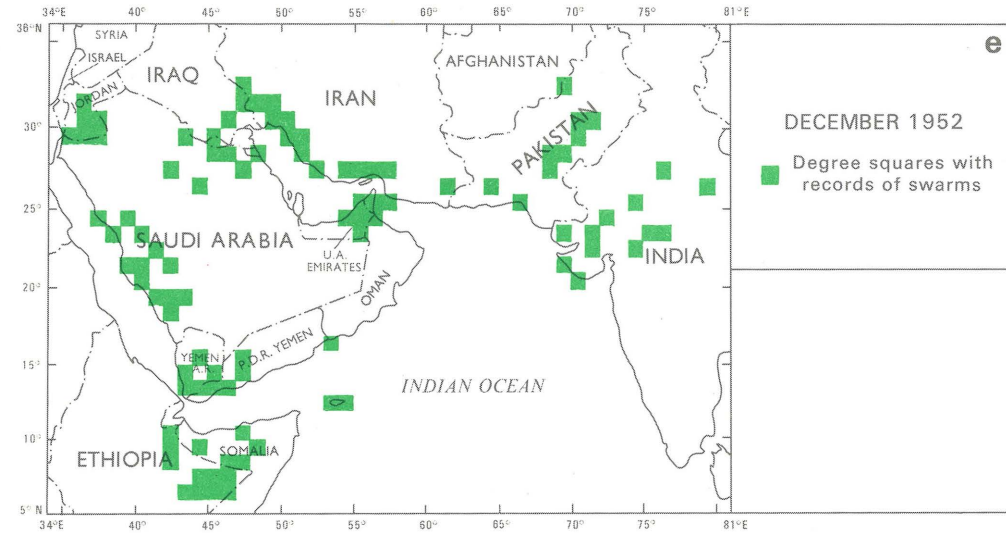
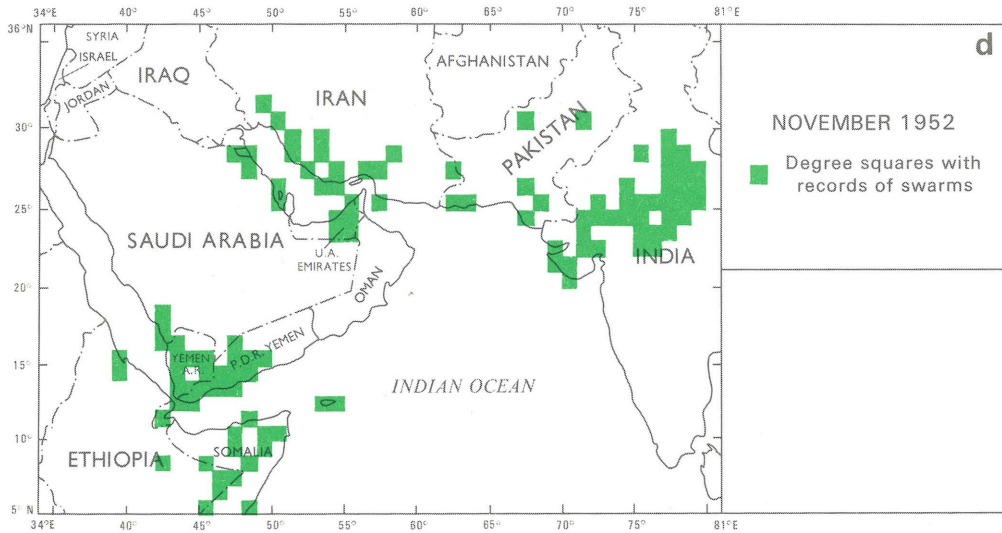
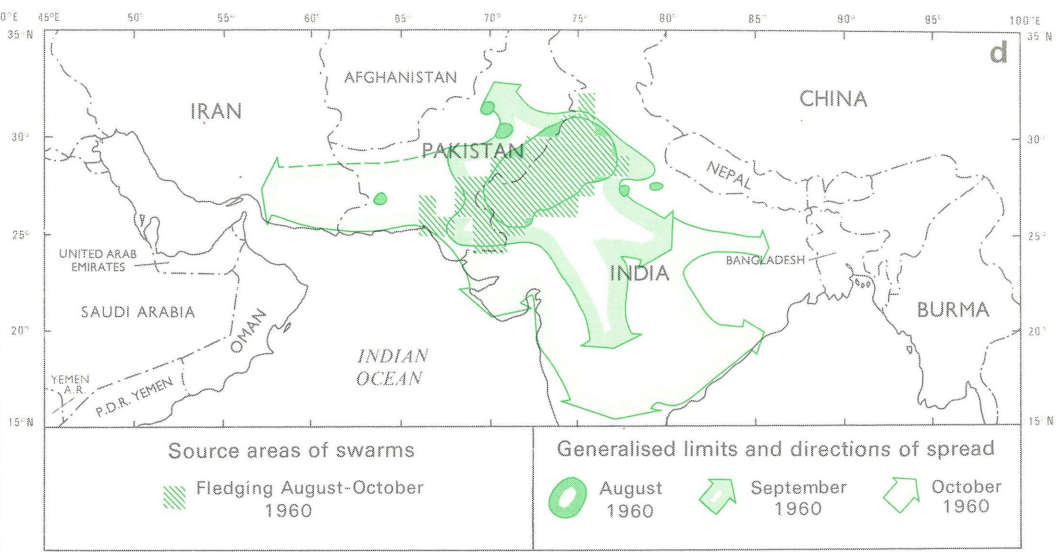
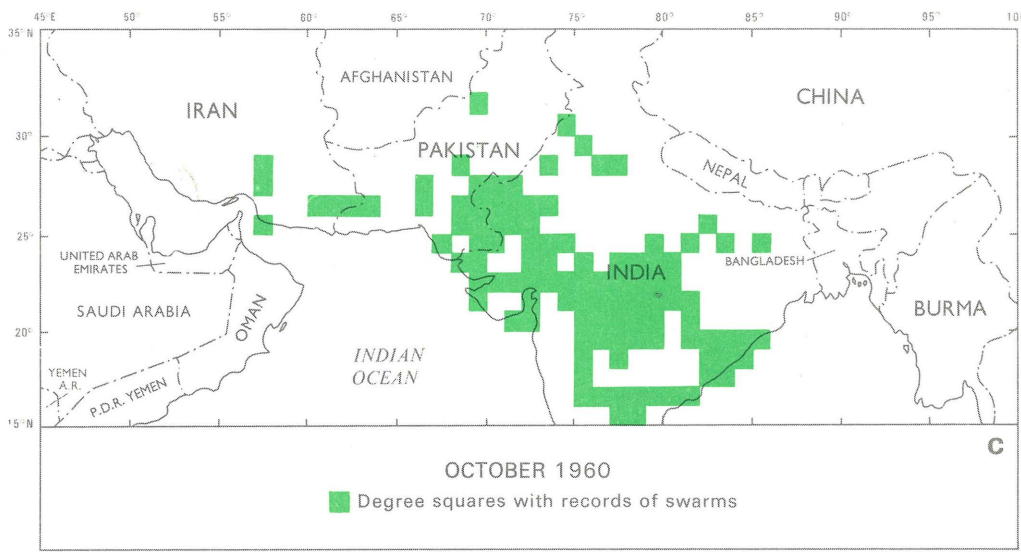
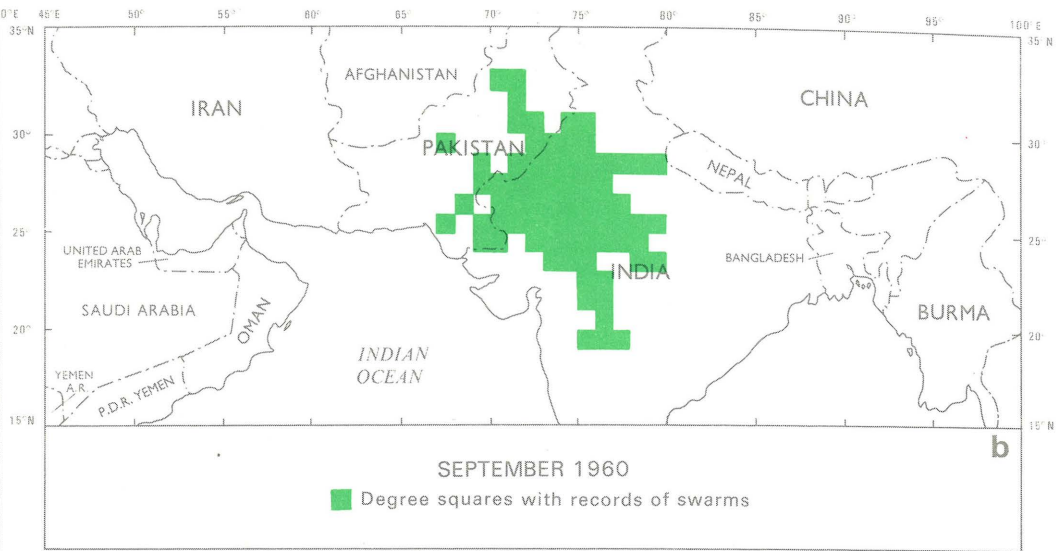
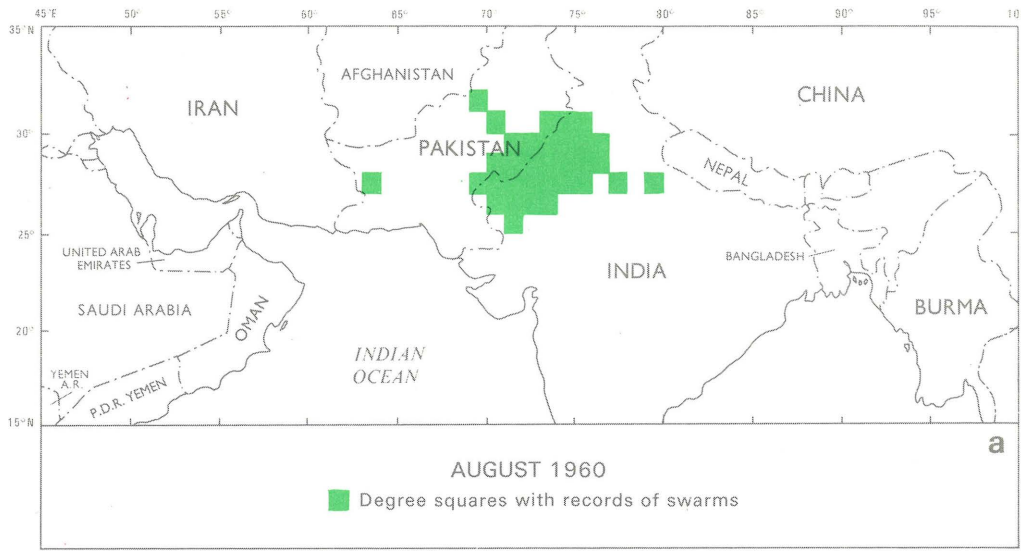


Fig. S3 a-f, 1952 MONSOON GENERATION SWARMS IN THE EASTERN, NORTH CENTRAL AND SOUTH CENTRAL REGIONS, AND 1952 SUMMER GENERATION SWARMS IN THE NORTH CENTRAL REGION.

Figs a,b,d and e show the monthly distribution of swarms by degree squares. Over the Somali Peninsula they show 1952 Long Rains generation swarms on Figs a and b, and include 1952 Short Rains generation swarms in Figs d and e.

Arrows on Figs c and f show schematically the spread of swarms (see p 27)



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Fig. S4 (see opposite page)

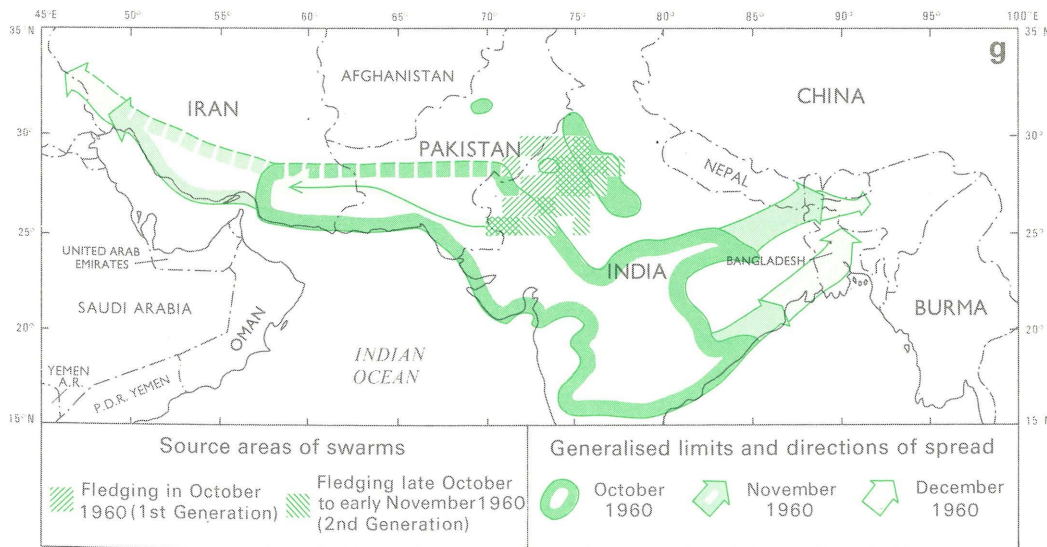
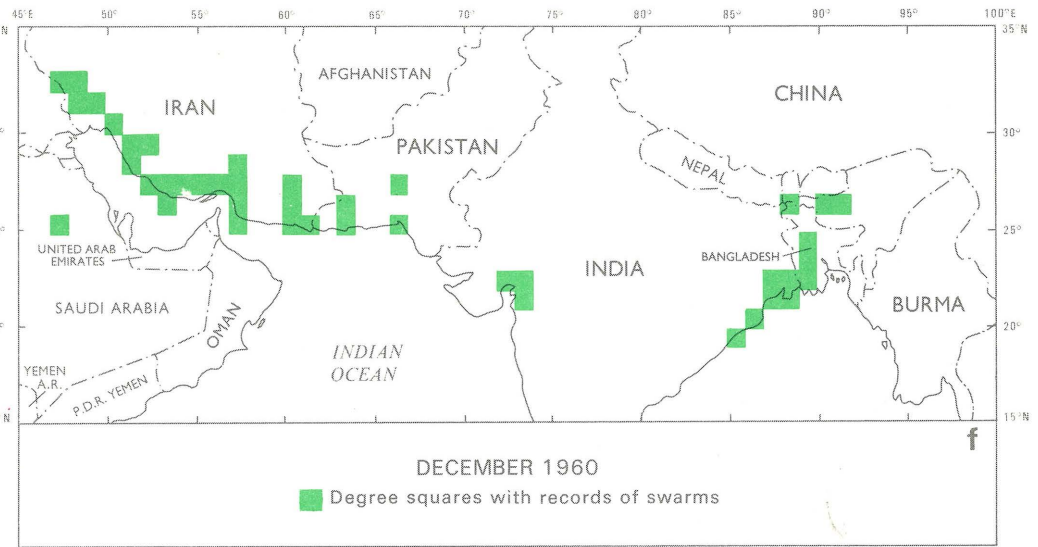
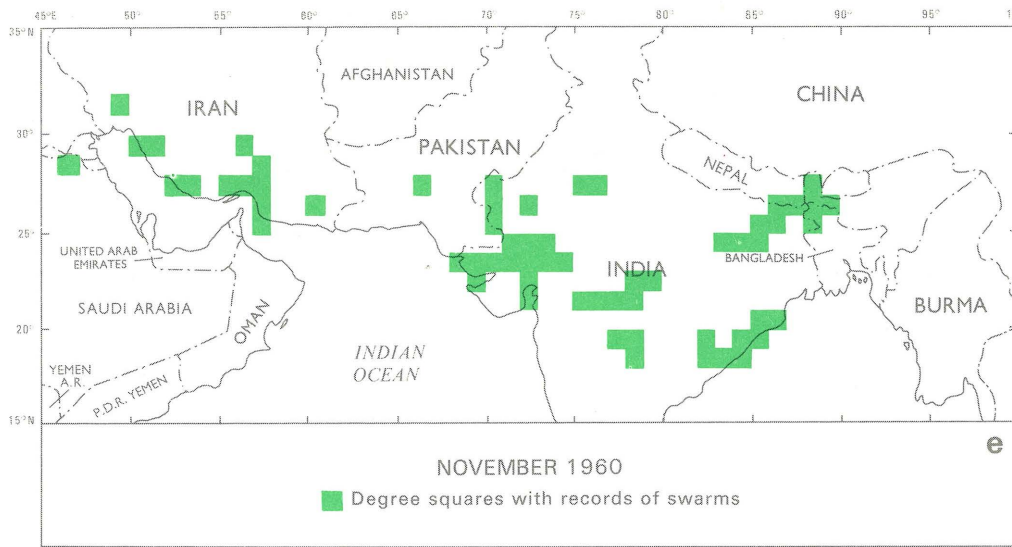


Fig. S4 a-k. 1960 MONSOON GENERATION SWARMS IN THE EASTERN REGION
 Figs a,b,c,e,f,h,i,j and k show the monthly distribution of swarms by degree squares.
 (Figs a and b show spring and first monsoon generations. Figs c and e show both monsoon generations. Figs f,h,i,j and k show both monsoon generations and the summer generation from the Central Region.) Arrows on Figs d and g show schematically the spread of swarms (see p 27)

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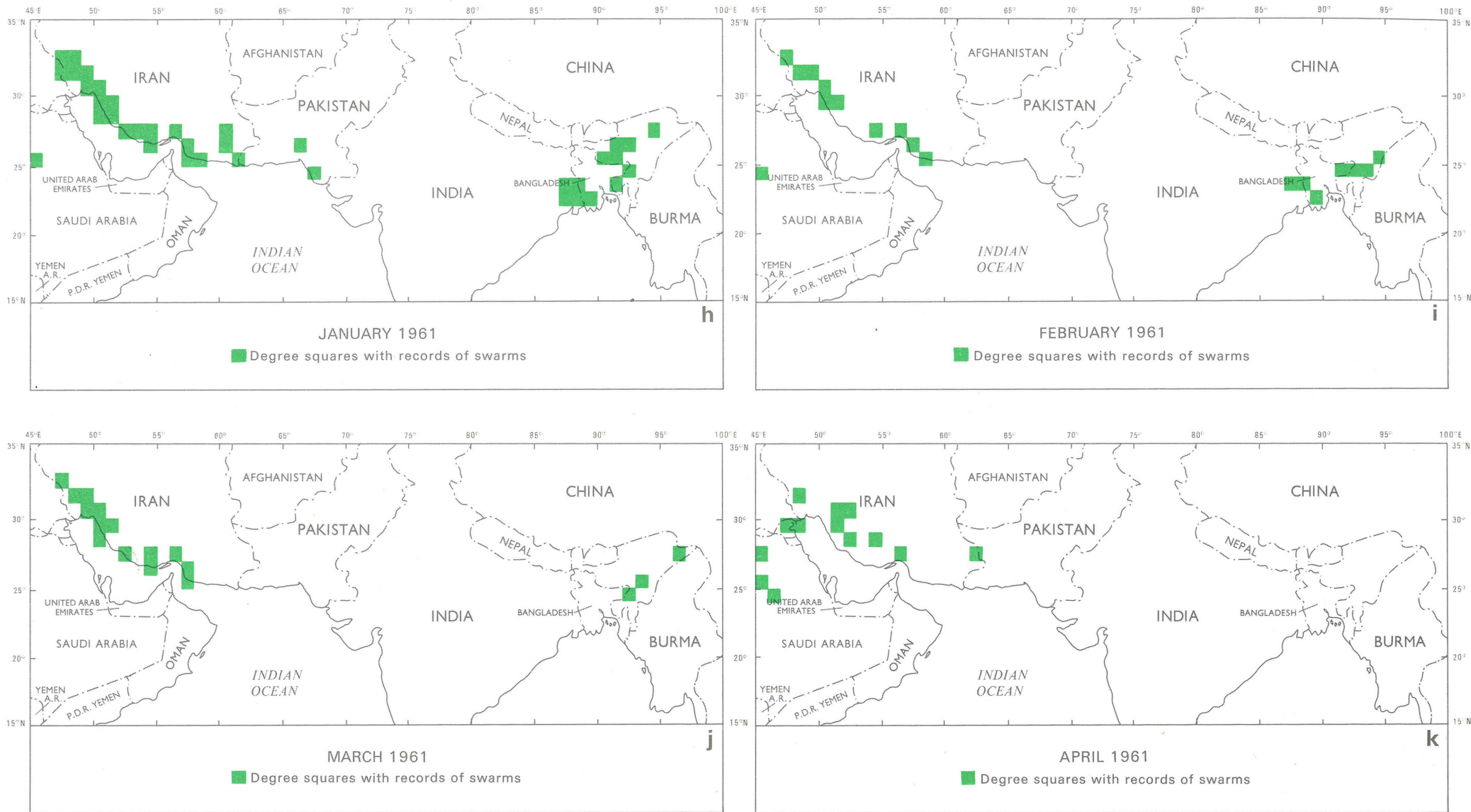


Fig. S4 a-k. 1960 MONSOON GENERATION SWARMS IN THE EASTERN REGION

Figs a,b,c,e,f,h,i,j and k show the monthly distribution of swarms by degree squares. (Figs a and b show Spring and first monsoon generations. Figs c and e show both monsoon generations. Figs f,h,i,j and k show both monsoon generations and the summer generation from the Central Region.) Arrows on Figs d and g show schematically the spread of swarms (see p 27)

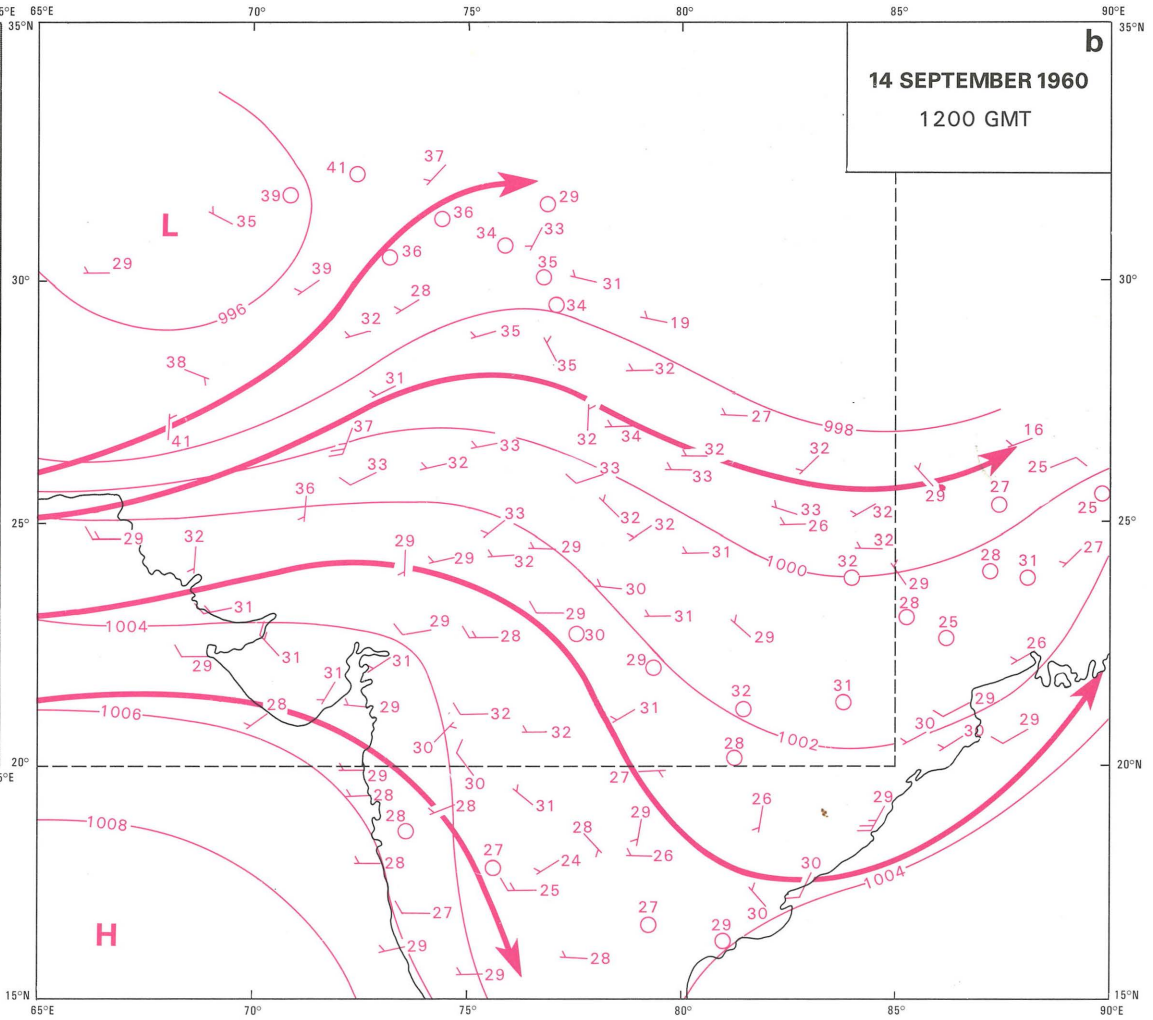
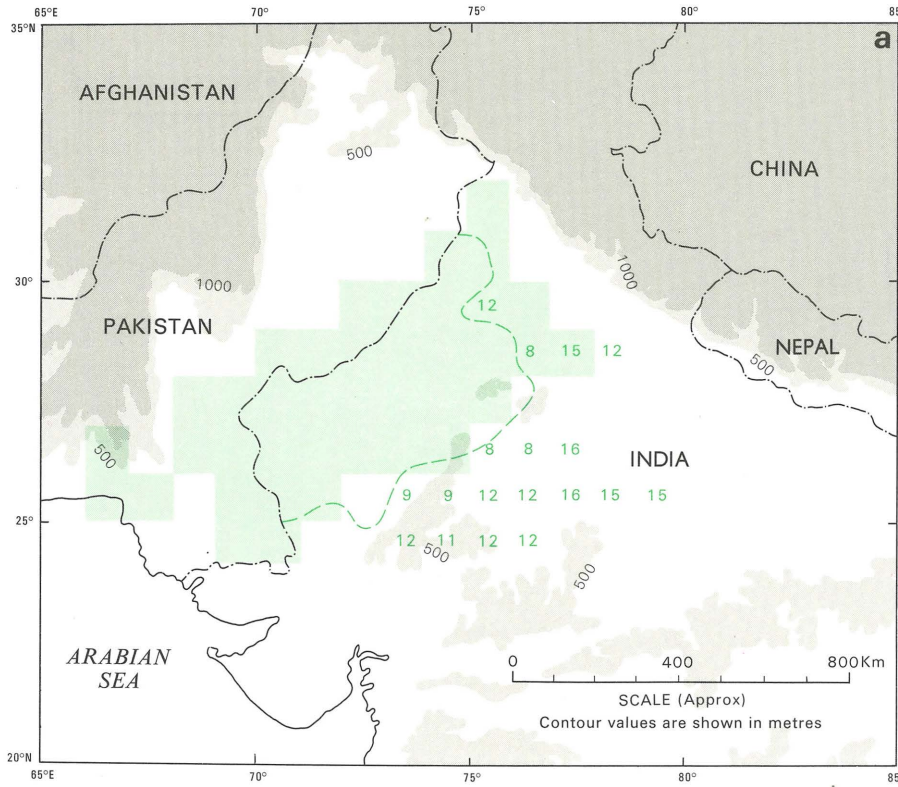




Fig. C4.1 EASTWARD SPREAD ACROSS INDIA, 8-17 SEPTEMBER 1960

a Degree squares and dates of first swarm reports
8-17 September 1960

beyond the eastern limit of swarm reports
 in India before 8 September 1960, shown 

 Degree squares with fledging likely
 in August and September

b Weather map for 14 September 1960 at 1200 GMT

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a Degree squares and dates of first swarm reports
18 September - 2 October 1960

beyond the limit of swarm reports
 in India, 1-17 September 1960, shown

○ Degree squares with fledging
 likely from August to October

b Weather map for 18 September 1960 at 1200 GMT

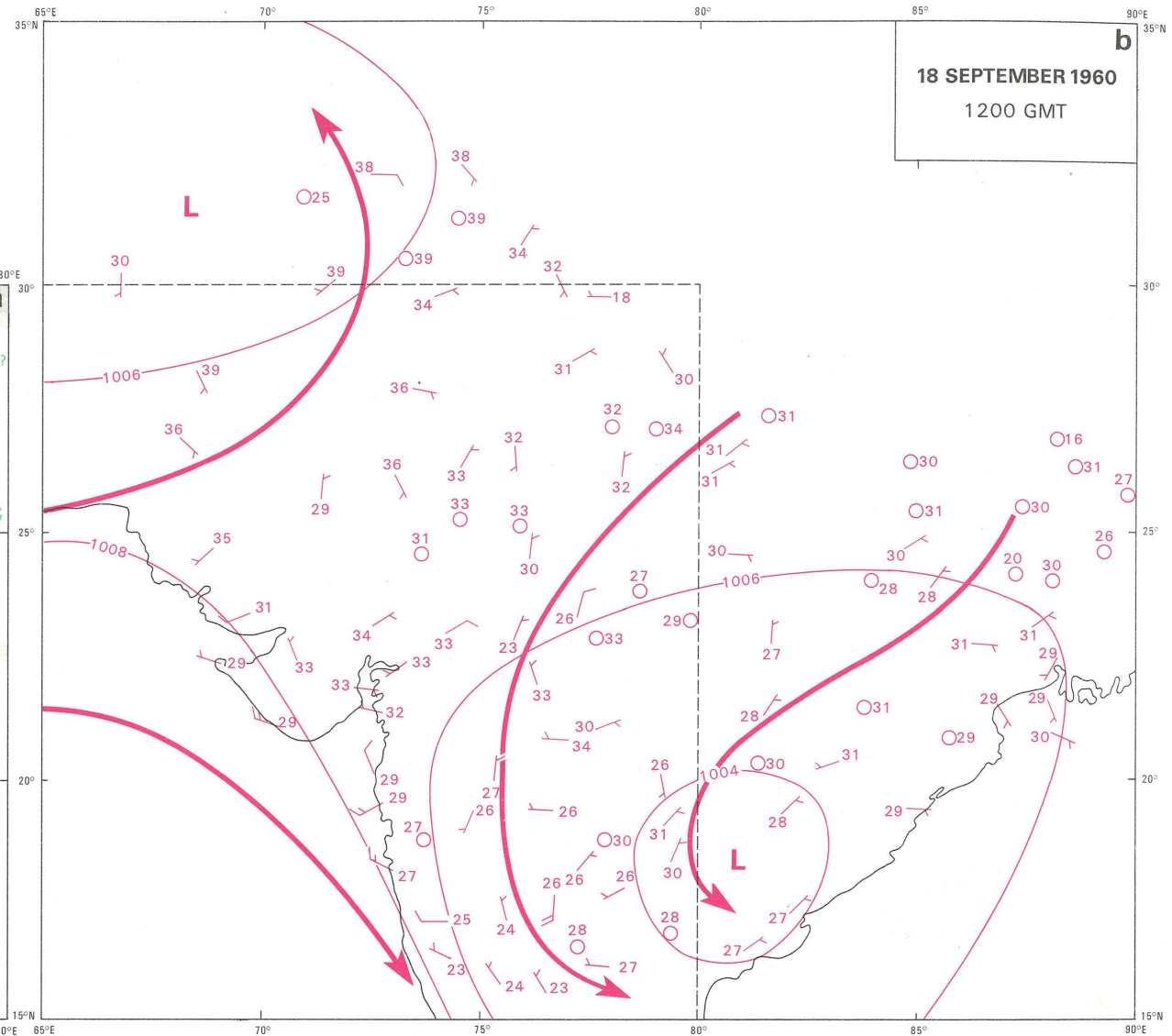
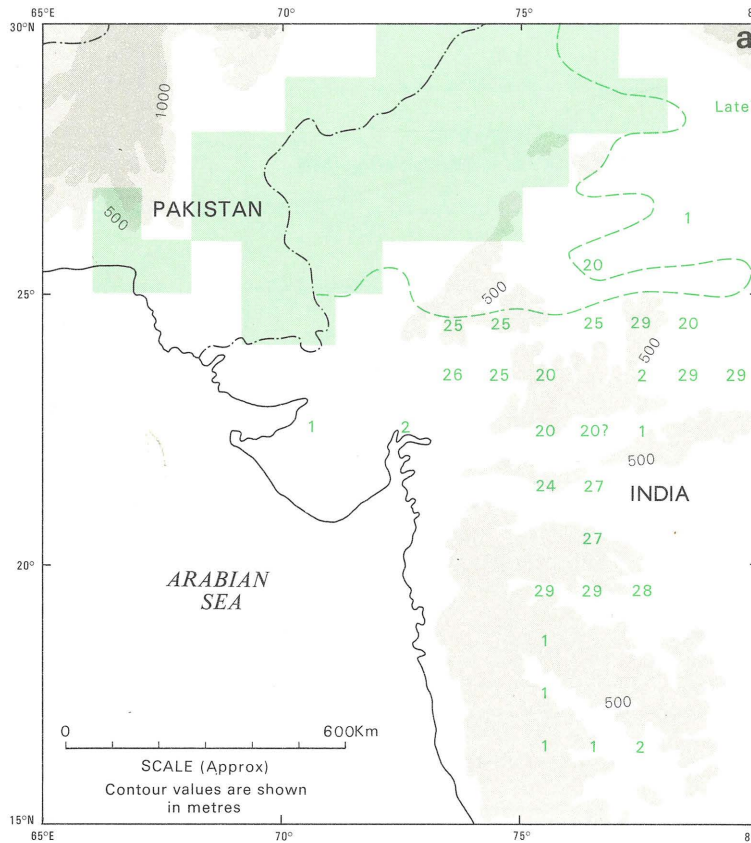


Fig. C4.2 SOUTHWARD SPREAD ACROSS INDIA, LATE SEPTEMBER 1960

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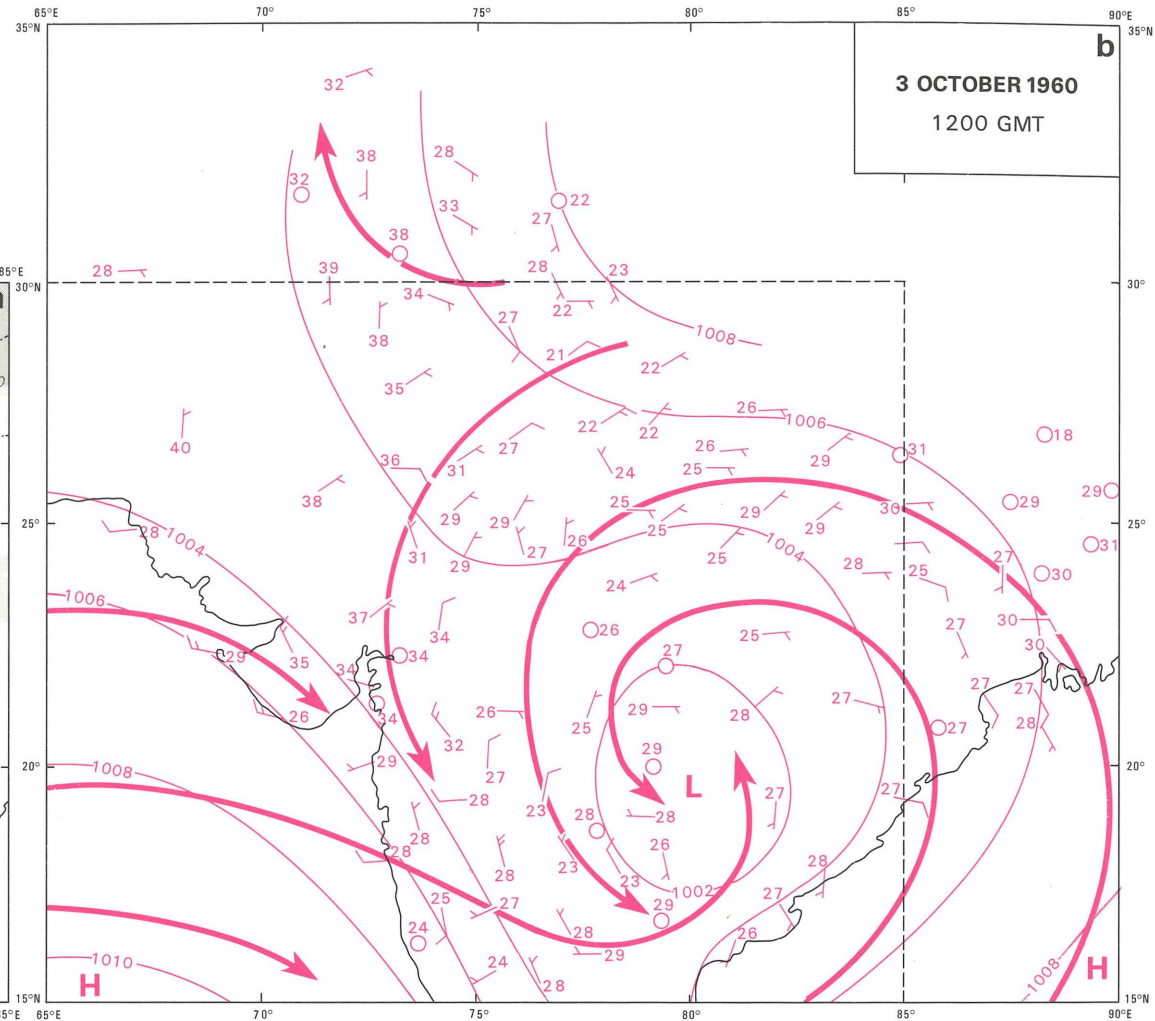
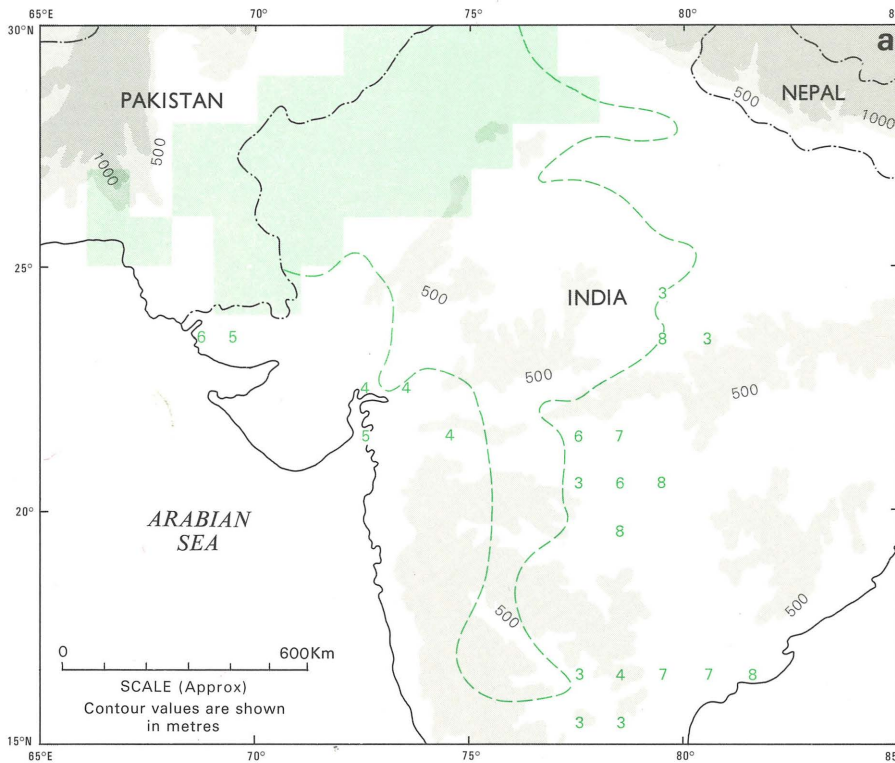
Fig. C4.3 SPREAD TO EASTERN INDIA, OCTOBER 1960

a Degree squares and dates of first swarm reports
3-8 October 1960

beyond the limit of swarm reports in India
 during September and 1-2 October 1960, shown


□ Degree squares with fledging likely
 in September and October


b Weather map for 3 October 1960 at 1200 GMT



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c Degree squares and dates of first swarm reports
9-26 October 1960

beyond the limit of swarm reports in India
 during September and 1-8 October 1960, shown 

 Degree squares with fledging likely
 in September and October

d Weather map for 12 October 1960 at 1200 GMT

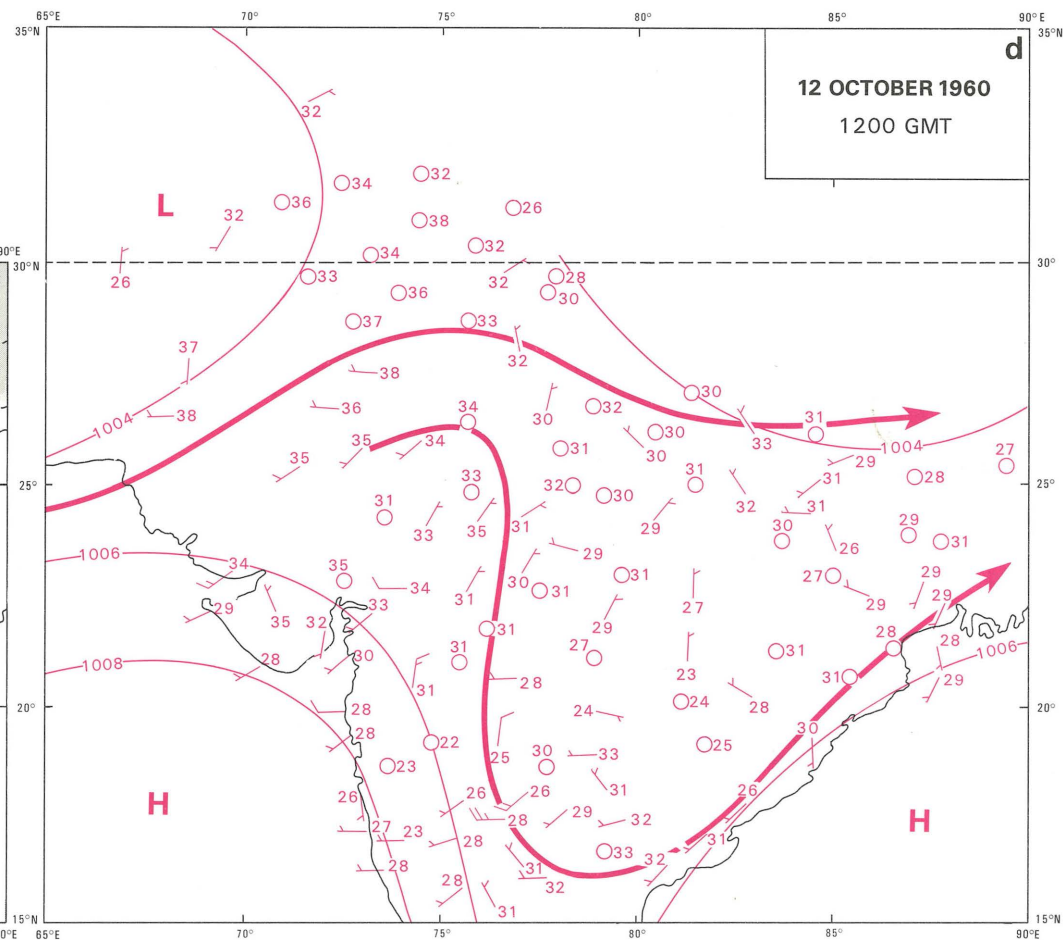
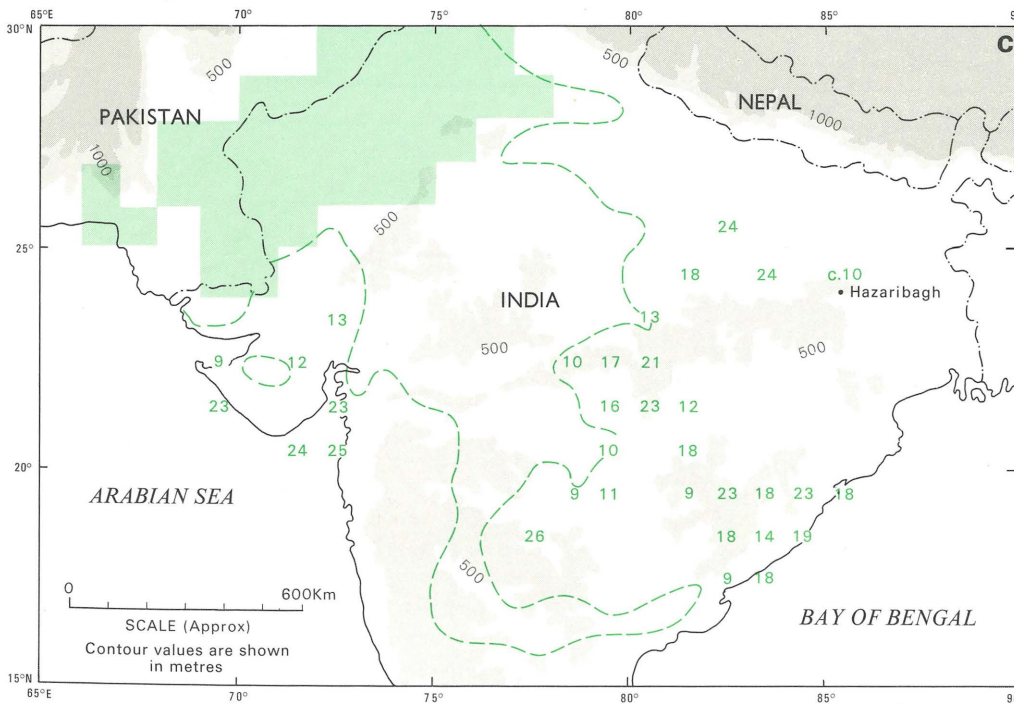


Fig. C4.3 SPREAD TO EASTERN INDIA, OCTOBER 1960 (see opposite page)

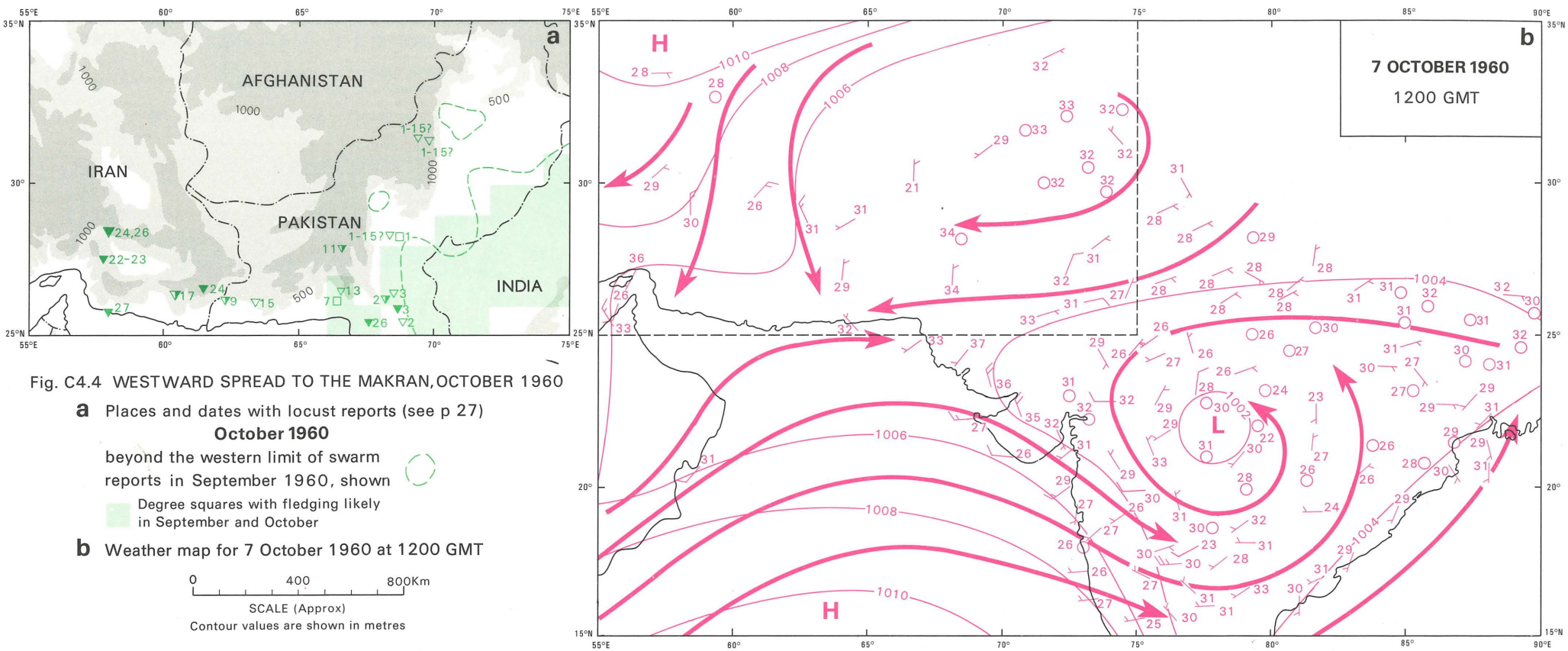


Fig. C.4.4 WESTWARD SPREAD TO THE MAKRAN, OCTOBER 1960

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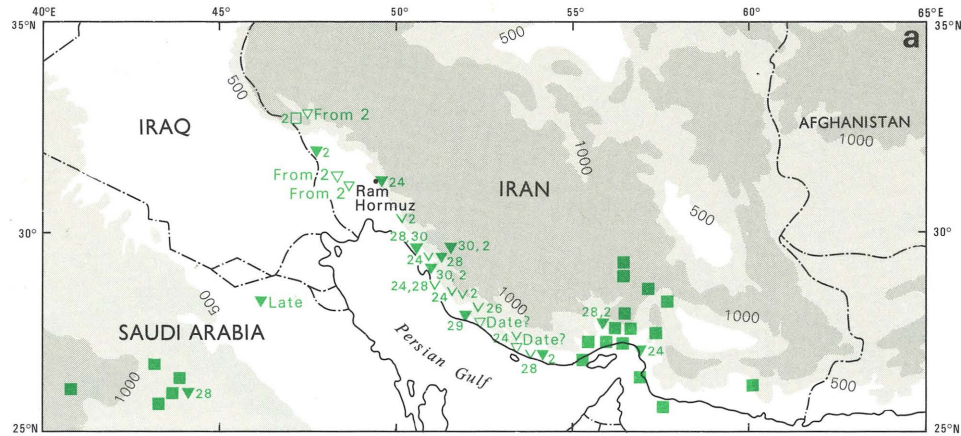


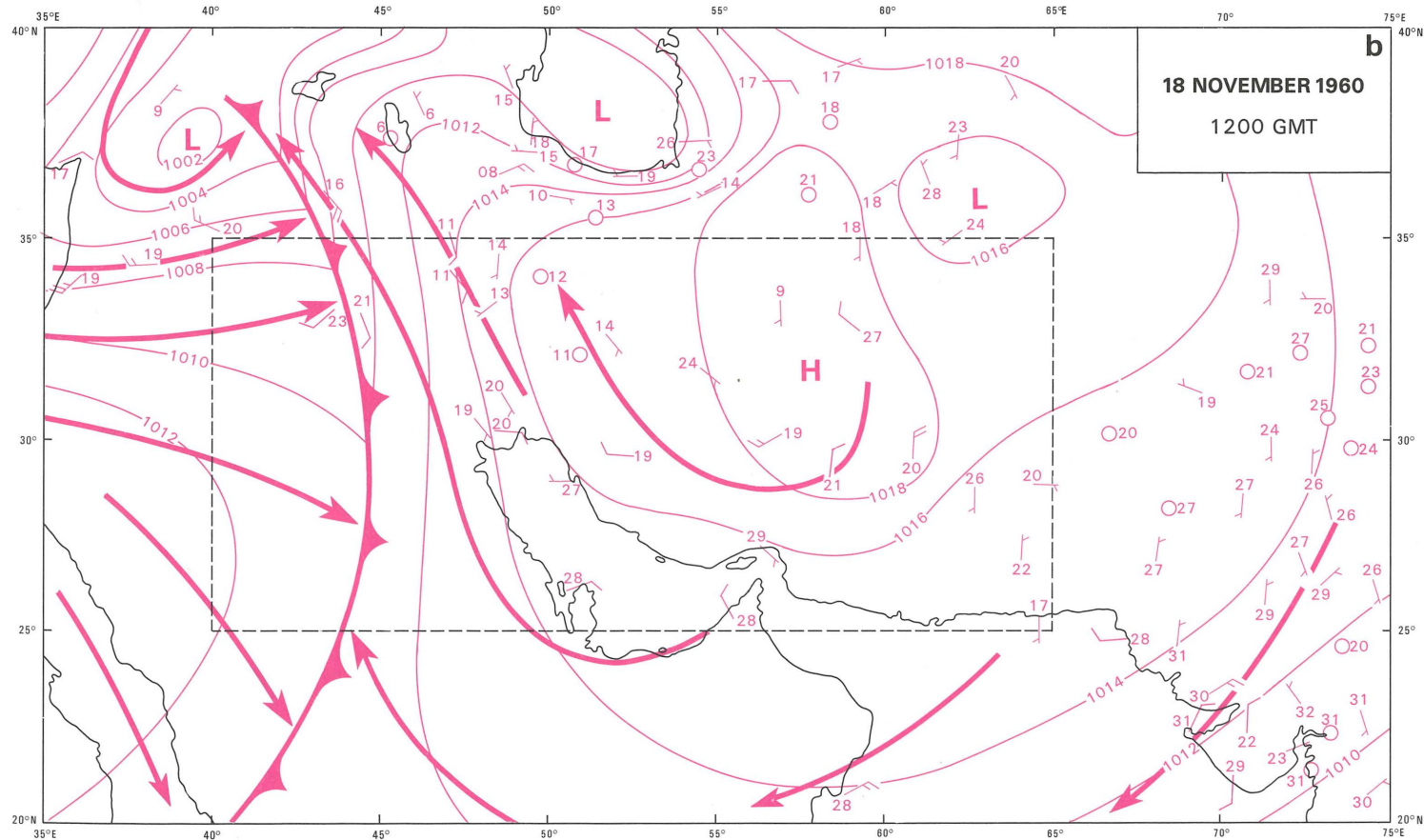
Fig. C4.5 WESTWARD SPREAD TO KHUZISTAN, NOVEMBER 1960

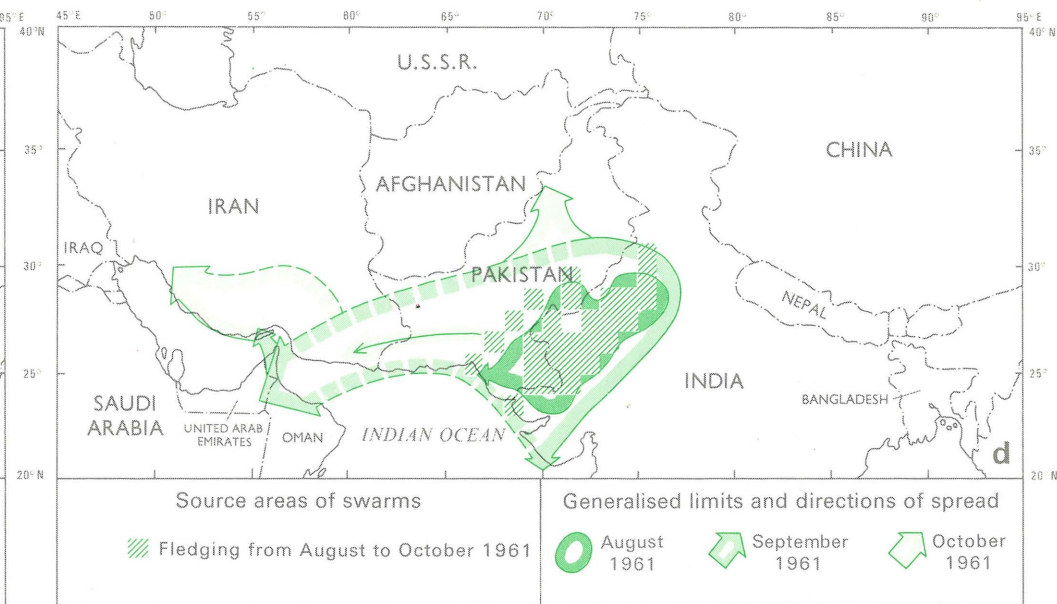
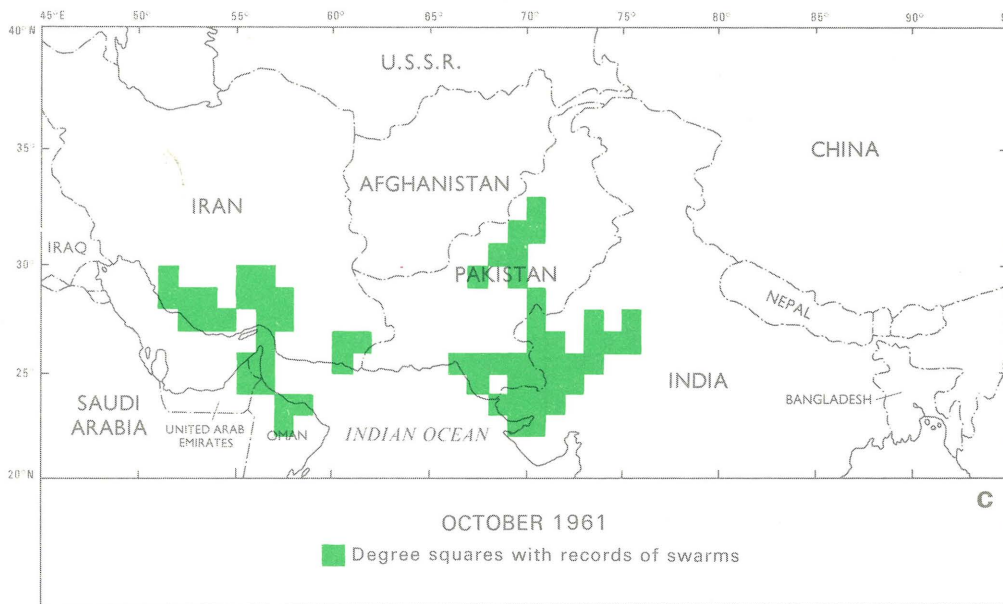
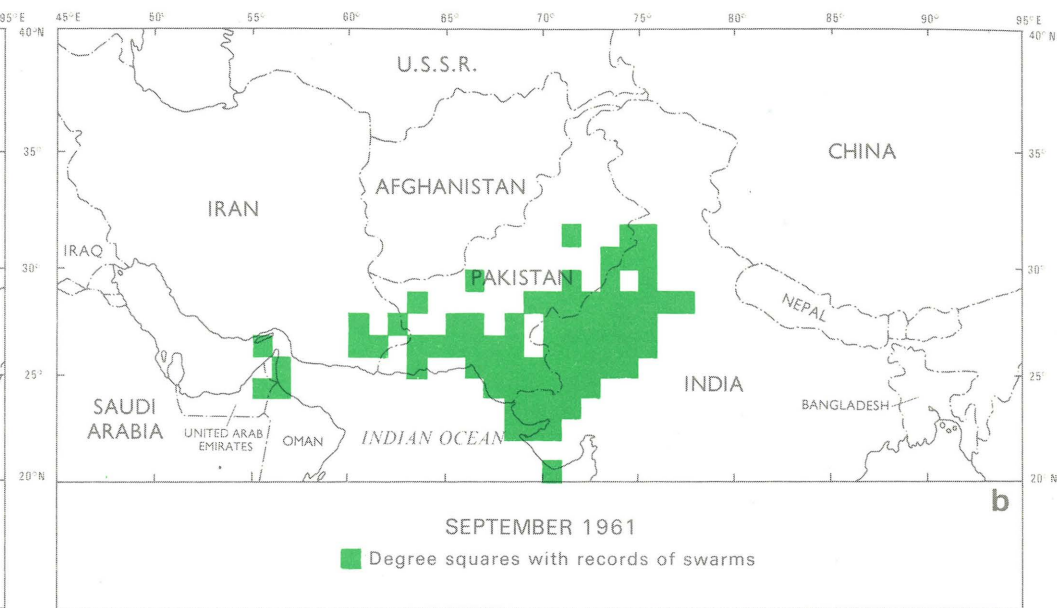
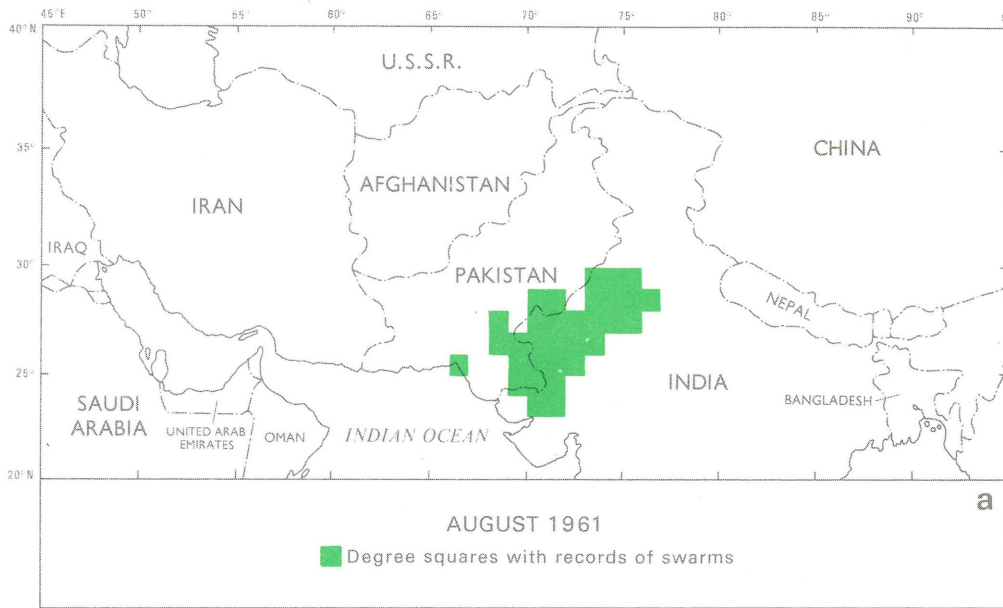
a Places and dates with locust reports (see p 27)
21 November - 2 December 1960

■ Swarms reported 1-20 November

b Weather map for 18 November 1960 at 1200 GMT

0 400 800Km
 SCALE (Approx)
 Contour values are shown in metres





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Fig. S5 (see opposite page)

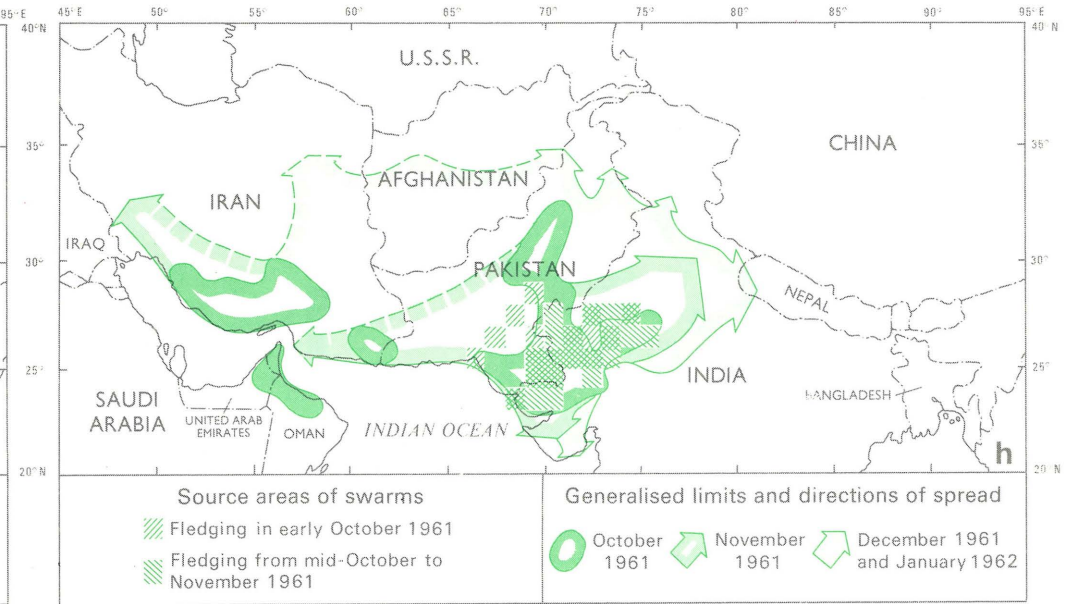
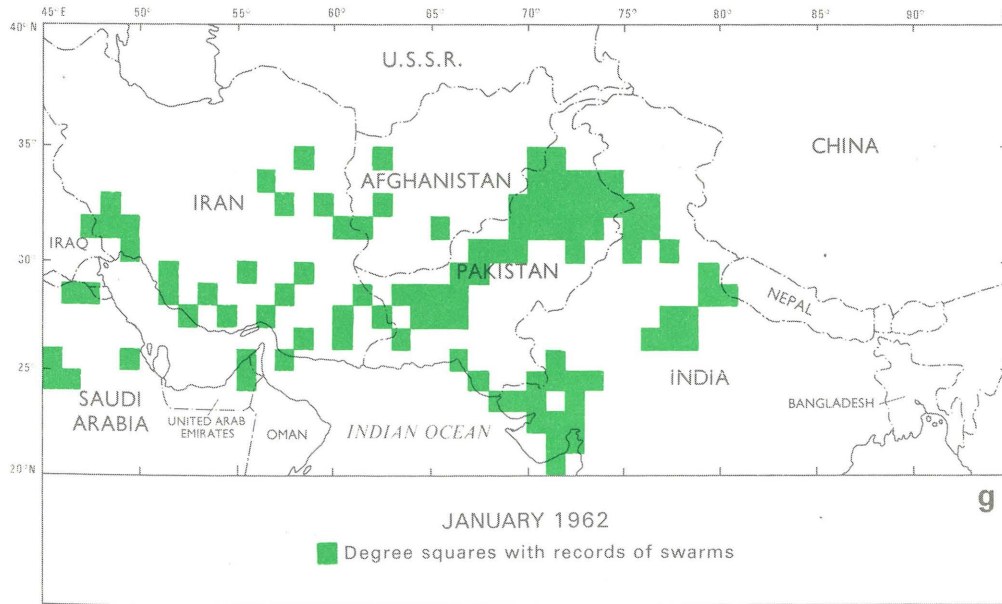
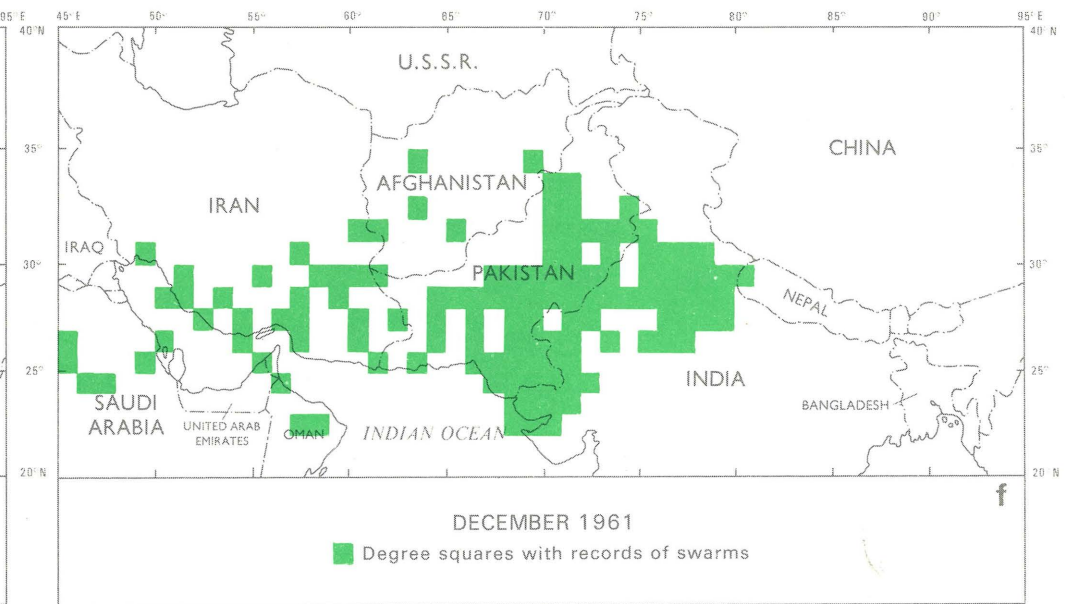
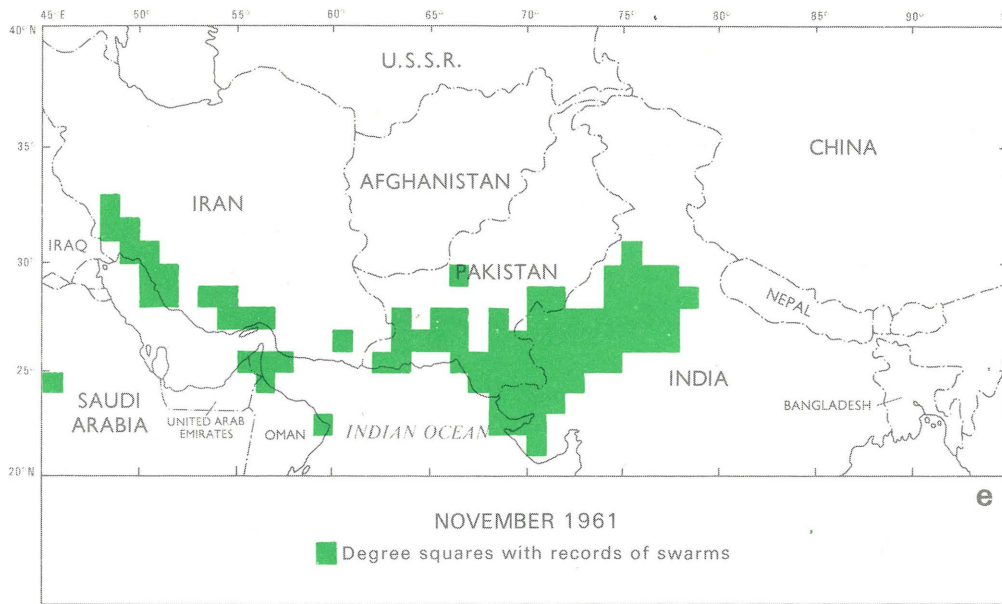


Fig. S5 a-l. 1961 MONSOON GENERATION SWARMS IN THE EASTERN REGION

Figs a,b,c,e,f,g,i,j, and k show the monthly distribution of swarms by degree squares. (Figs a and b show spring and first monsoon generations. Fig c shows both monsoon generations. Figs f,g,i,j, and k show both monsoon generations and the summer generation from the Central Region.) Arrows on Figs d,h, and l show schematically the spread of swarms (see p 27)

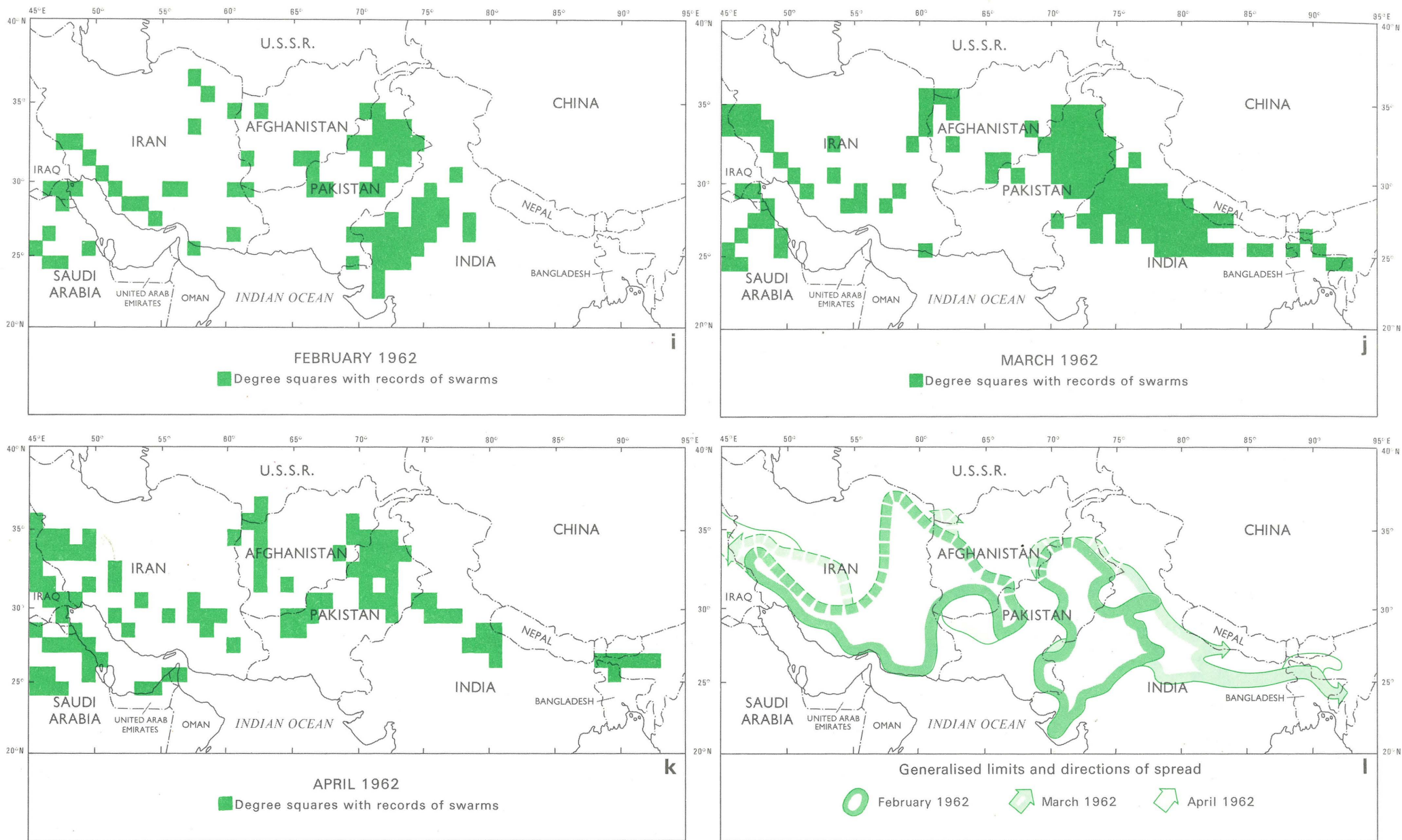


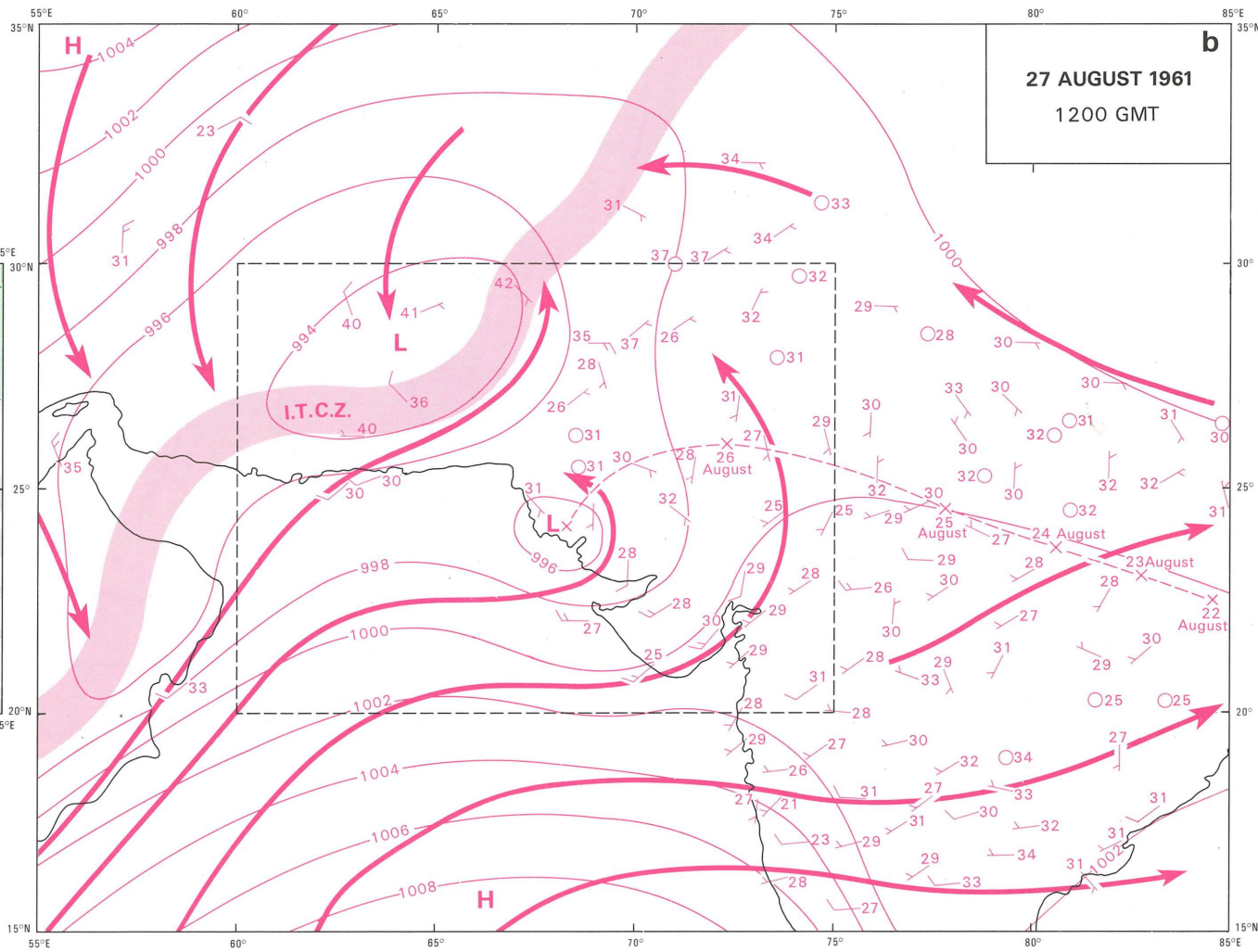
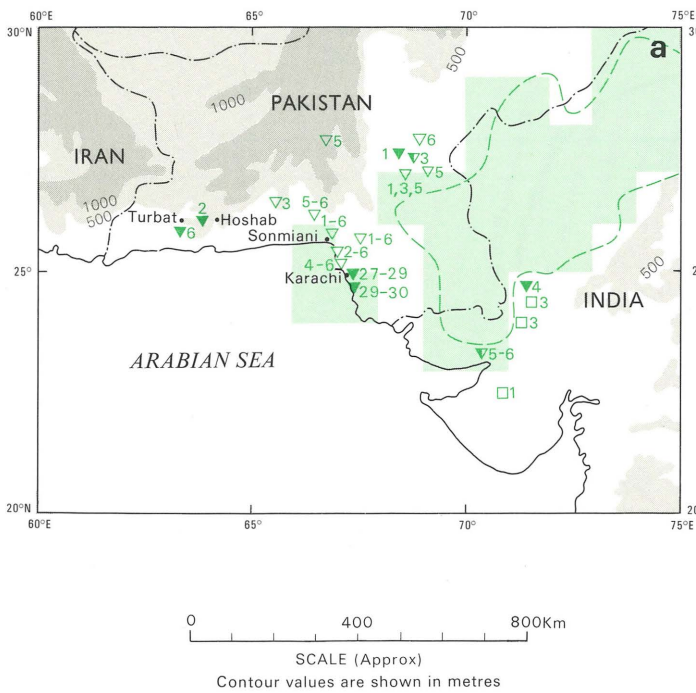


Fig. S5 a-l. 1961 MONSOON GENERATION SWARMS IN THE EASTERN REGION

Figs a,b,c,e,f,g,i,j and k show the monthly distribution of swarms by degree squares. (Figs a and b show Spring and first monsoon generations. Fig c shows both monsoon generations. Figs f,g,i,j and k show both monsoon generations and the Summer generation from the Central Region.) Arrows on Figs d,h, and l show schematically the spread of swarms (see p 27)

a Places and dates with locust reports (see p 27)
26 August - 6 September 1961
 beyond the limit of swarm
 reports 1-25 August 1961, shown 
 Degree squares with fledging likely
 in late August and September

b Weather map for 27 August 1961 at 1200 GMT



**Fig. C5.1 WESTWARD SPREAD ACROSS PAKISTAN,
 LATE AUGUST AND EARLY SEPTEMBER 1961**

a Degree squares and dates of first swarm reports
24 August - 13 September 1961
 beyond the limit of swarm reports 1-23 August 1961, shown 

 Degree squares with fledging likely in the second half of August and September

b Weather map for 10 September 1961 at 1200 GMT

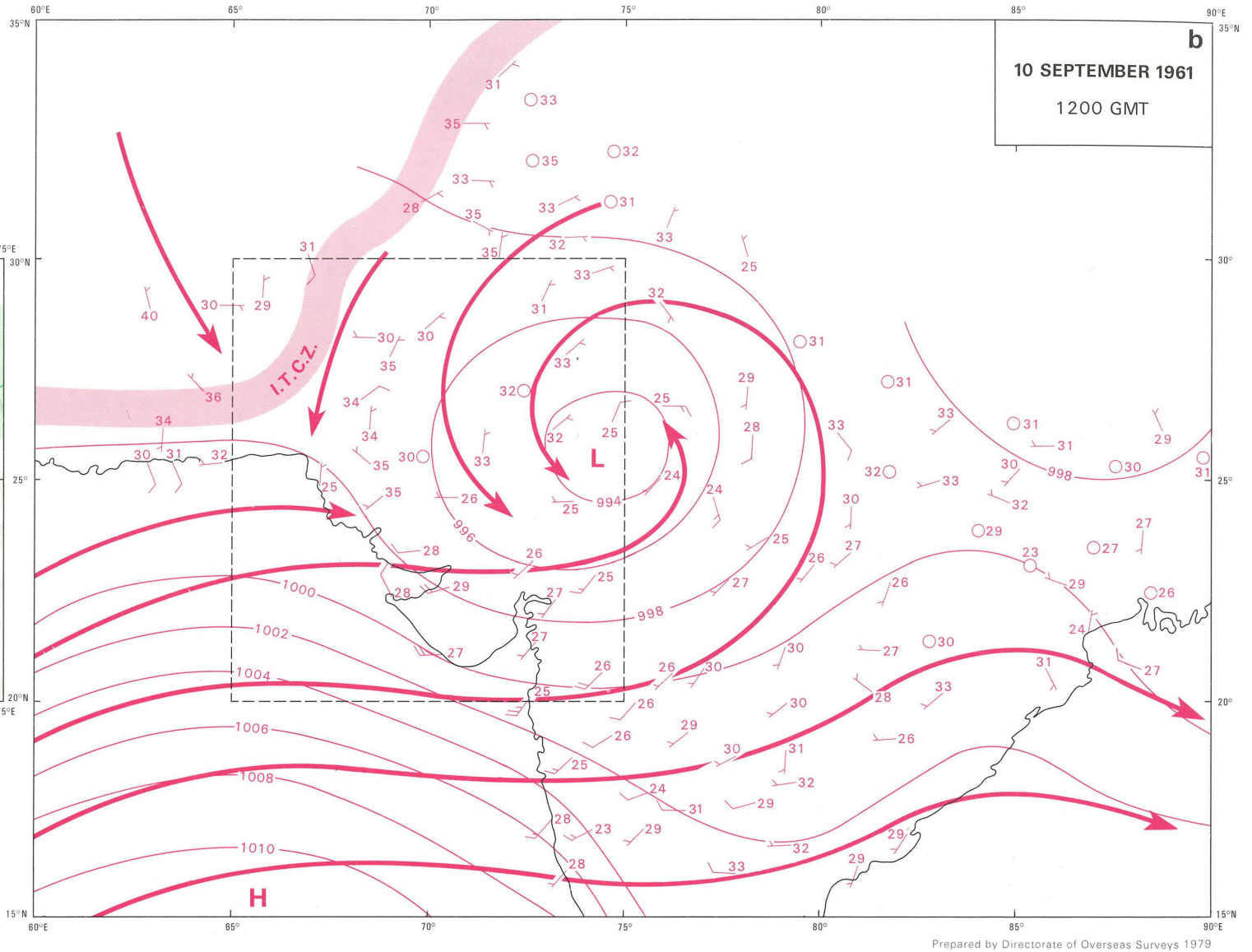
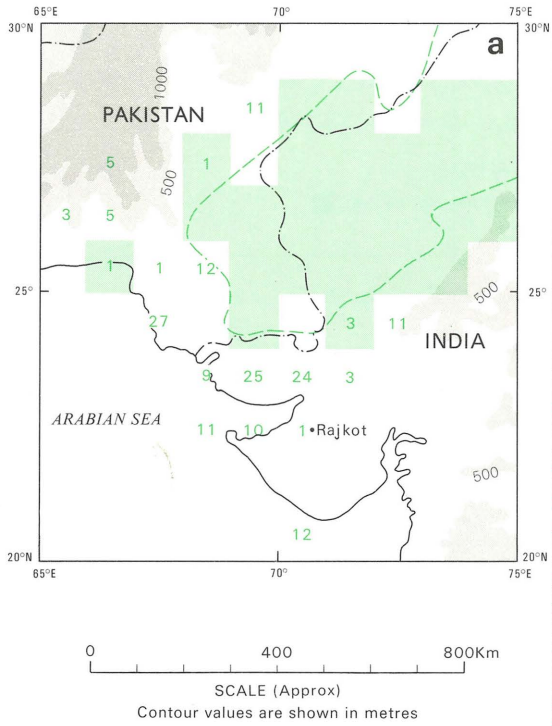
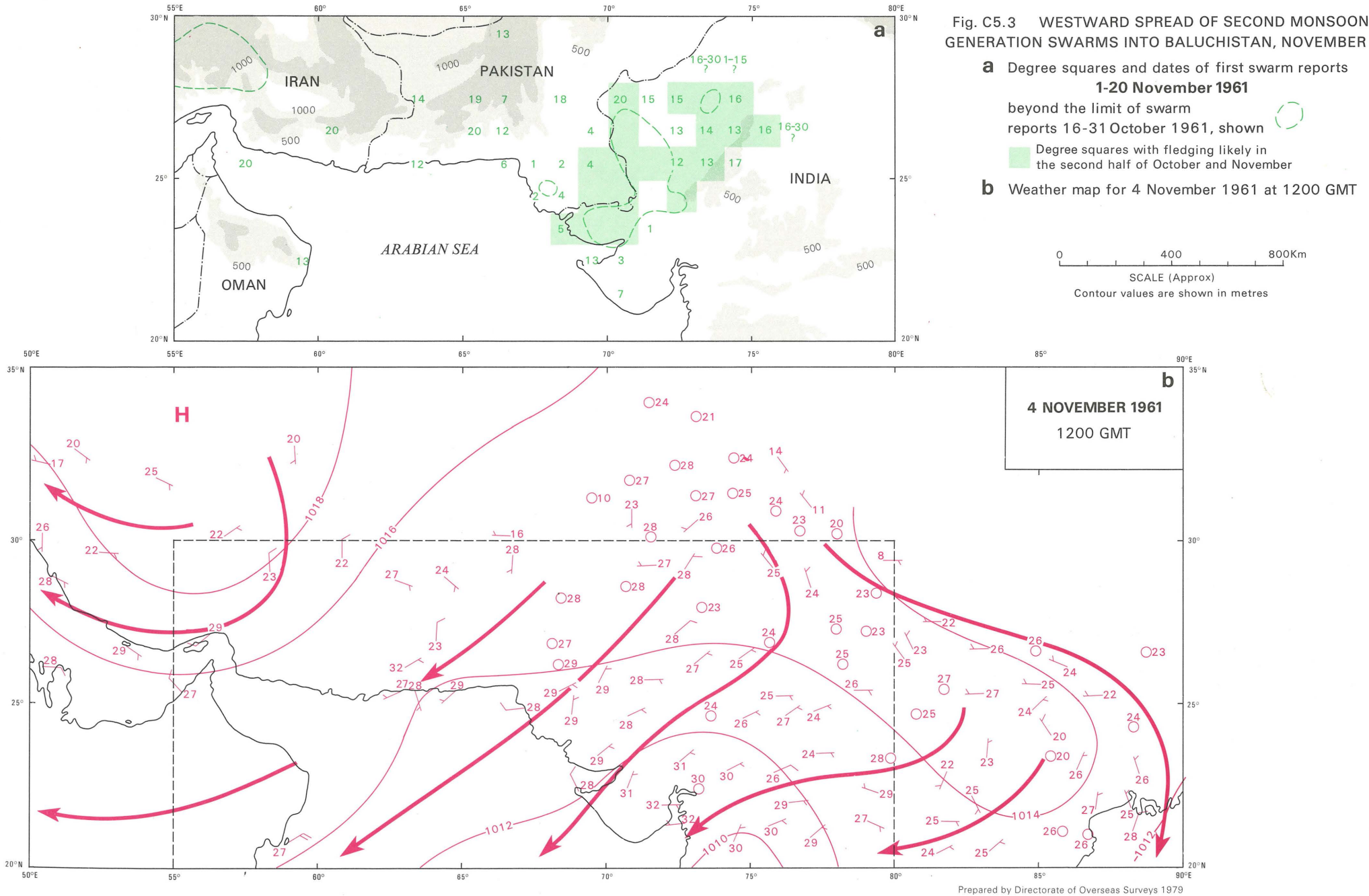


Fig. C5.2 SOUTHWARD SPREAD TO GUJARAT, LATE AUGUST AND SEPTEMBER 1961

Prepared by Directorate of Overseas Surveys 1979

Fig. C5.3 WESTWARD SPREAD OF SECOND MONSOON GENERATION SWARMS INTO BALUCHISTAN, NOVEMBER 1961



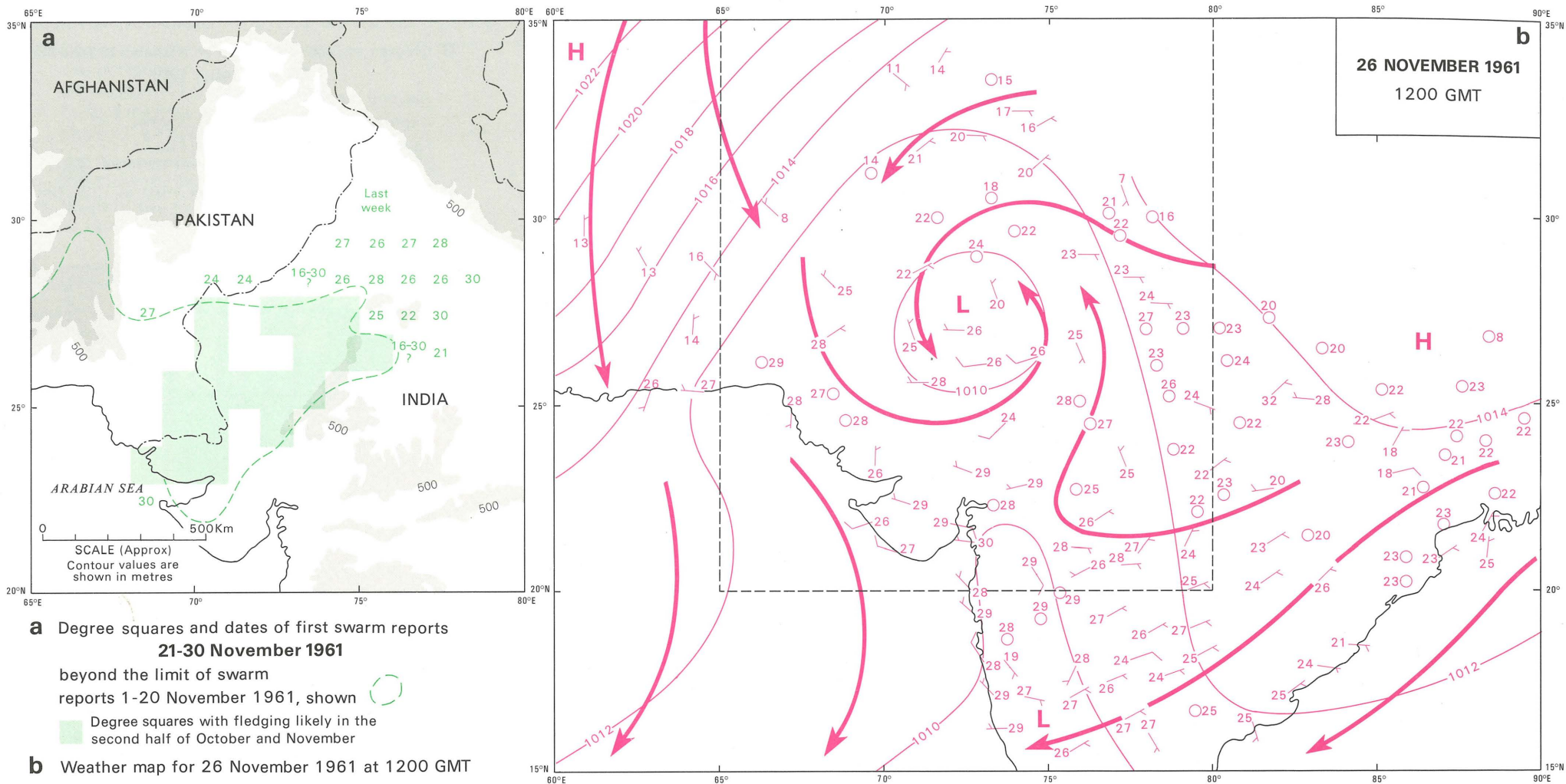


Fig. C5.4 MOVEMENT OF SECOND MONSOON GENERATION SWARMS TO DELHI AND UTTAR PRADESH, NOVEMBER 1961

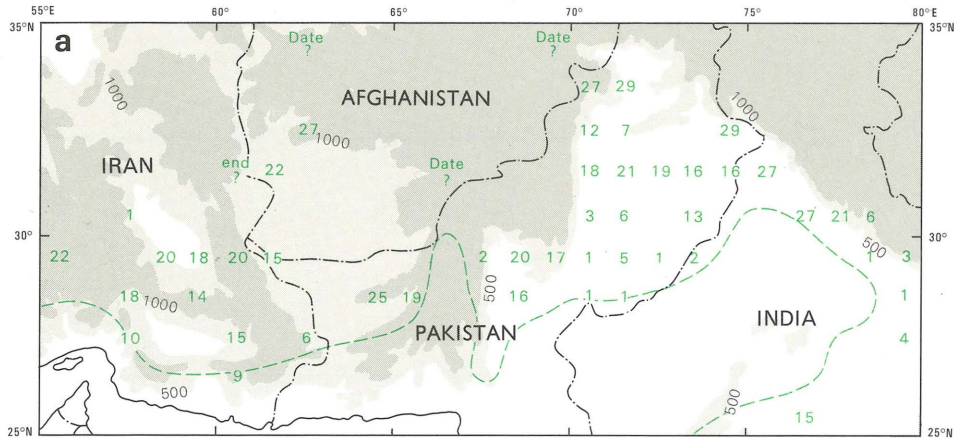


Fig. C5.5. NORTHWARD SPREAD TO AFGHANISTAN, DECEMBER 1961

a Degree squares and dates of first swarm reports
December 1961

beyond the limit of swarm reports in November 1961, shown

b Weather map for 24 December 1961 at 1200 GMT

0 400 800Km
SCALE (Approx)
Contour values are shown in metres

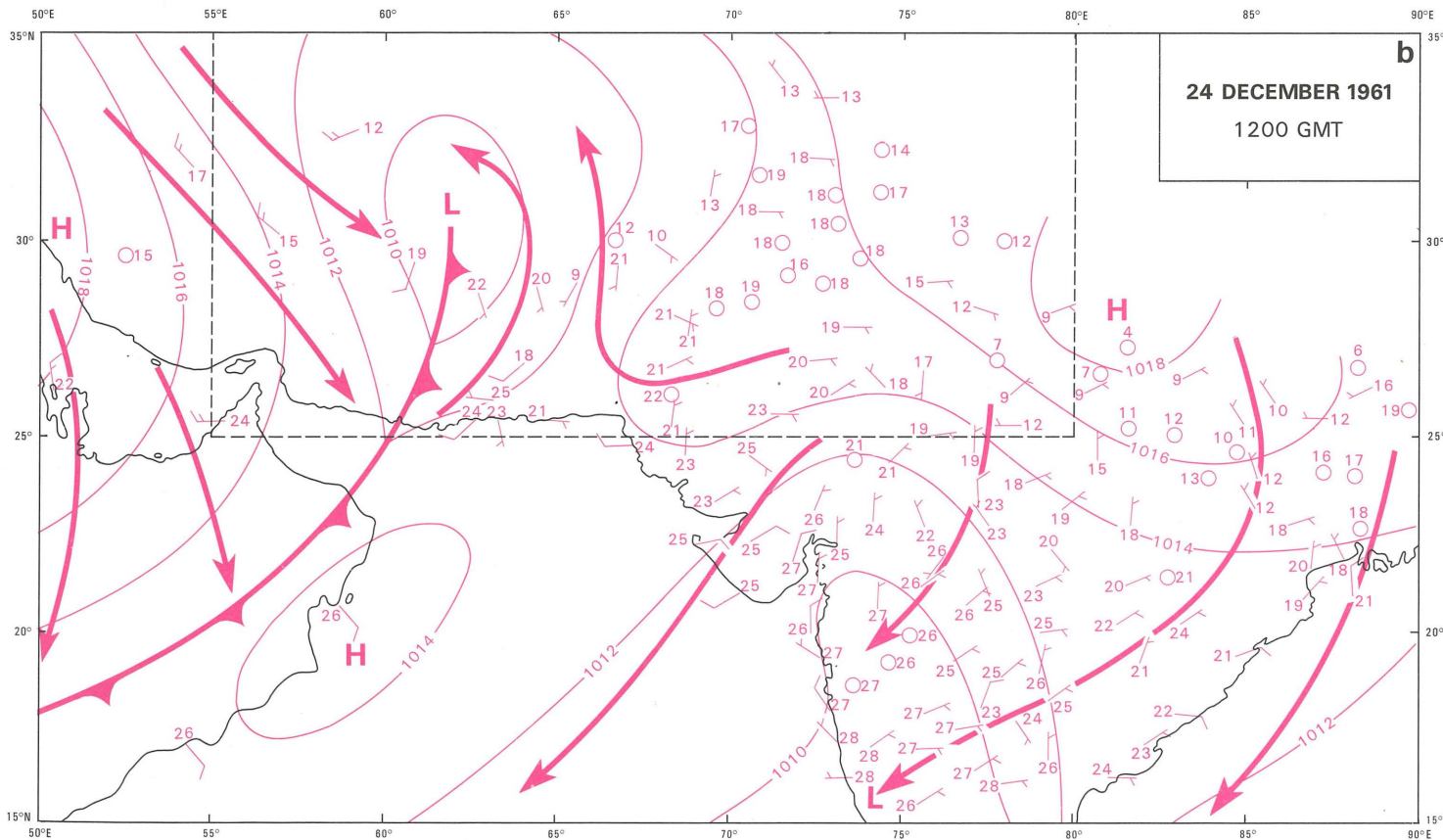
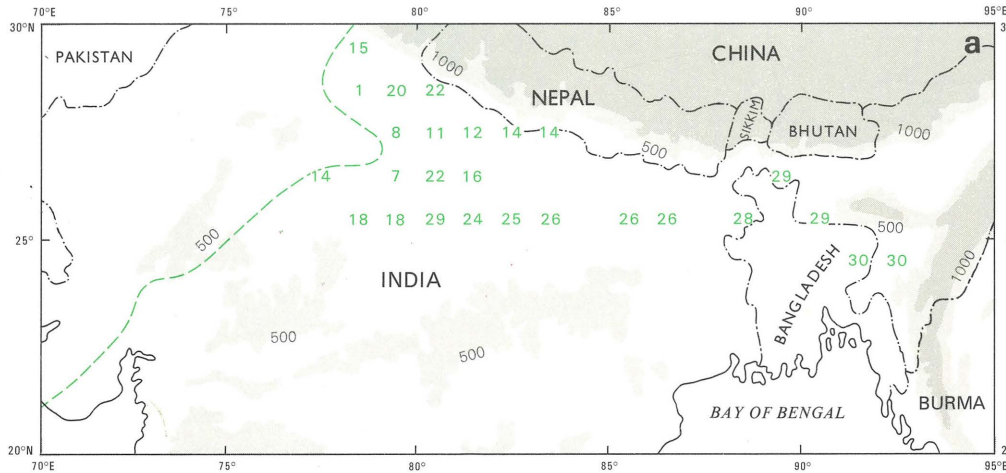


Fig. C5.6 EASTWARD SPREAD TO ASSAM, MARCH 1962

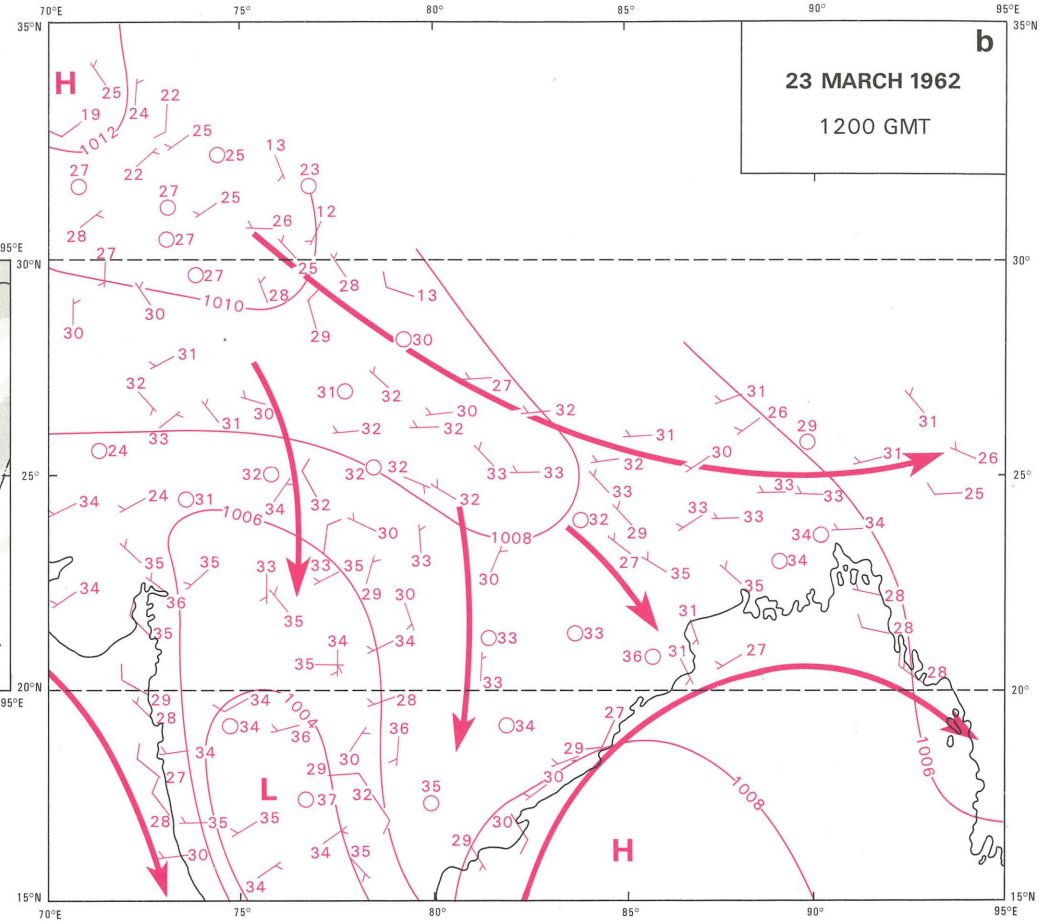
a Degree squares and dates of first swarm reports
March 1962

beyond the limit of swarm reports
 in India during February 1962, shown

b Weather map for 23 March 1962 at 1200 GMT



0 400 800km
 SCALE (Approx)
 Contour values are shown in metres



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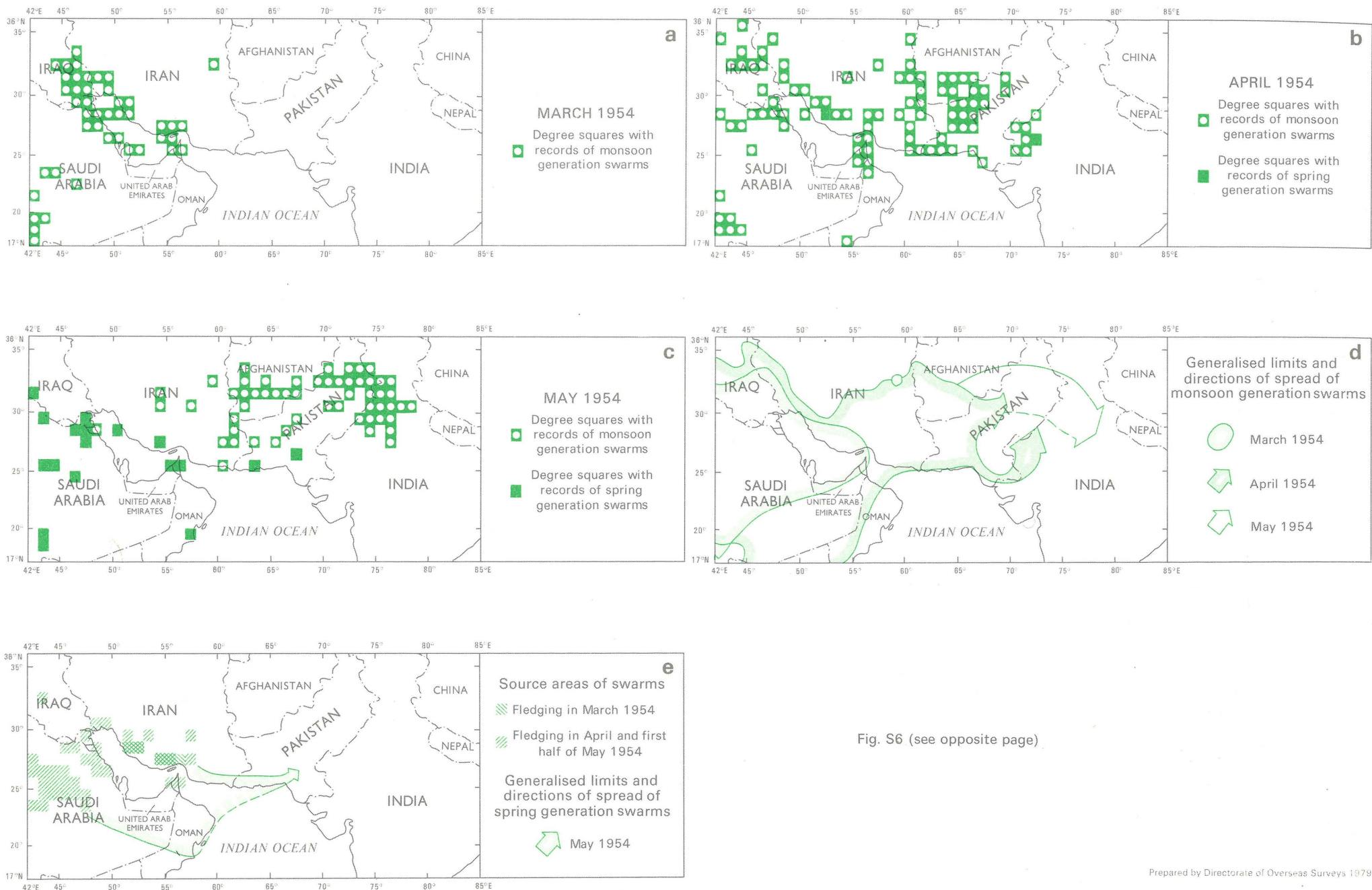


Fig. S6 (see opposite page)

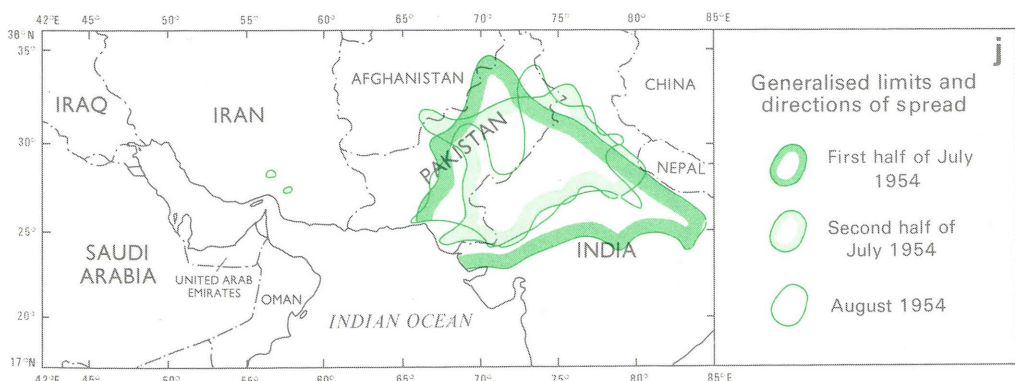
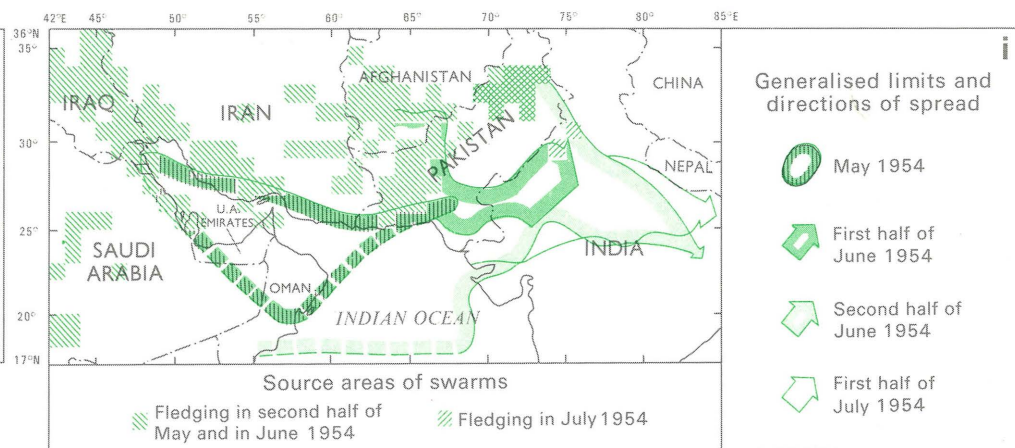
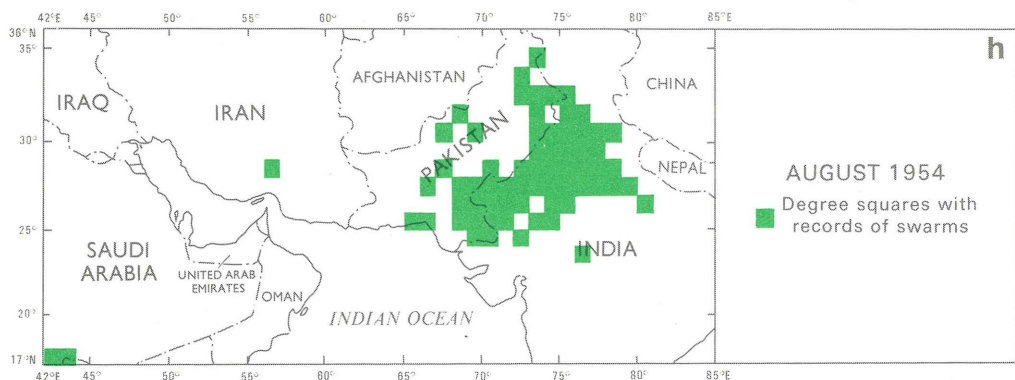
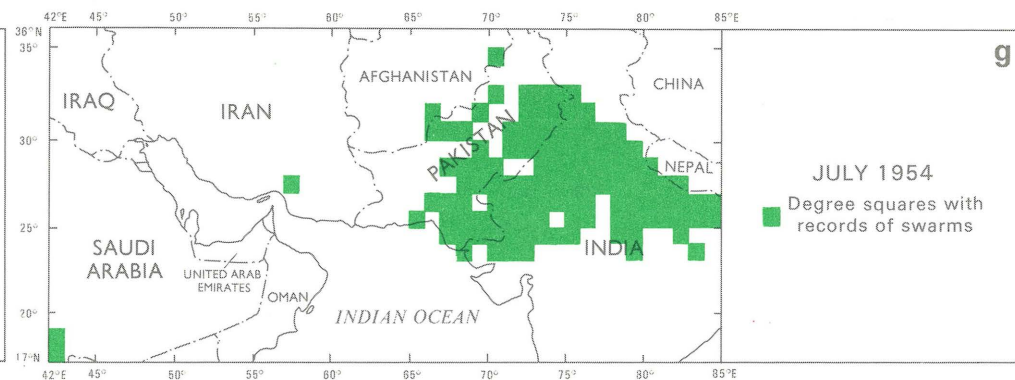
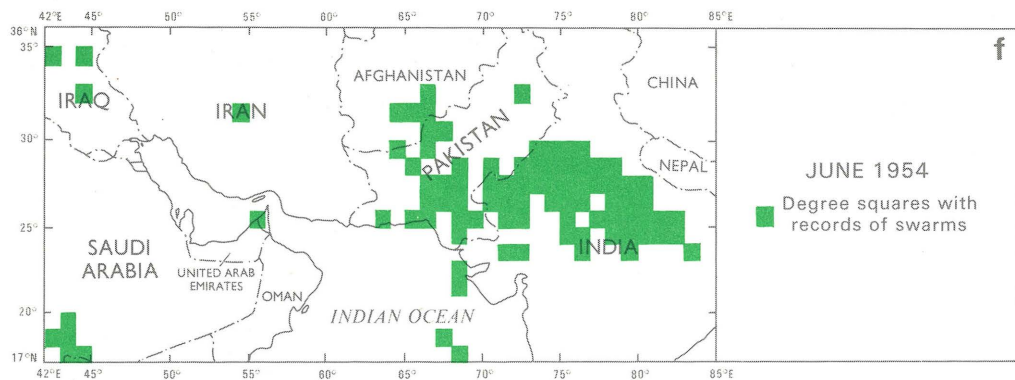


Fig. S6 a-j. 1953 MONSOON AND 1954 SPRING GENERATION SWARMS IN THE EASTERN REGION

Figs a,b,c,f,g, and h show the monthly distribution of swarms by degree squares. (Figs f,g, and h show mostly 1954 spring generation swarms.)

Arrows on Figs d,e,i and j show schematically the spread of swarms (see p 27)

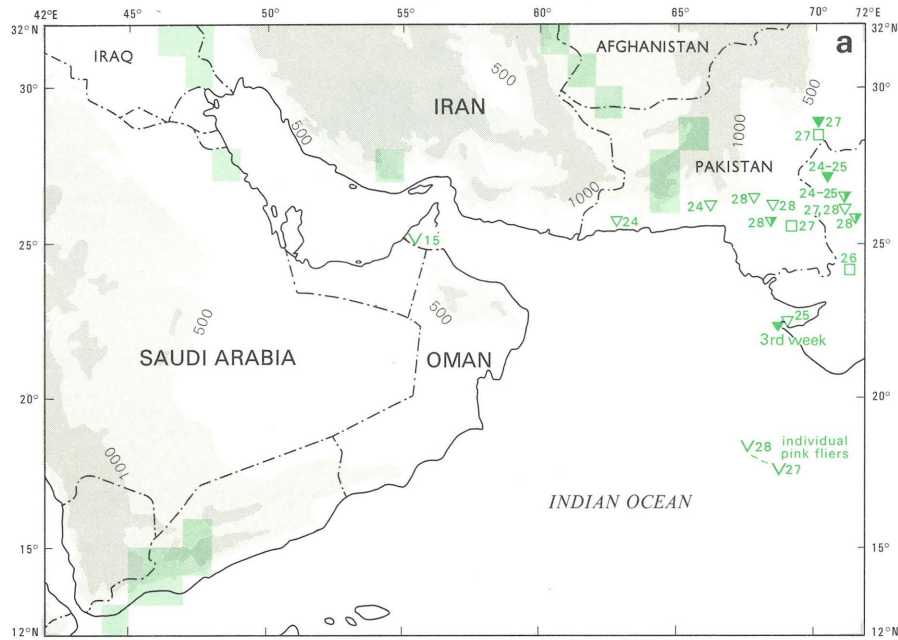


Fig. C6.1 SWARMS ON THE KATHIAWAR COAST OF INDIA, JUNE 1954

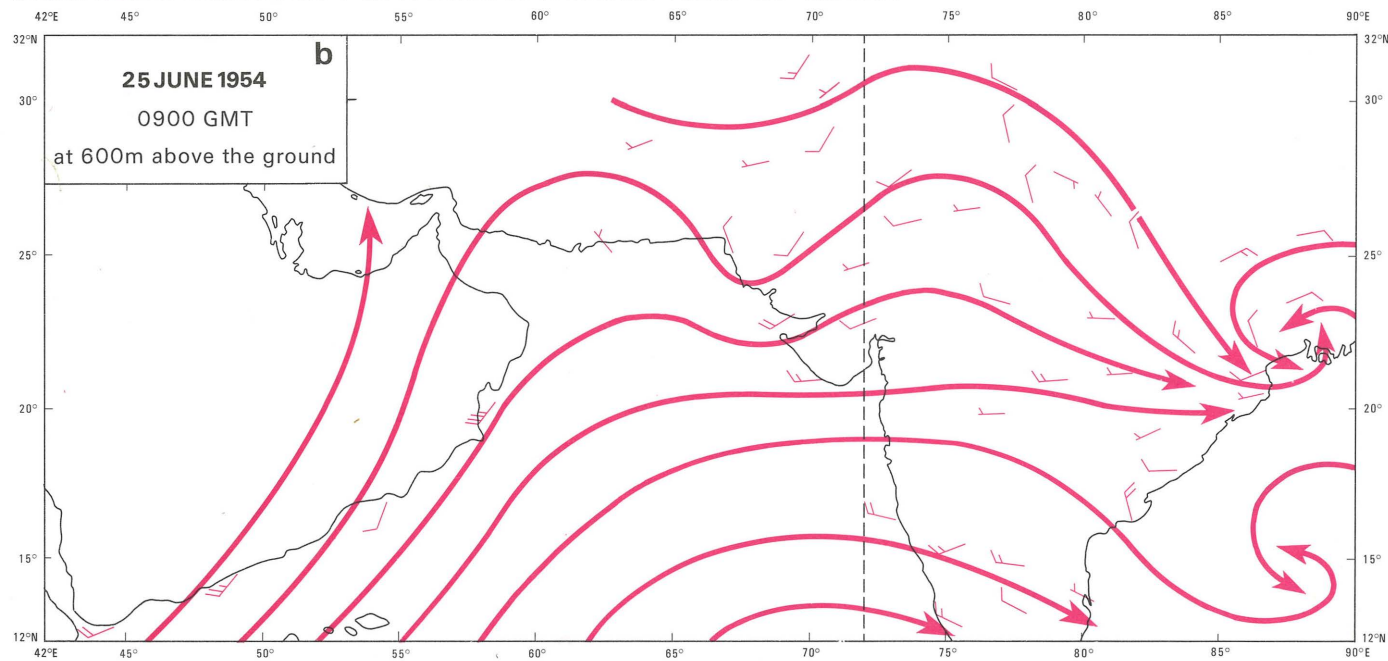
a Places and dates with locust reports. (see p 27)

15-30 June 1954

Green square Degree squares with fledging likely
5-15 June 1954

b Map of winds at 600m above the ground
25 June 1954 at 0900 GMT

0 500 1000 Km
SCALE (Approx)
Contour values are shown in metres



Prepared by Directorate of Overseas Surveys 1979

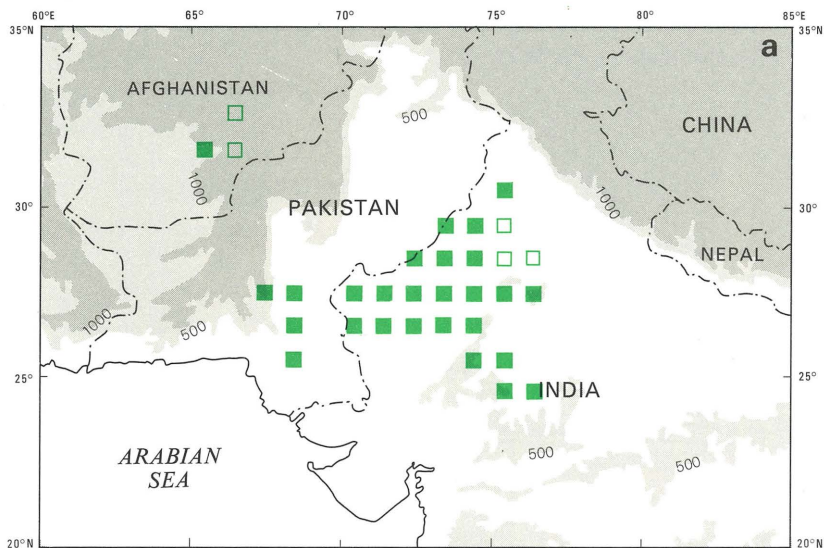


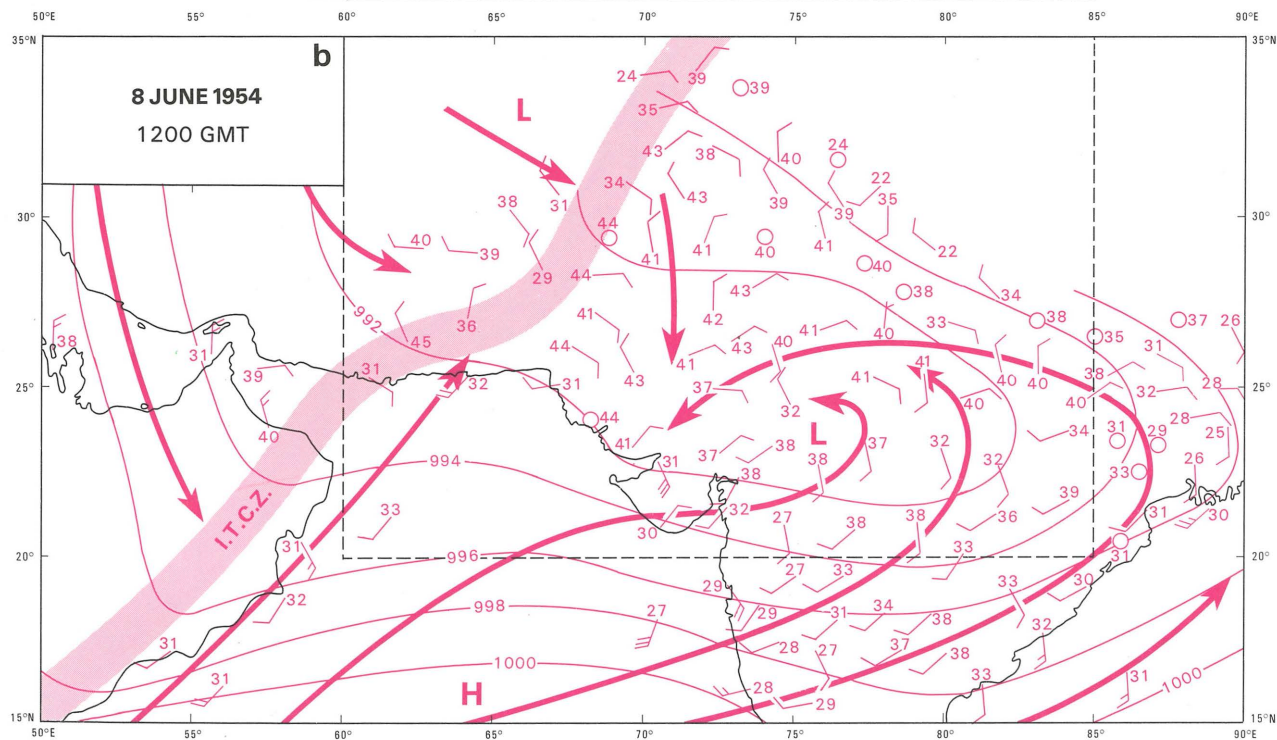
Fig. C6.2 EASTWARD SPREAD ACROSS INDIA,
JUNE AND JULY 1954

a Degree squares with swarms
1-14 June 1954

- Laying swarms
- Other swarms

b Weather map for 8 June 1954 at 1200 GMT

0 400 800km
SCALE (Approx)
Contour values are shown in metres



Prepared by Directorate of Overseas Surveys 1979

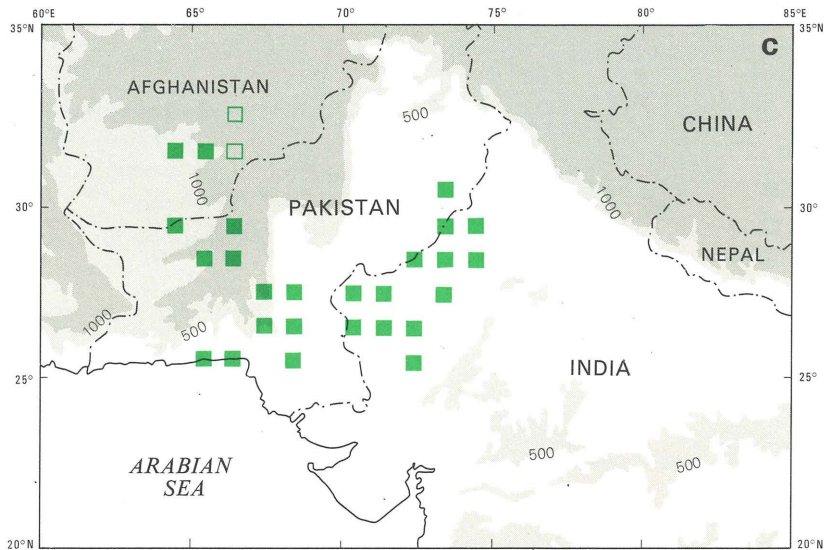


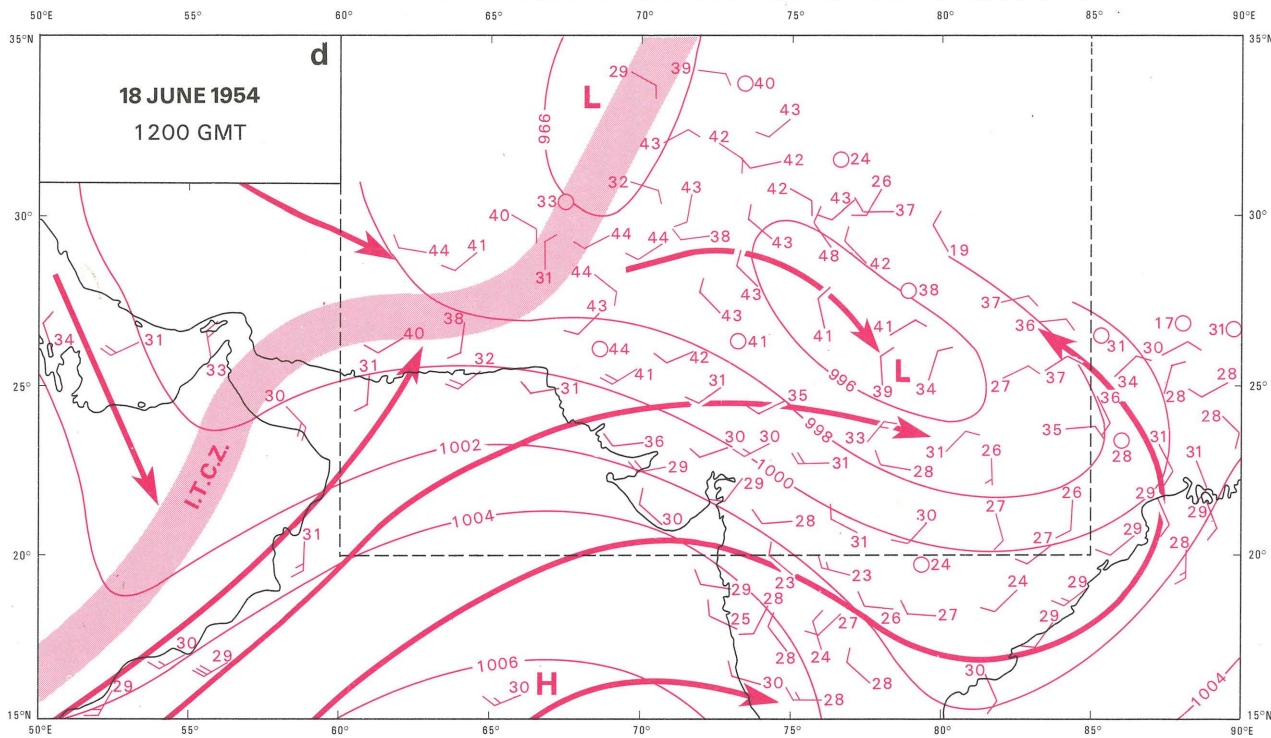
Fig. C6.2 EASTWARD SPREAD ACROSS INDIA,
JUNE AND JULY 1954

C Degree squares with swarms
15-19 June 1954

- Laying swarms
- Other swarms

d Weather map for 18 June 1954 at 1200 GMT

0 400 800Km
SCALE (Approx)
Contour values are shown in metres



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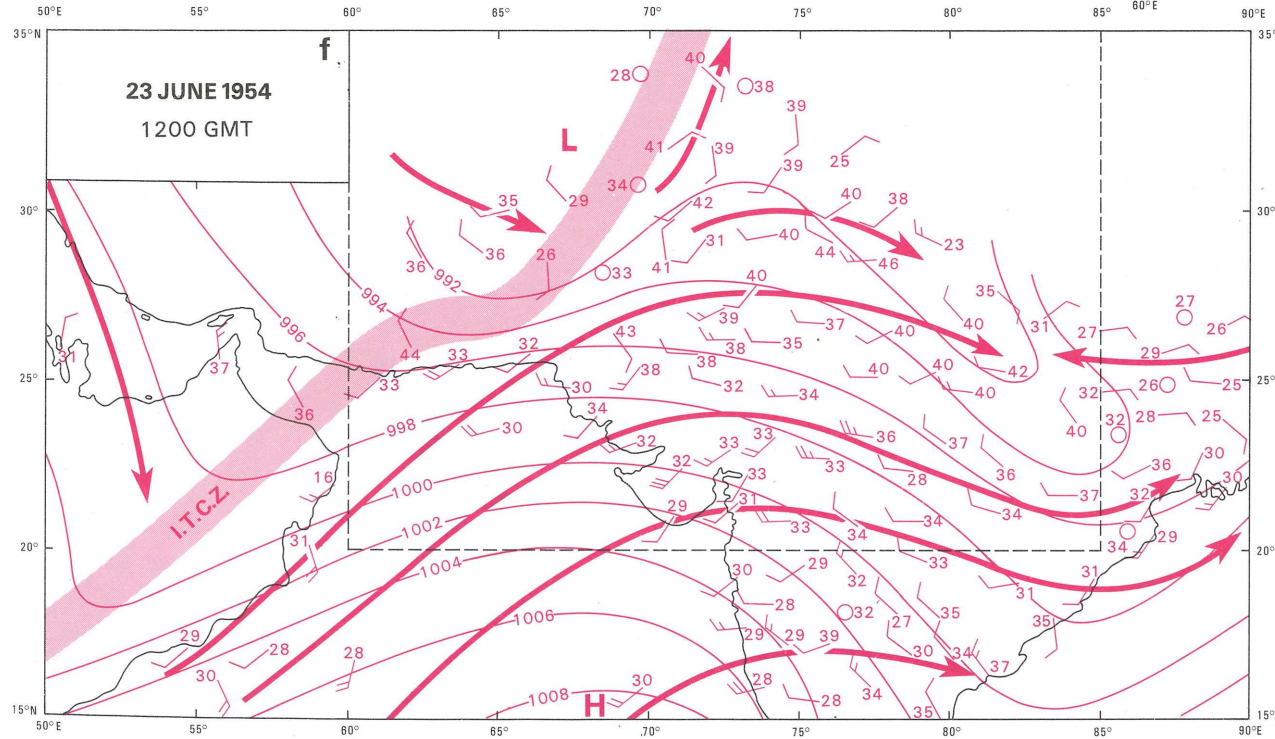
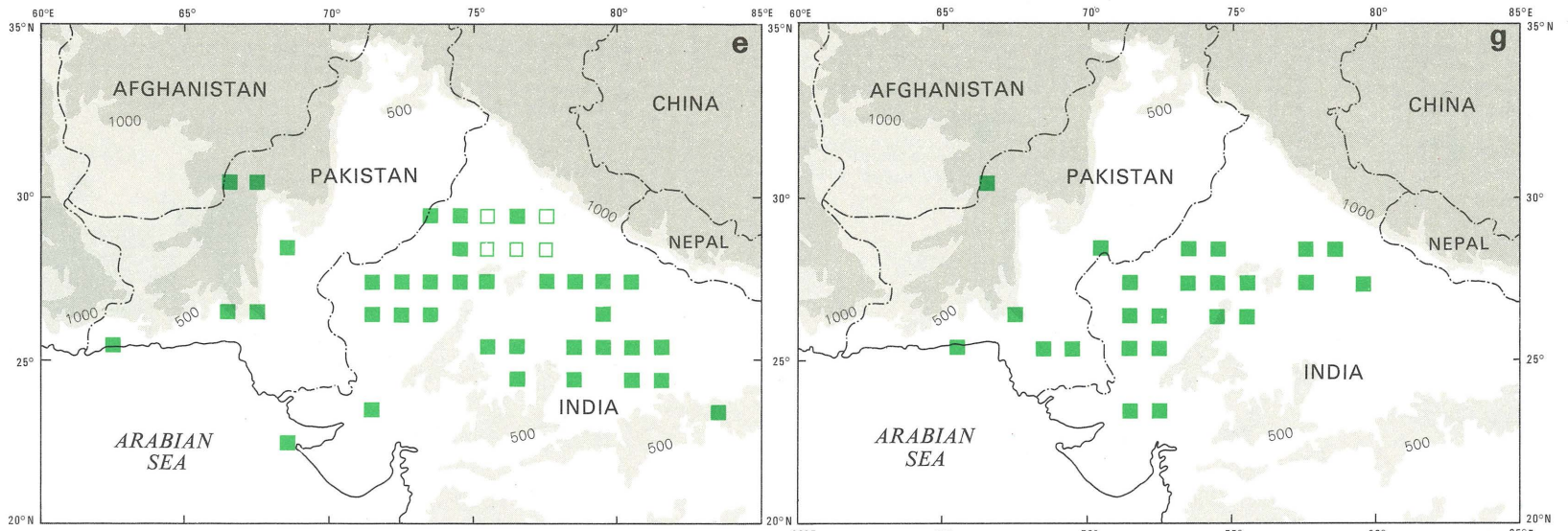


Fig. C6.2 EASTWARD SPREAD ACROSS INDIA, JUNE AND JULY 1954

e Degree squares with swarms
20-26 June 1954

g Degree squares with swarms
27-30 June 1954

□ Laying swarms
■ Other swarms

f Weather map for 23 June 1954 at 1200 GMT

0 400 800 Km
SCALE (Approx)
Contour values are shown in metres

Prepared by Directorate of Overseas Surveys 1979

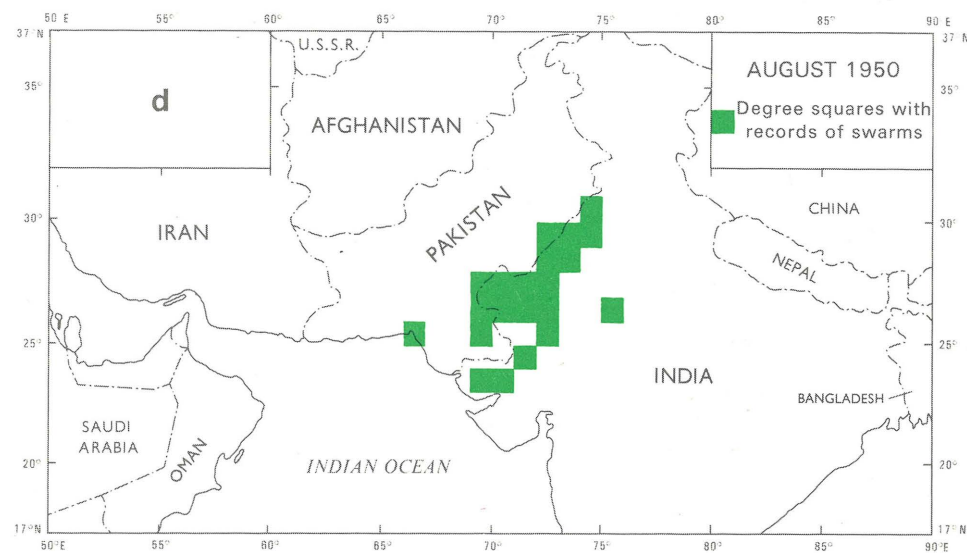
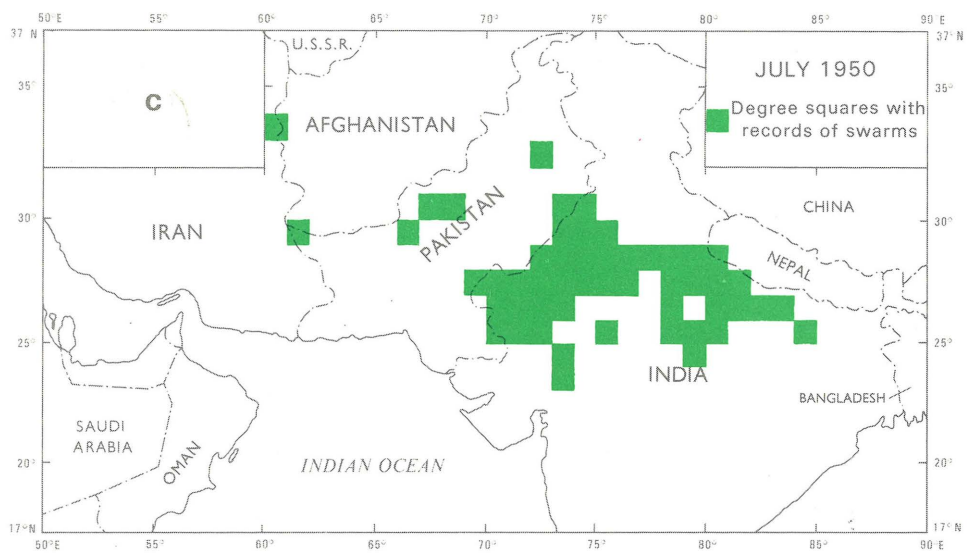
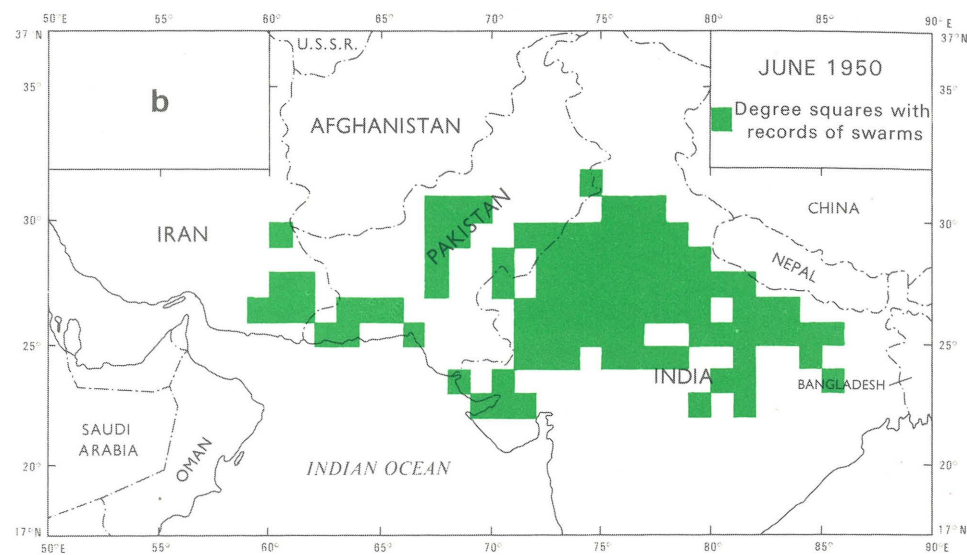
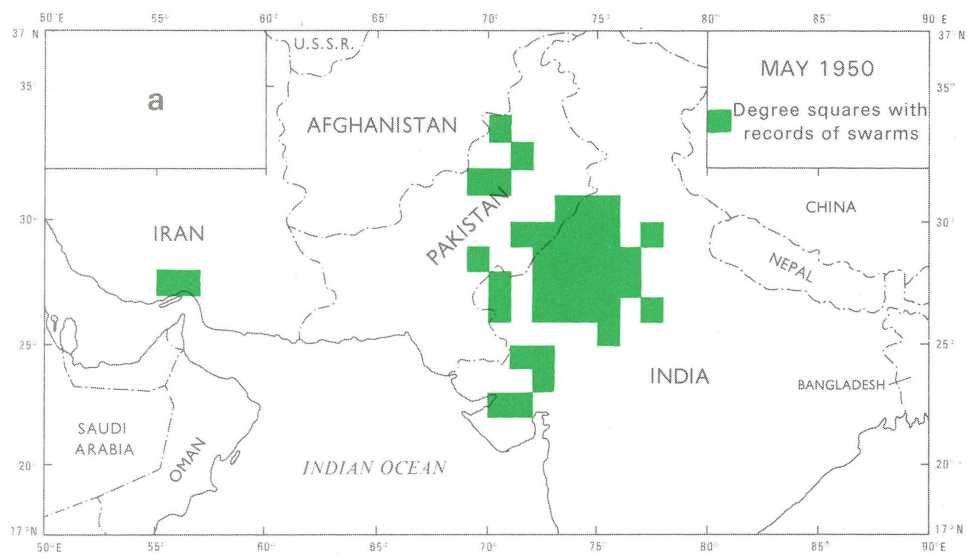


Fig. S7 (see opposite page)

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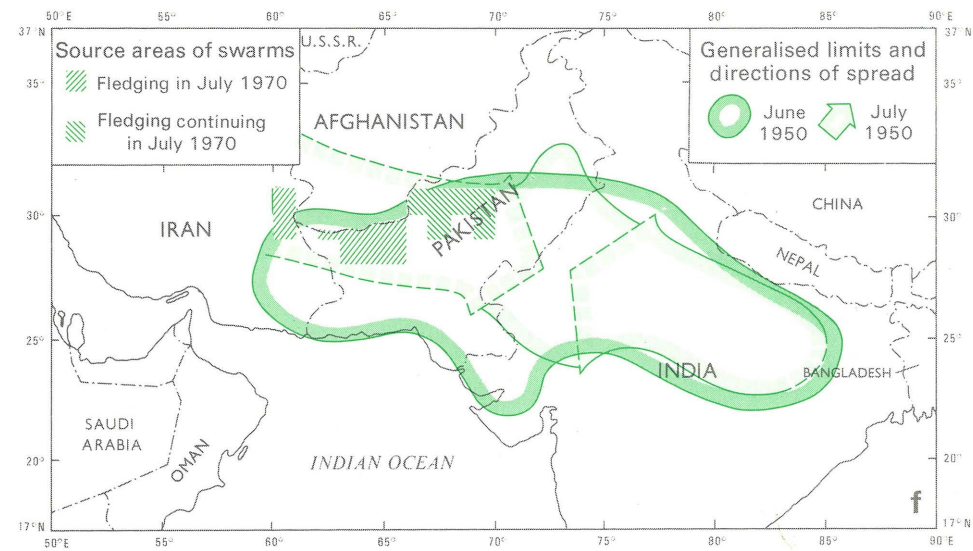
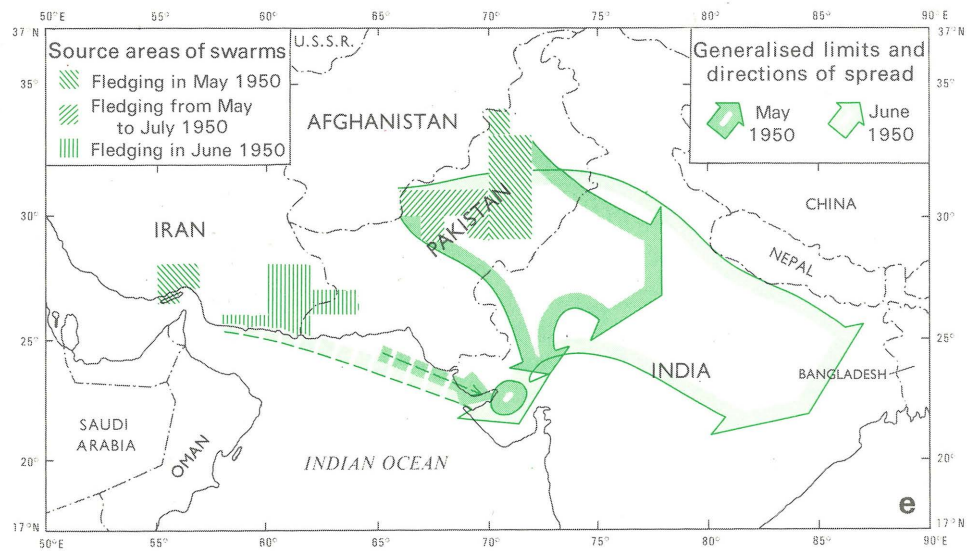


Fig. S7 a-f. 1950 SPRING GENERATION SWARMS IN THE EASTERN REGION

Figs a,b,c, and d show the monthly distribution of swarms by degree squares.
 Arrows on Figs e and f show schematically the spread of swarms (see p 27)

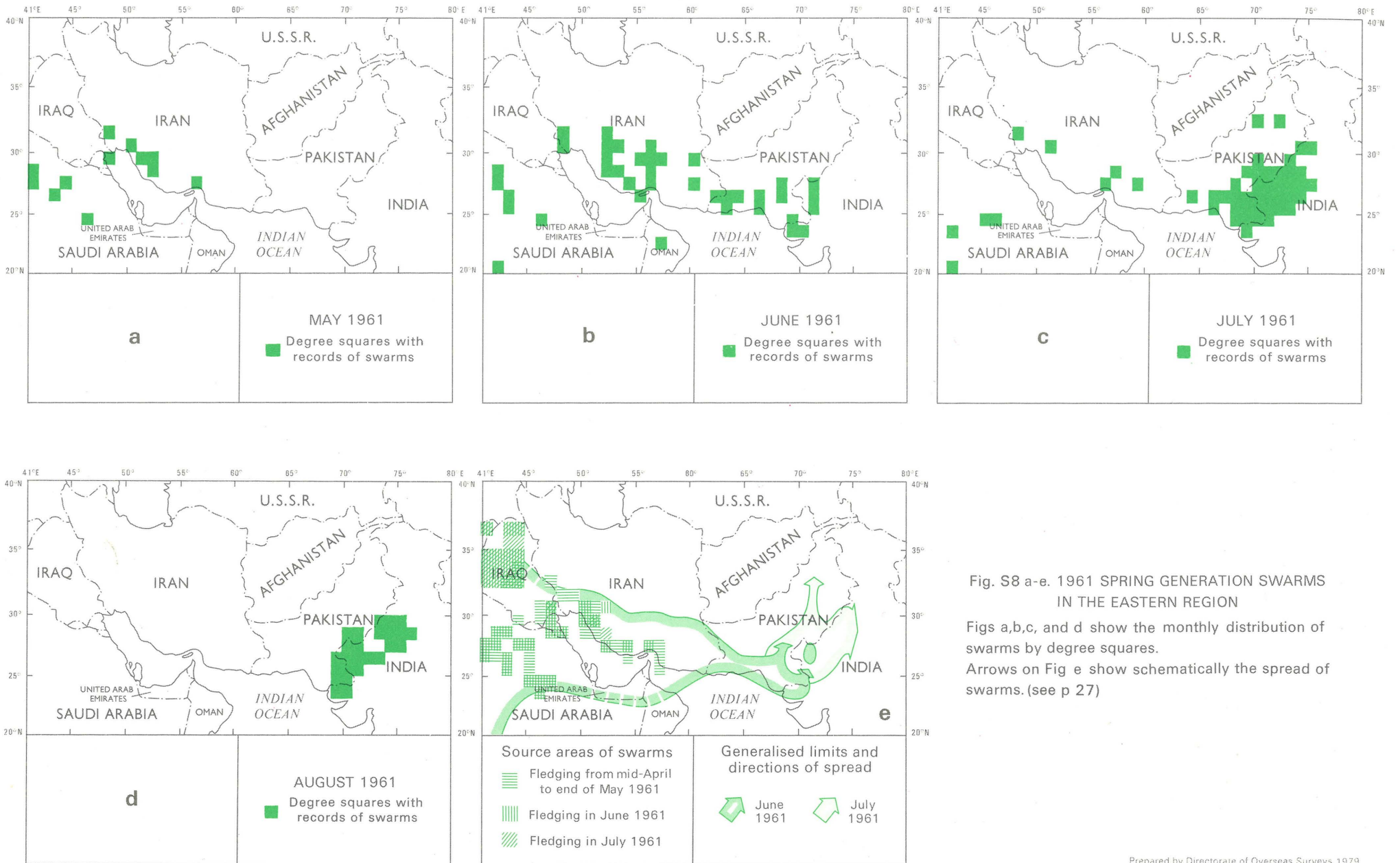


Fig. S8 a-e. 1961 SPRING GENERATION SWARMS IN THE EASTERN REGION
Figs a,b,c, and d show the monthly distribution of swarms by degree squares. Arrows on Fig e show schematically the spread of swarms. (see p 27)

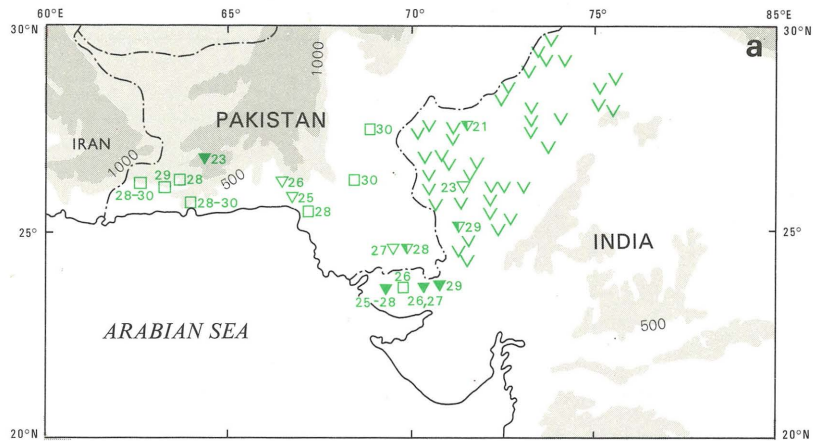
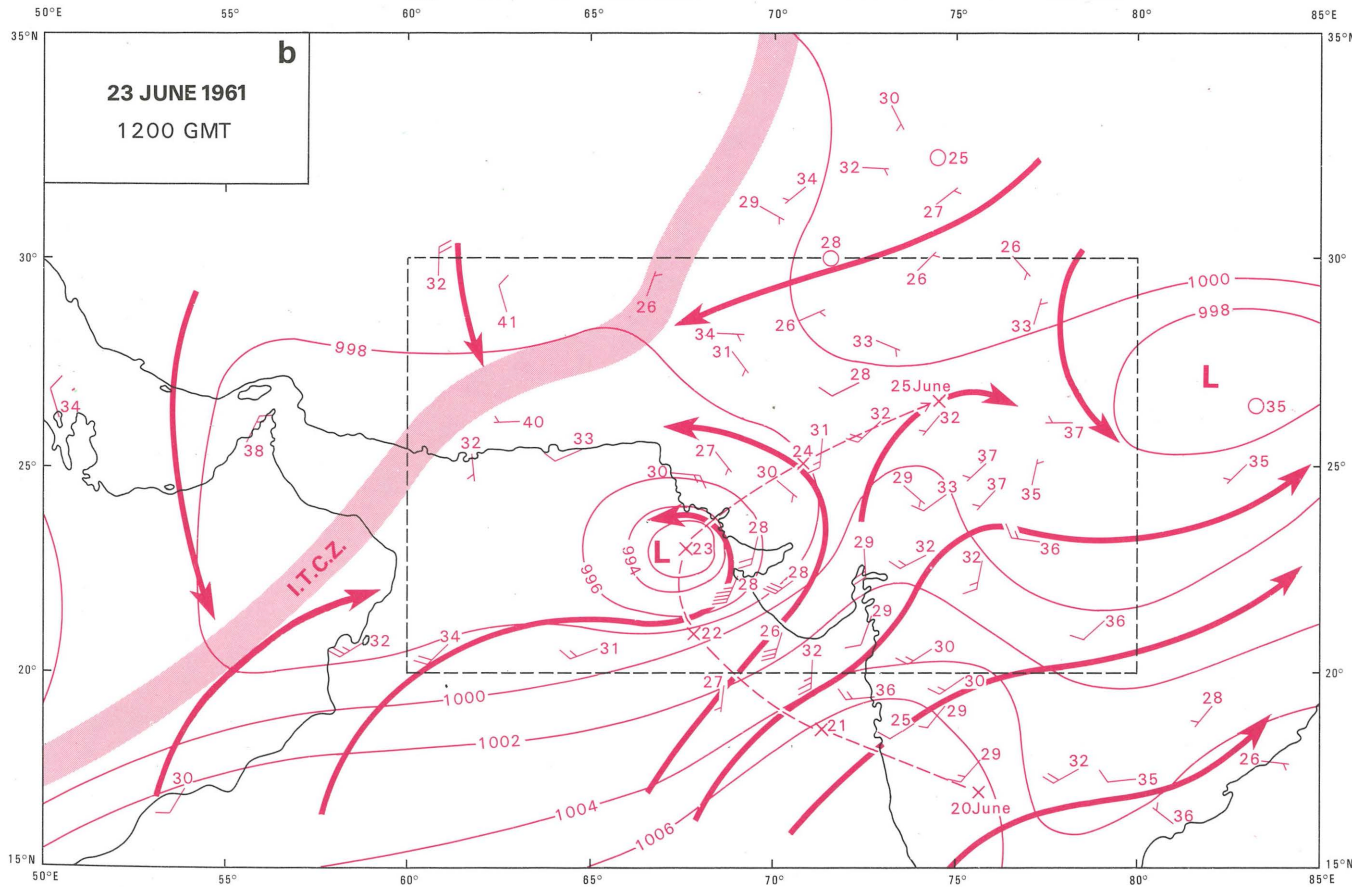


Fig. C8.1 SWARMS IN PAKISTAN AND INDIA, LATE JUNE 1961

a Places and dates with locust reports
21-30 June 1961 (see p 27)

b Weather map for 23 June 1961 at 1200 GMT

0 400 800Km
SCALE (Approx)
Contour values are shown in metres



Prepared by Directorate of Overseas Surveys 1979

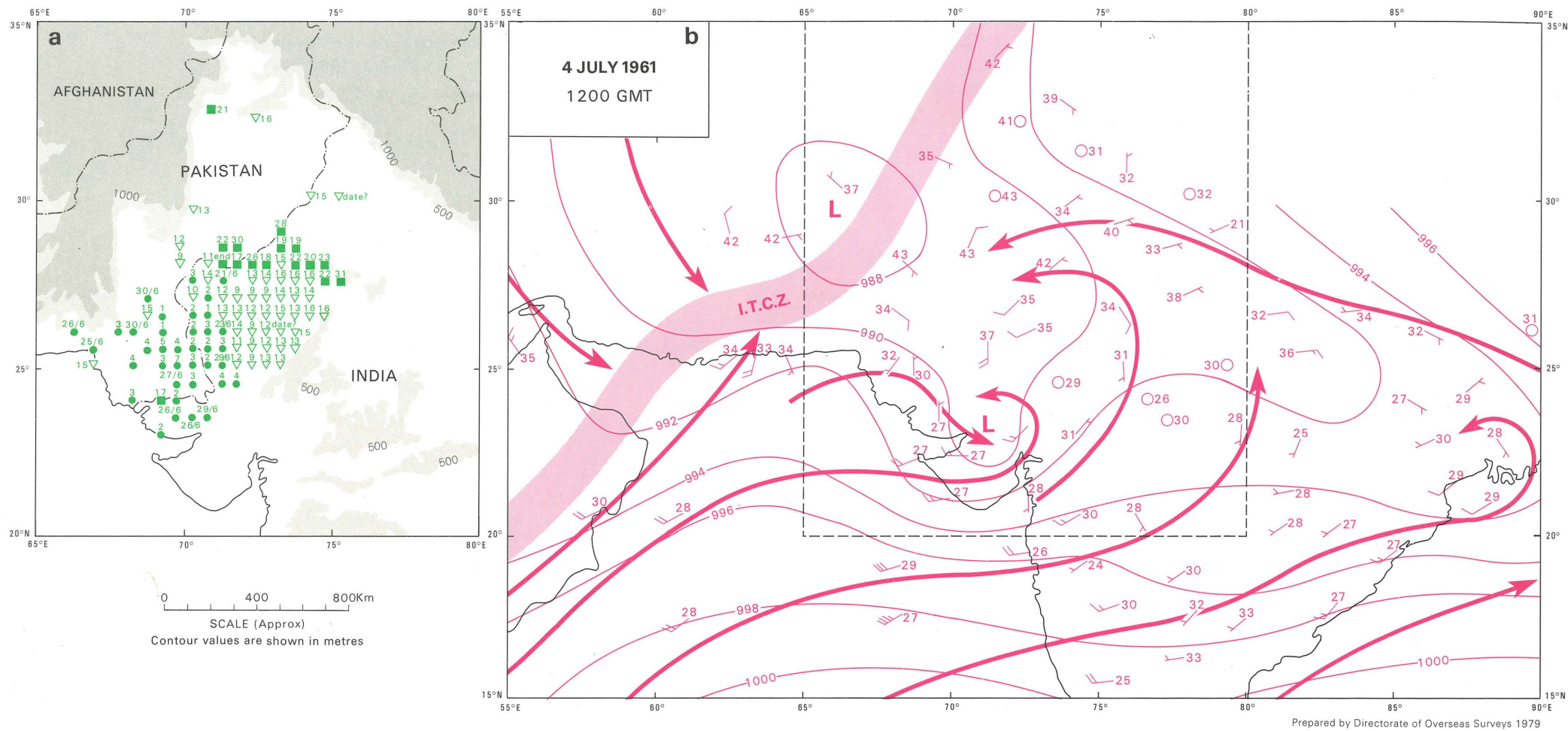


Fig. C8.2 SWARMS IN PAKISTAN AND INDIA, LATE JUNE AND JULY 1961

a Dates of first appearances in each quarter of a degree square

● 21 June – 7 July 1961

▽ 8–16 July 1961

■ 17–31 July 1961

b Weather map for 4 July 1961 at 1200 GMT

c Weather map for 14 July 1961 at 1200 GMT

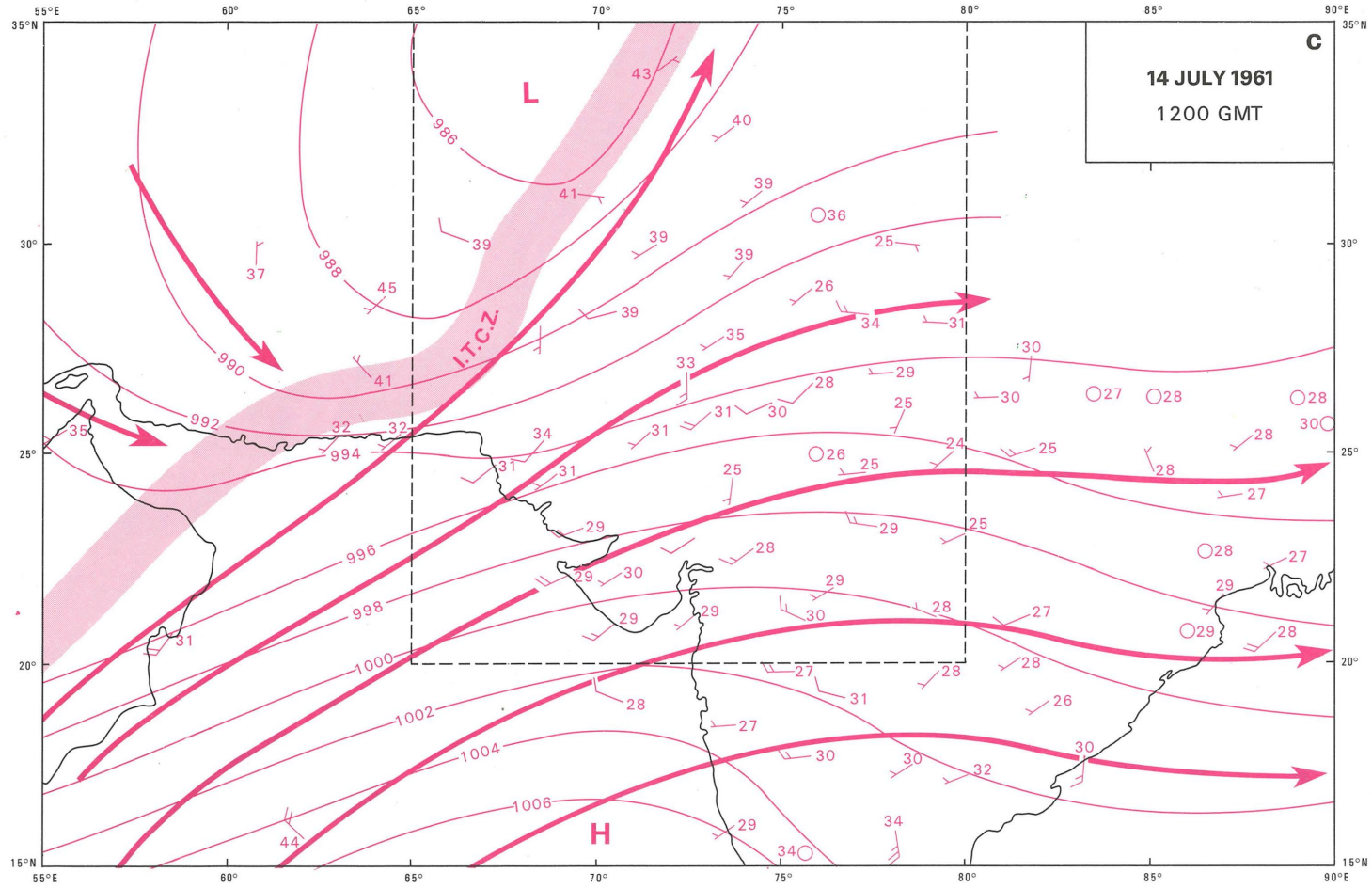


Fig. C8.2 (see opposite page)

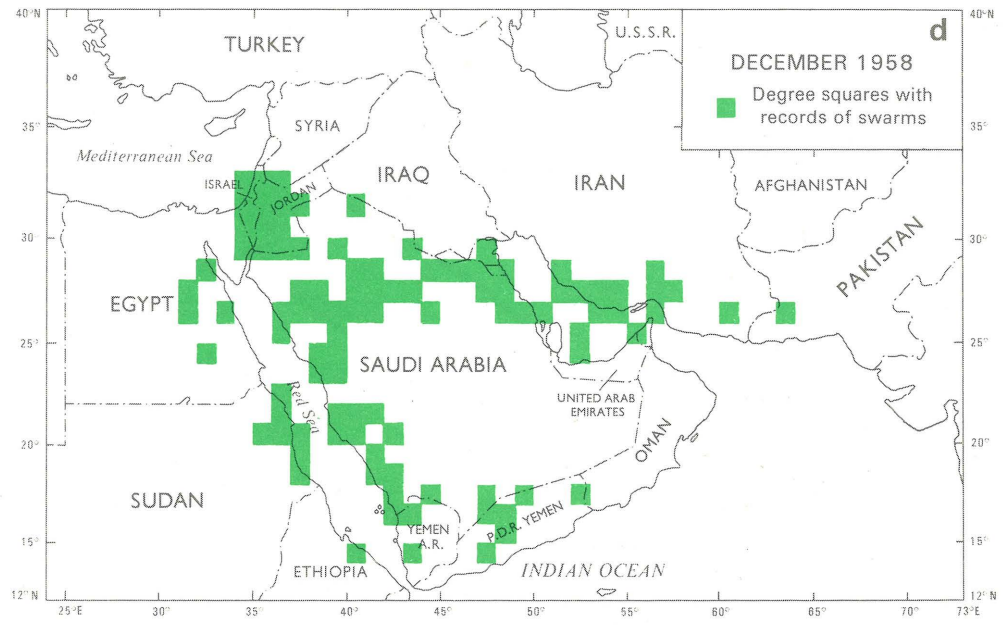
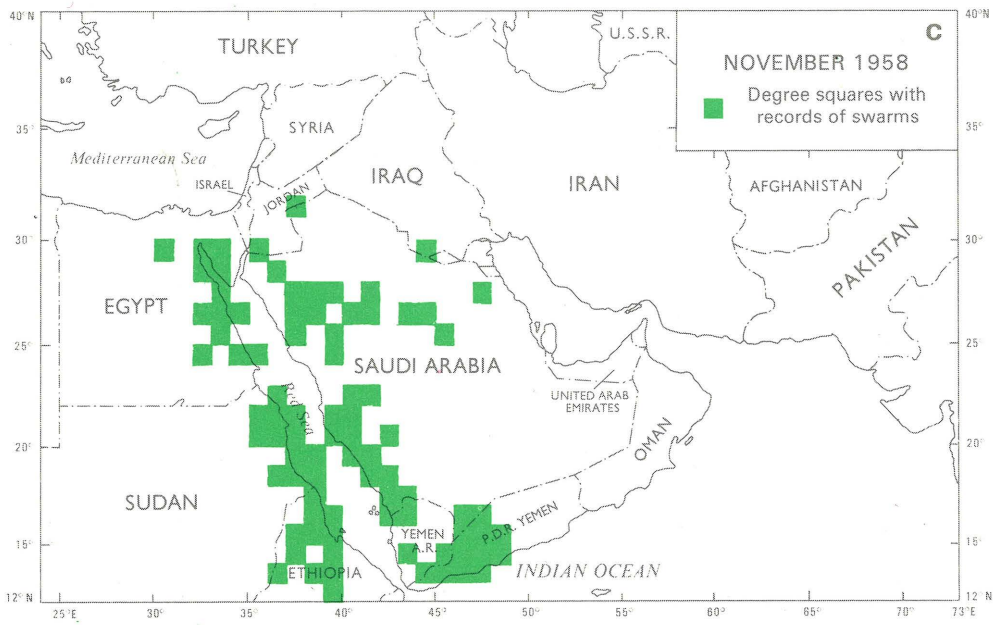
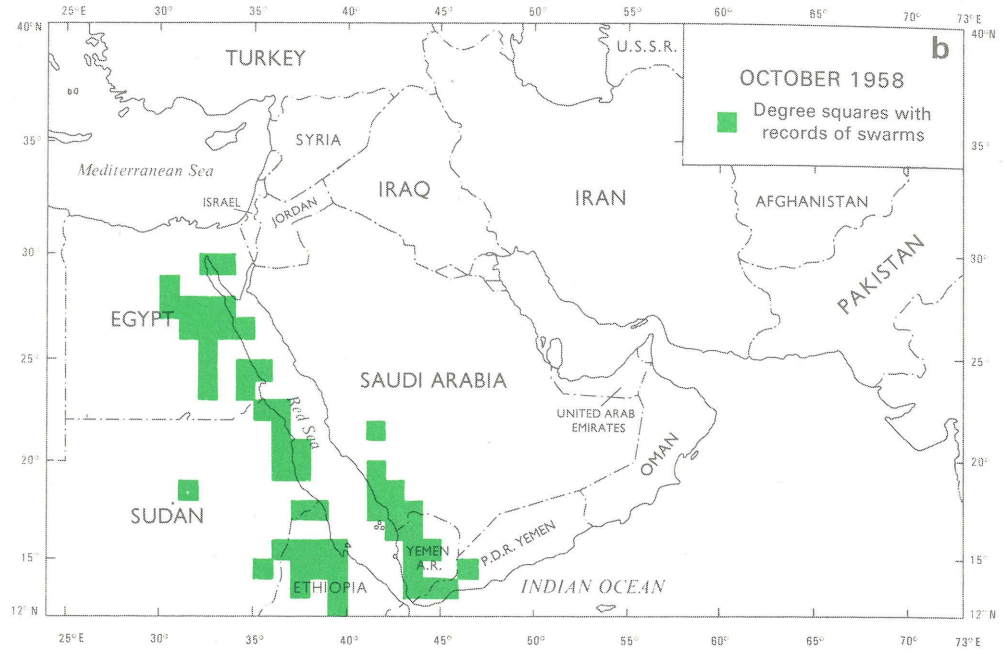
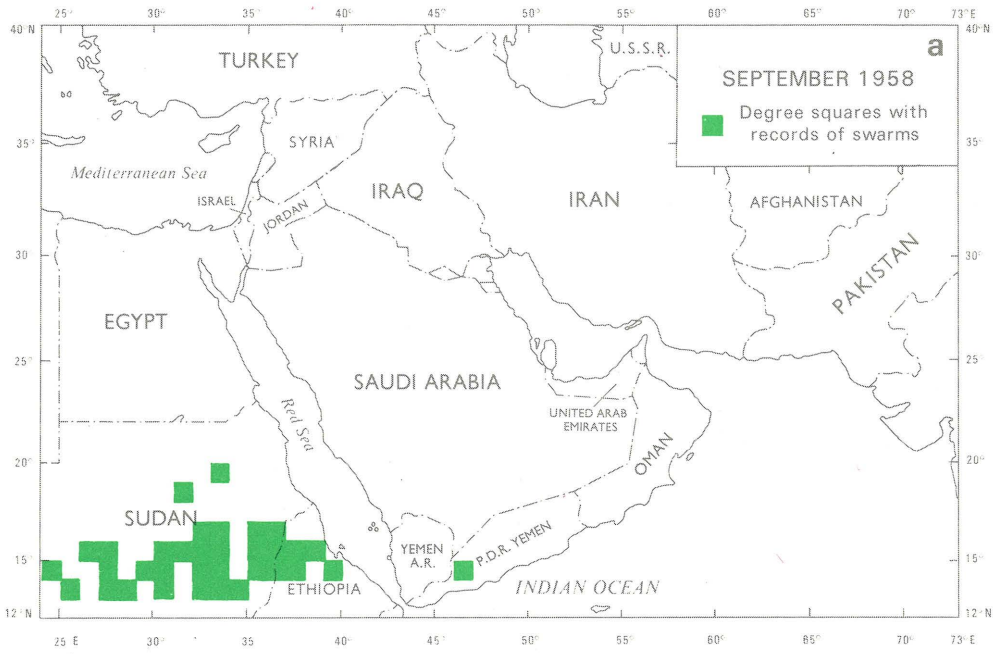


Fig. S9 (see opposite page)

Prepared by Directorate of Overseas Surveys 1979

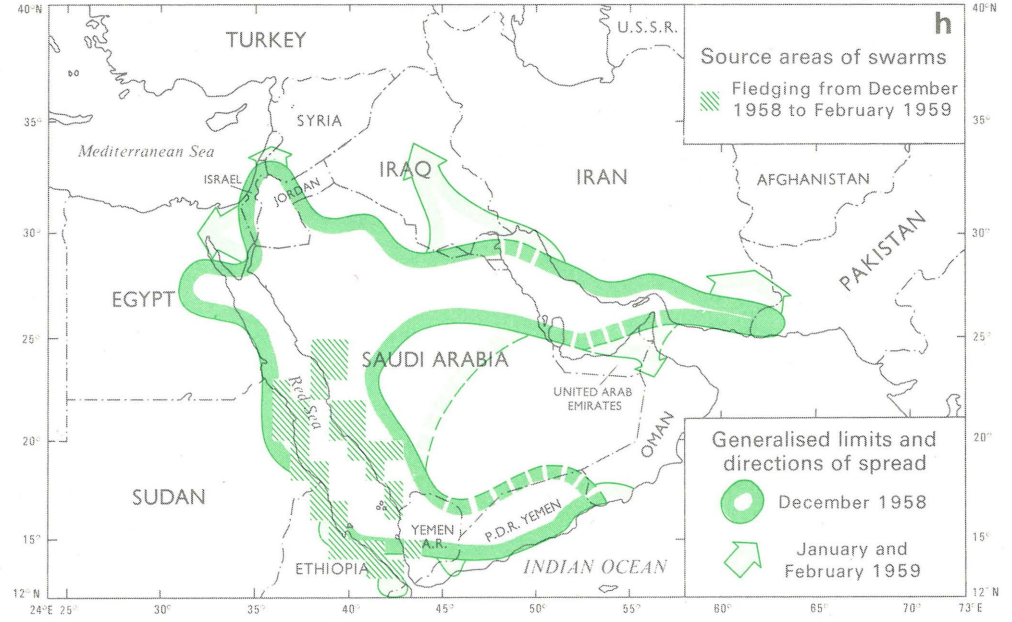
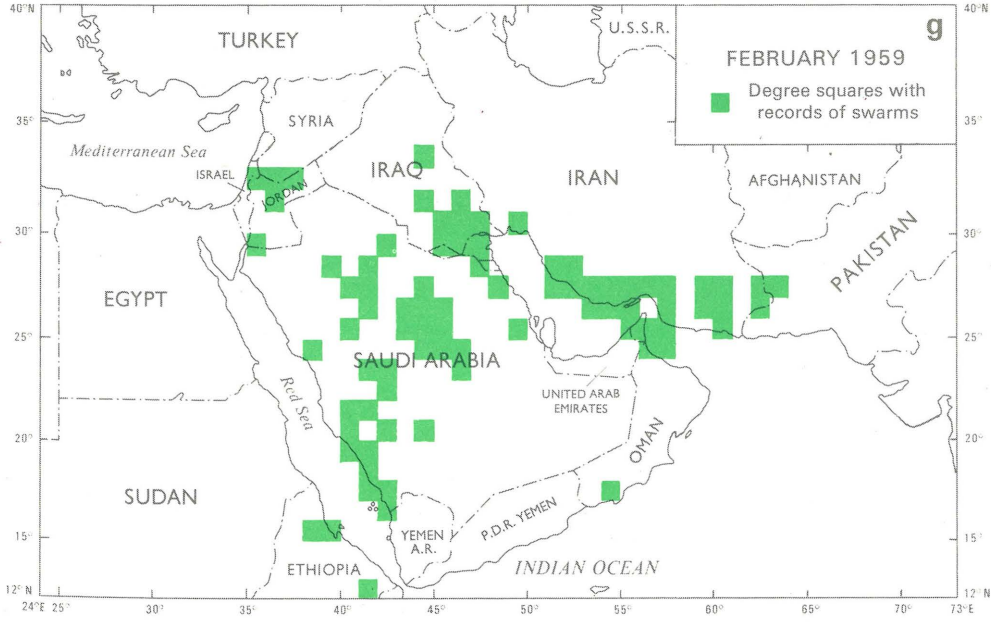
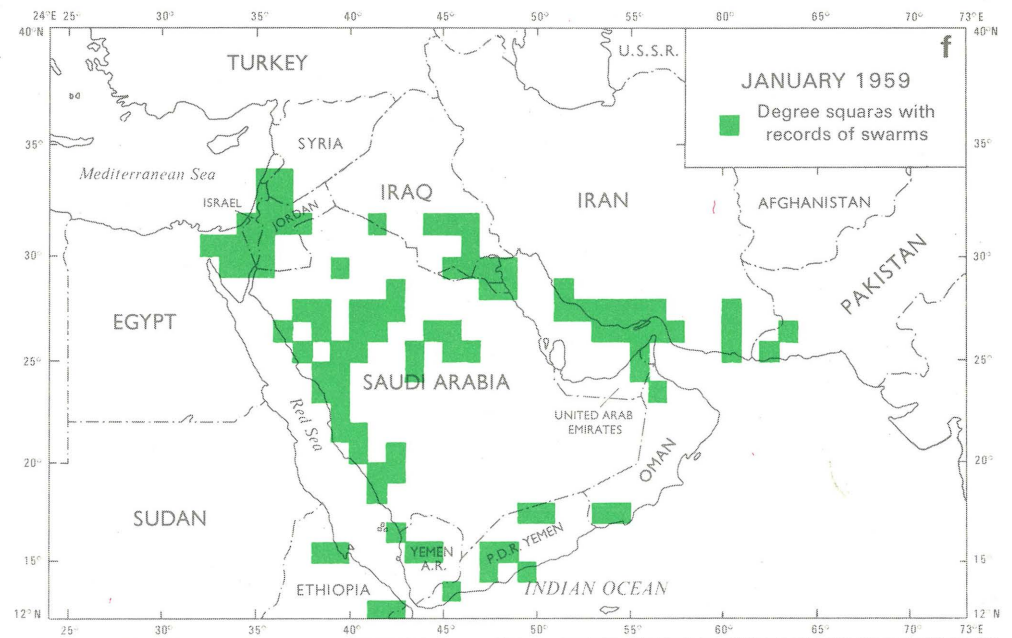
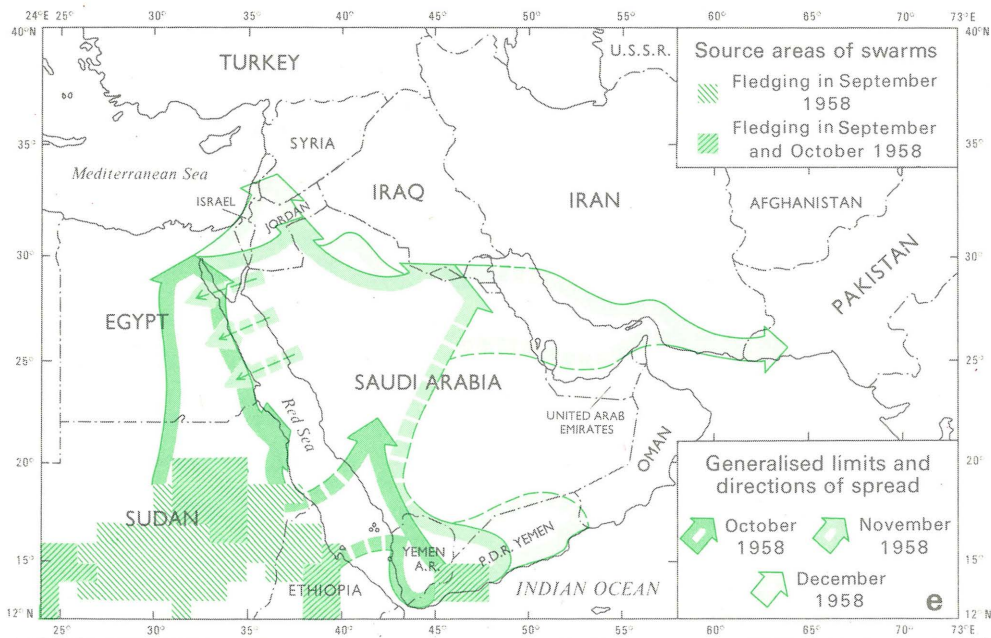


Fig. S9 a-n 1958 SUMMER GENERATION AND 1958-59 WINTER-SPRING GENERATION SWARMS IN THE NORTH CENTRAL AND EASTERN REGIONS
 Figs a,b,c,d,f,g,i,k,l and m show the monthly distribution of swarms by degree squares. Arrows on Figs e,h,j and n show schematically the spread of swarms.(see p 27)

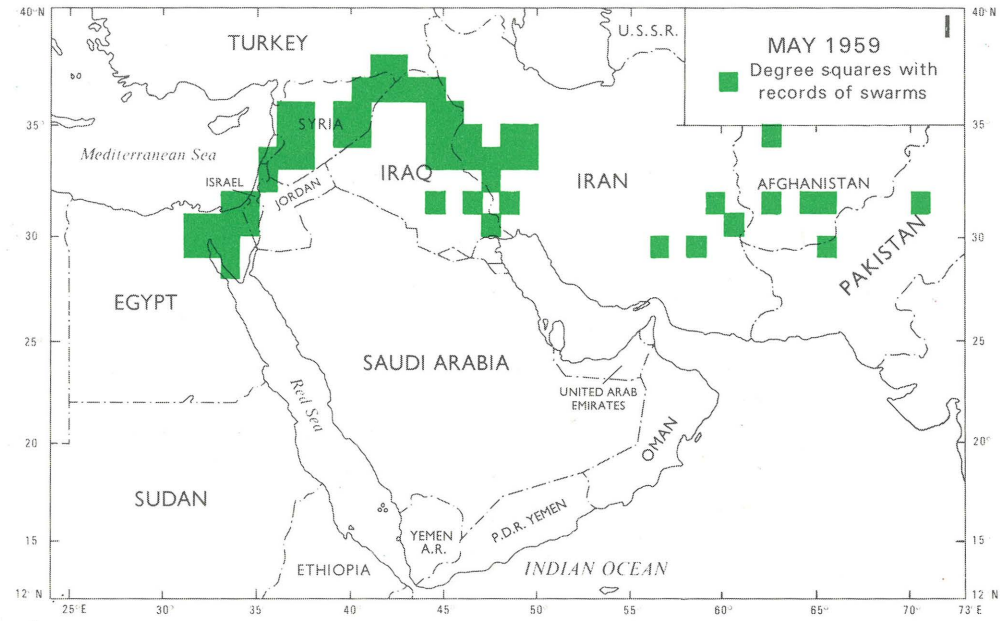
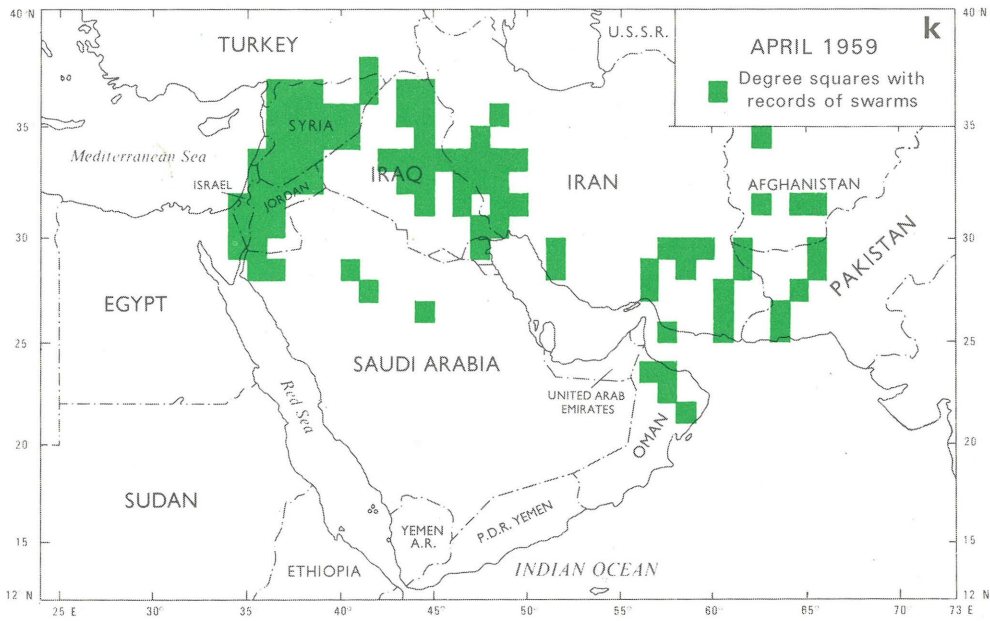
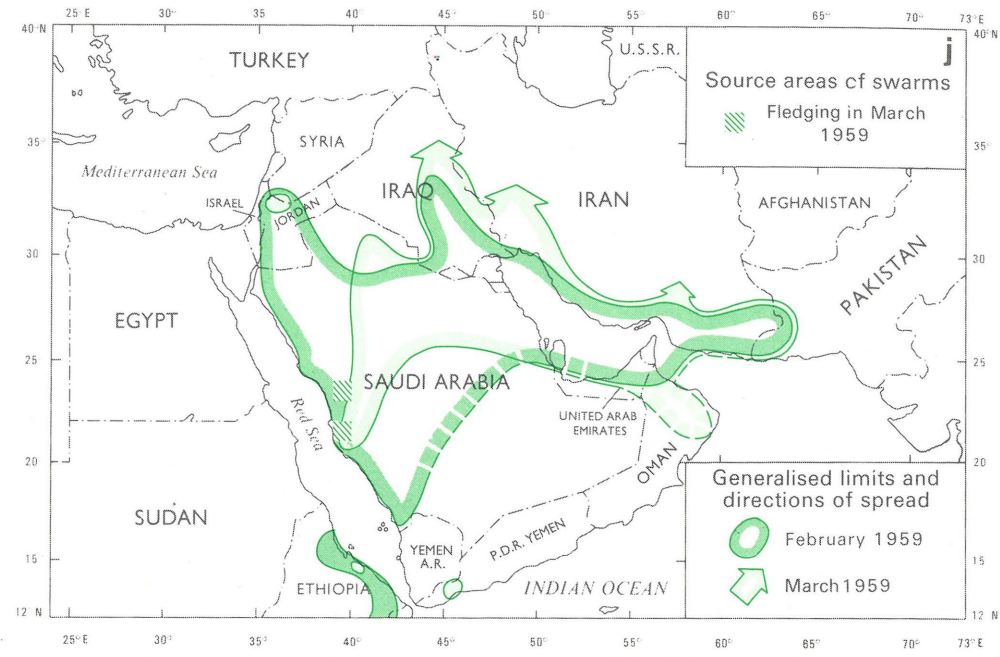
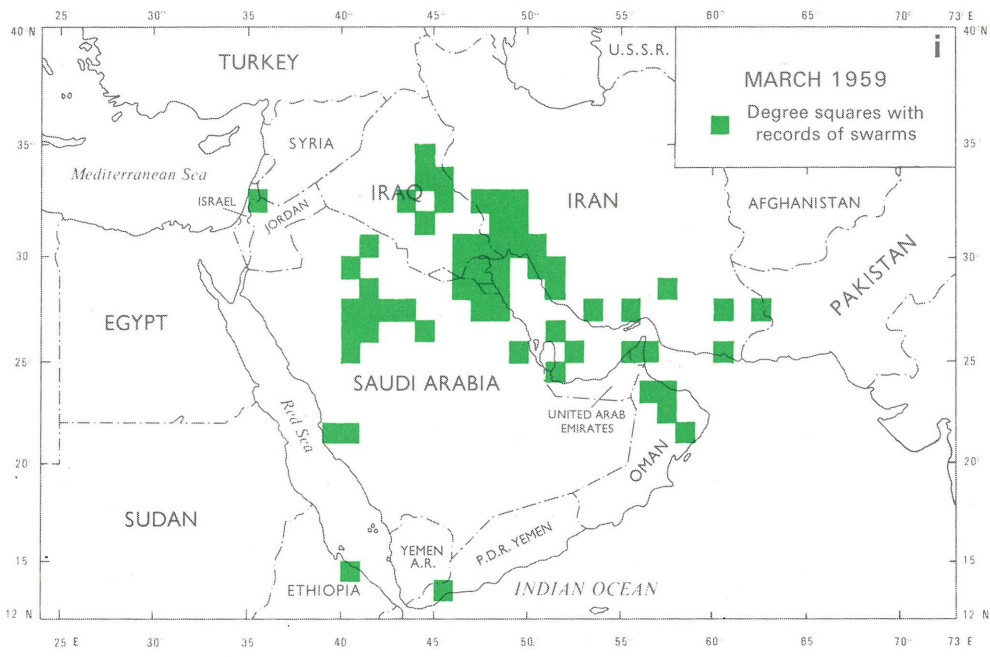


Fig. S9 (see opposite page)

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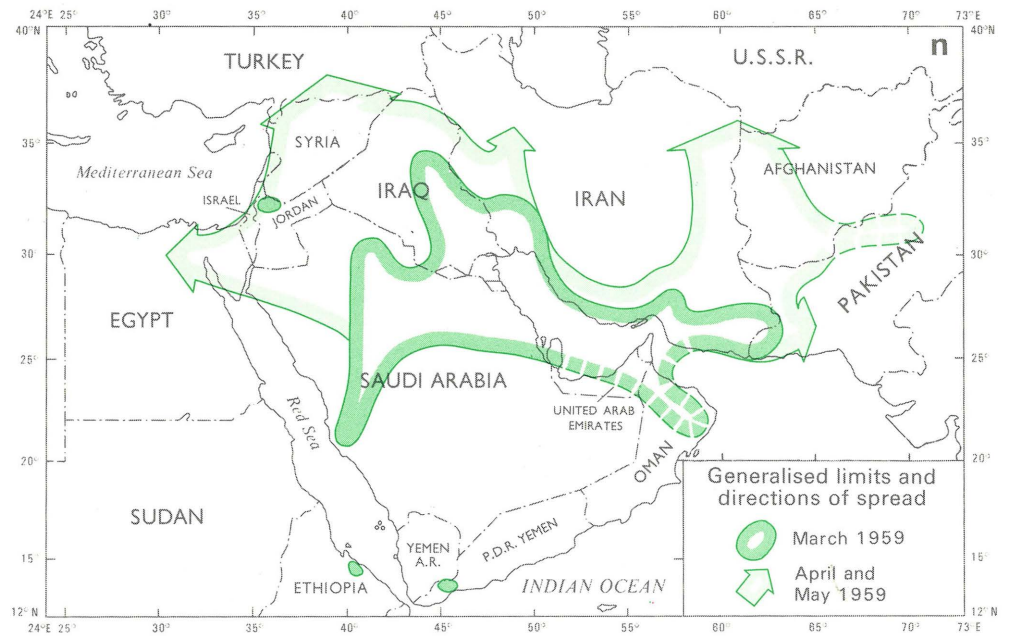
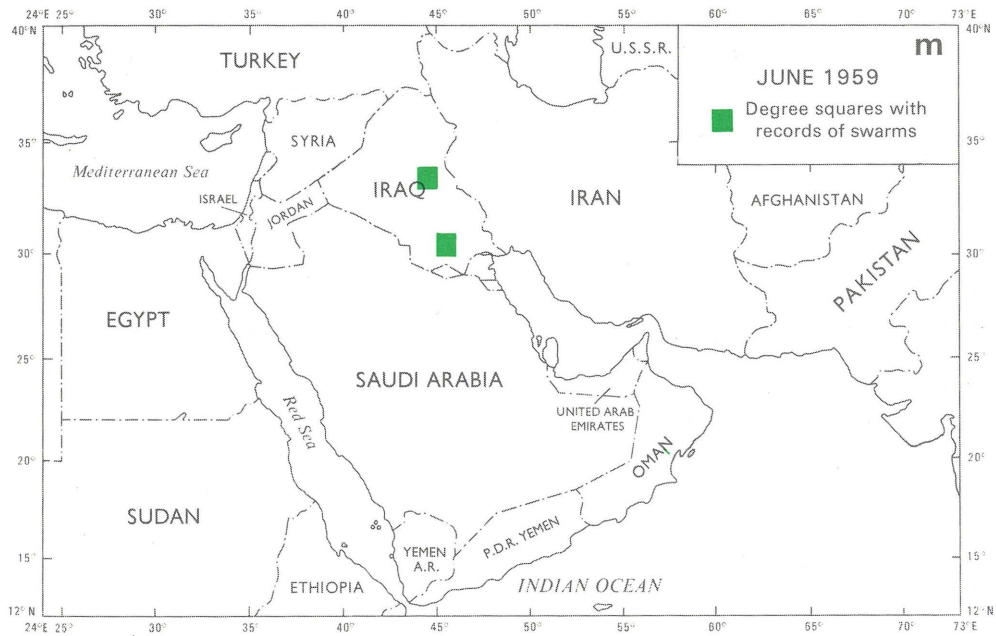


Fig. S9 a-n 1958 SUMMER GENERATION AND 1958-59 WINTER-SPRING GENERATION SWARMS IN THE NORTH CENTRAL AND EASTERN REGIONS

Figs a,b,c,d,f,g,i,k,l and m show the monthly distribution of swarms by degree squares.

Arrows on Figs e,h,j and n show schematically the spread of swarms (see p 27)

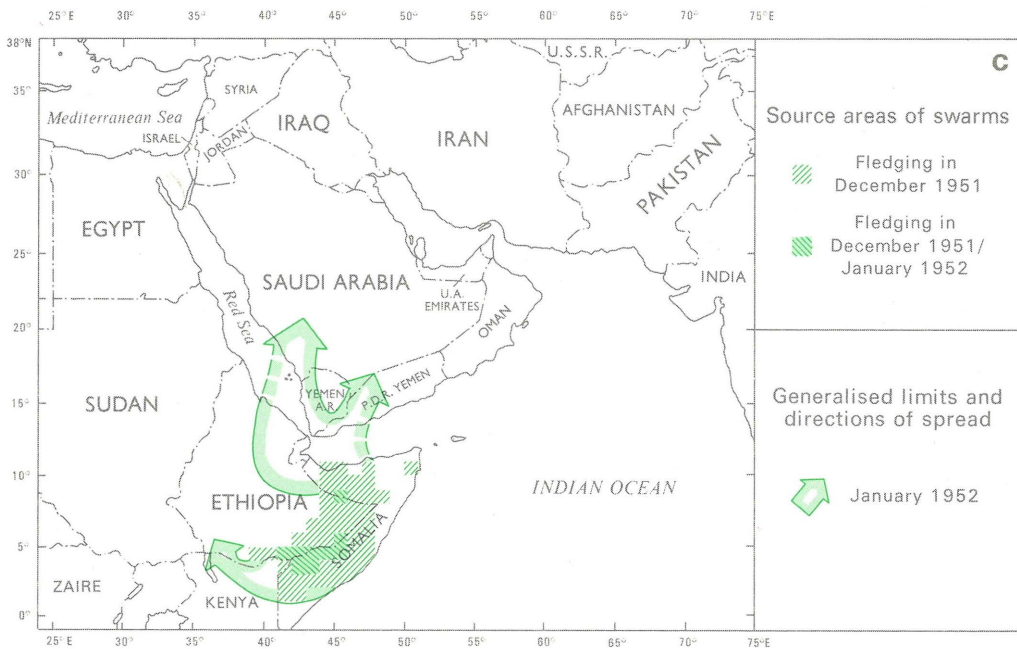
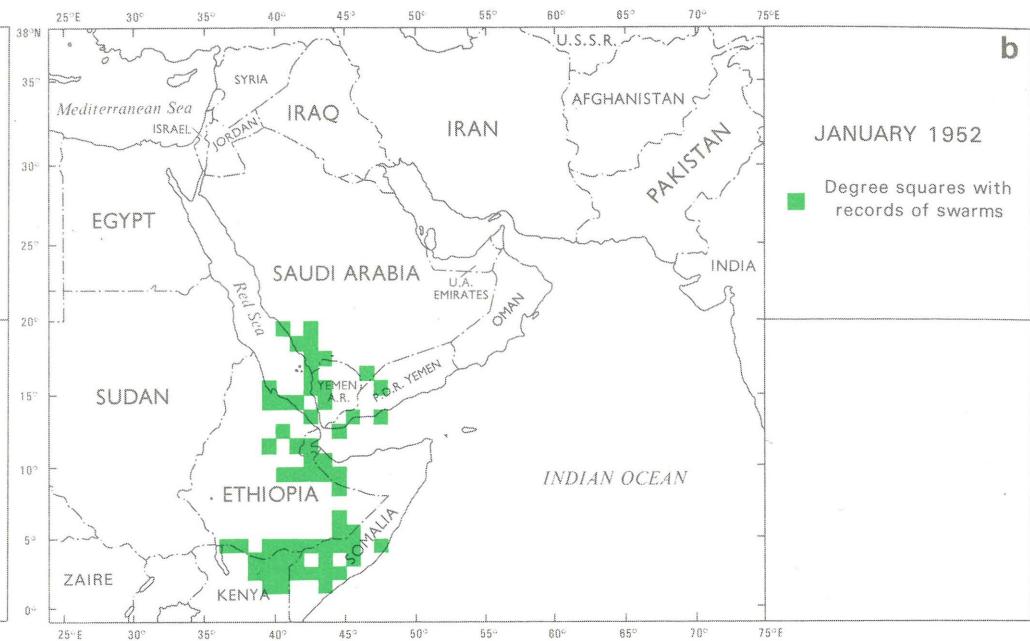
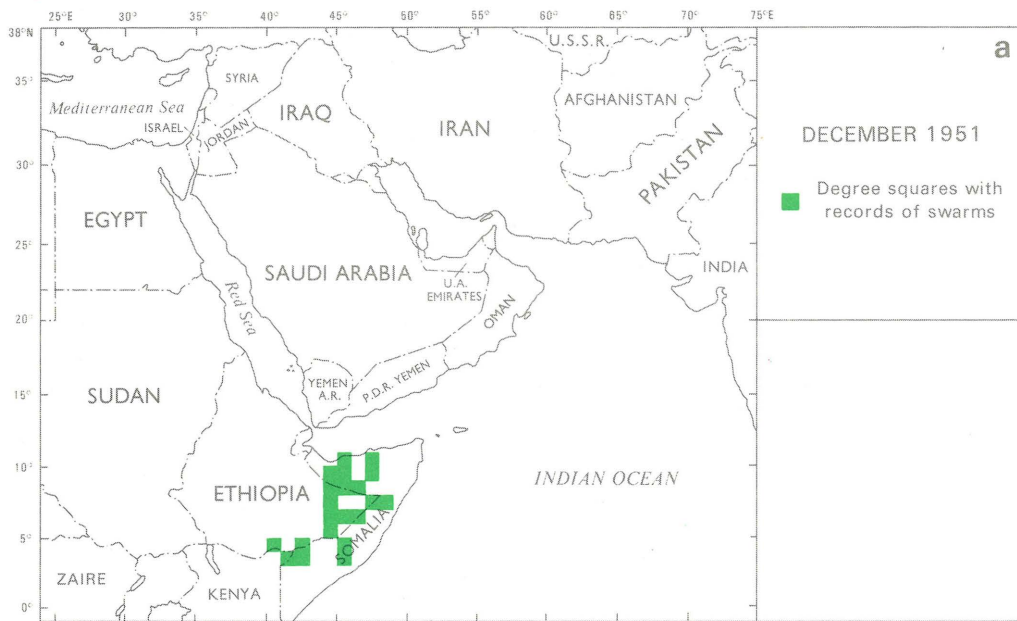


Fig. S10 a-k. 1951- 52 SHORT RAINS GENERATION IN THE NORTH CENTRAL, EASTERN AND SOUTH CENTRAL REGIONS.

Figs a,b,d,f,h,i and j show the monthly distribution of swarms by degree squares. Arrows on Figs c,e,g and k show schematically the spread of swarms.(see p 27)

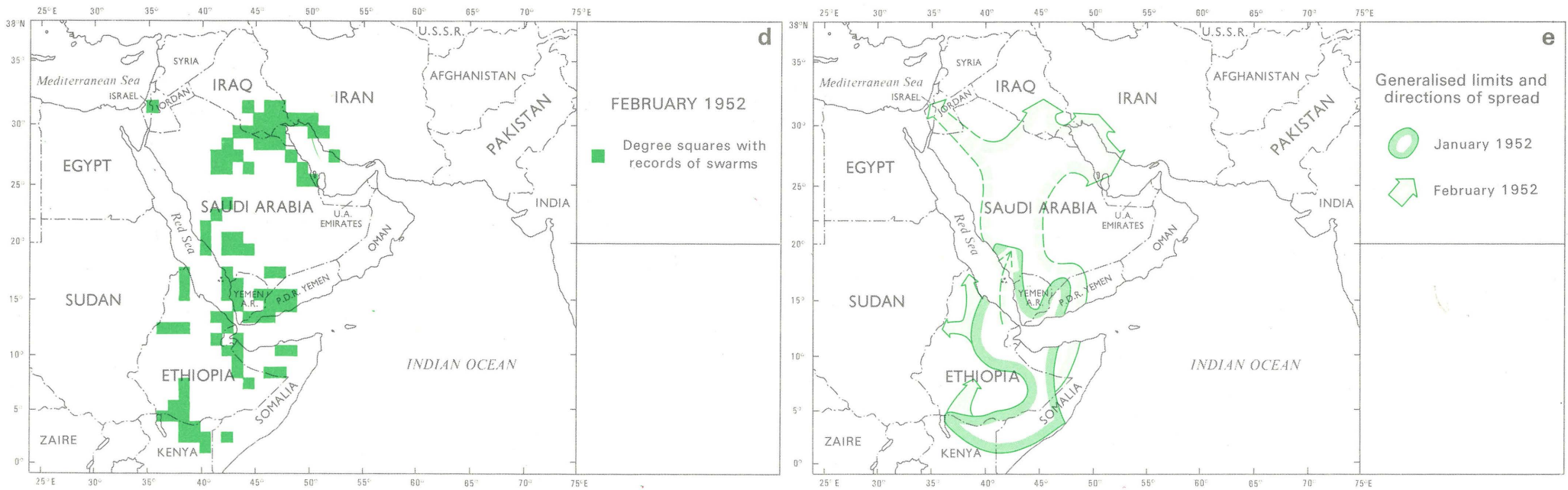


Fig. S10 (see opposite page)

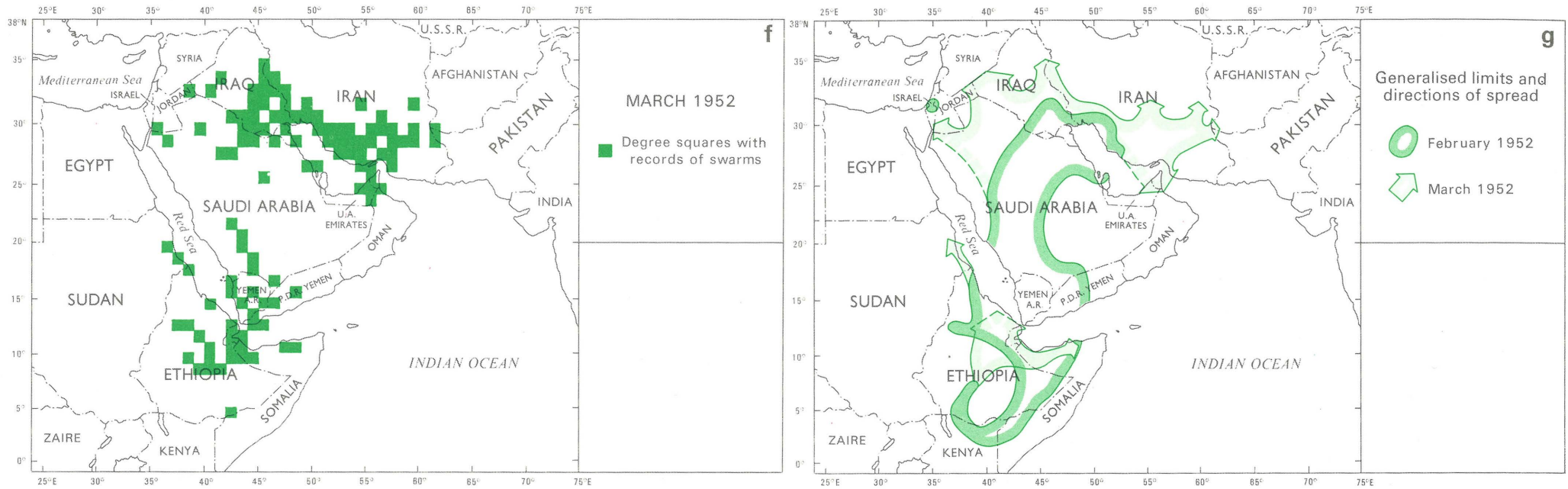
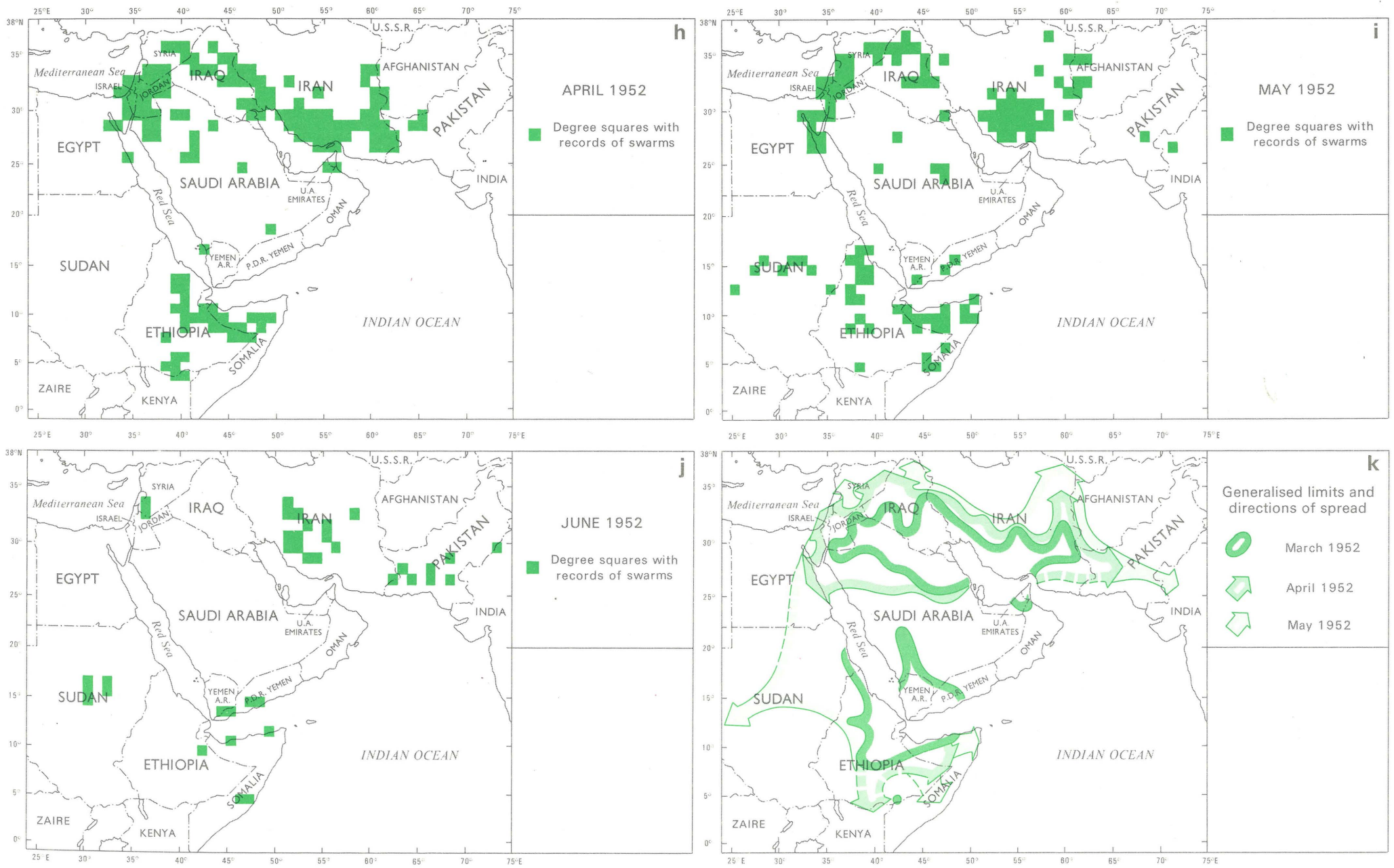


Fig. S10 a-k. 1951-52 SHORT RAINS GENERATION IN THE NORTH CENTRAL, EASTERN AND SOUTH CENTRAL REGIONS

Figs a,b,d,f,h,i and j show the monthly distribution of swarms by degree squares. Arrows on Figs c,e,g and k show schematically the spread of swarms (see p 27)



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Fig. S10 (see opposite page)

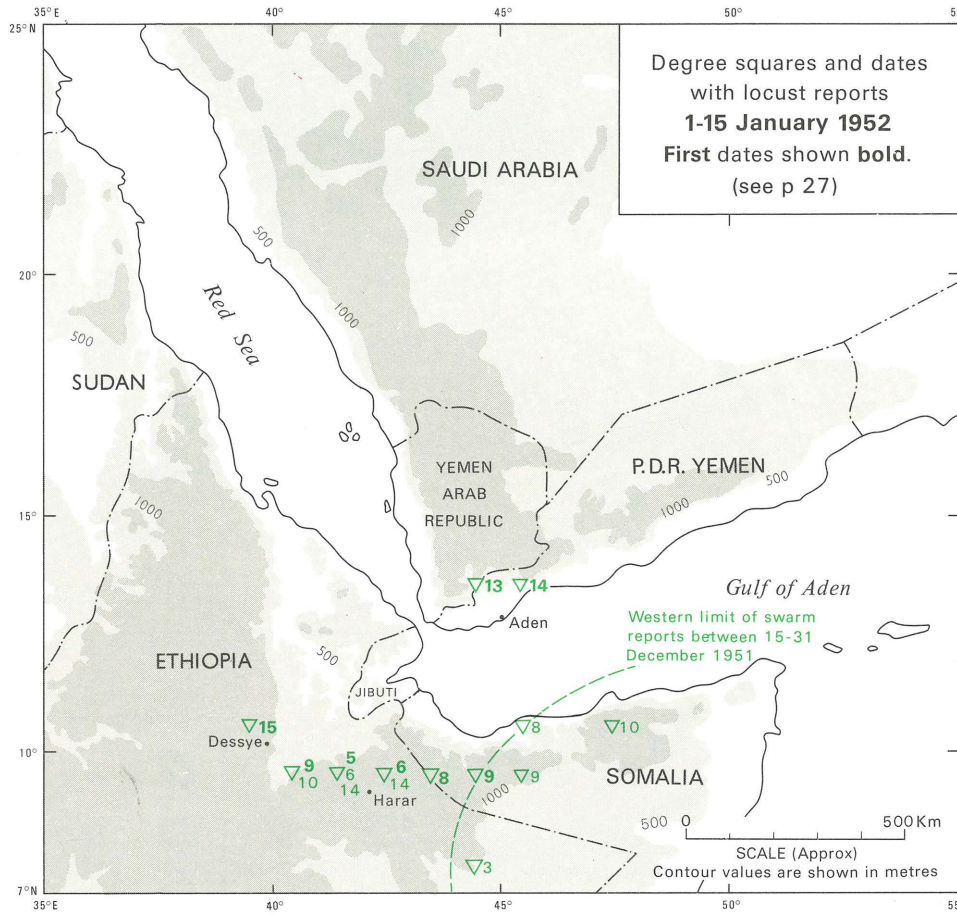


Fig. C10.1 NORTHWESTWARD SPREAD OF SHORT RAINS GENERATION SWARMS, EARLY JANUARY 1952

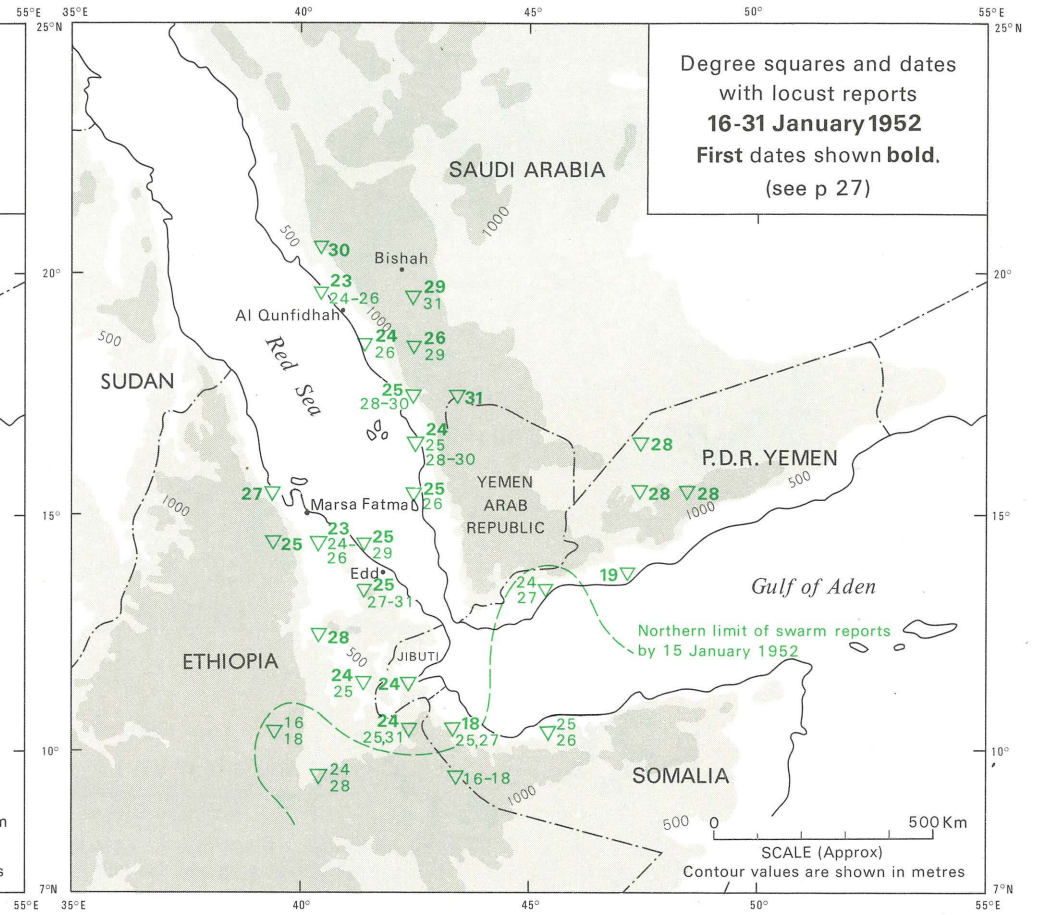


Fig. C10.2 NORTHWARD CROSSING OF THE SOUTHERN RED SEA, LATE JANUARY 1952

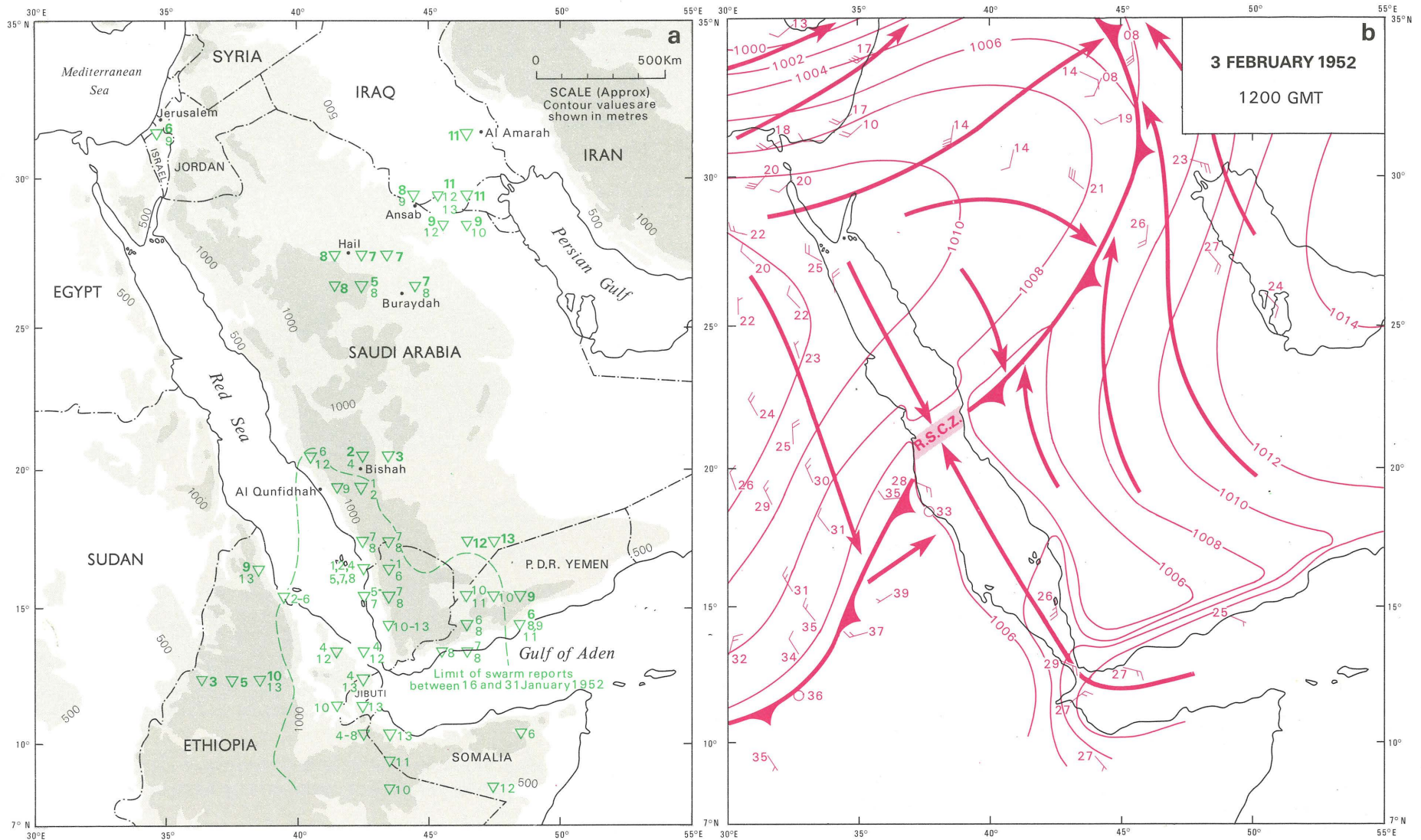


Fig. C10.3 NORTHWARD SPREAD ACROSS ARABIA, EARLY FEBRUARY 1952

- a** Degree squares and dates with locust reports
1-13 February 1952
First dates shown **bold** (see p 27)
- b** Weather map for 3 February 1952 at 1200 GMT
- c** Weather map for 6 February 1952 at 1200 GMT
- d** Weather map for 9 February 1952 at 1200 GMT

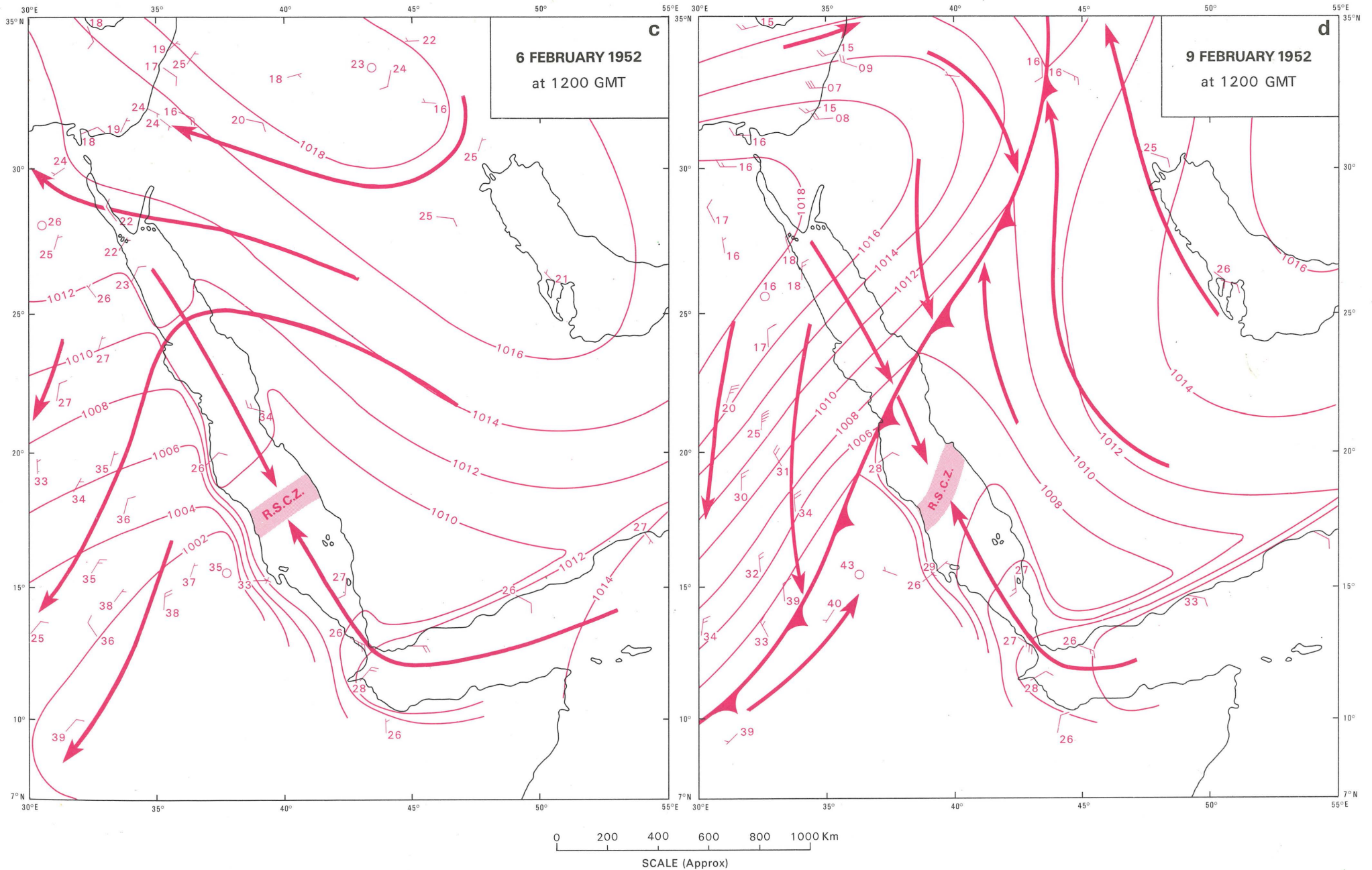


Fig. C10.3 (see opposite page)

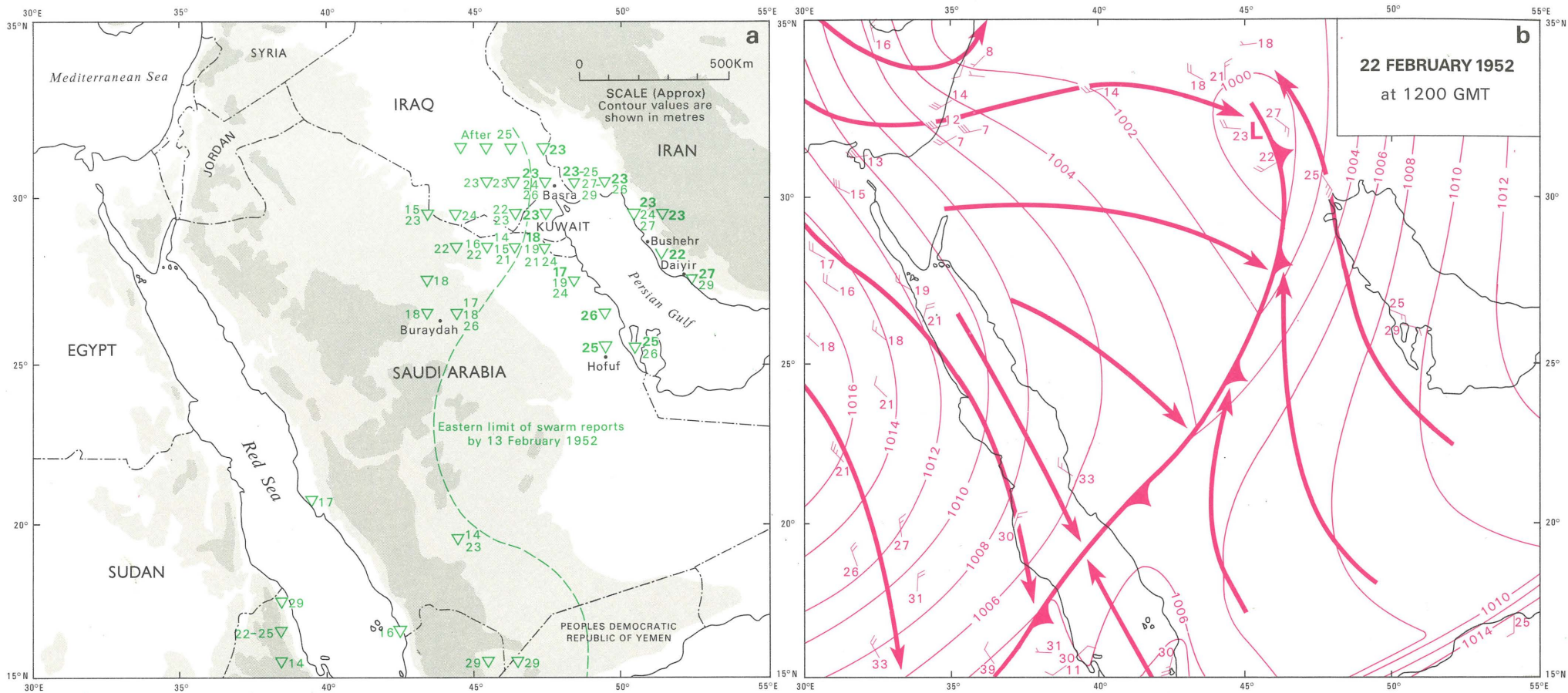


Fig. C10.4 SPREAD TO KUWAIT, IRAQ AND IRAN, LATE FEBRUARY 1952

a Degree squares and dates with locust reports

14-29 February 1952

First dates shown bold (see p 27)

b Weather map for 22 February 1952 at 1200 GMT

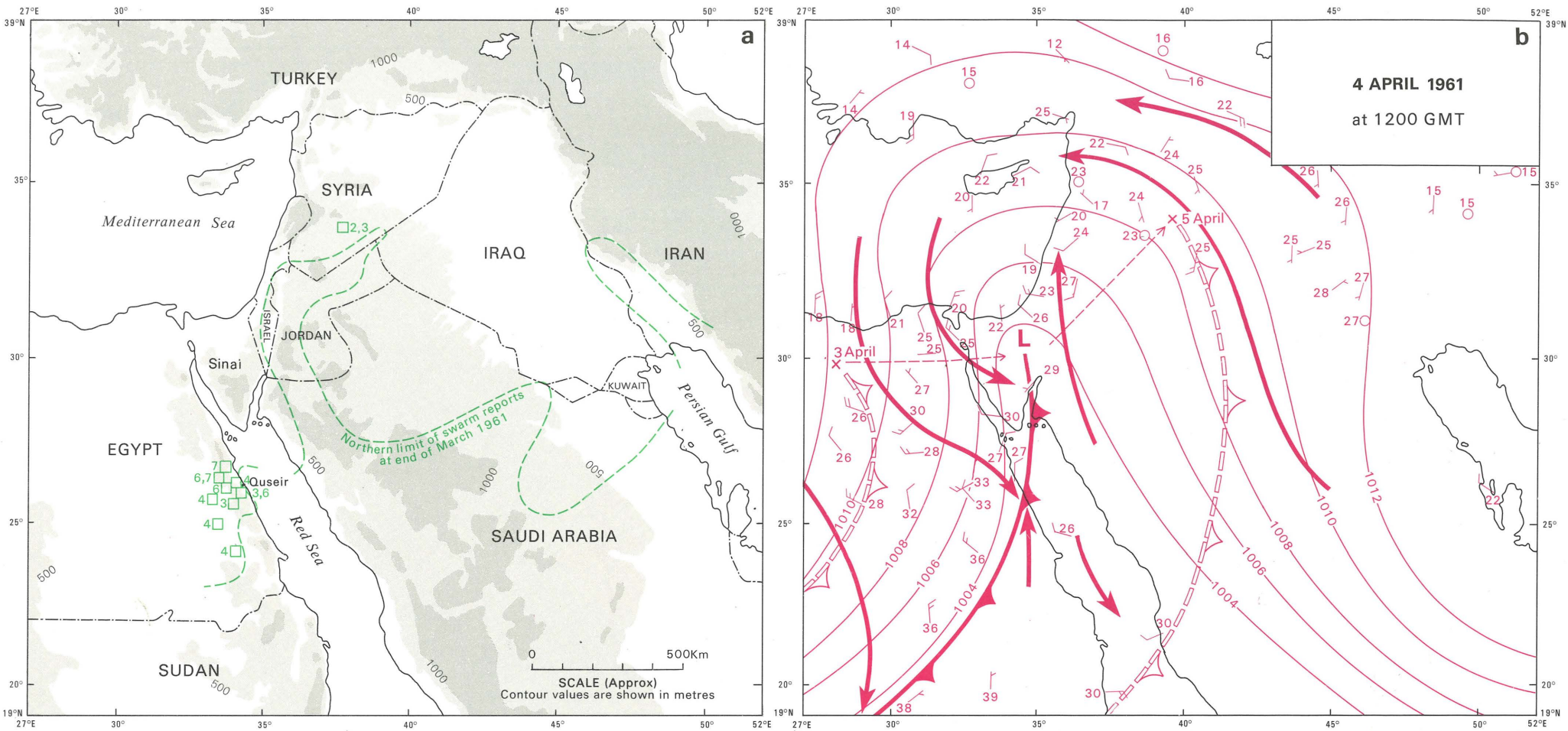


Fig. C10.6 NORTHWARD SPREAD IN EGYPT AND SYRIA, EARLY APRIL 1961

a Places and dates with locust reports

3-7 April 1961

beyond the limit shown (see p 27)

b Weather map for 4 April 1961 at 1200 GMT

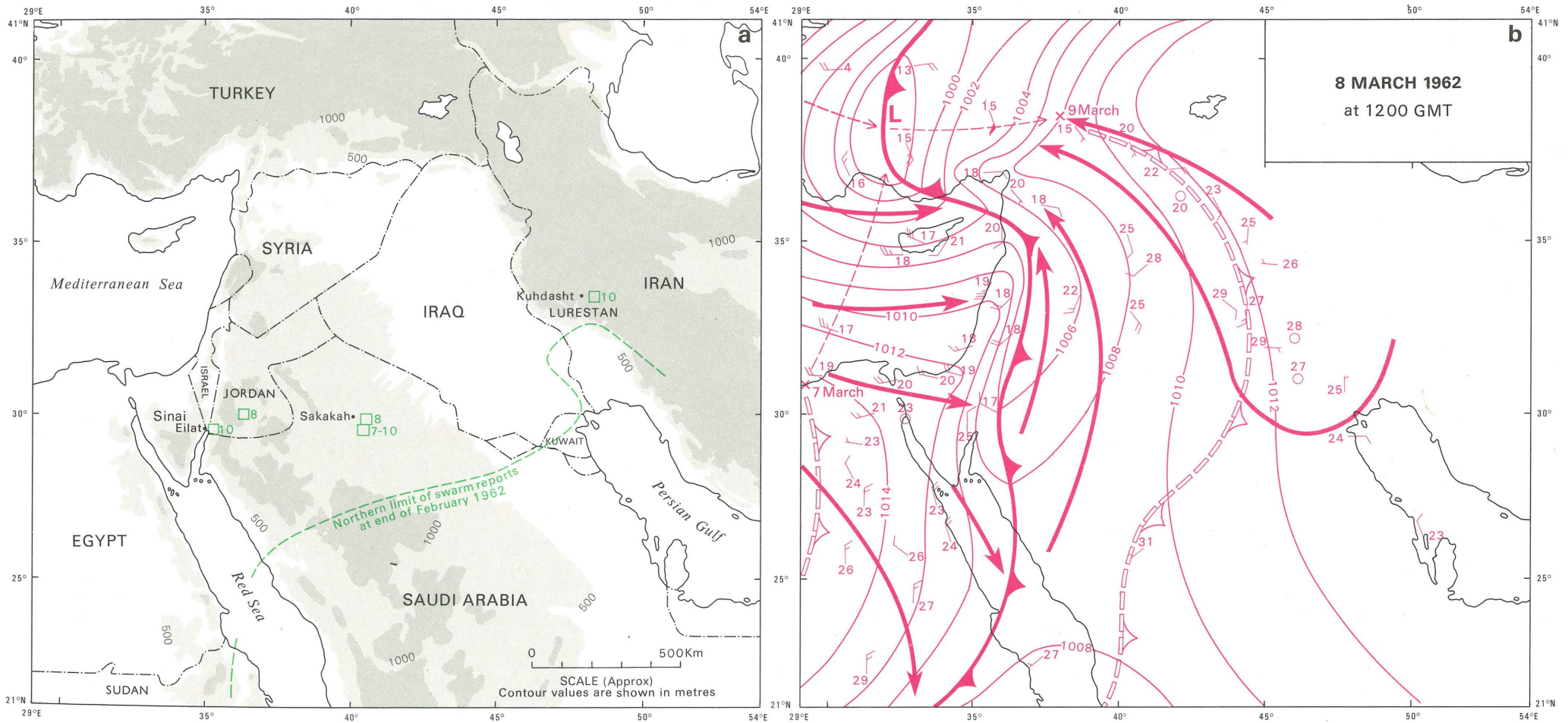


Fig. C10.7 NORTHWARD SPREAD ACROSS THE MIDDLE EAST, EARLY MARCH 1962

a Places and dates with locust reports

7-10 March 1962

beyond the limit (see p 27)

b Weather map for 8 March 1962 at 1200 GMT

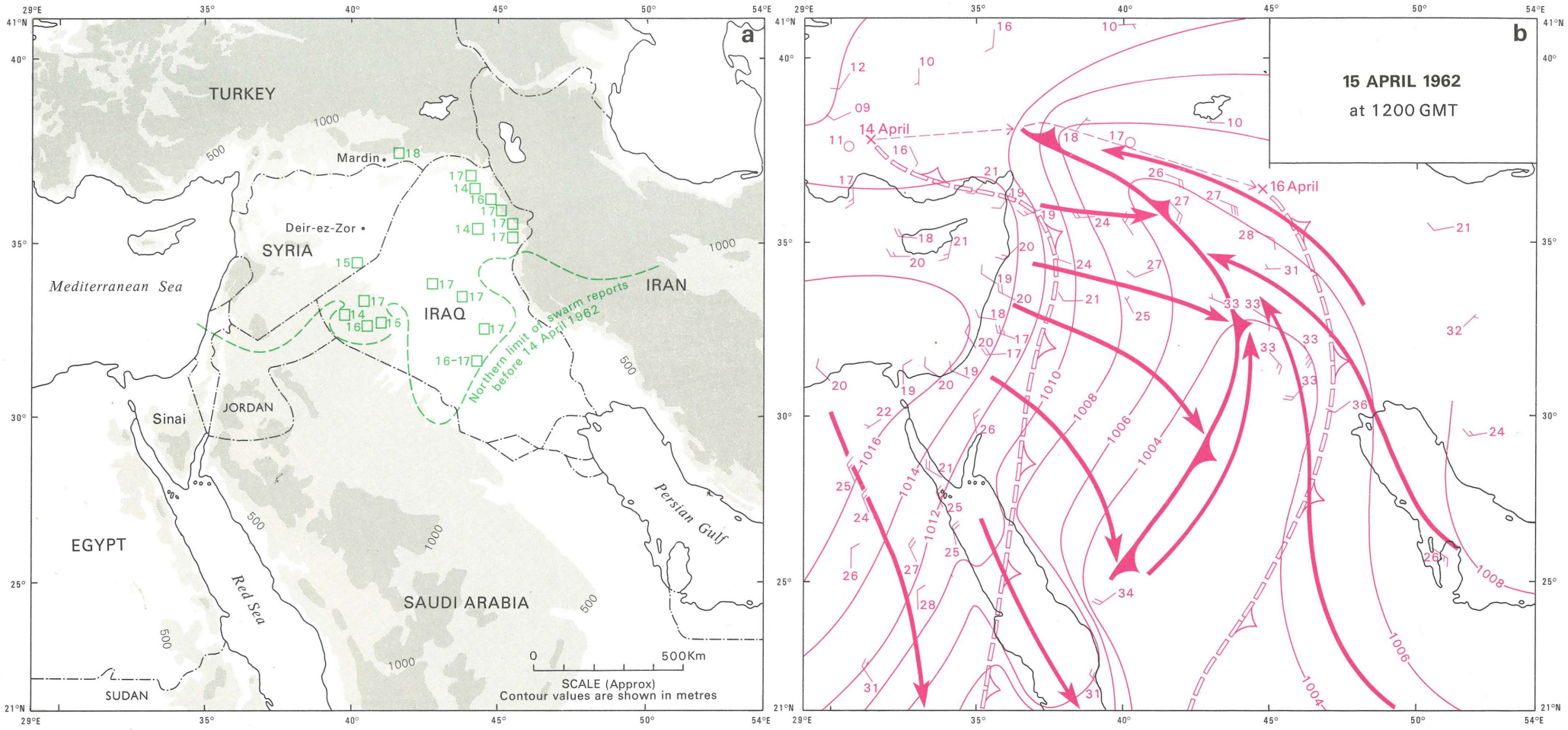


Fig. C10.8 NORTHWESTWARD SPREAD TO SYRIA AND TURKEY, APRIL 1962

a Places and dates with locust reports

14-18 April 1962

beyond the limit shown (see p 27)

b Weather map for 15 April 1962 at 1200 GMT

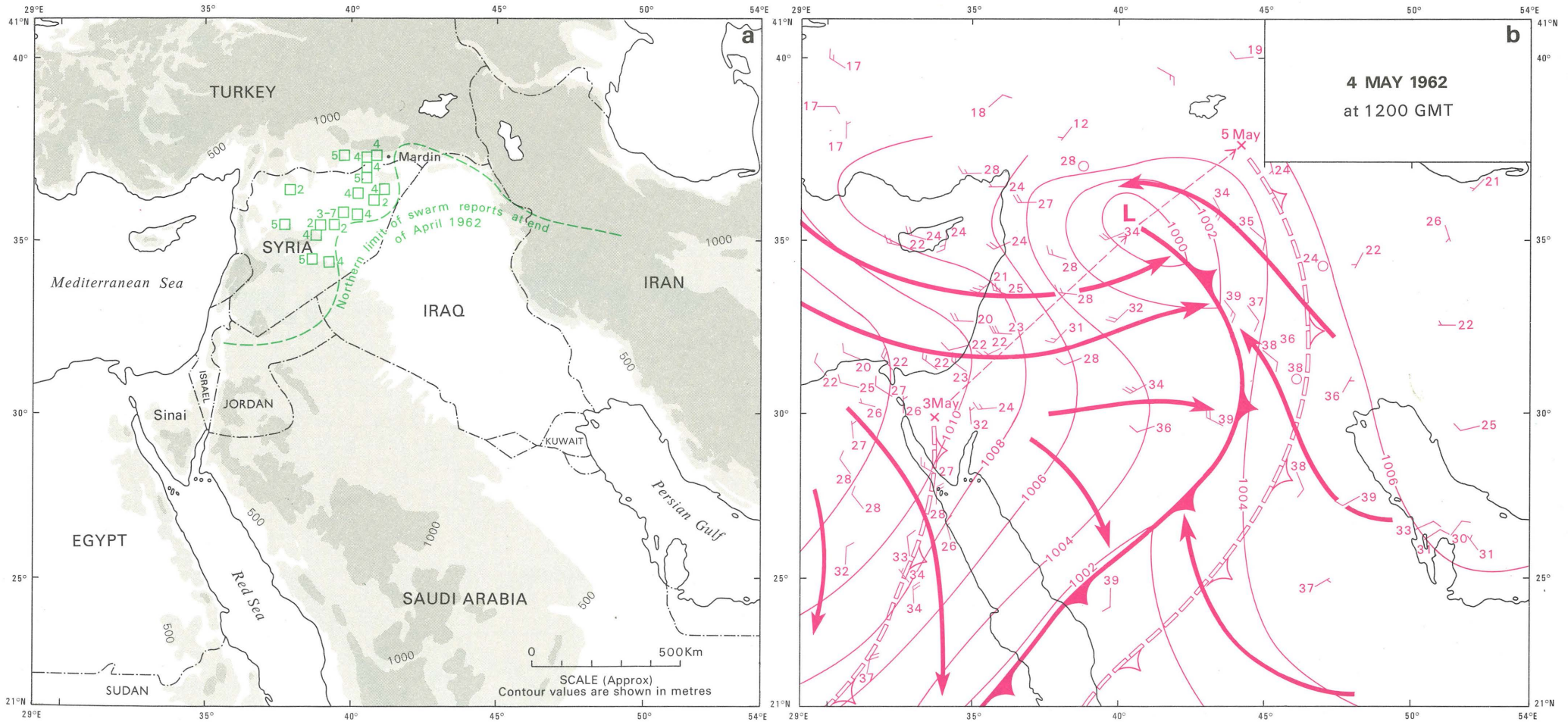


Fig. C10.9 WESTWARD SPREAD IN SYRIA AND TURKEY, MAY 1962

a Places and dates with locust reports

1-5 May 1962

beyond the limit shown (see p 27)

b Weather map for 4 May 1962 at 1200 GMT

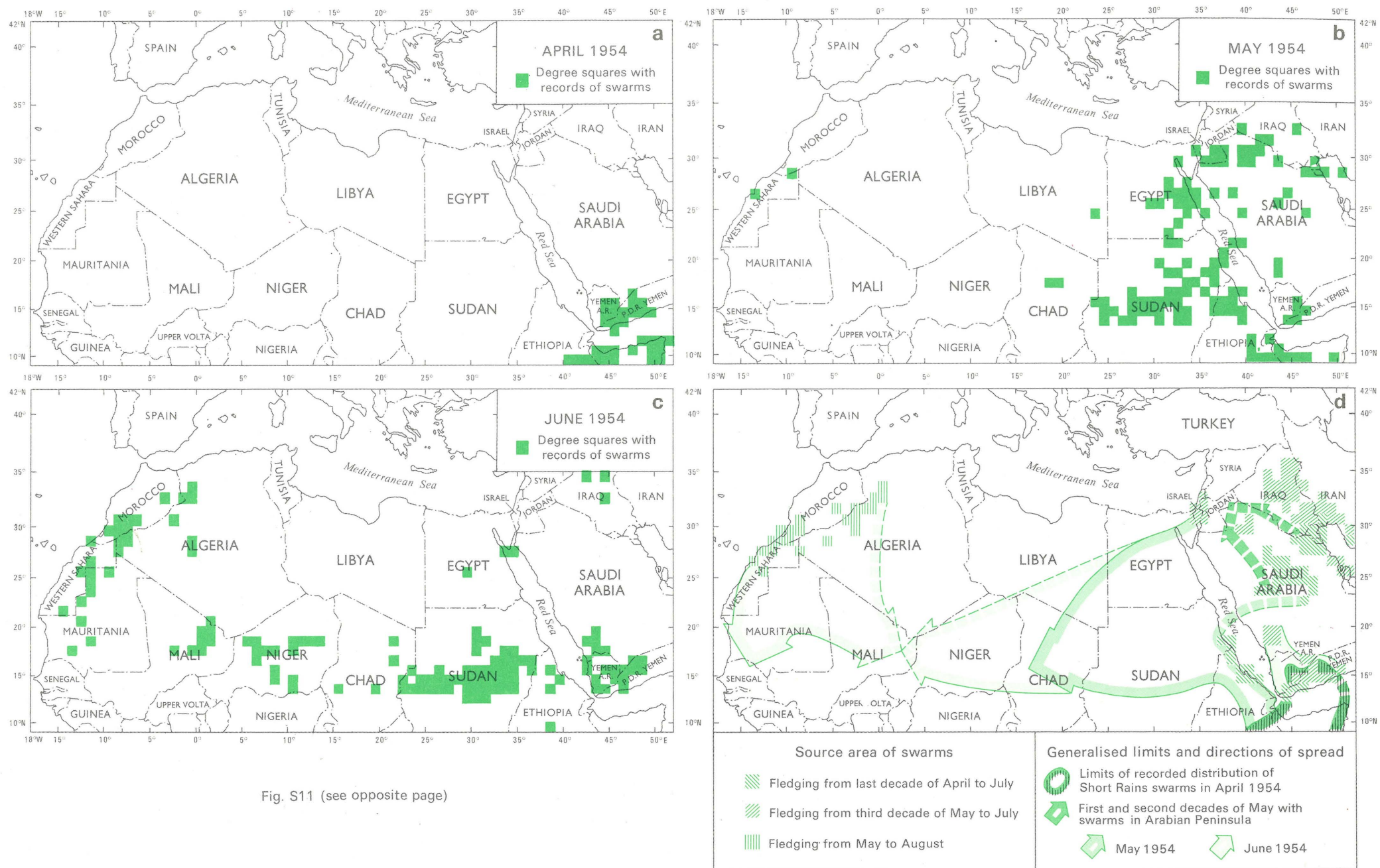


Fig. S11 (see opposite page)

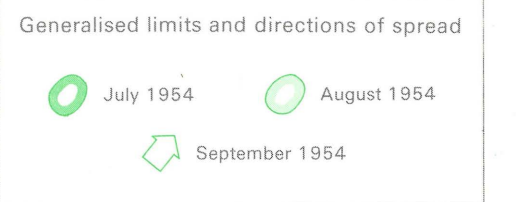
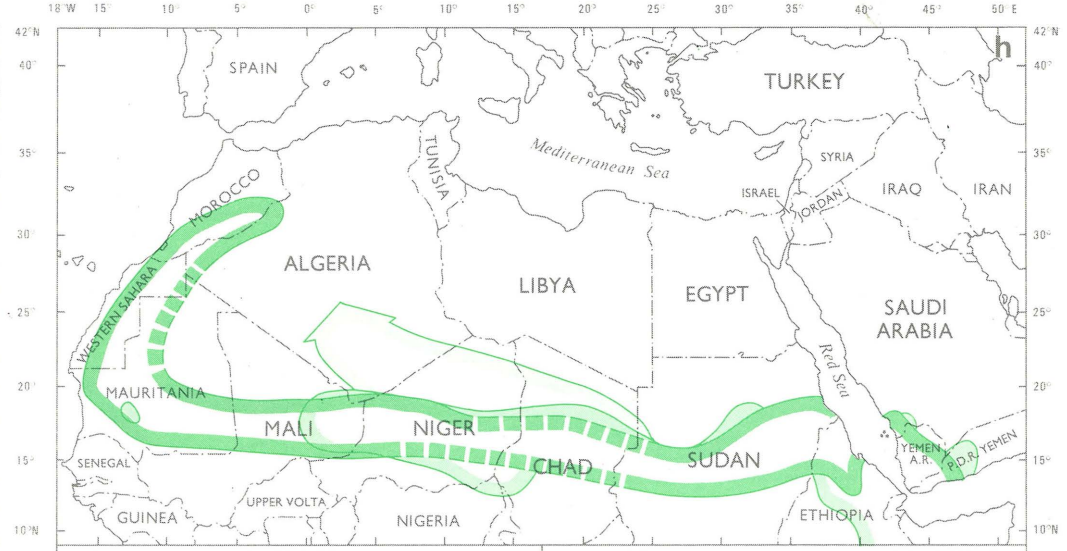
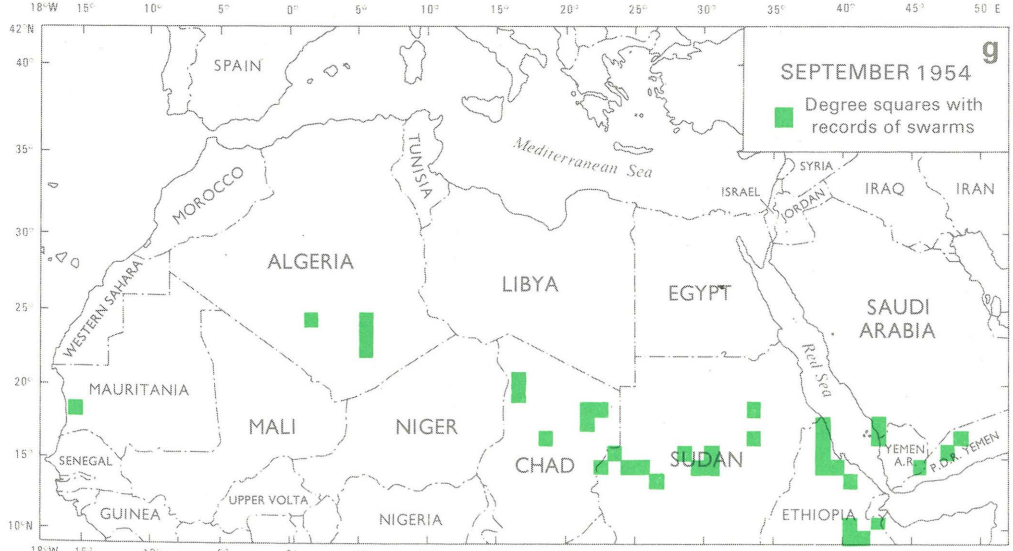
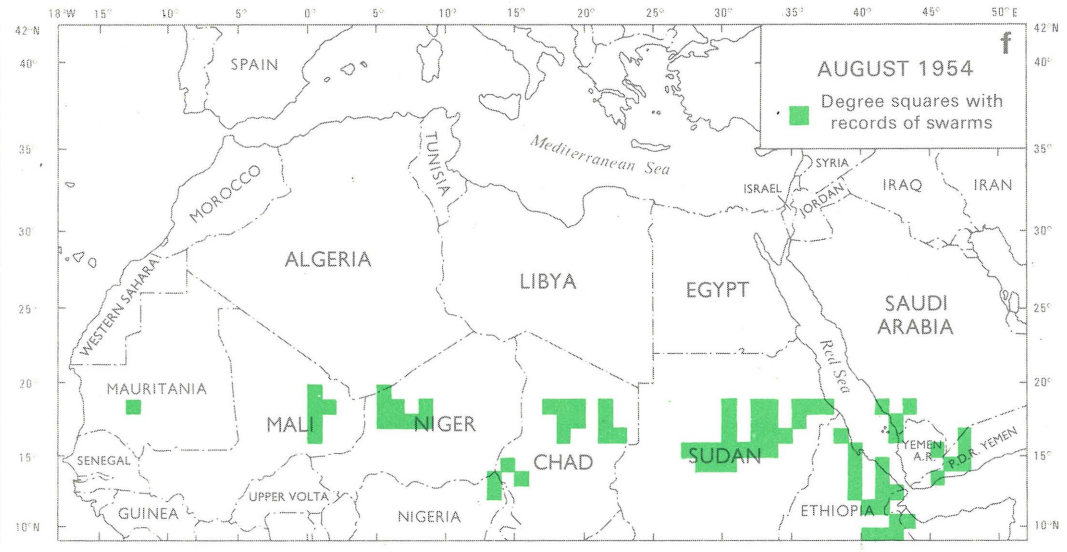
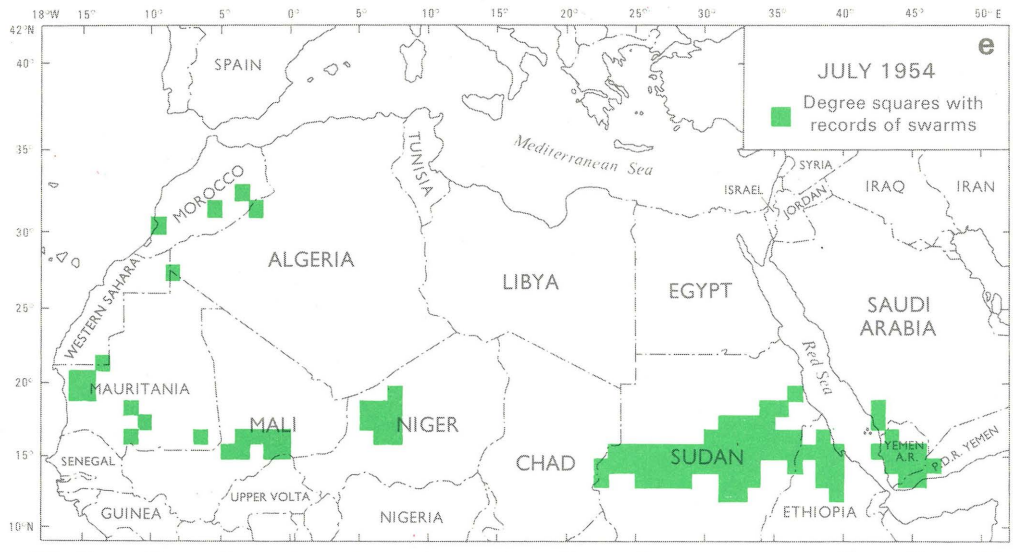


Fig. S11 a-h. 1953-54 SHORT RAINS AND 1954 SPRING GENERATIONS SWARMS IN THE SUMMER BREEDING AREAS OF THE WESTERN AND NORTH CENTRAL REGIONS.

Figs. a,b, and c show the monthly distribution of Short Rains generation swarms by degree squares. Figs. b,c,e,f, and g show spring generation swarms.

Arrows on Figs. d and h show schematically the spread of swarms (see p 27)

Fig. C11.1 SWARMS IN NORTHERN ETHIOPIA,
EARLY MAY 1954

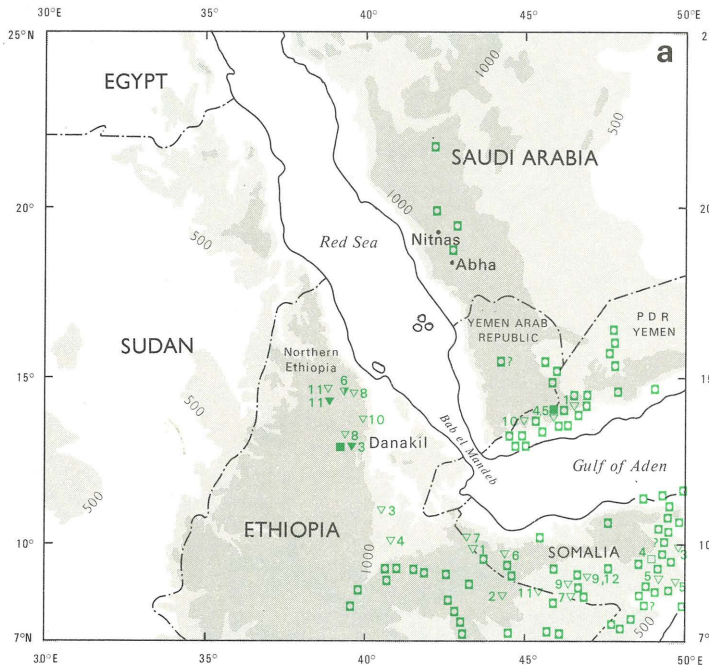
a Places and dates with locust reports (see p 27)

1-11 May 1954

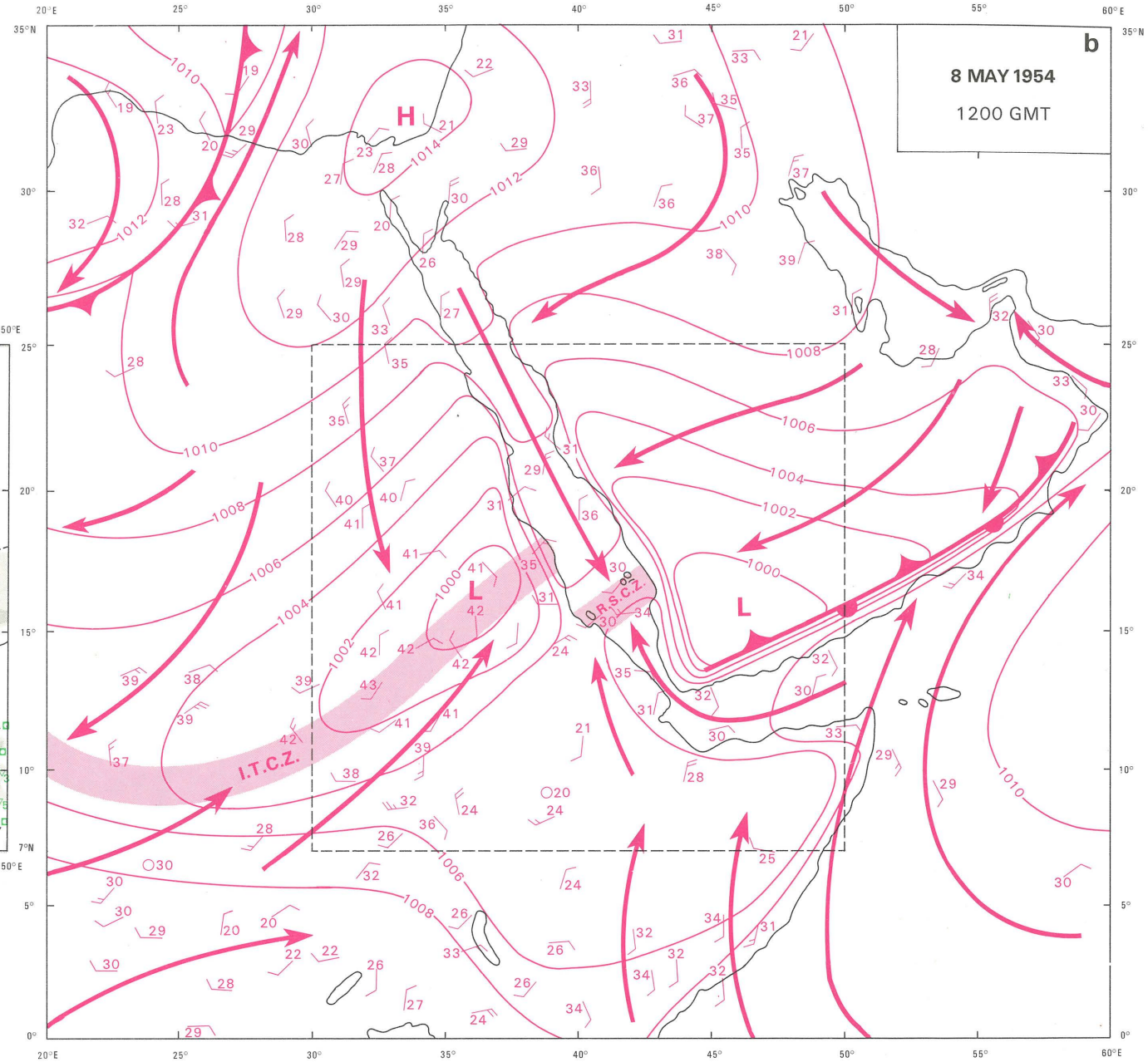
Swarms reported 16-30 April 1954
(including some mature swarms inferred
from presence of egg fields) shown thus:-

- Mature swarms
- Immature swarms

b Weather map for 8 May 1954 at 1200 GMT

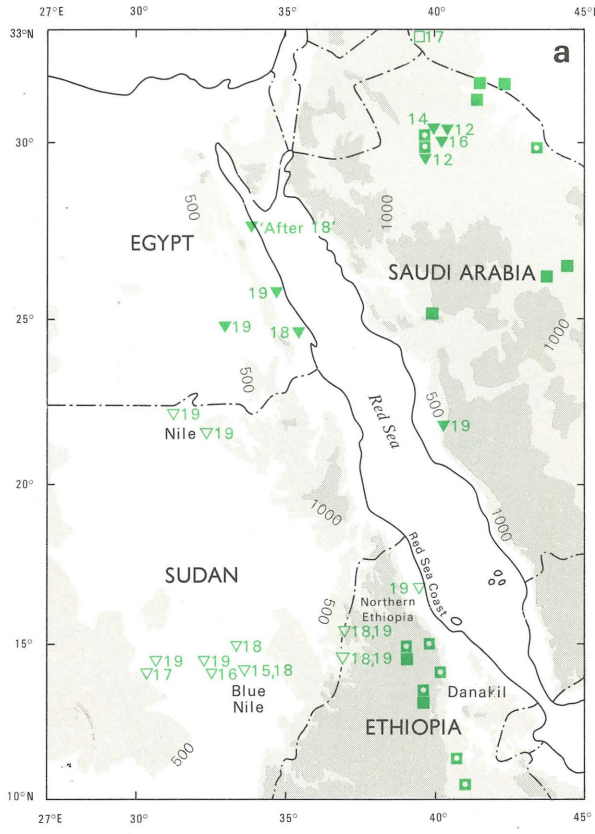


0 400 800 1200 Km
SCALE (Approx)
Contour values are shown in metres



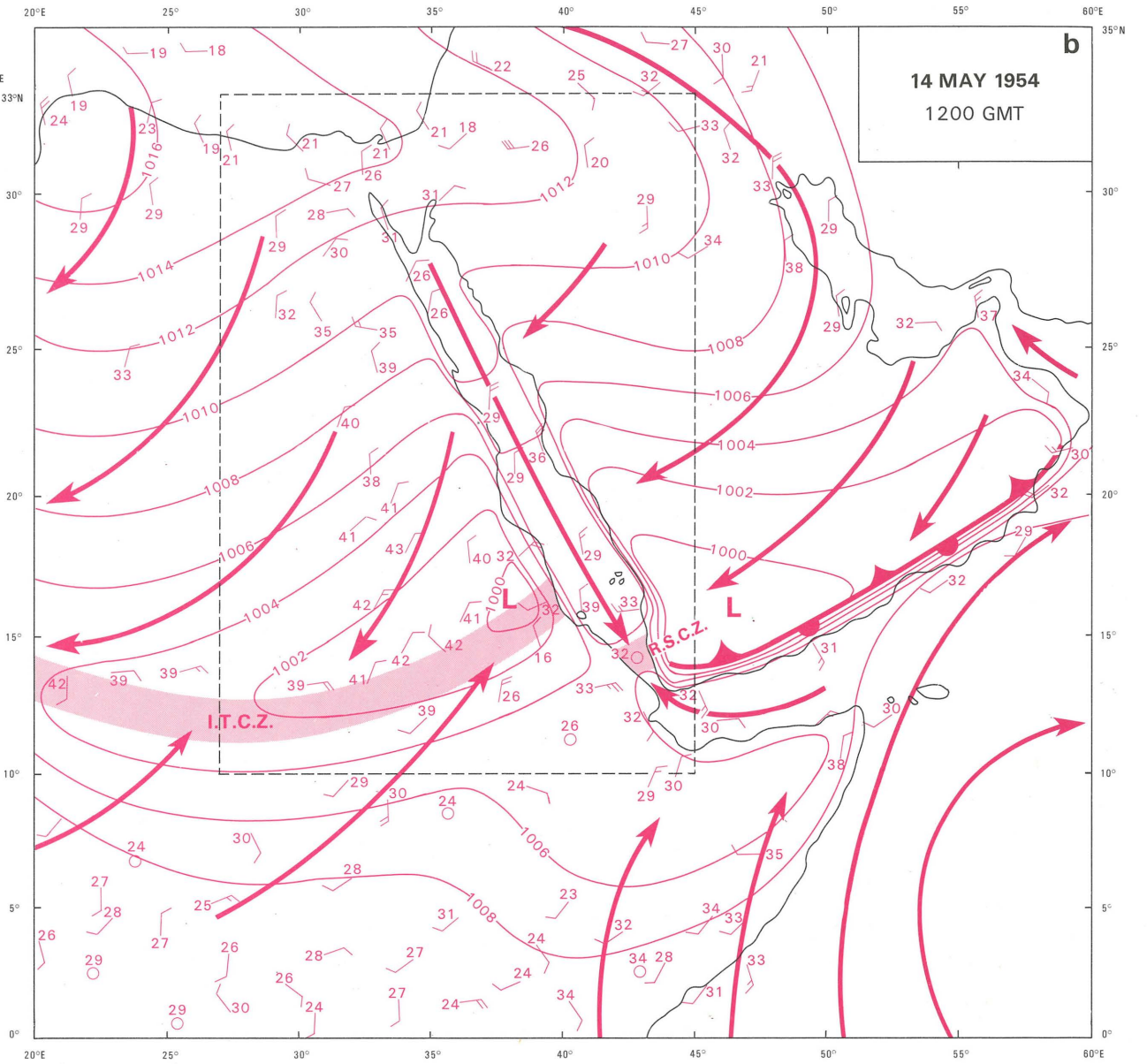
b
8 MAY 1954
1200 GMT

Prepared by Directorate of Overseas Surveys 1979



0 400 800 1200 Km
SCALE (Approx)
Contour values are shown in metres

Fig. C11.2 (see opposite page)



Prepared by Directorate of Overseas Surveys 1979

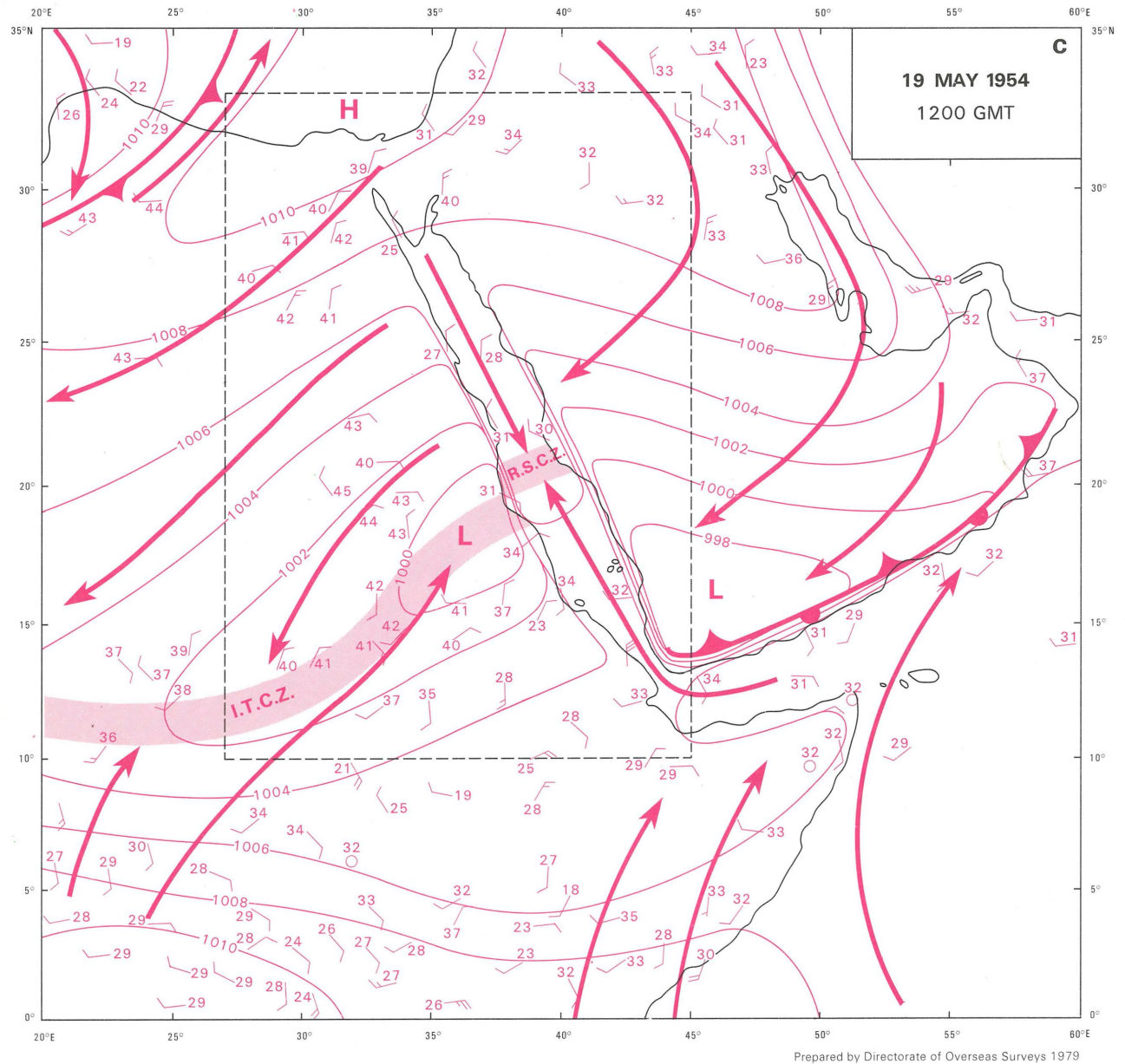
Fig. C11.2 INVASION OF EGYPT AND SUDAN
MID-MAY 1954

a Places and dates with locust reports (see p 27)
12–19 May 1954

- Immature swarms reported 1-11 May 1954
- Mature swarms reported 1-11 May 1954

b Weather map for 14 May 1954 at 1200 GMT

c Weather map for 19 May 1954 at 1200 GMT



a Places and dates with locust reports (see p 27)

29-31 May 1954

west of swarms reported 20-28 May 1954
which are shown by

- Mature swarms
- Immature swarms

b Weather map for 29 May 1954 at 1200 GMT

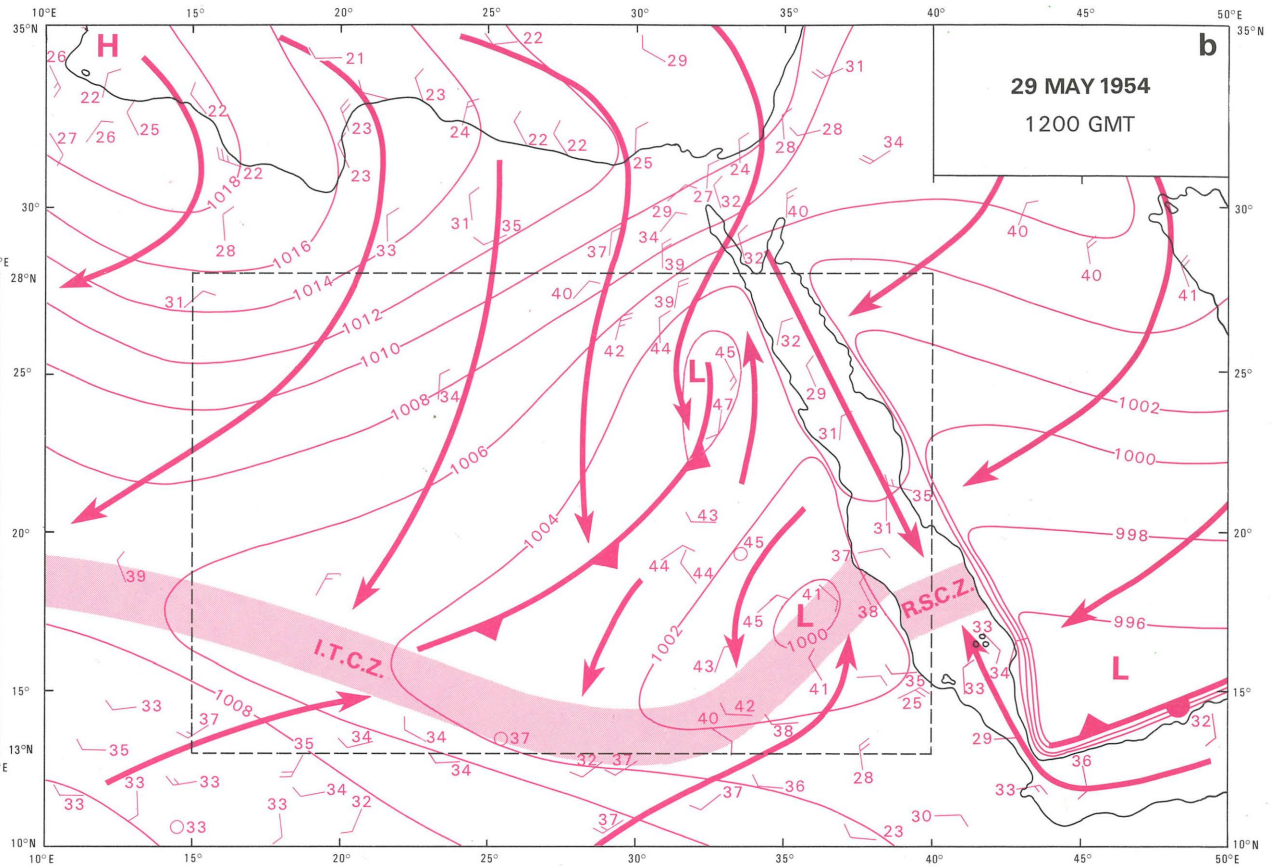
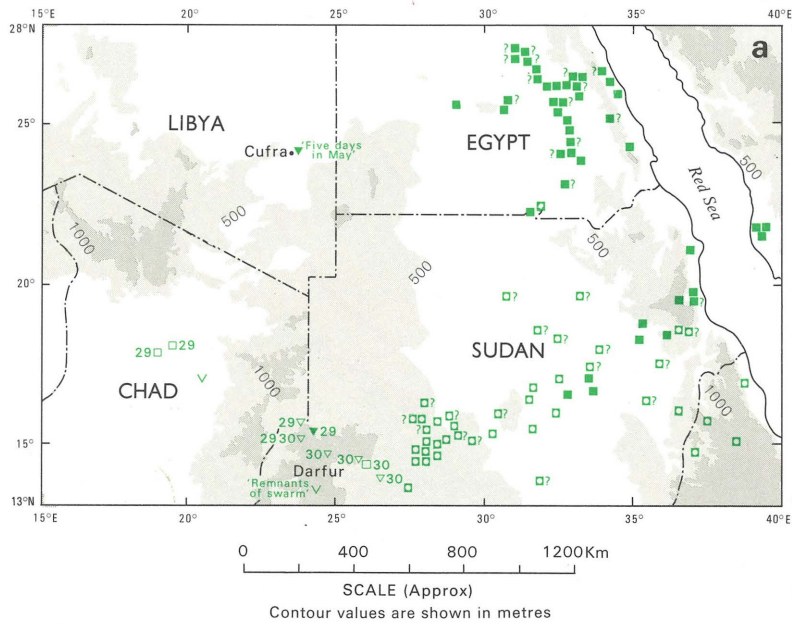


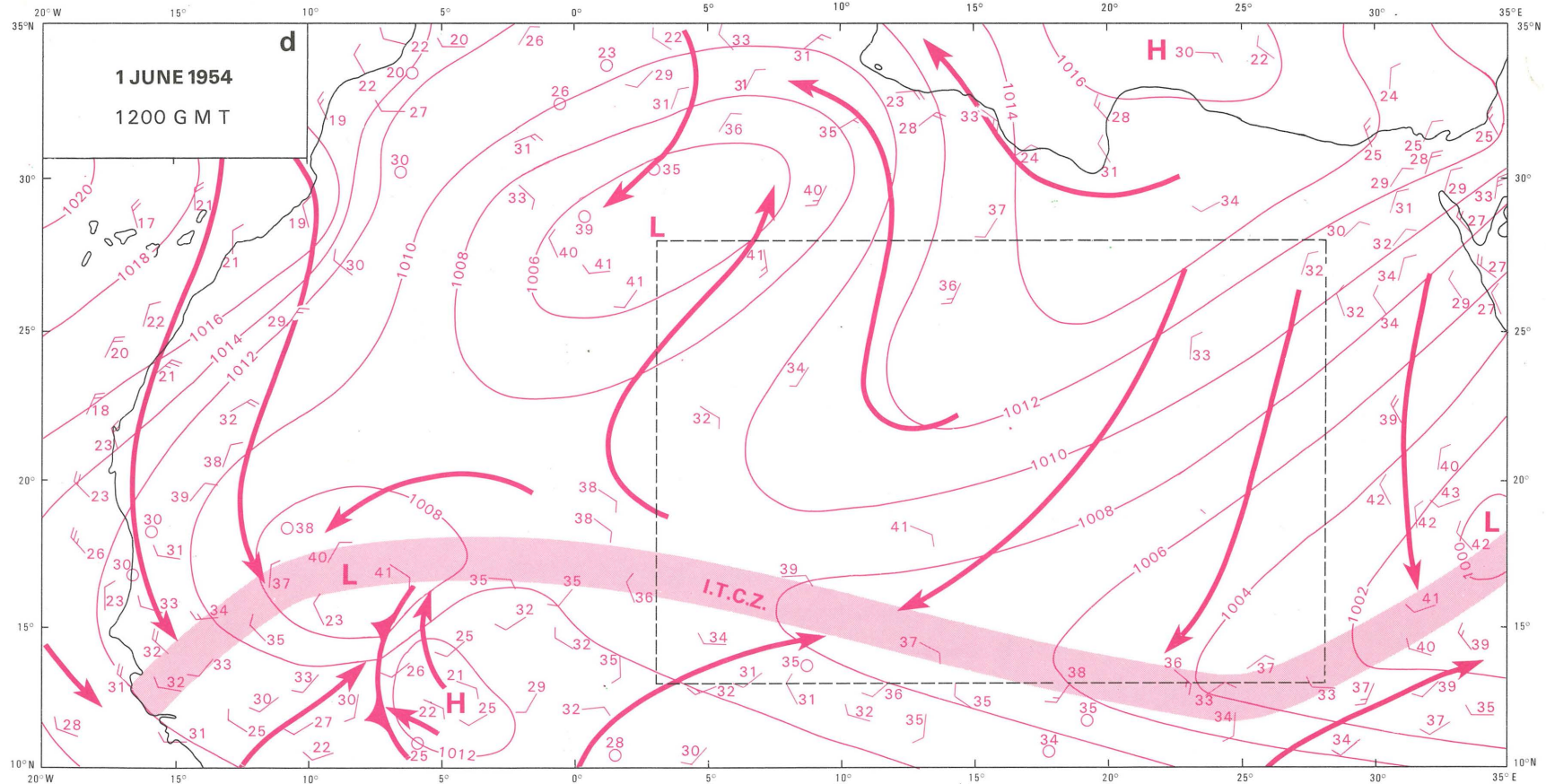
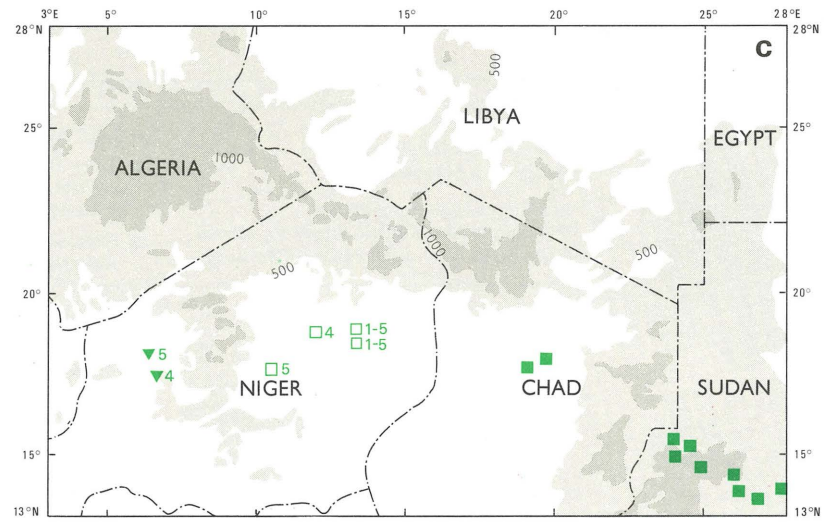
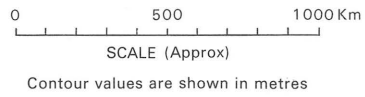
Fig. C11.3 WESTWARD SPREAD INTO SUDAN, LIBYA, CHAD AND NIGER, MAY-JUNE 1954

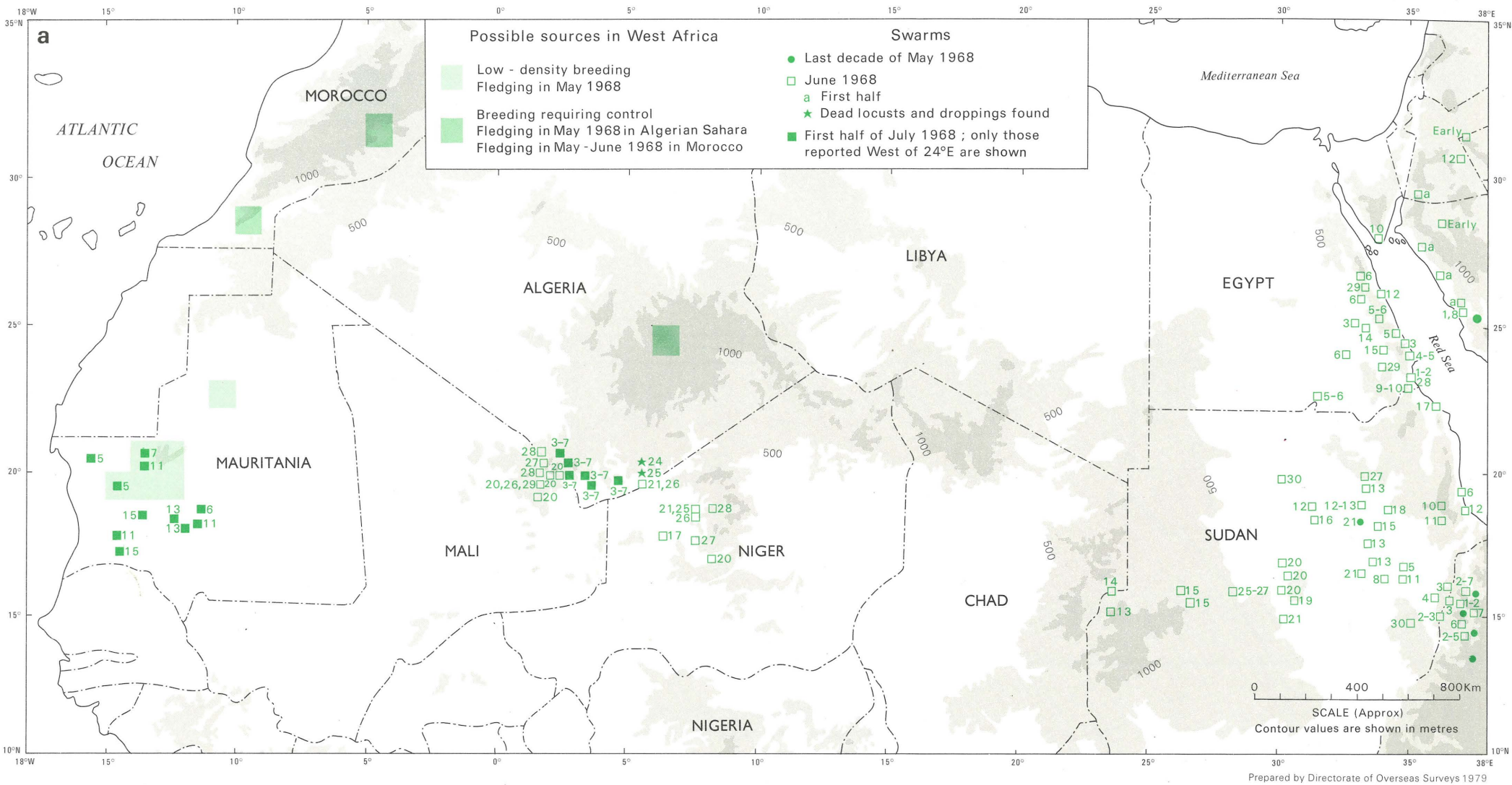
Fig. C11.3 (Continued) WESTWARD SPREAD INTO SUDAN, LIBYA, CHAD AND NIGER, MAY - JUNE 1954

c Places and dates with locust reports (see p 27)
1-5 June 1954.

West of swarms reported 29-31 May 1954 which are shown by ■

d Weather map for 1 June 1954 at 1200 GMT





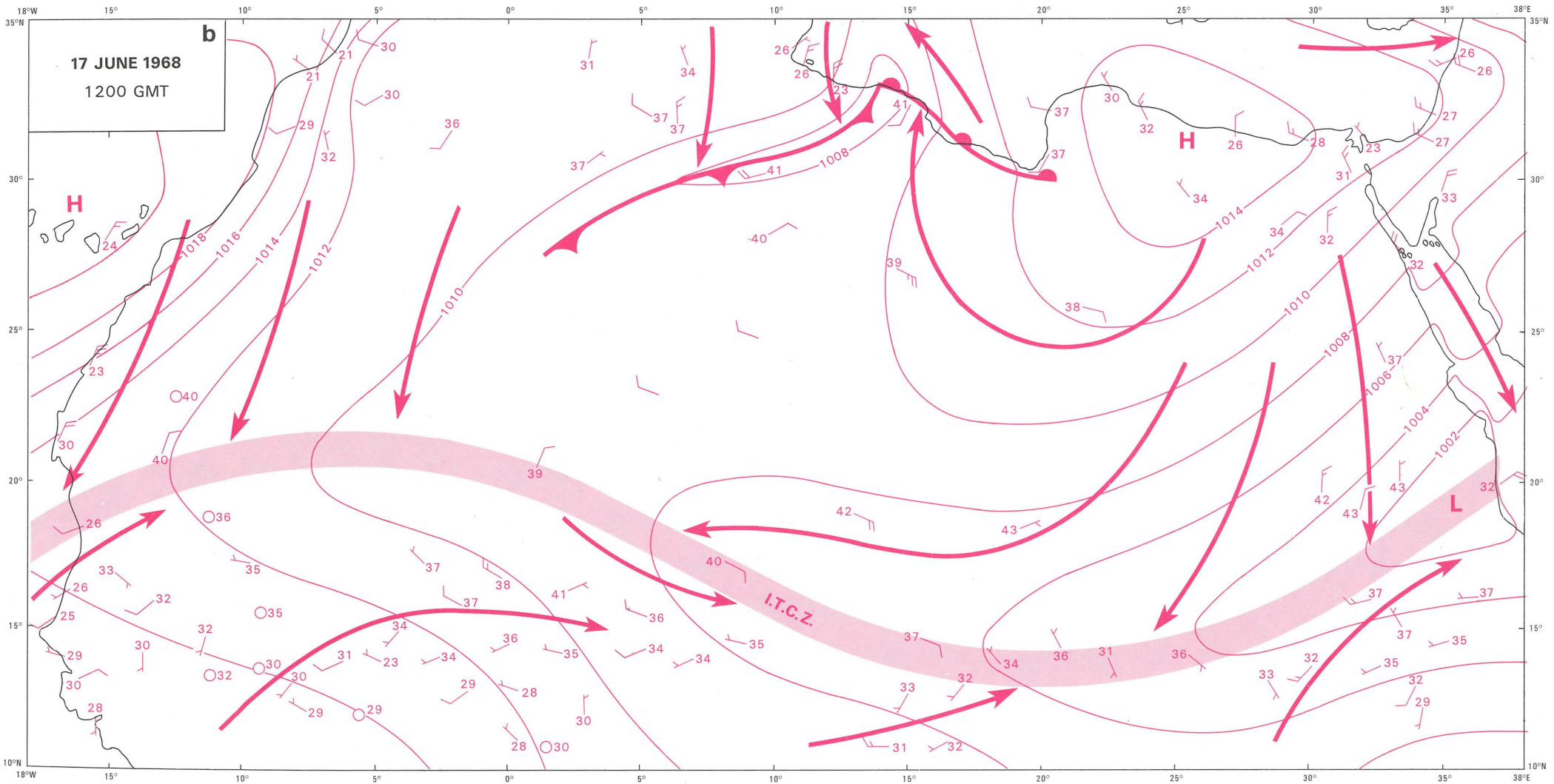


Fig. C11.4 (see opposite page)

Prepared by Directorate of Overseas Surveys 1979

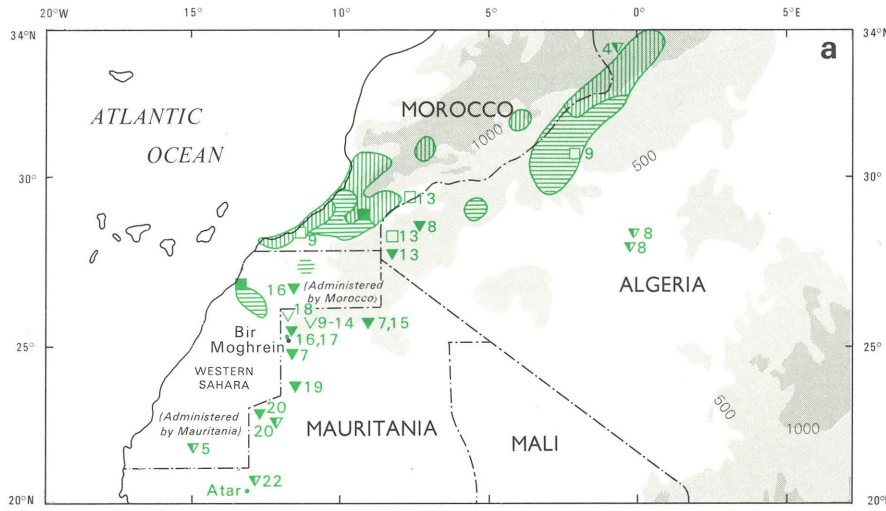


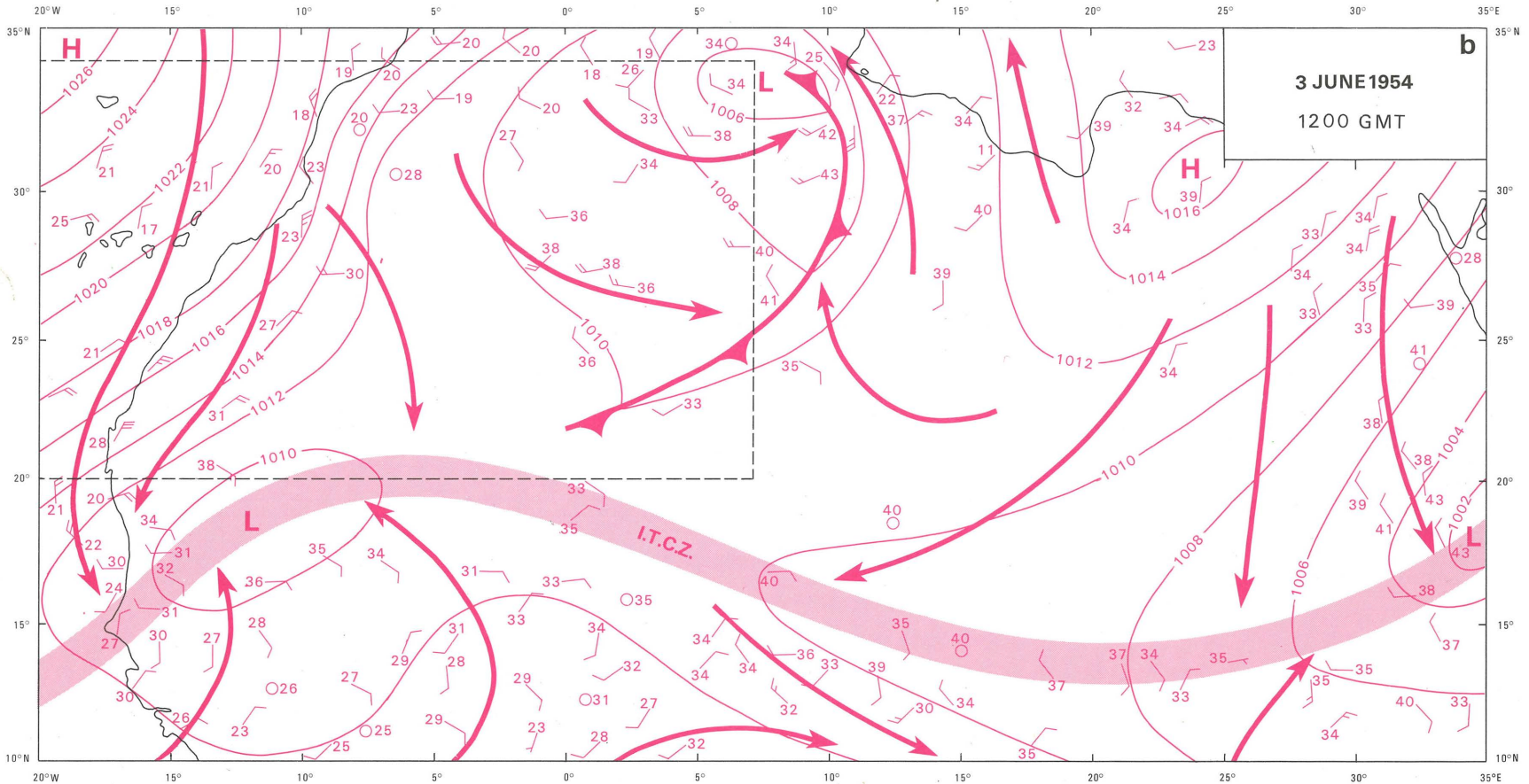
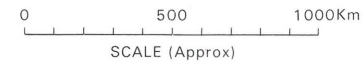
Fig. C11.5 INVASION OF MAURITANIAN WESTERN SAHARA, MAURITANIA AND CENTRAL ALGERIA, JUNE 1954

a Places and dates with locust reports (see p 27)

1-22 June 1954.

- Young swarms reported in May 1954
- Breeding areas where fledging is estimated to have taken place from mid-May to 20 June 1954
- Breeding areas where fledging is estimated to have started in the third decade of June 1954

b Weather map for 3 June 1954 at 1200 GMT



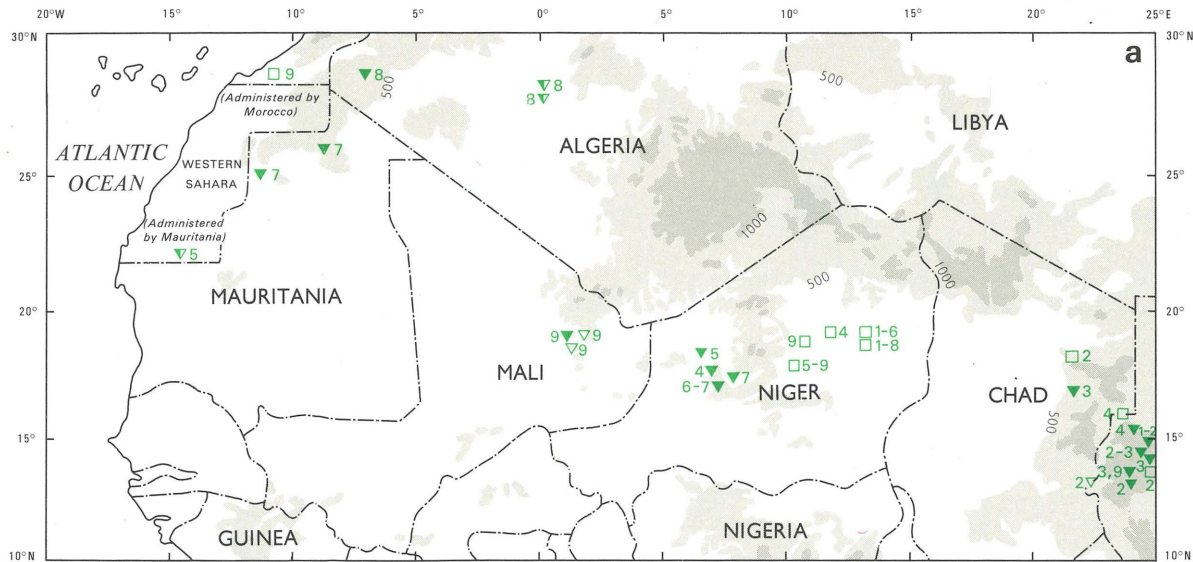
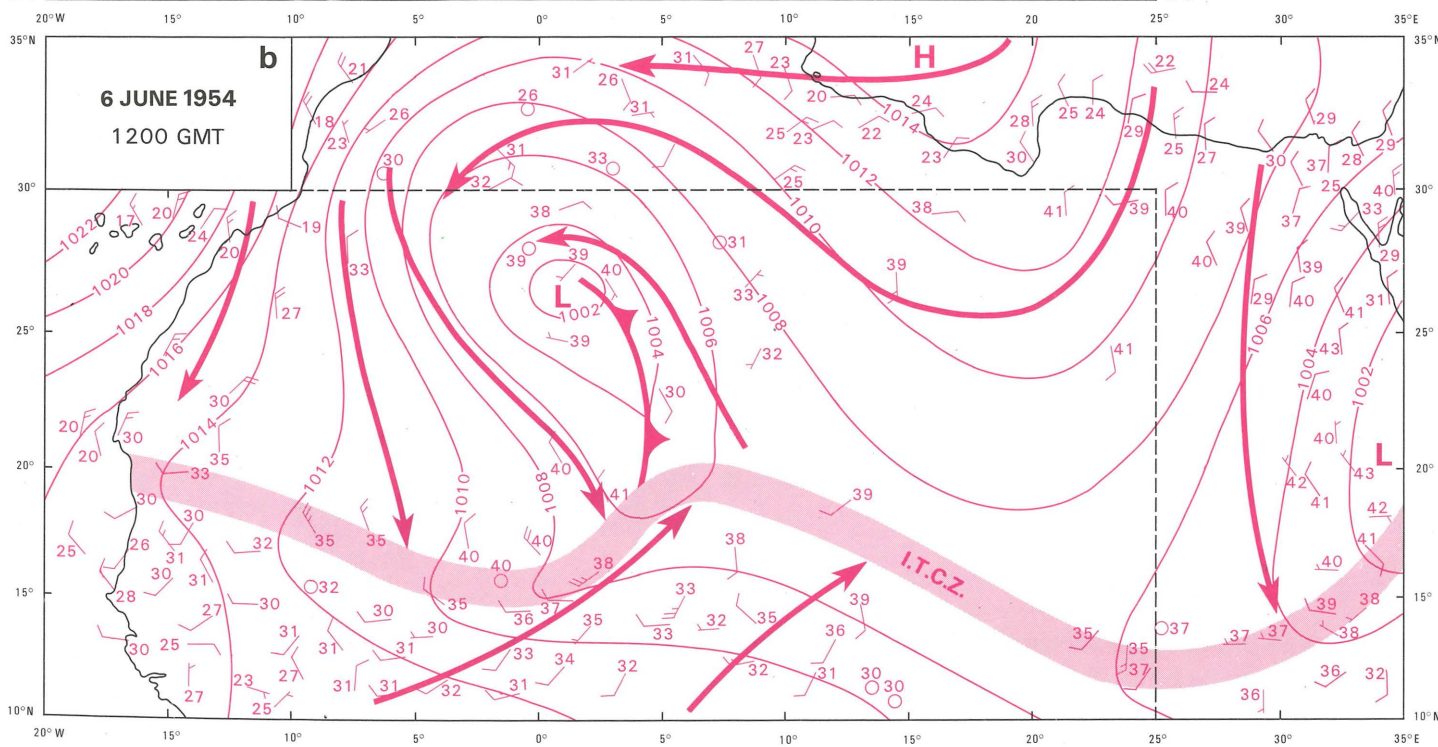


Fig. C11.6 INVASION OF MALI, JUNE 1954

a Places and dates with locust reports (see p 27)
1-19 June 1954

b Weather map for 6 June at 1200 GMT

0 500 1000 Km
 SCALE (Approx)
 Contour values are shown in metres



Prepared by Directorate of Overseas Surveys 1979

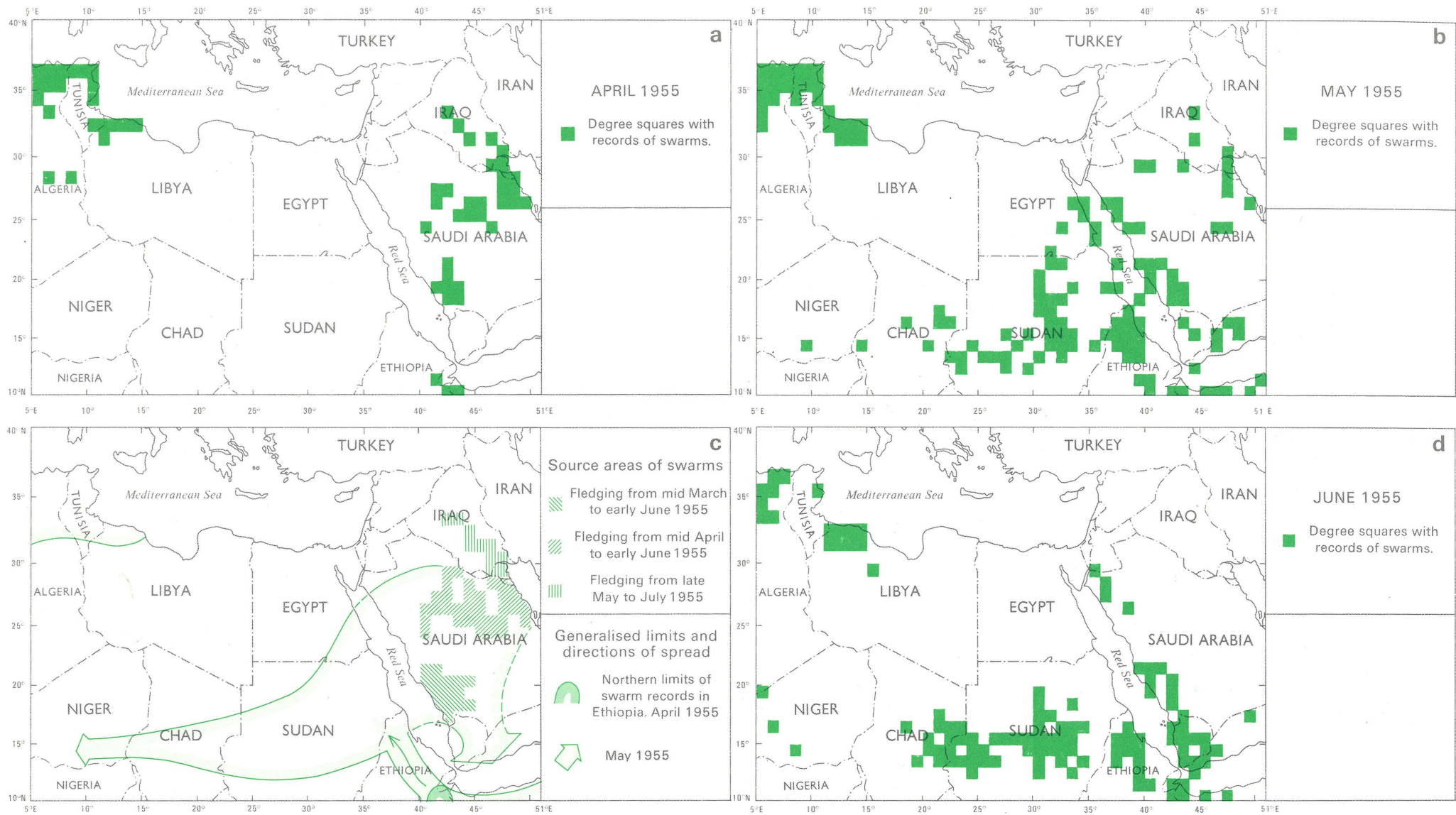


Fig. S12 a-d. 1955 SPRING AND 1954-55 SHORT RAINS GENERATIONS SWARMS IN THE NORTH CENTRAL AND WESTERN REGIONS

Figs. a,b and d, show the monthly distribution of swarms by degree squares.

Fig. c, shows schematically the spread of swarms (see p 27)

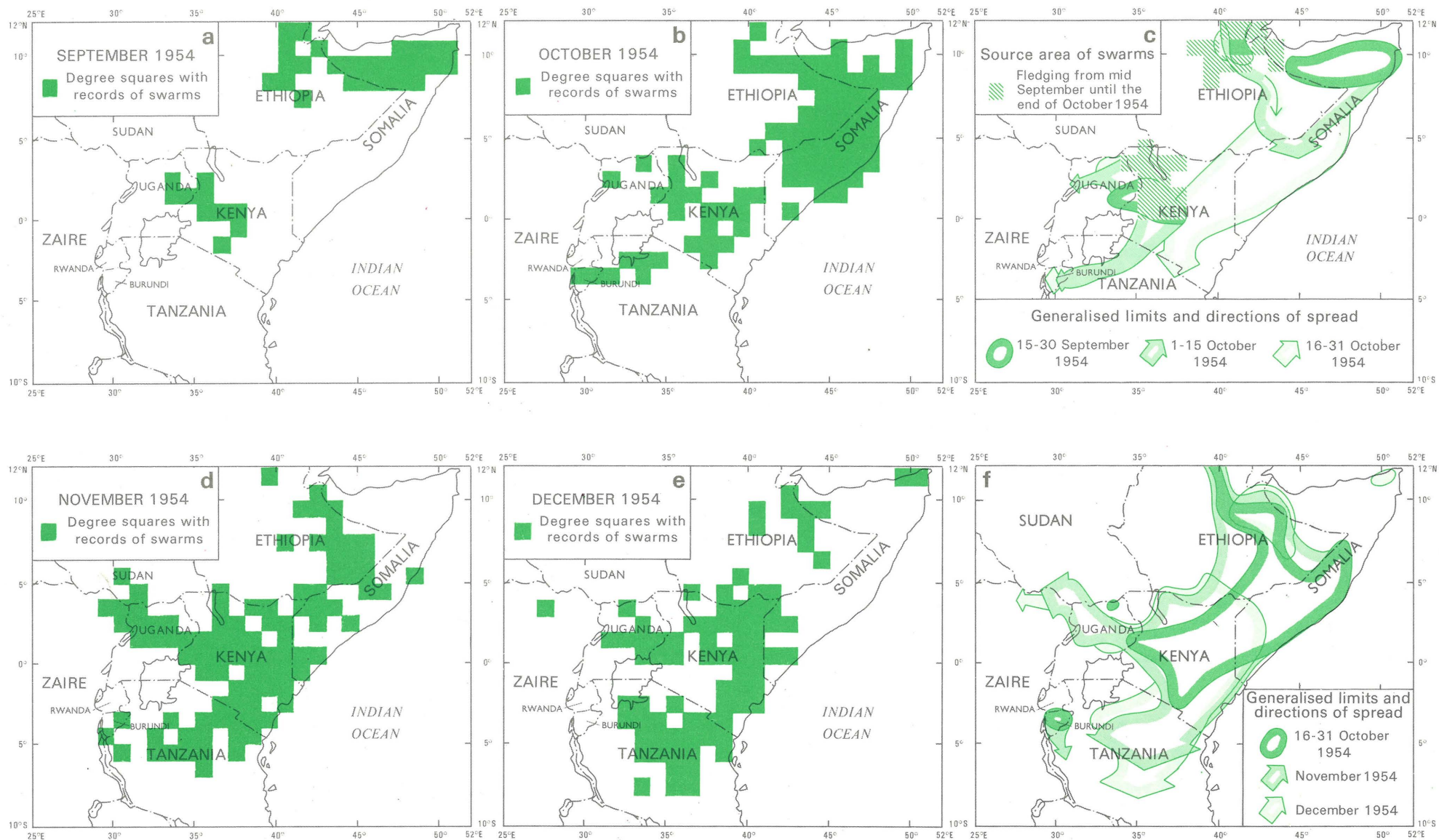


Fig. S13 (see opposite page)

Prepared by Directorate of Overseas Surveys 1979

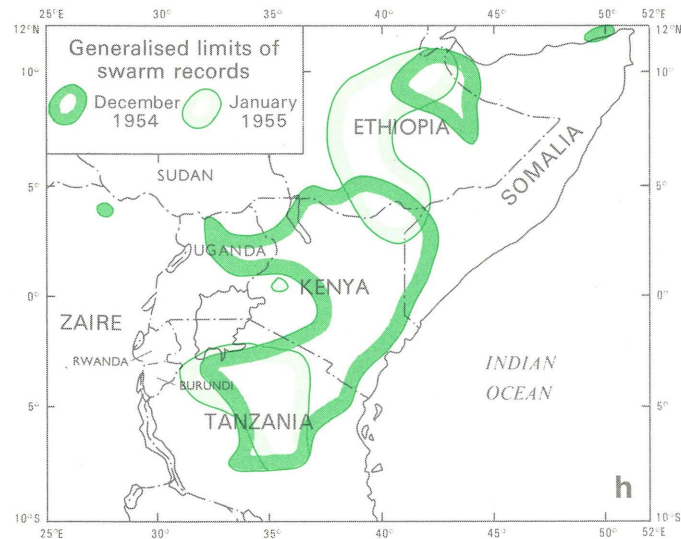
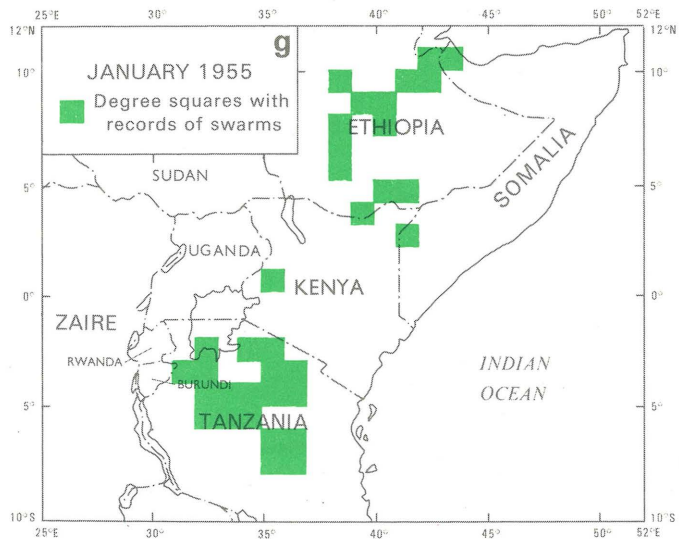


Fig. S13 a-h. 1954 LONG RAINS AND SUMMER GENERATIONS SWARMS IN THE SOUTH CENTRAL REGION, OCTOBER 1954 TO JANUARY 1955

Figs a,b,d,e, and g show the monthly distribution of swarms by degree squares. Arrows on Figs c,f and h show schematically the spread of swarms (see p 27)

a Places and dates with locust reports (see p 27)
1-16 October 1954.

■ Degree squares with summer breeding, and fledging likely by end of September

b Weather map for 10 October 1954 at 1200 GMT

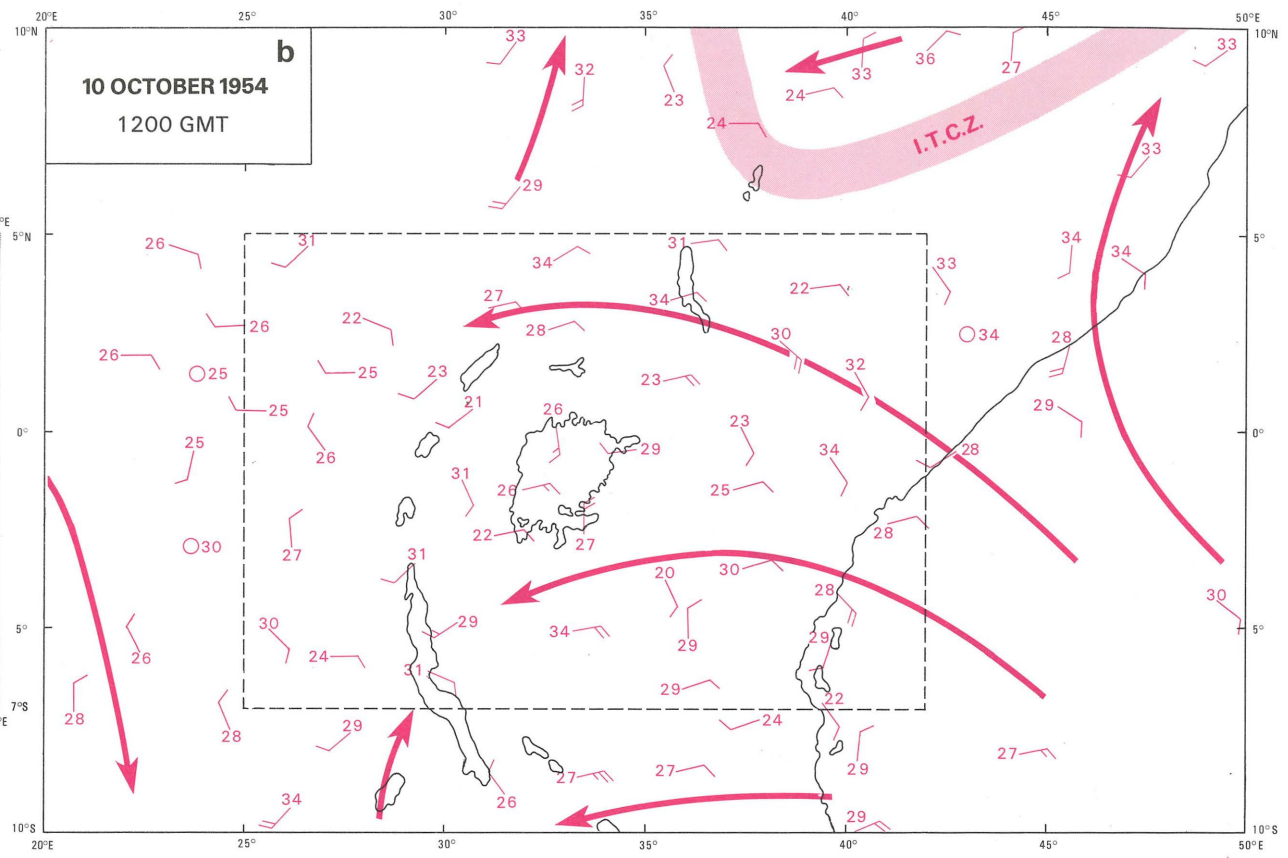
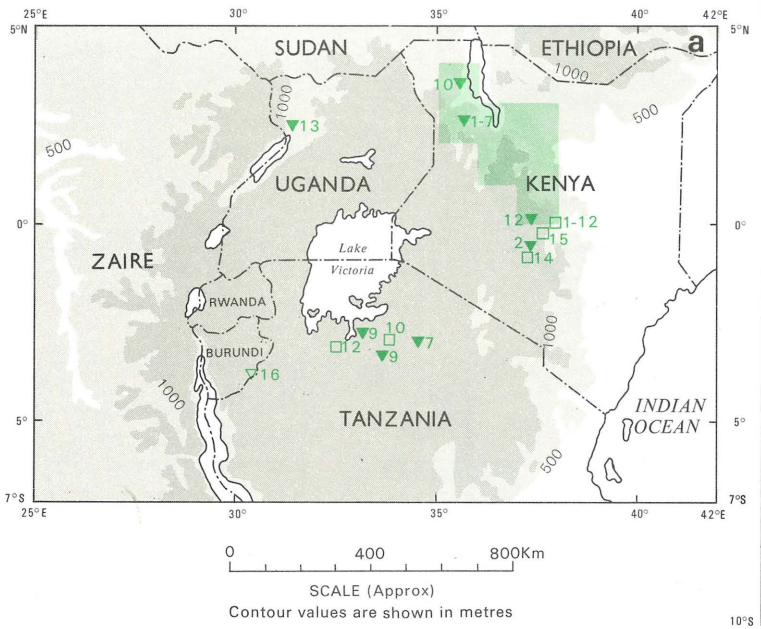


Fig. C13.1 WESTWARD SPREAD ACROSS TANZANIA, OCTOBER 1954

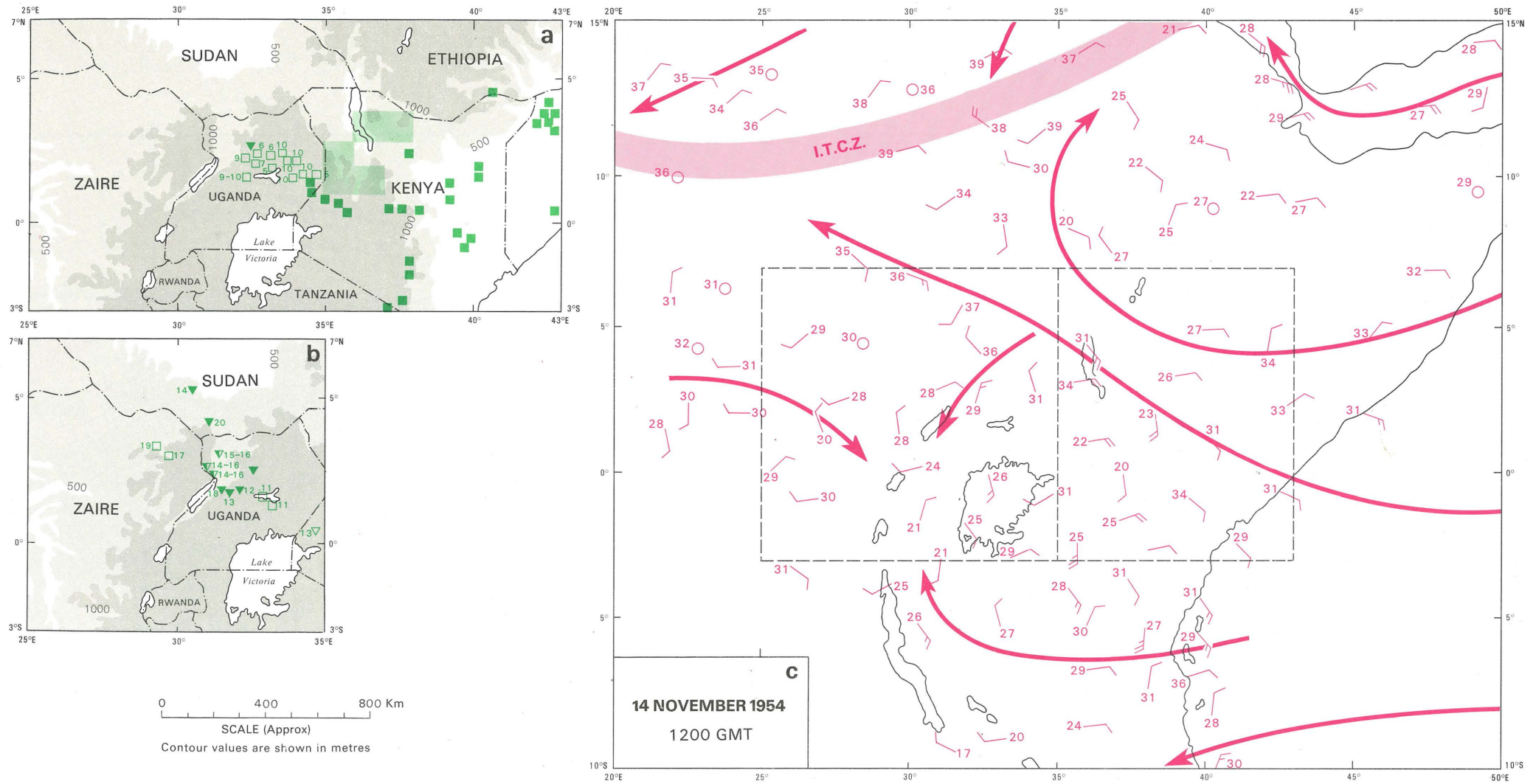


Fig. C13.2 SWARMS IN UGANDA, ZAIRE AND SOUTHERN SUDAN, NOVEMBER 1954

a Places and dates with locust reports (see p 27)

1-10 November 1954.

West of swarms reported 26- 31 October 1954, shown ■

■ Degree squares with records of fledging probable in second half of October

b Places and dates with locust reports (see p 27)

11-20 NOVEMBER 1954.

c Weather map for 14 November 1954 at 1200 GMT

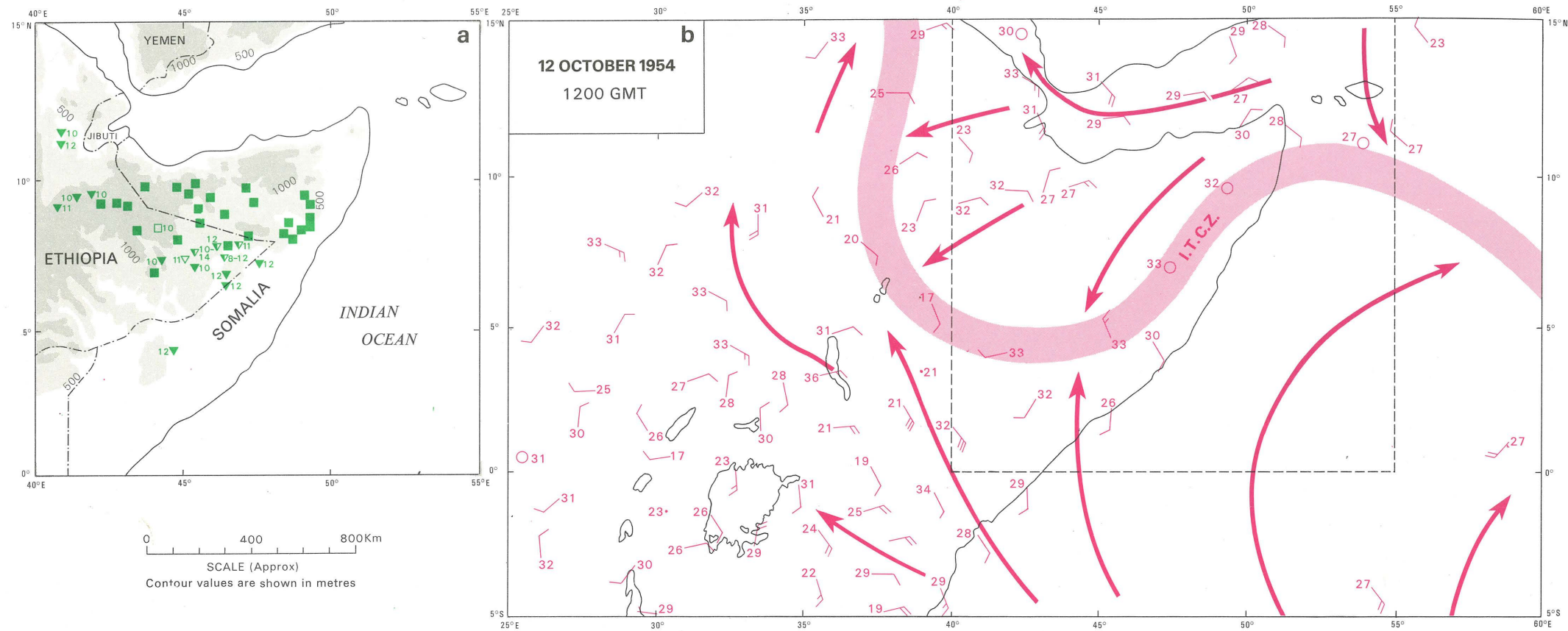


Fig. C13.3 SOUTHWARD SPREAD ACROSS ETHIOPIA AND SOMALIA, OCTOBER 1954

a Places and dates with locust reports (see p 27)

10-14 October 1954.

■ Swarms reported 1-9 October

b Weather map for 12 October 1954 at 1200 GMT

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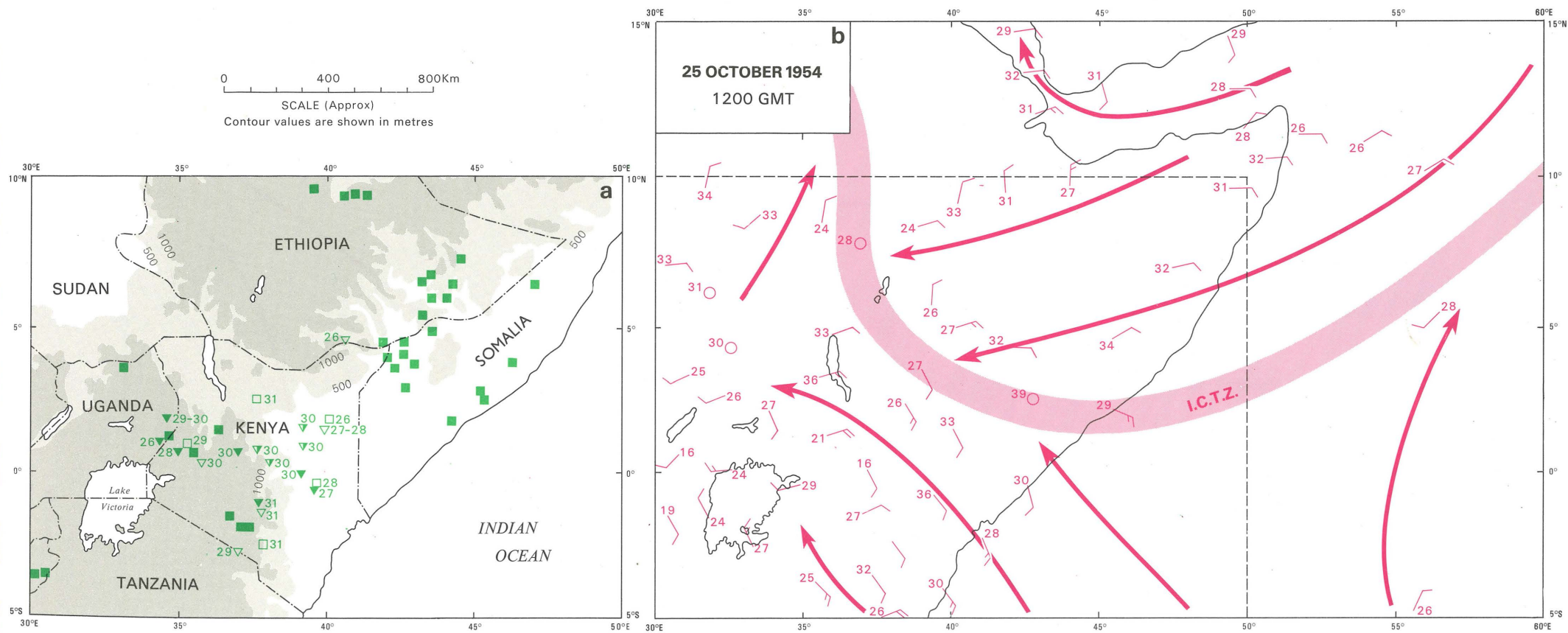


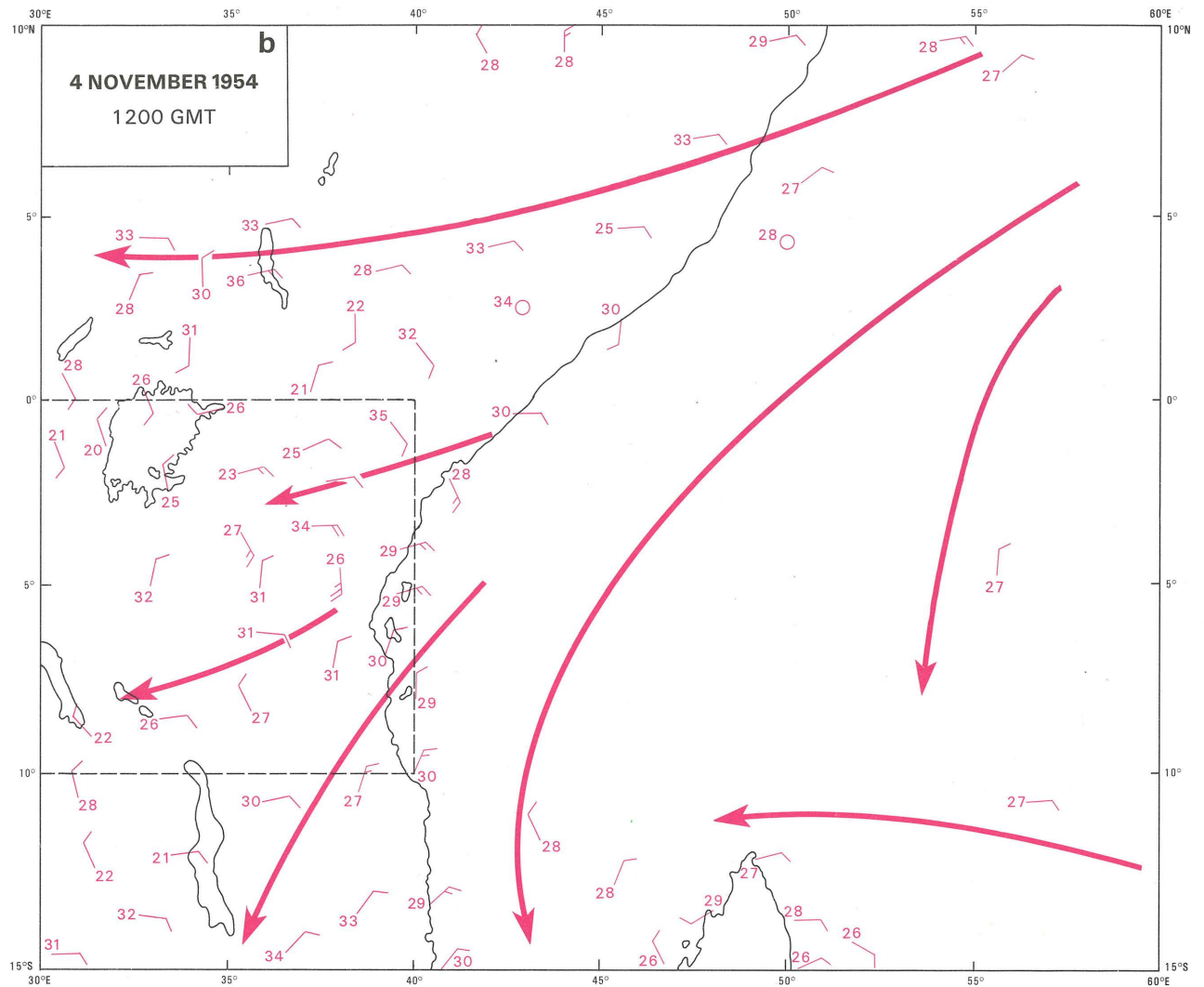
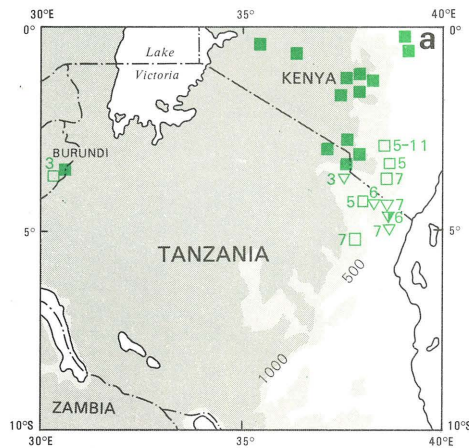
Fig. C13.4 INVASION OF KENYA, LATE OCTOBER 1954

a Places and dates with locust reports (see p 27)

26-31 October 1954

■ Swarms reported 21-25 October

b Weather map for 25 October 1954 at 1200 GMT



Prepared by Directorate of Overseas Surveys 1979

Fig. C13.5 INVASION OF TANZANIA, EARLY NOVEMBER 1954

a Places and dates with locust reports (see p 27)
3-7 November 1954

■ Swarms reported 29 October to 2 November

b Weather map for 4 November 1954 at 1200 GMT

0 400 800Km
 SCALE (Approx)
 Contour values are shown in metres

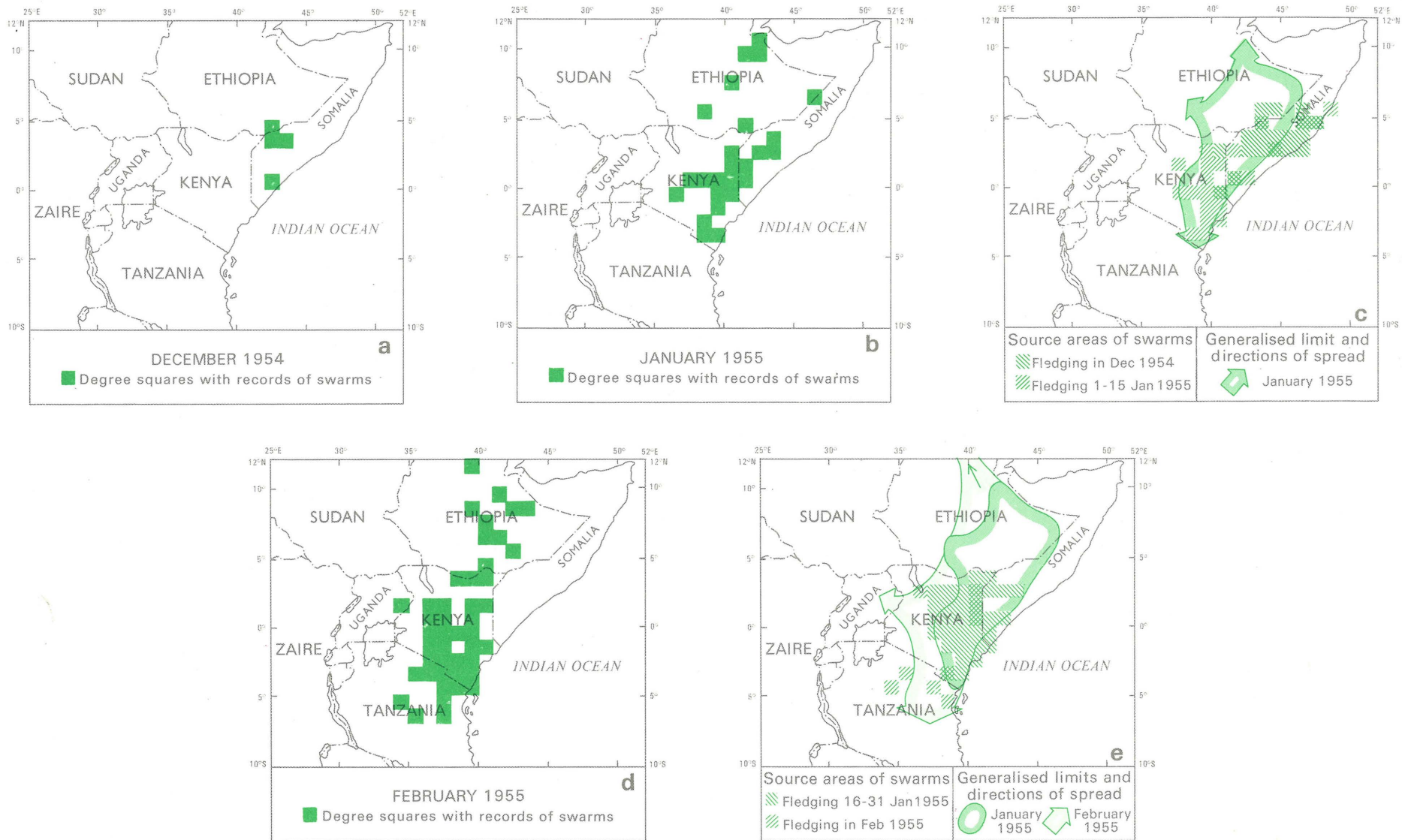


Fig. S14 (see opposite page)

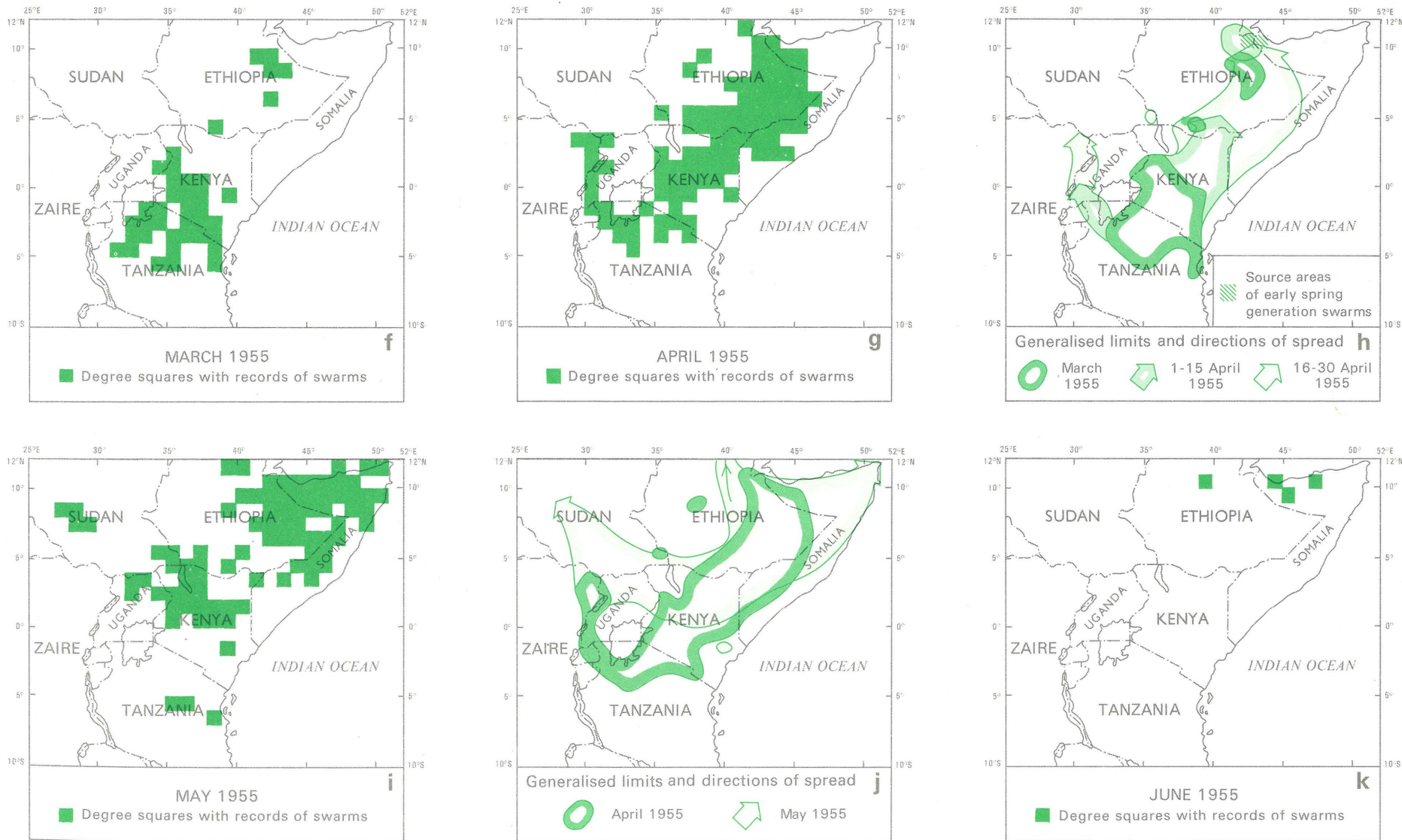


Fig. S14 a-k. 1954-55 SHORT RAINS GENERATION SWARMS IN THE SOUTH CENTRAL REGION
 Figs. a,b,d,f,g,i, and k show the monthly distribution of swarms by degree squares. From April 1955 they include swarms of the early 1955 spring generation, and in May they include swarms of the early Long Rains generation. Arrows on Figs. c,e,h, and j show schematically the spread of swarms (see p 27)

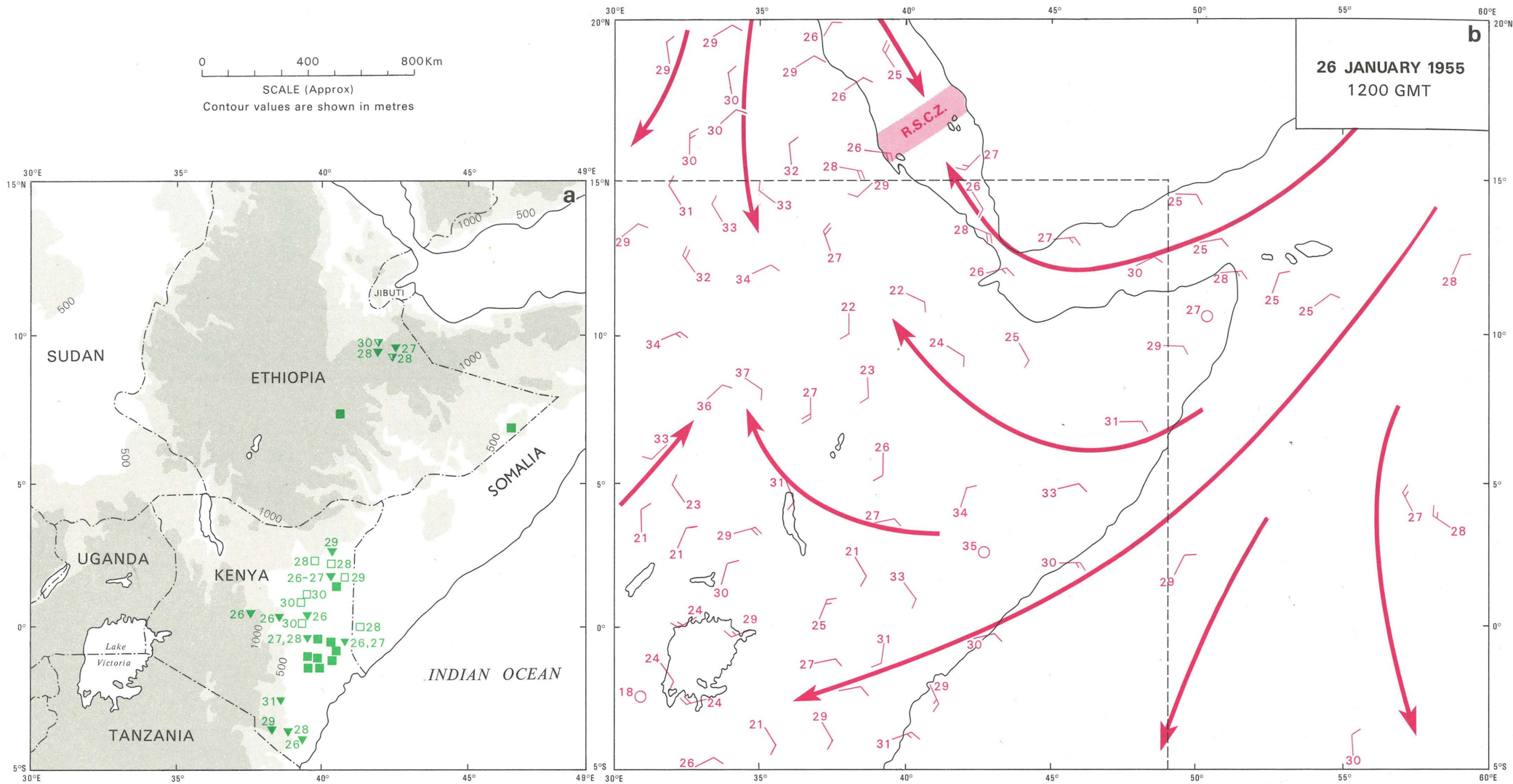


Fig. C14.1 SHORT RAINS GENERATION SWARMS IN SOUTH-CENTRAL REGION, LATE JANUARY 1955

a Places and dates with locust reports (see p 27)

26-31 January 1955

■ Swarms reported 20-25 January 1955

b Weather map for 26 January 1955 at 1200 GMT

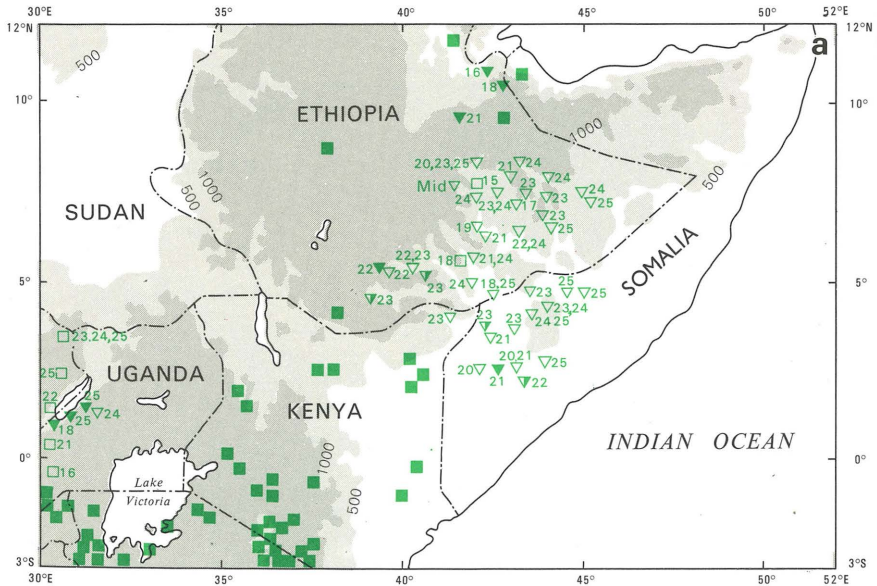
Prepared by Directorate of Overseas Surveys 1979

Fig. C14.2 SHORT RAINS GENERATION SWARMS IN ETHIOPIA AND SOMALIA, APRIL 1955

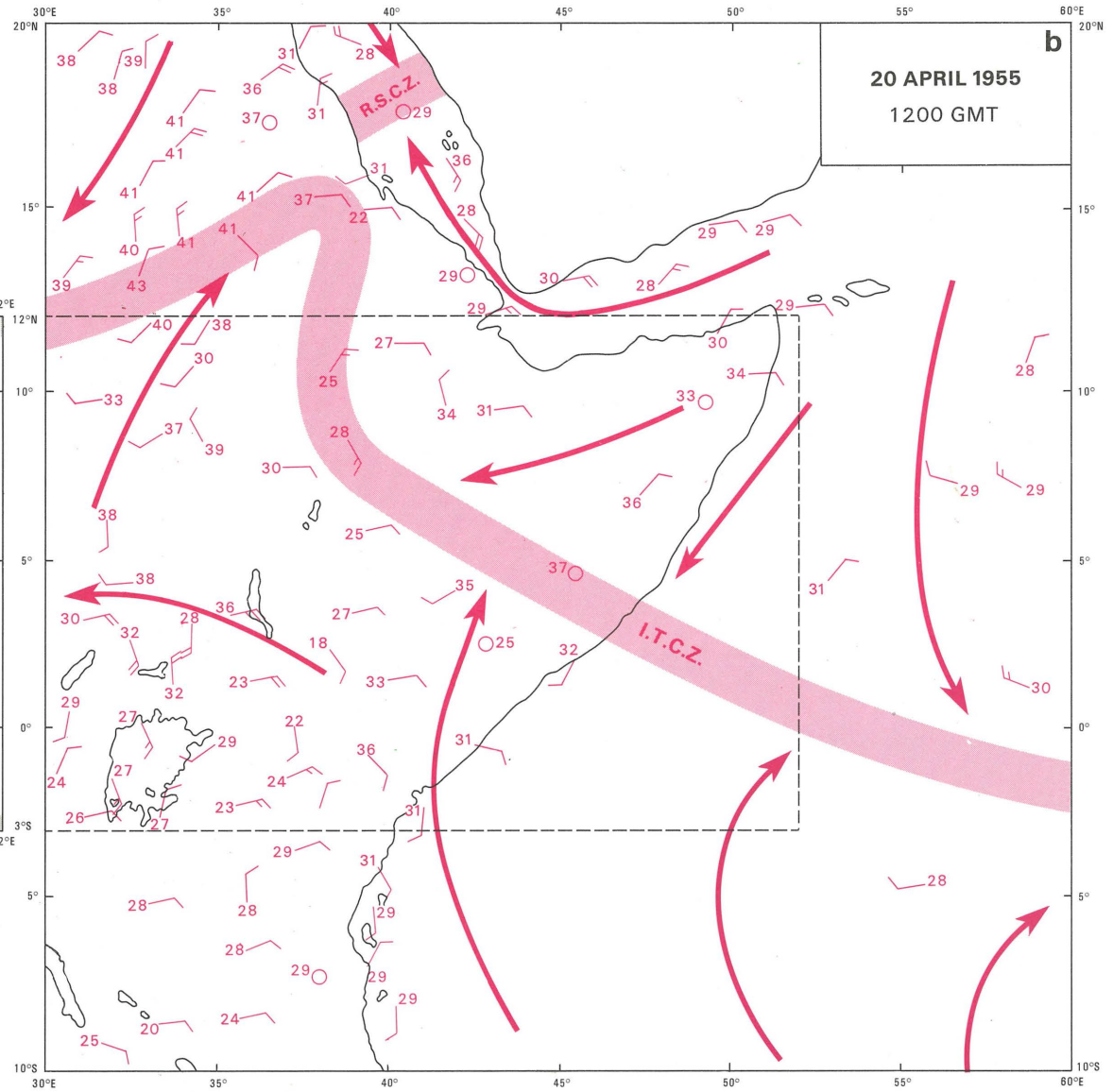
a Places and dates with locust reports (see p 27)
16-25 April 1955

■ Swarms reported 1-15 April 1955

b Weather map for 20 April 1955 at 1200 GMT



0 400 800Km
 SCALE (Approx)
 Contour values are shown in metres



Prepared by Directorate of Overseas Surveys 1979

Fig. C14.3 SWARMS WEST OF LAKE VICTORIA, APRIL 1955

a Places and dates with locust reports (see p 27)
west of 32°E April 1955

■ Swarms reported east of 32°E 26 March-5 April 1955

b Weather map for 4 April 1955 at 1200 GMT

0 400 800Km
 SCALE (Approx)
 Contour values are shown in metres

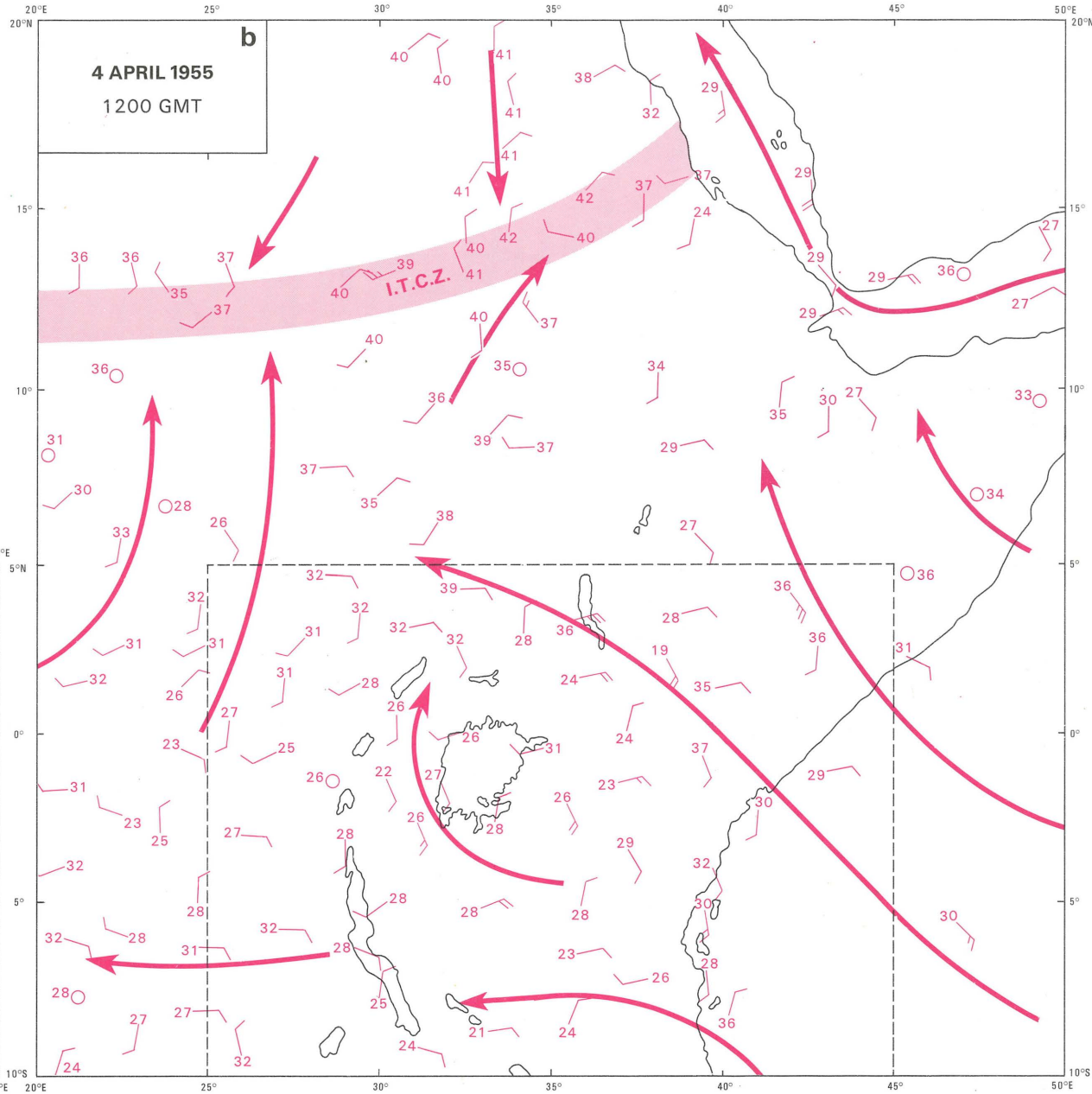
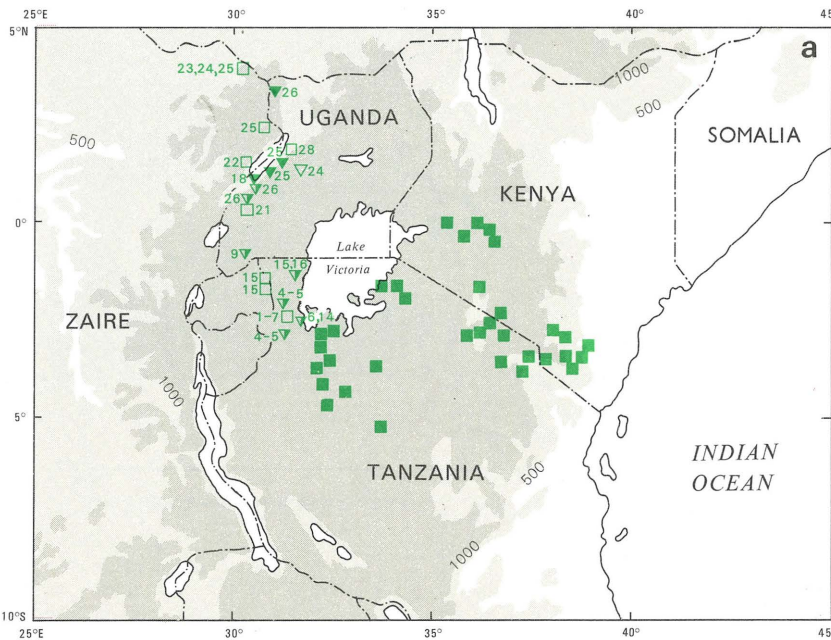
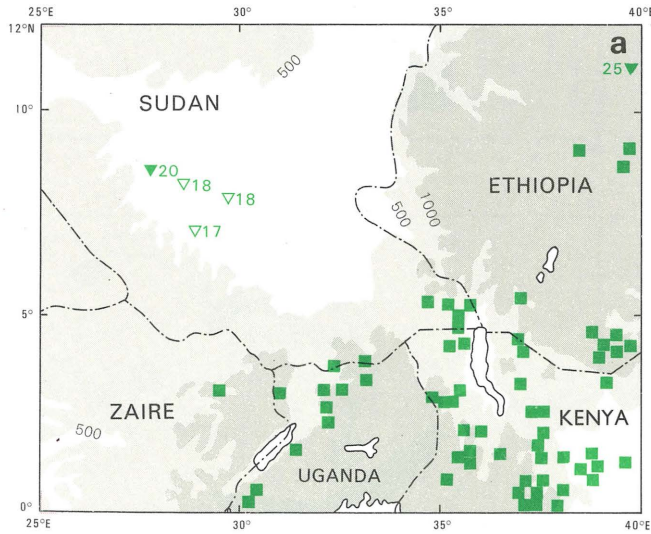


Fig. C14.4 INVASION OF SOUTHERN SUDAN, MAY 1955

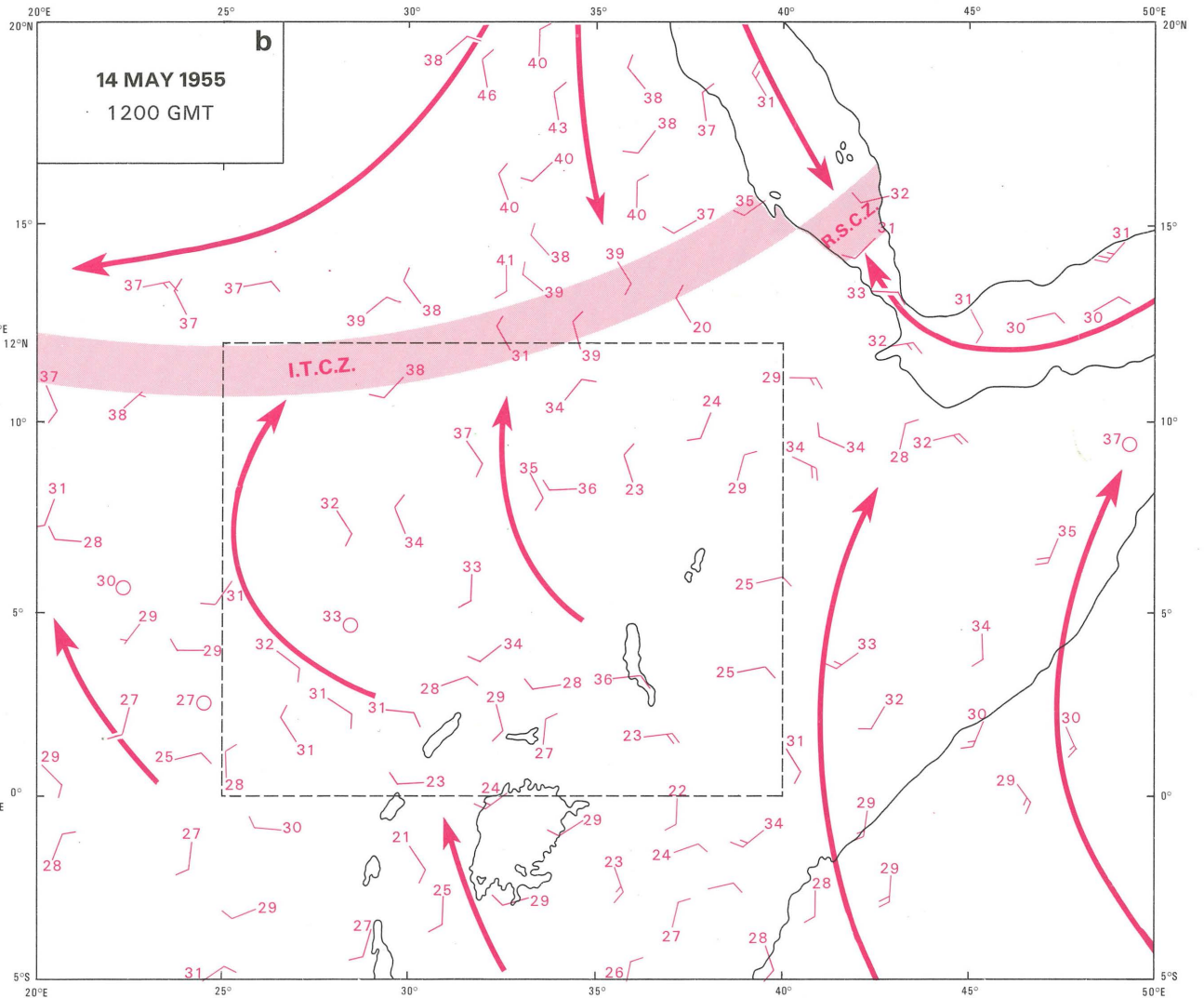
a Places and dates with locust reports (see p 27)
south of 12°N 10-25 May 1955

■ Swarms reported 26 April-15 May 1955

b Weather map for 14 May 1955 at 1200 GMT



0 400 800Km
SCALE (Approx)
Contour values are shown in metres



Prepared by Directorate of Overseas Surveys 1979

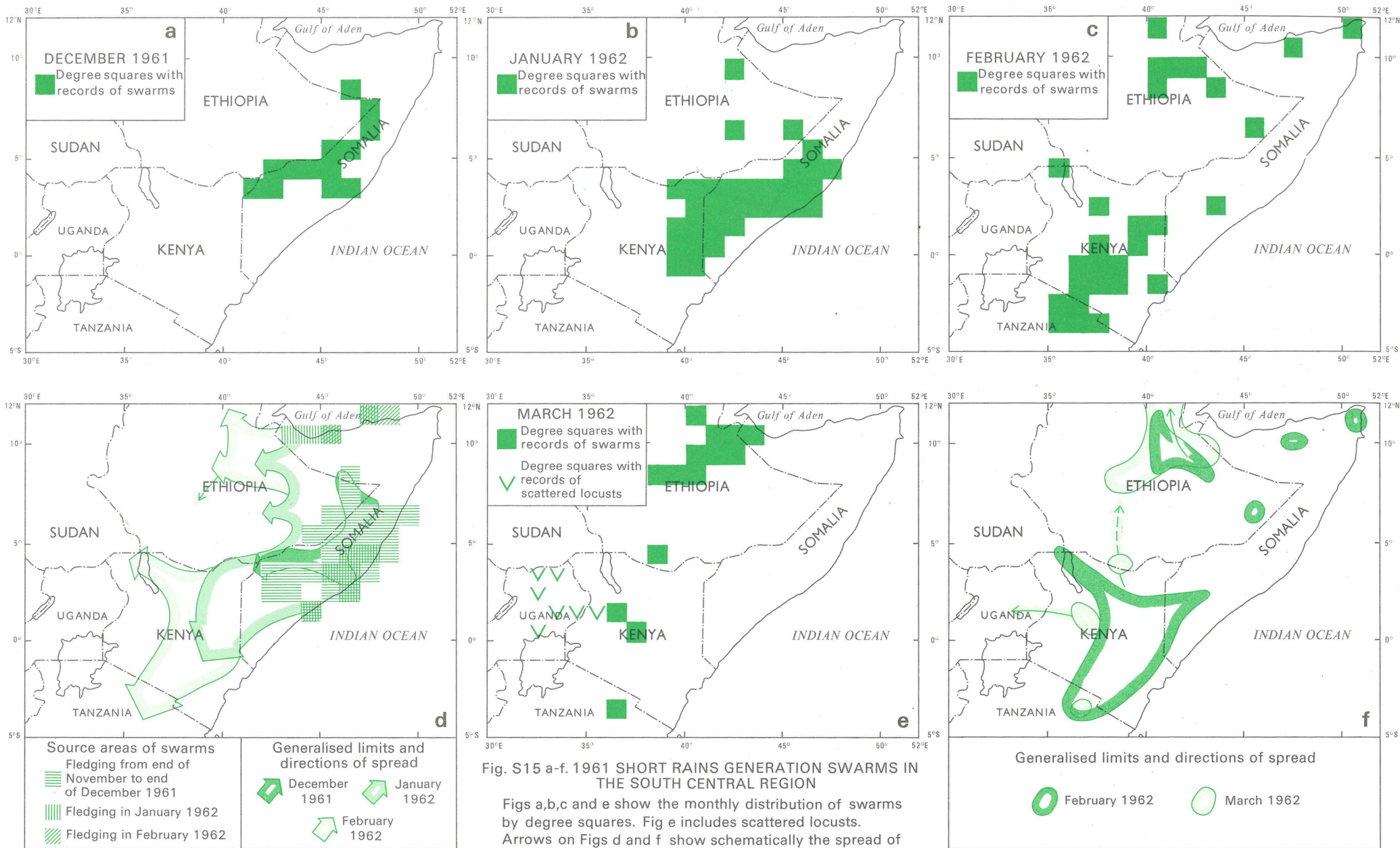


Fig. S15 a-f. 1961 SHORT RAINS GENERATION SWARMS IN THE SOUTH CENTRAL REGION

Figs a,b,c and e show the monthly distribution of swarms by degree squares. Fig e includes scattered locusts. Arrows on Figs d and f show schematically the spread of swarms (see p 27)

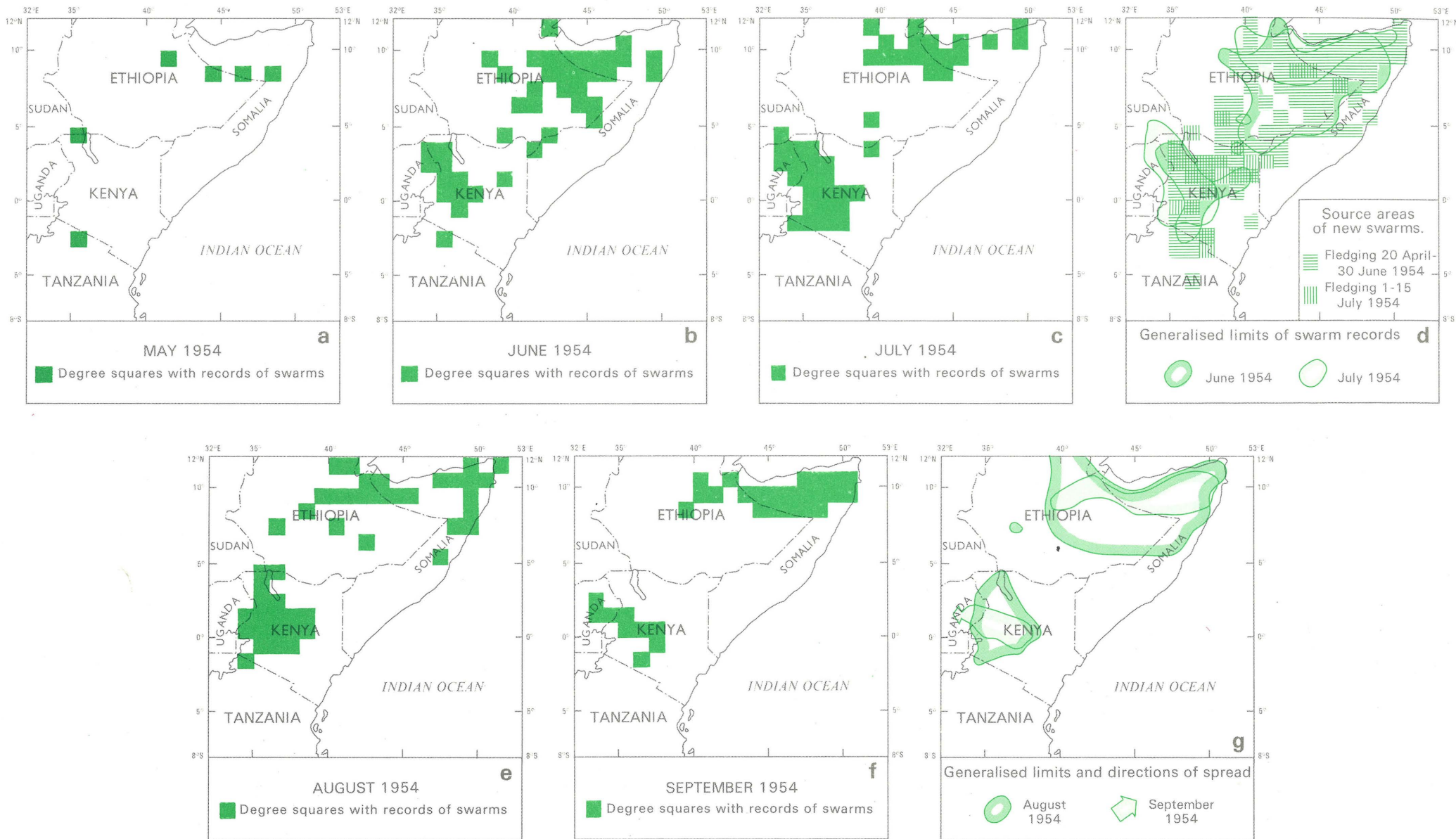


Fig. S16 a-g.1954 LONG RAINS GENERATION SWARMS IN THE SOUTH CENTRAL REGION, MAY TO SEPTEMBER 1954

Figs. a,b,c,e and f show the monthly distribution of swarms by degree squares.

Arrows on Figs. d and g show schematically the spread of swarms (see p 27)

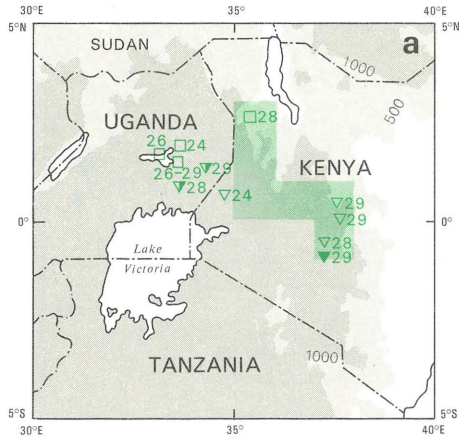
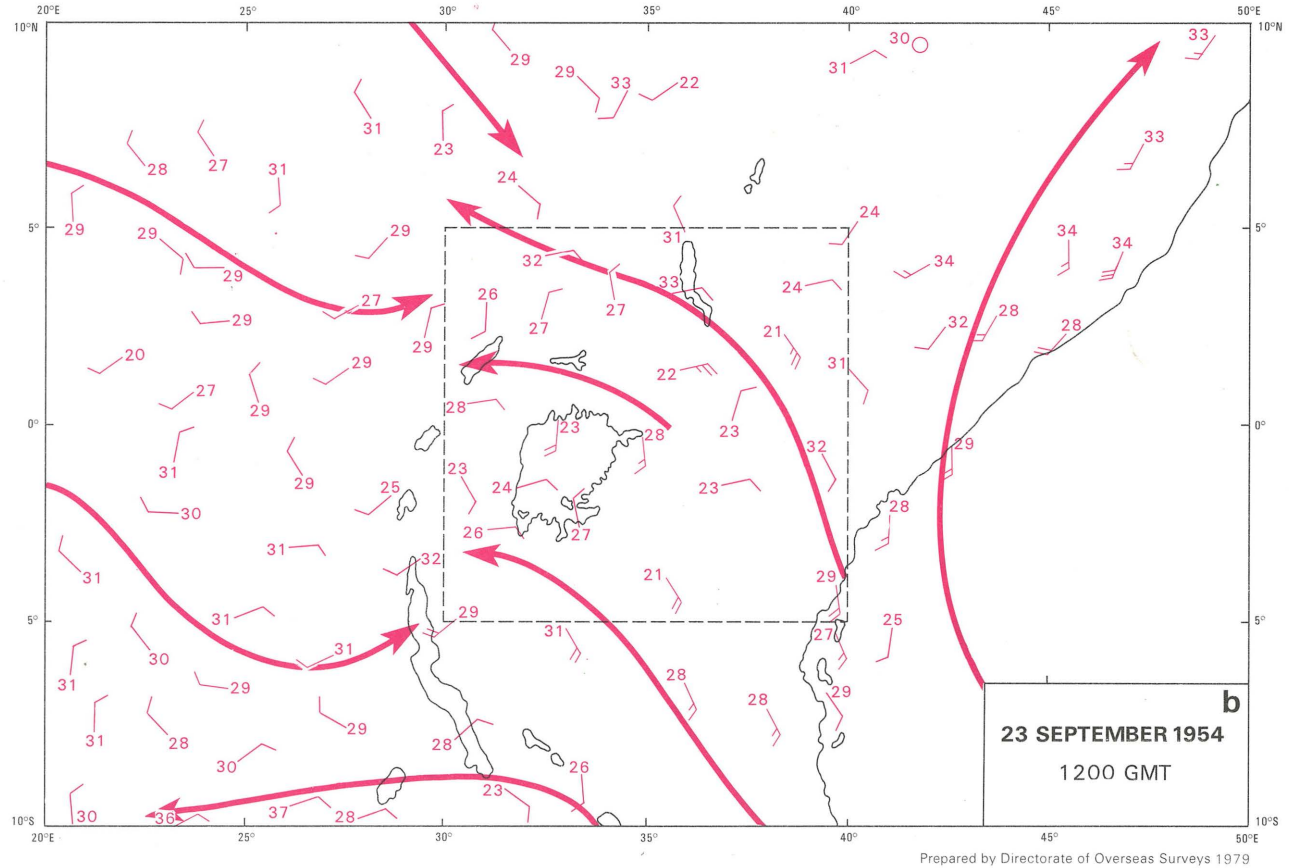
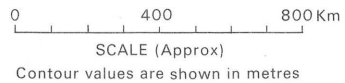


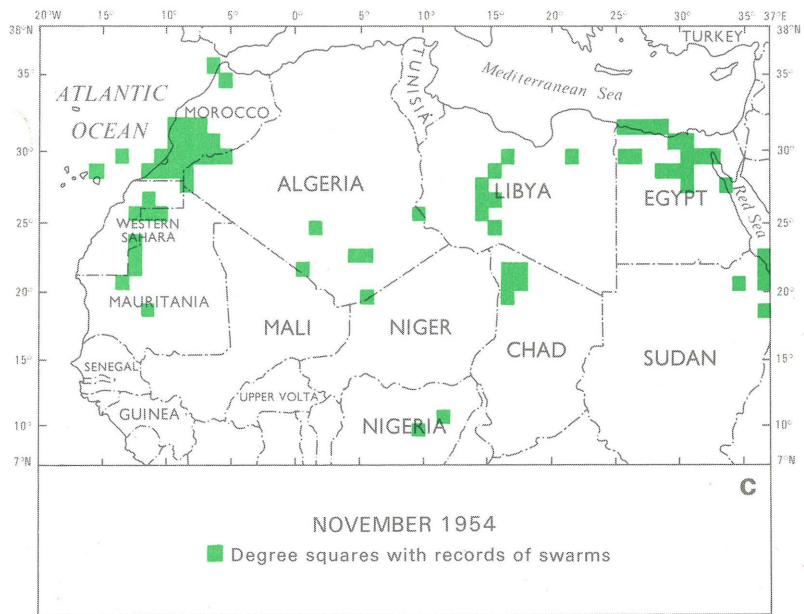
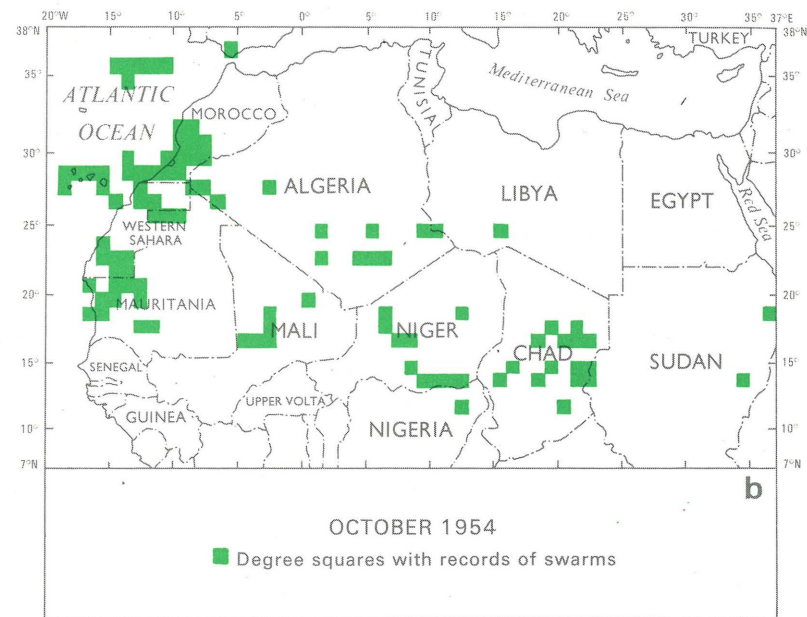
Fig. C16.1 INVASION OF UGANDA, SEPTEMBER 1954

a Places and dates with locust reports (see p 27)
24-30 September 1954

■ Degree squares with swarm reports 1-23 September

b Weather map for 23 September 1954 at 1200 GMT





F
Oct-Dec

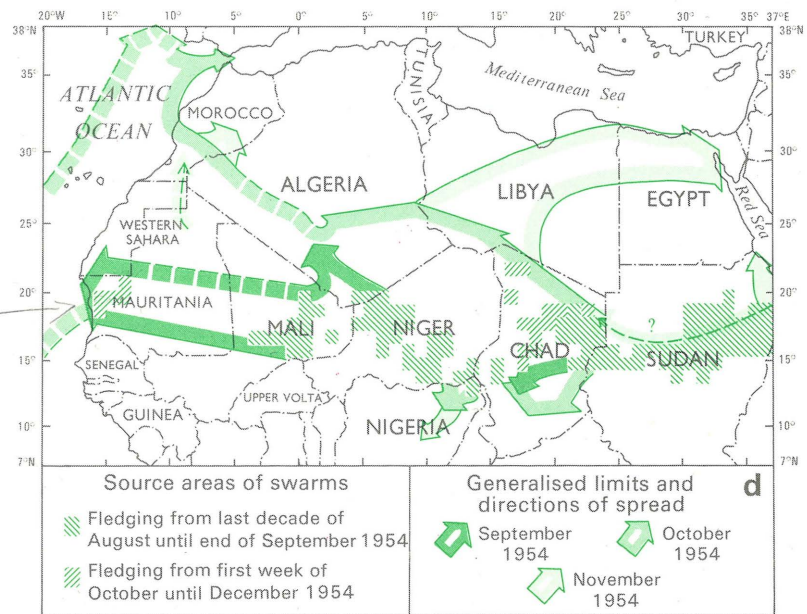


Fig. S17 (see opposite page)

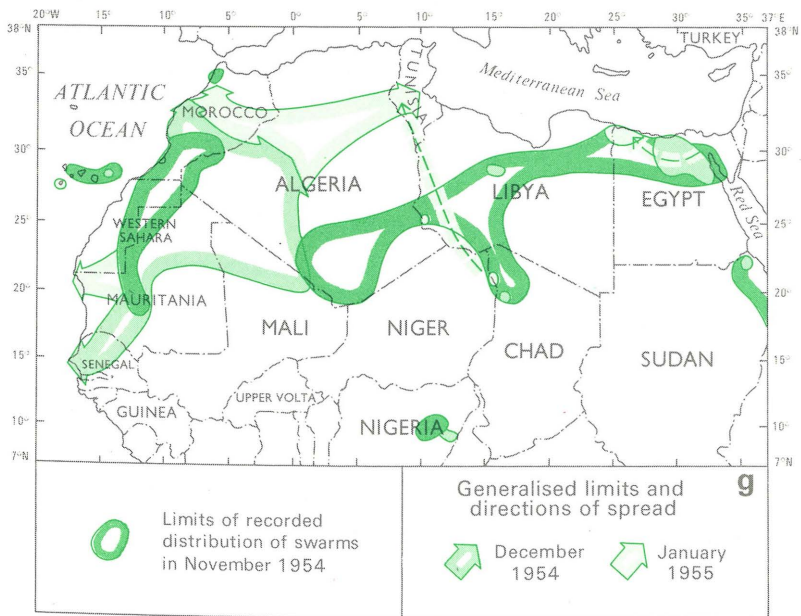
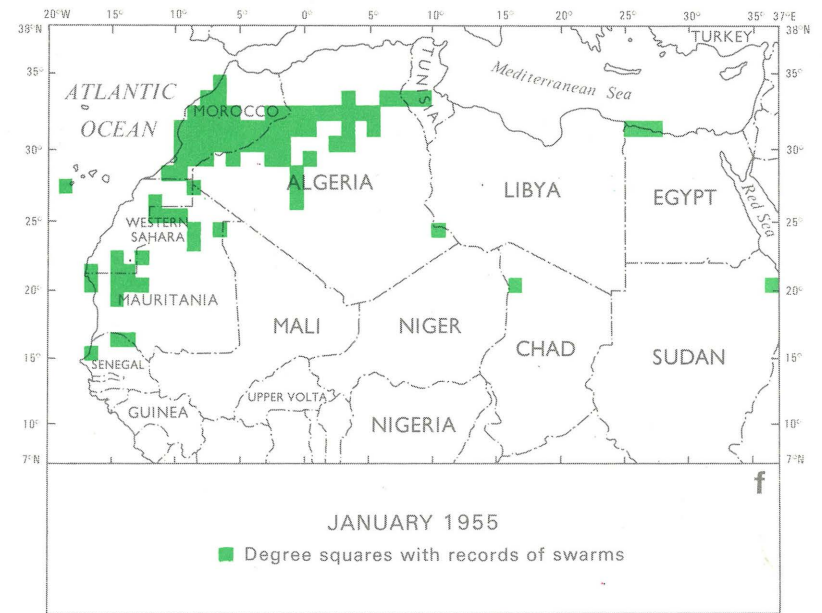
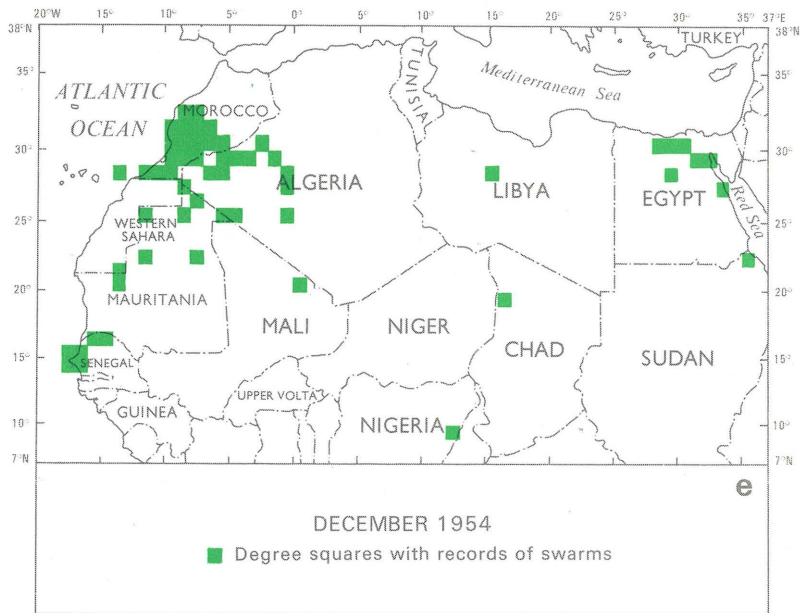


Fig. S17 a-n. 1954 SUMMER GENERATION SWARMS IN THE WESTERN REGION

Figs. a,b,c,e,f,h,i,k,l and m show the monthly distribution of swarms by degree squares. Arrows on Figs.d,g,j and n show schematically the spread of swarms (see p 27)

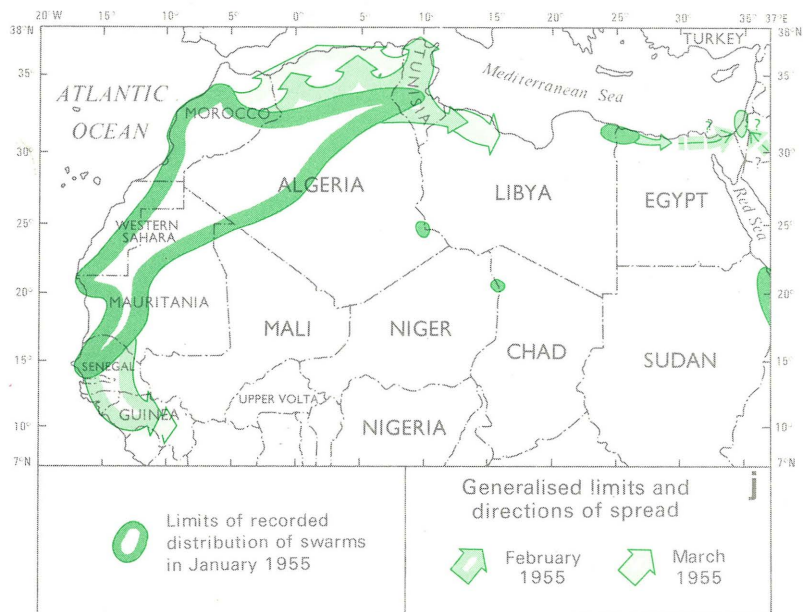
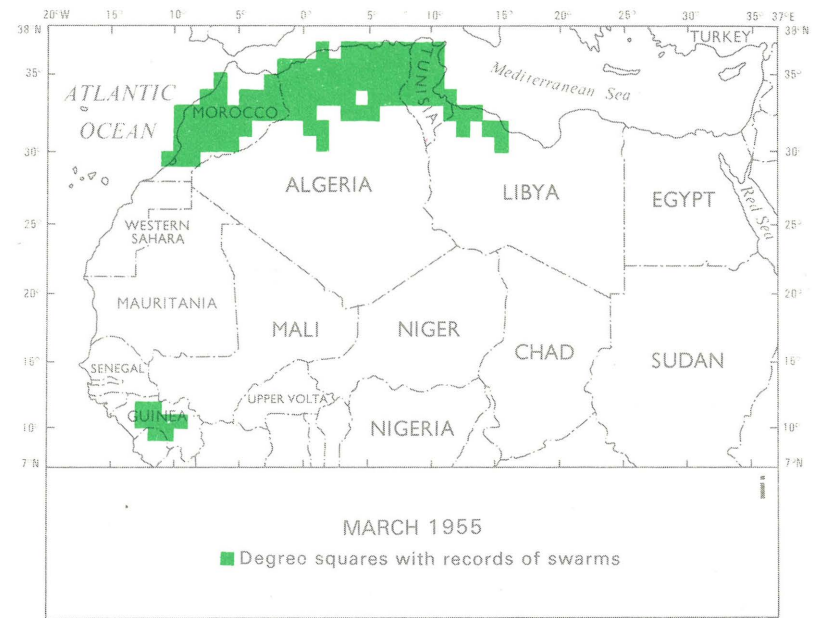
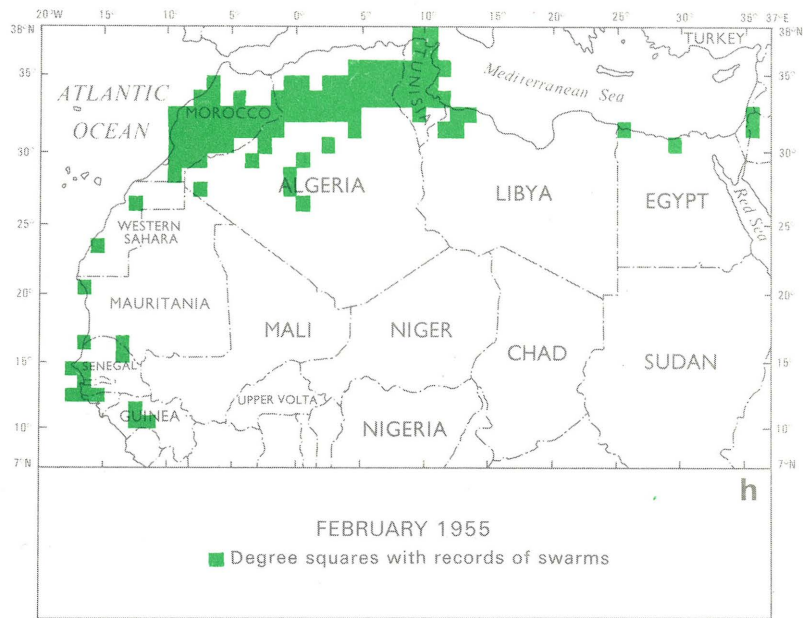
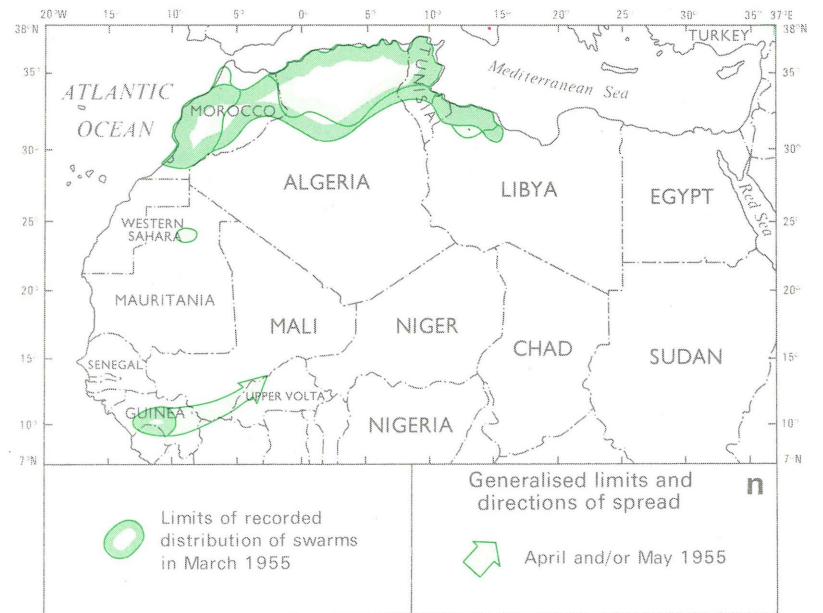
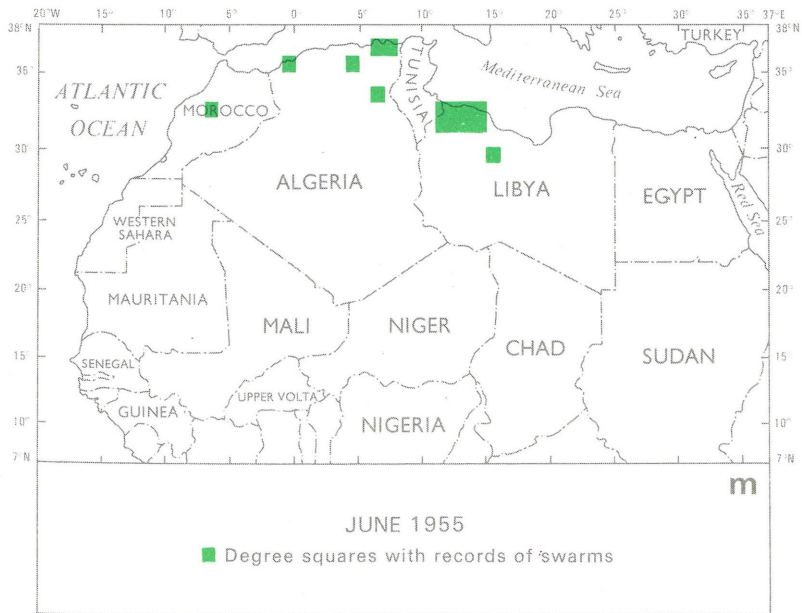
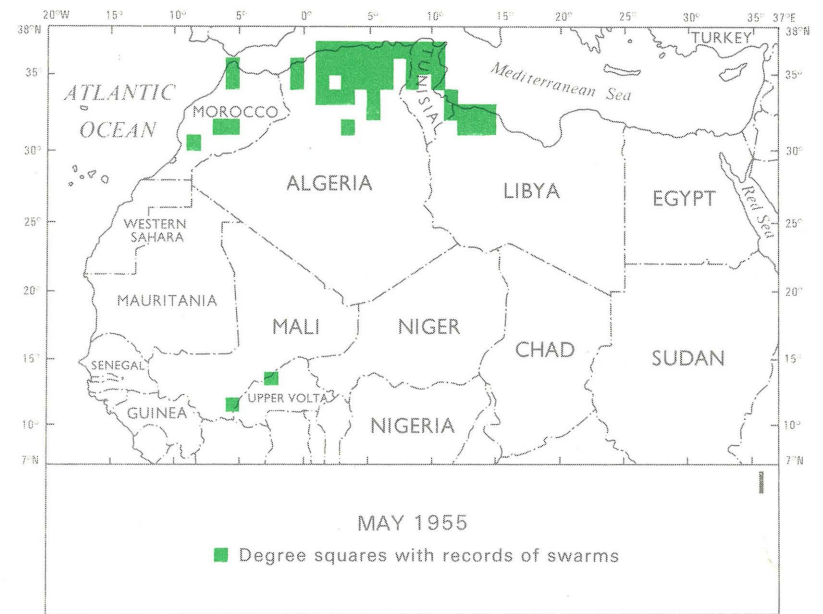
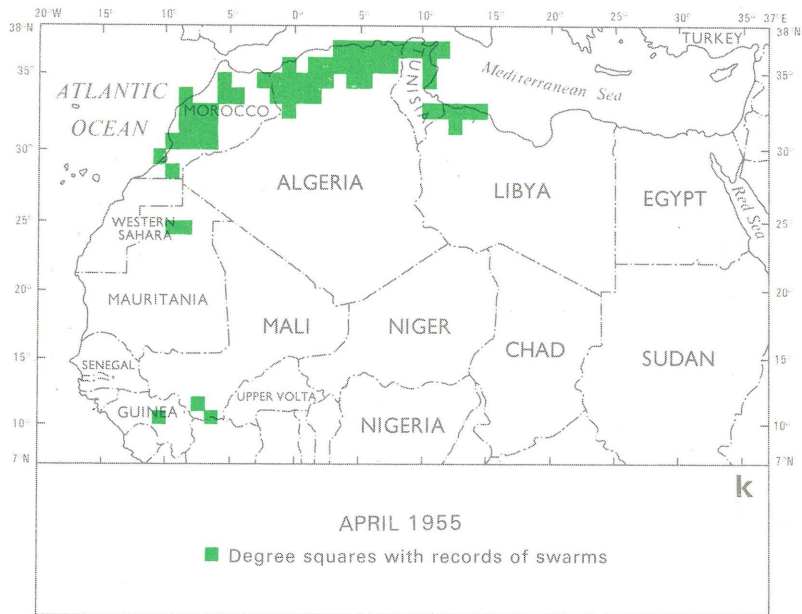


Fig. S17 a-n 1954 SUMMER GENERATION SWARMS IN THE WESTERN REGION

Figs. a, b, c, e, f, h, i, k, l and m show the monthly distribution of swarms by degree squares. Arrows on Figs. d, g, j, and n show schematically the spread of swarms (see p 27)



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Fig. S17 (see opposite page)

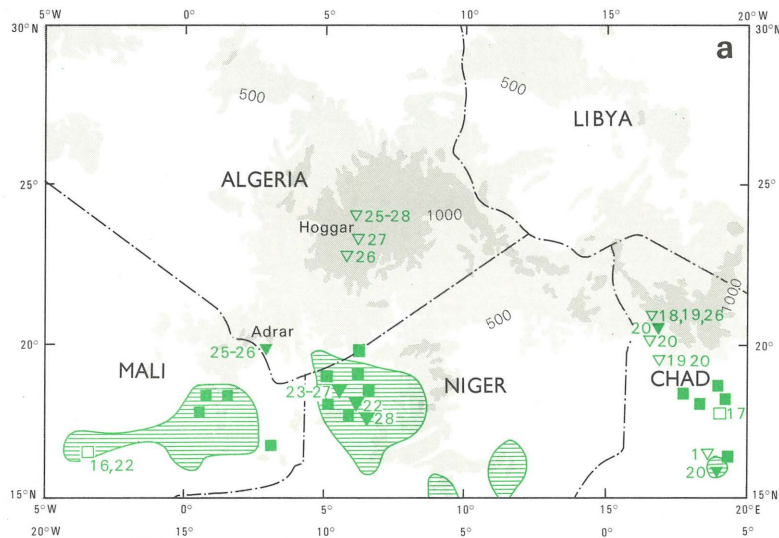


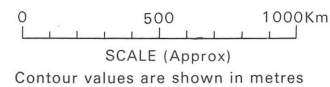
Fig. C17.1 INVASION OF SOUTHERN ALGERIA, LATE SEPTEMBER 1954

a Places and dates with Locust reports (see p 27)

1-28 September 1954

- Mature swarms reported during the second half of August 1954.
- Breeding areas where fledging is estimated to have begun by mid-September 1954.

b Weather map for 23 September 1954 at 1200 GMT



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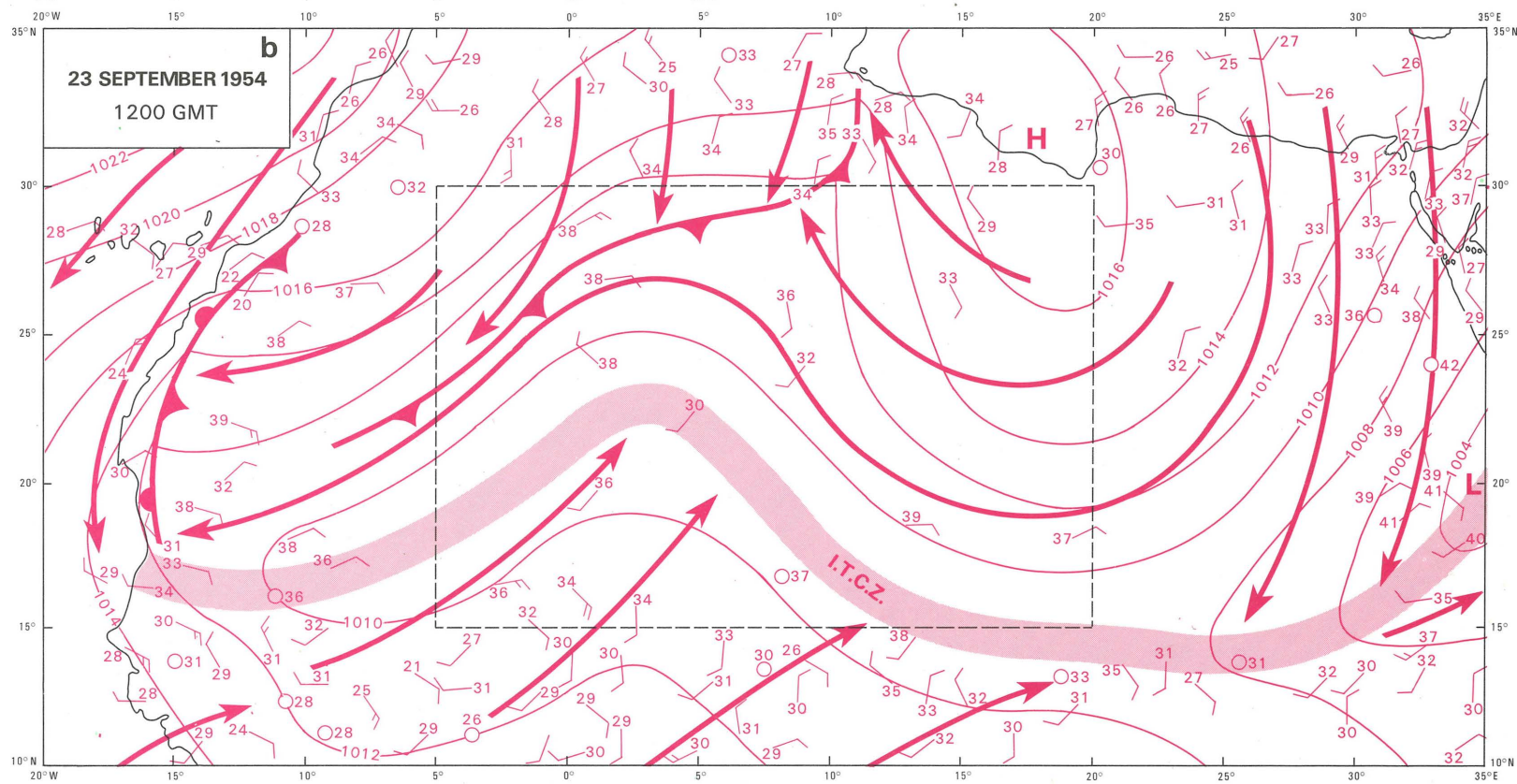



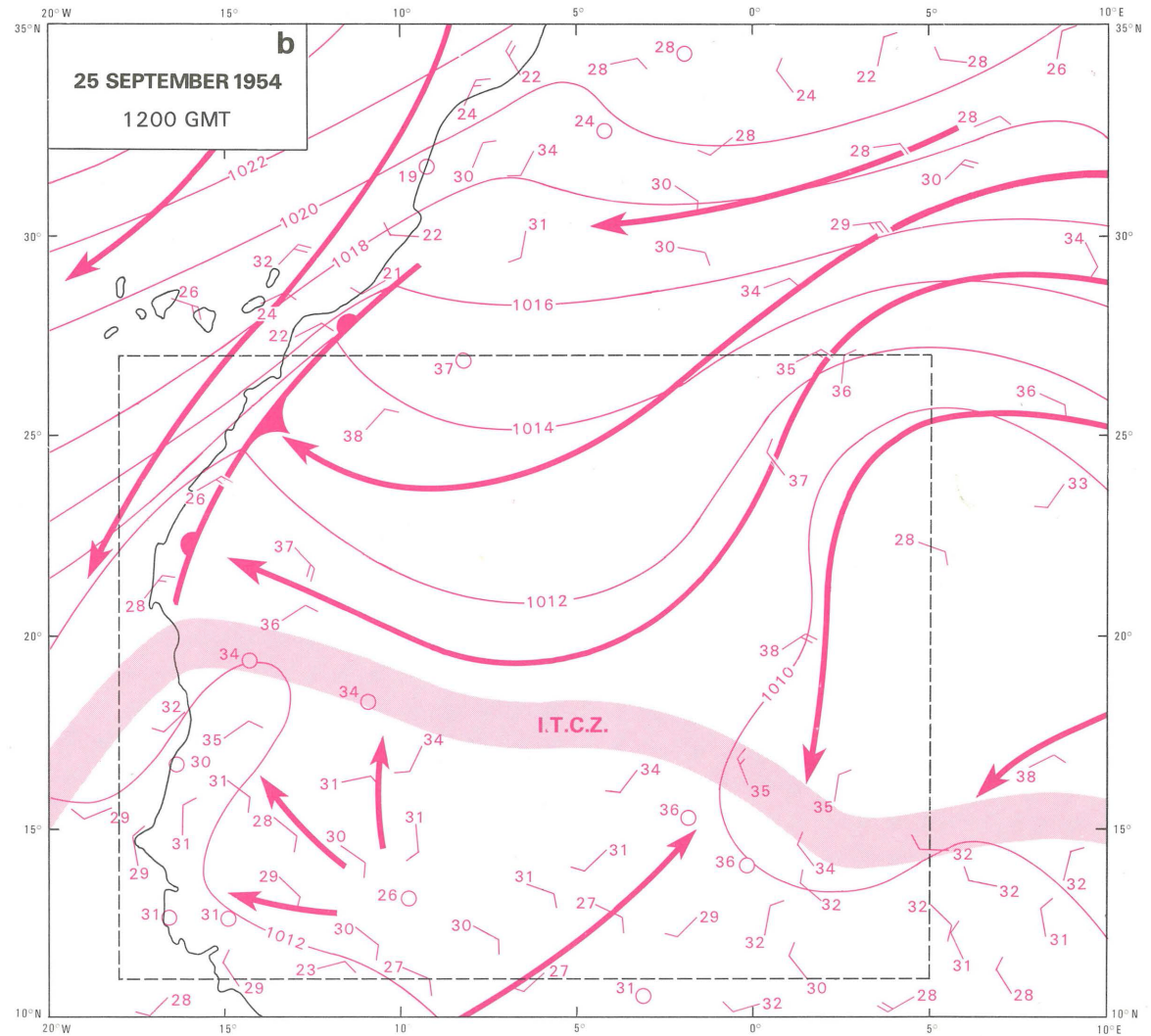
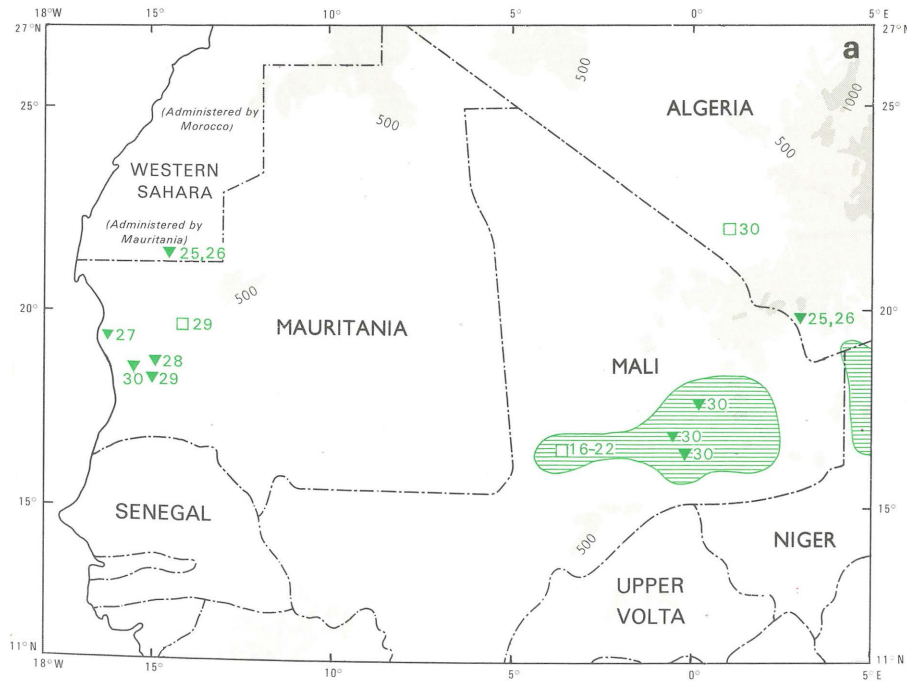
Fig. C17.2 INVASION OF SOUTHERN MAURITANIAN WESTERN SAHARA AND WESTERN MAURITANIA, LATE SEPTEMBER 1954

a Places and dates with locust reports (see p 27)
September 1954

 Breeding areas where fledging is estimated to have begun by the second half of August 1954

b Weather map for 25 September 1954 at 1200 GMT

0 400 800 Km
 SCALE (Approx)
 Contour values are shown in metres



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Fig. C17.3 IMMATURE SWARMS IN CHAD AND NIGERIA SOUTH OF THE SUMMER BREEDING AREAS, LATE SEPTEMBER TO EARLY OCTOBER 1954

a Places and dates with locust reports (see p 27)

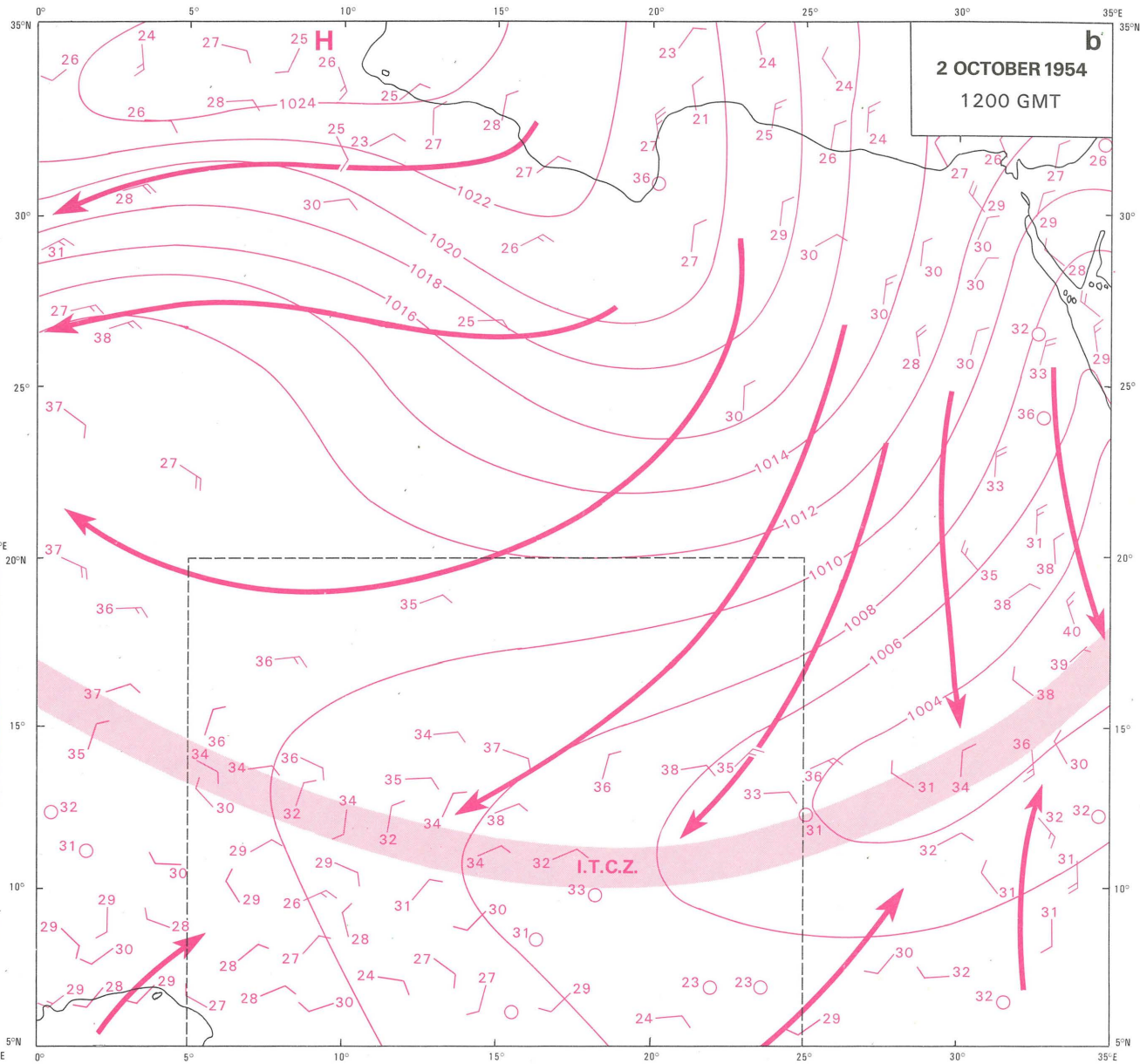
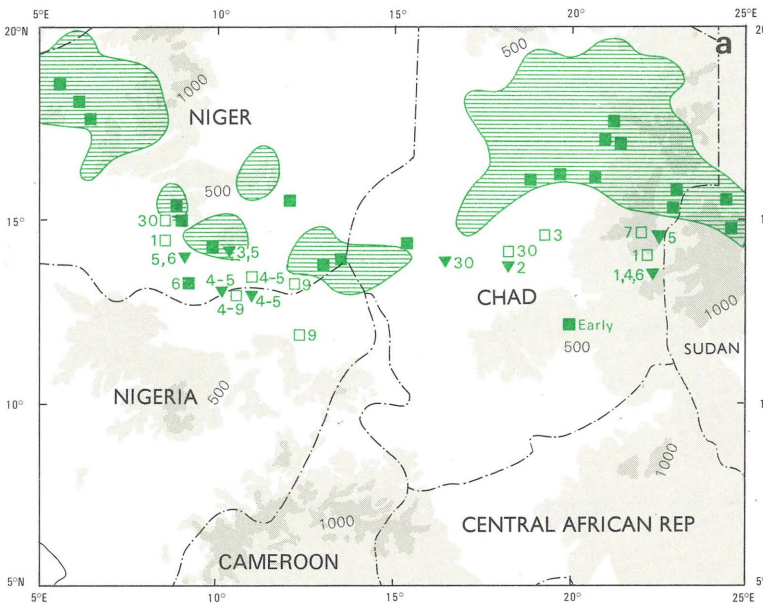
30 September - 9 October 1954

south of the September swarms and of the summer breeding areas, shown

■ Immature swarms reported from 20-29 September 1954

b Weather map for 2 October 1954 at 1200 GMT

0 400 800 Km
SCALE (Approx)
Contour values are shown in metres



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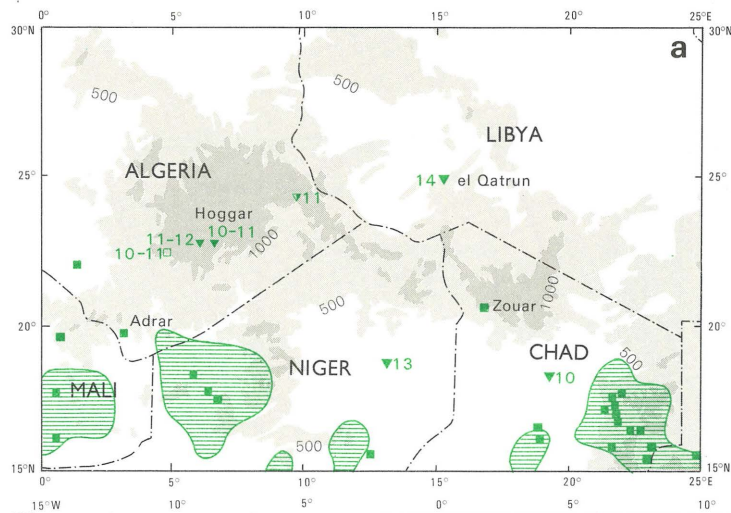


Fig. C17.4 NORTHWARD SPREAD OF IMMATURE SWARMS IN ALGERIA AND LIBYA, MID-OCTOBER 1954.

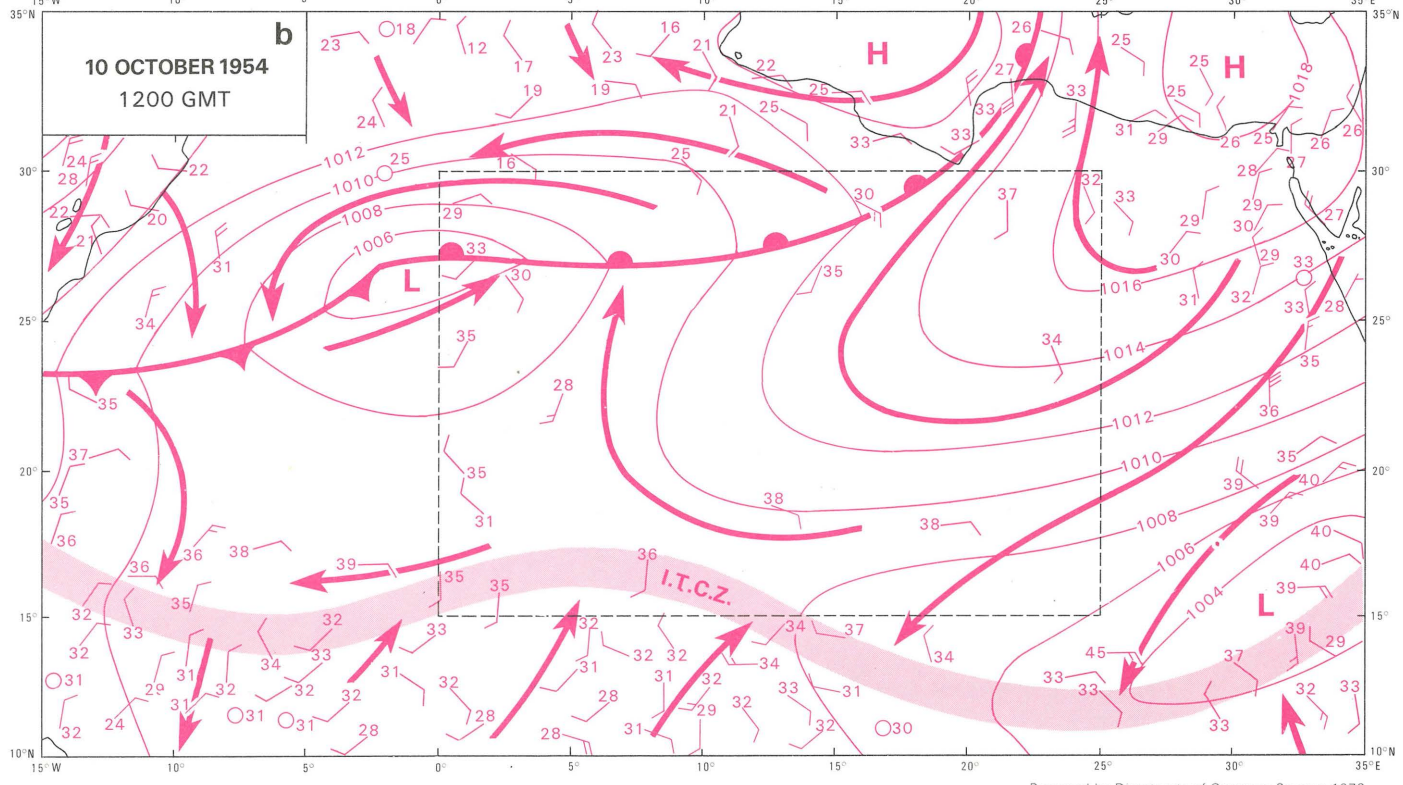
a Places and dates with locust reports (see p 27)
10-14 October 1954

outside the breeding areas where fledging is estimated to have begun by the first week of October 1954

■ Immature swarms reported in the second half of September and the first ten days of October 1954

b Weather map for 10 October 1954 at 1200 GMT

0 500 1000Km
 SCALE (Approx)
 Contour values are shown in metres



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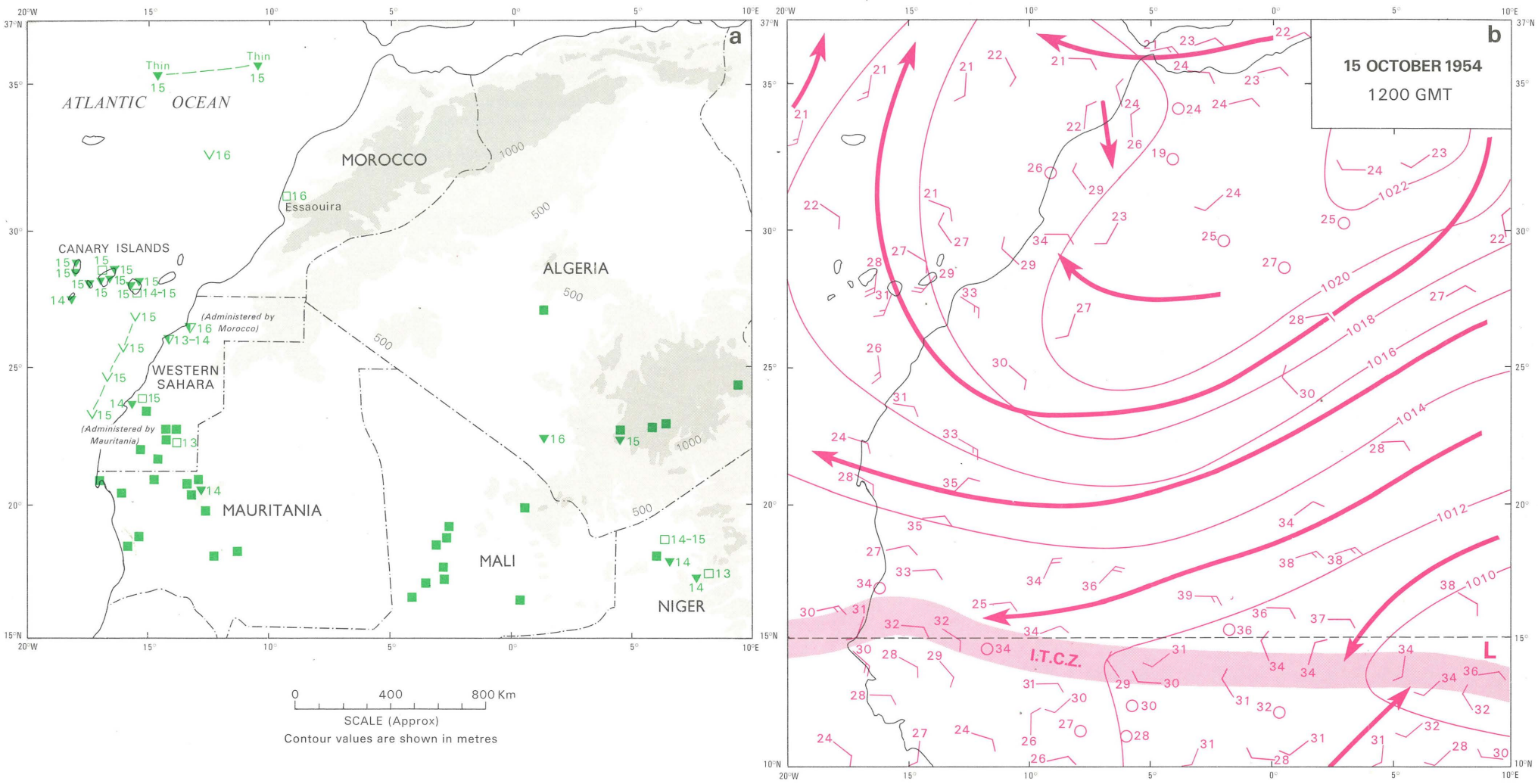


Fig. C17.5 INVASION OF CANARY ISLANDS AND MOROCCO, MID-OCTOBER 1954

a Places and dates with locust reports (see p 27)

13-16 October 1954

■ Summer generation swarms reported 1-12 October 1954.

b Weather map for 15 October 1954 at 1200 GMT

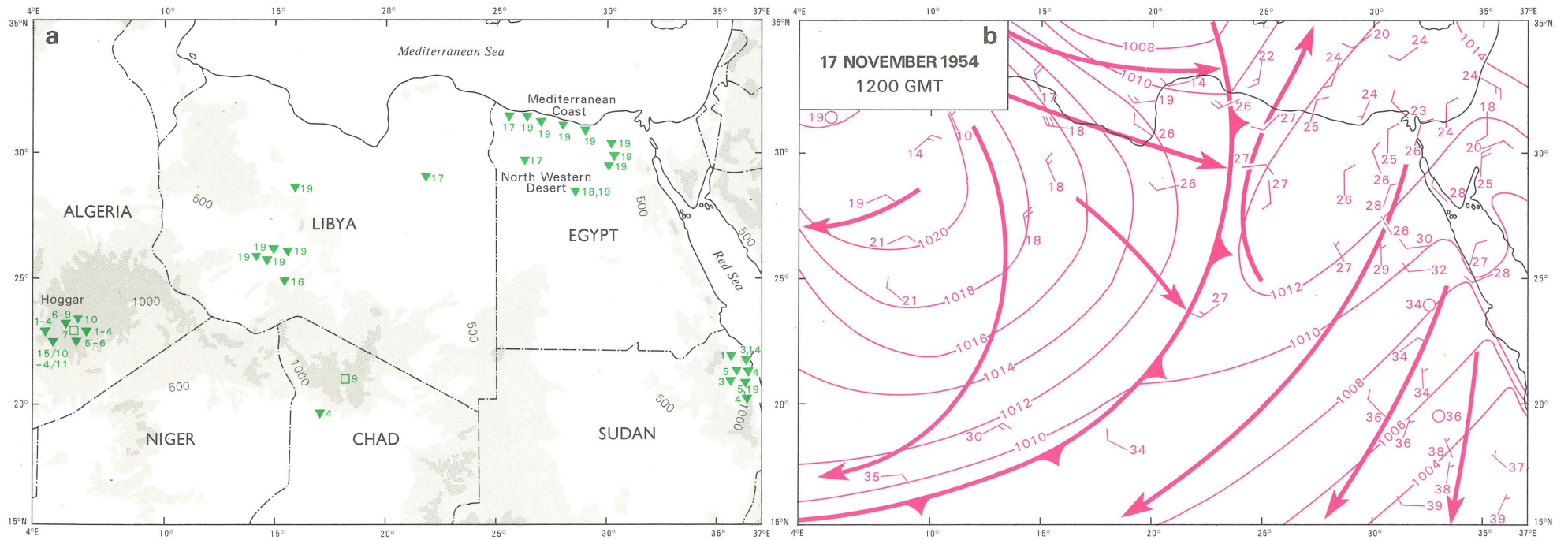


Fig. C17.6 INVASION OF EGYPT, MID-NOVEMBER 1954

a Places and dates with locust reports (see p 27)
1-19 November 1954

b Weather map for 17 November 1954 at 1200 GMT

0 500 1000 Km
 SCALE (Approx)
 Contour values are shown in metres

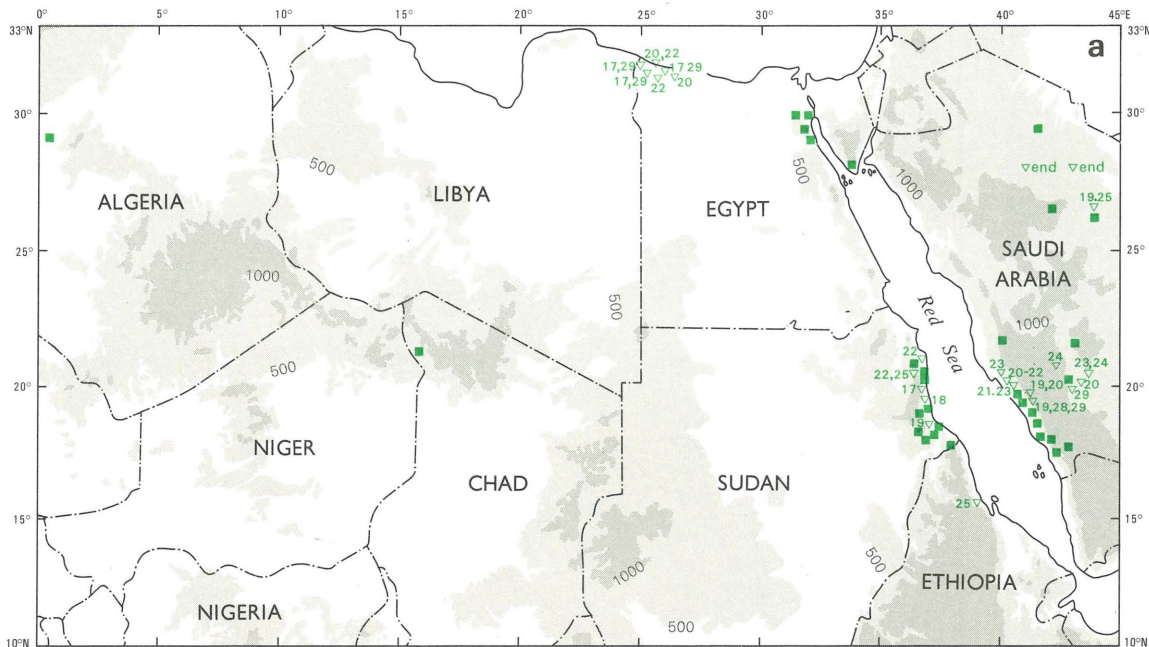


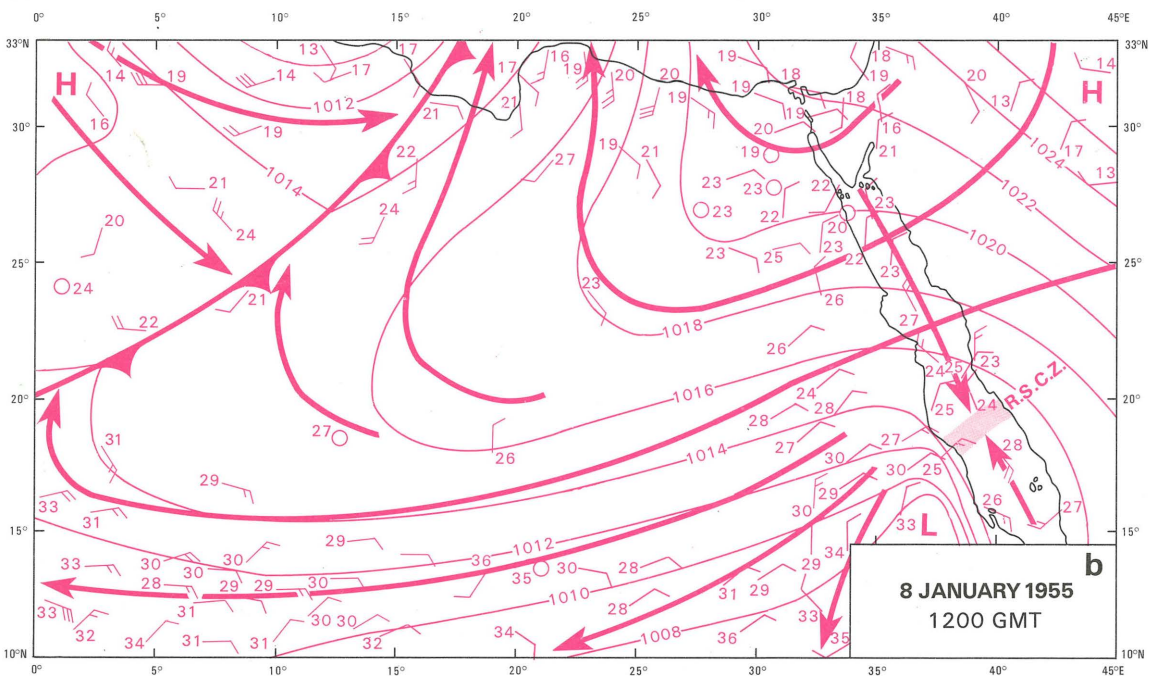
Fig. C17.7 INVASION OF NORTH-WESTERN EGYPT, MID-JANUARY 1955

a Places and dates with locust reports (see p 27)
17-29 January 1955

■ Swarms reported during the last week of December 1954 and up to 16 January 1955

b Weather map for 8 January 1955 at 1200 GMT

0 500 1000 Km
 SCALE (Approx)
 Contour values are shown in metres



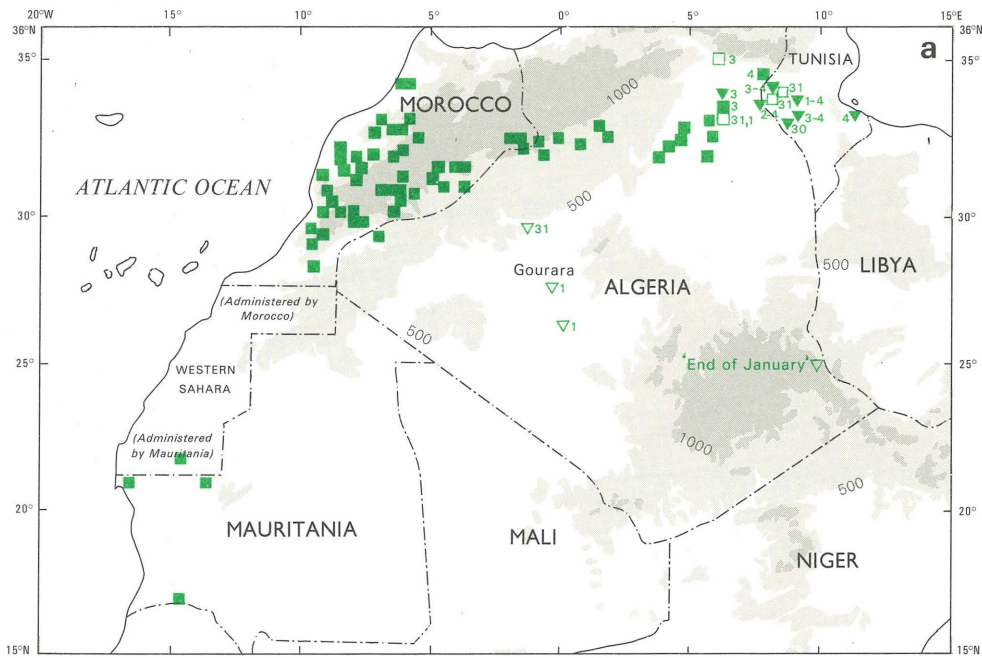


Fig. C17.8 INVASION OF TUNISIA AND CENTRAL ALGERIA, LATE JANUARY TO EARLY FEBRUARY 1955

a Places and dates with locust reports (see p 27)

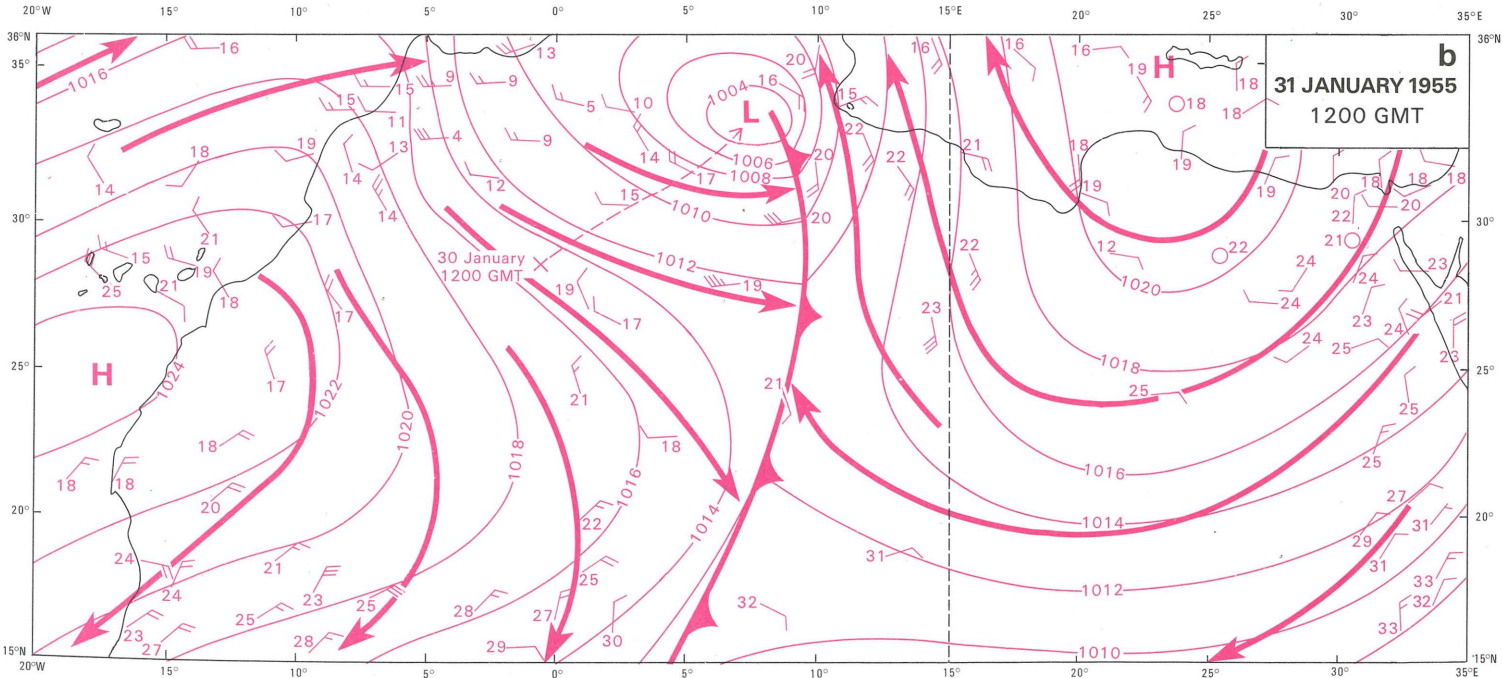
30 January-4 February 1955

east and south of swarms reported

20-29 January 1955 shown thus ■

b Weather map for 31 January 1955 at 1200 GMT

0 500 1000 Km
SCALE (Approx)
Contour values are shown in metres



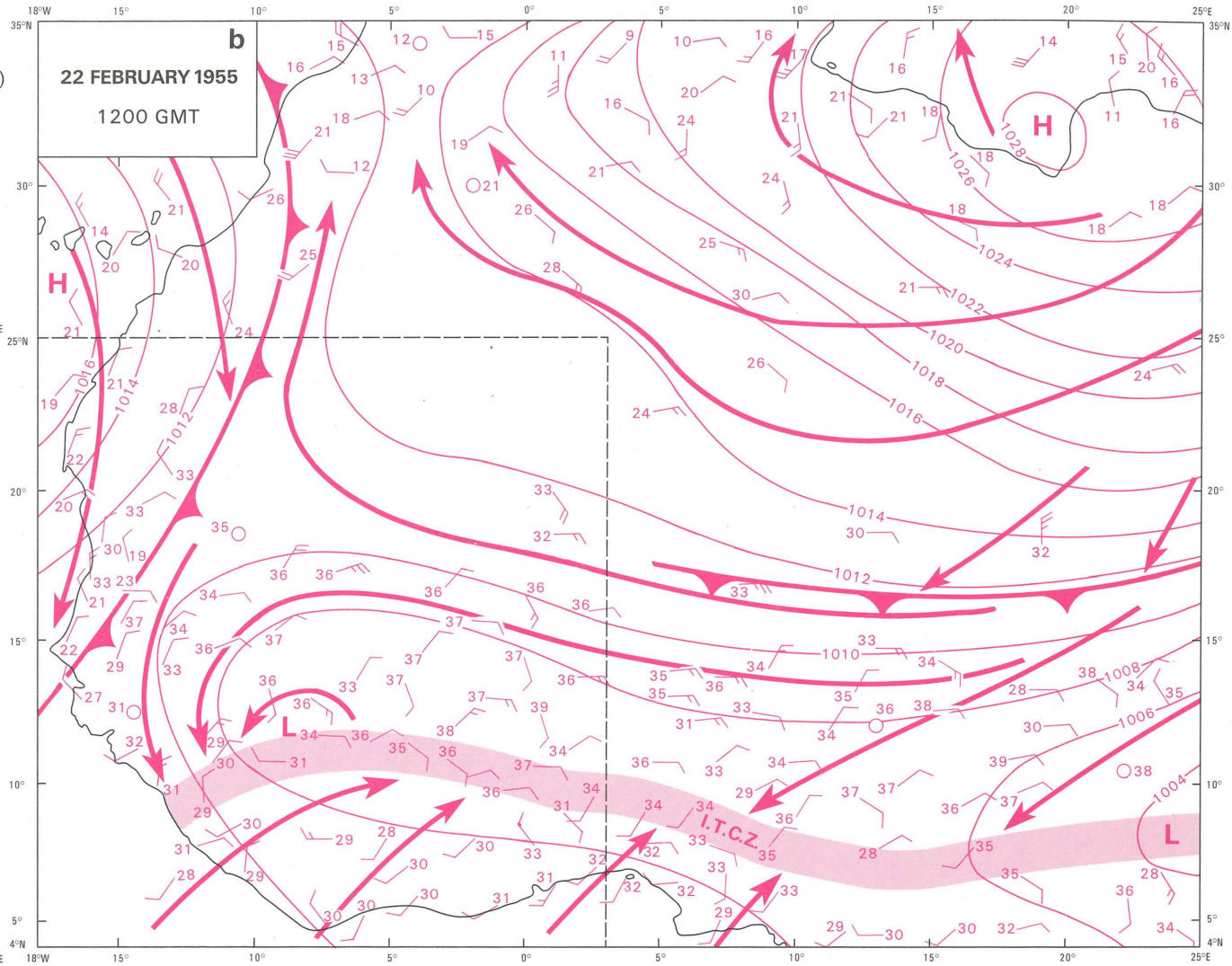
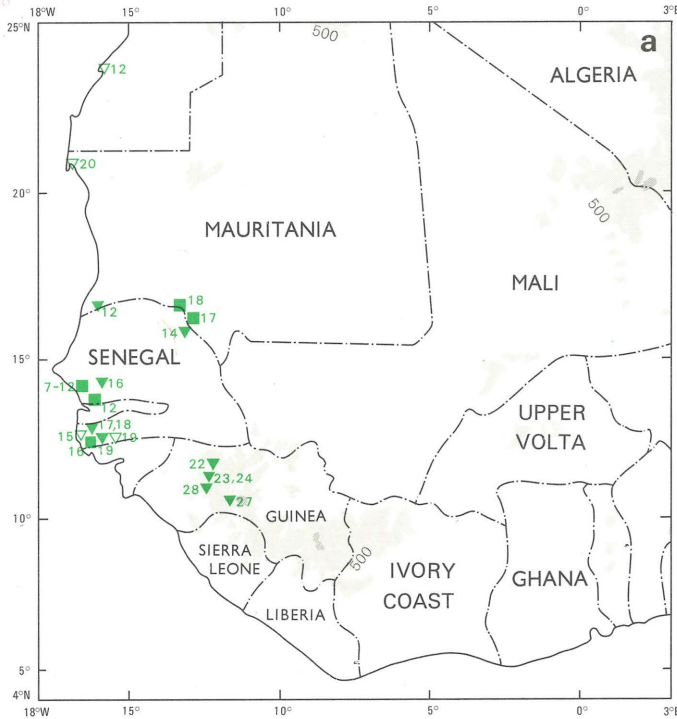
Prepared by Directorate of Overseas Surveys 1979

Fig. C17.9 INVASION OF GUINEA, LATE FEBRUARY 1955

a Places and dates with locust reports (see p 27)
February 1955

b Weather map for 22 February 1955
at 1200 GMT

0 500 1000 Km
SCALE (Approx)
Contour values are shown in metres



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Fig. C17.10 INVASION OF SOUTHERN MALI, EARLY APRIL 1955

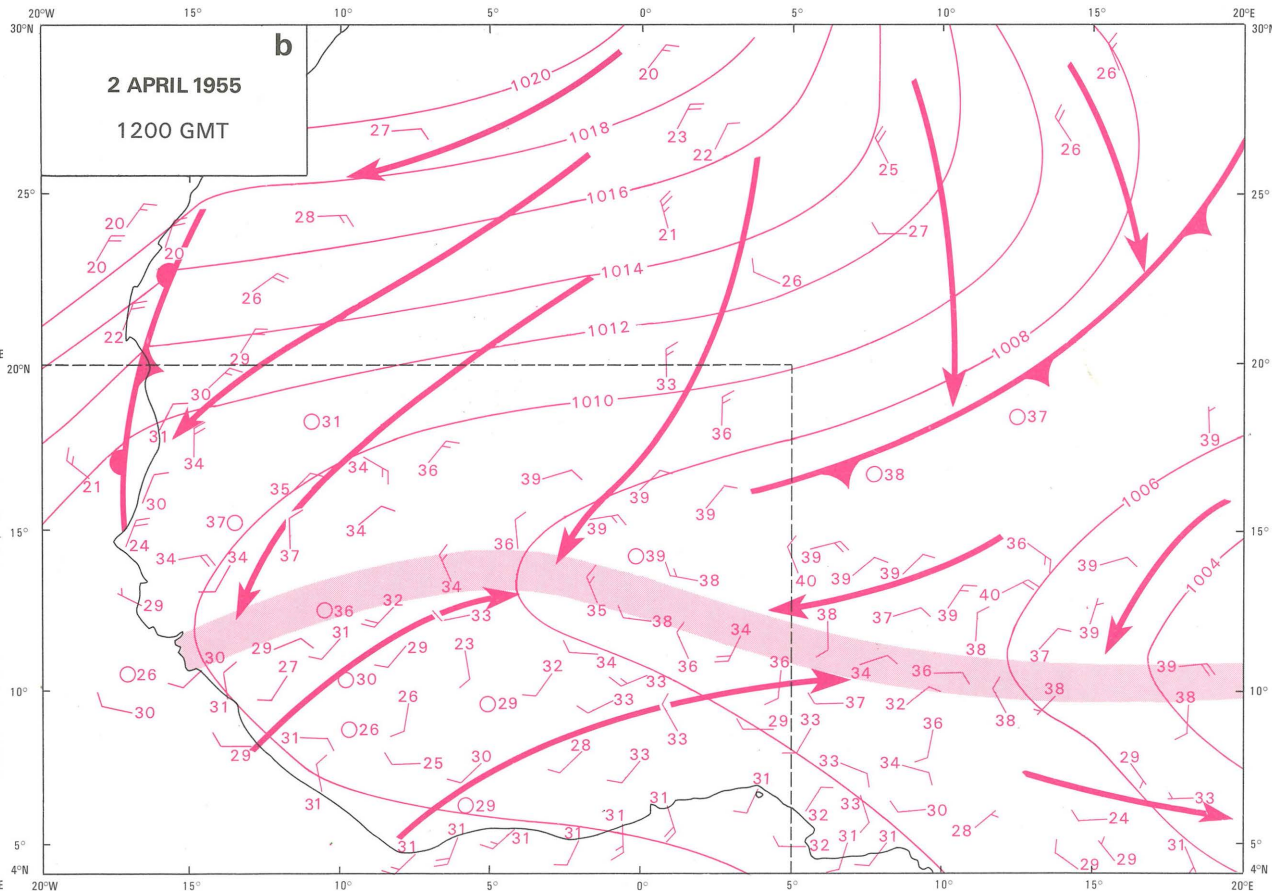
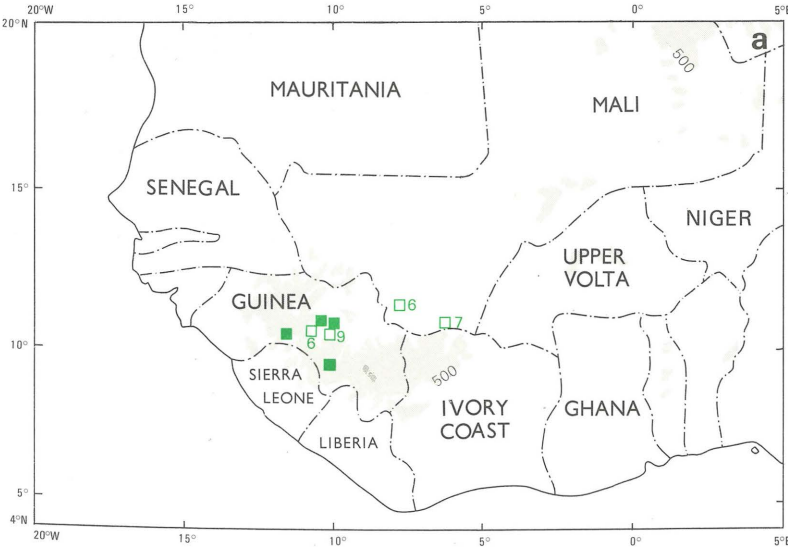
a Places and dates with locust reports (see p 27)
early April 1955

east of swarms reported in March

■ Swarms reported during the second half of March 1955

b Weather map for 2 April 1955 at 1200 GMT

0 500 1000 Km
 SCALE (Approx)
 Contour values are shown in metres



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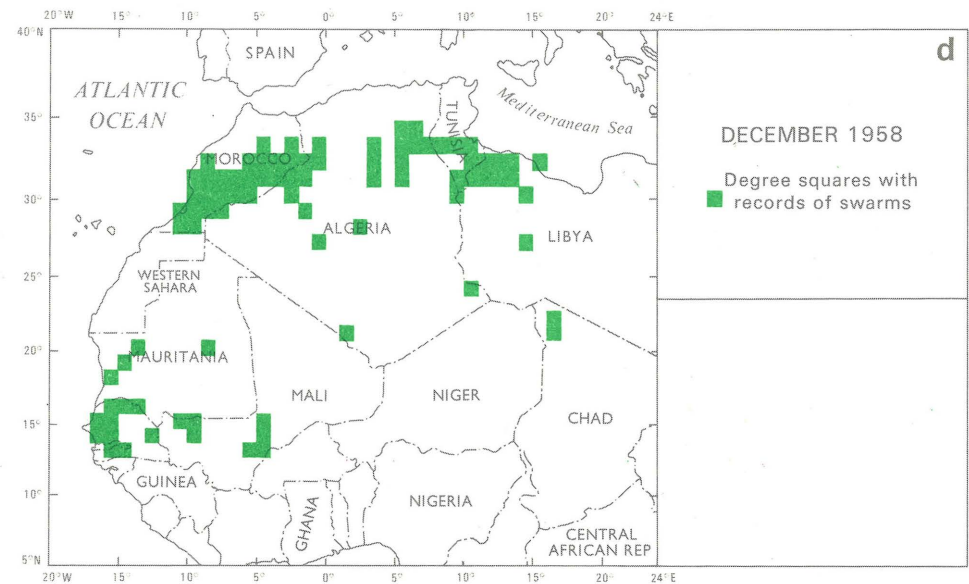
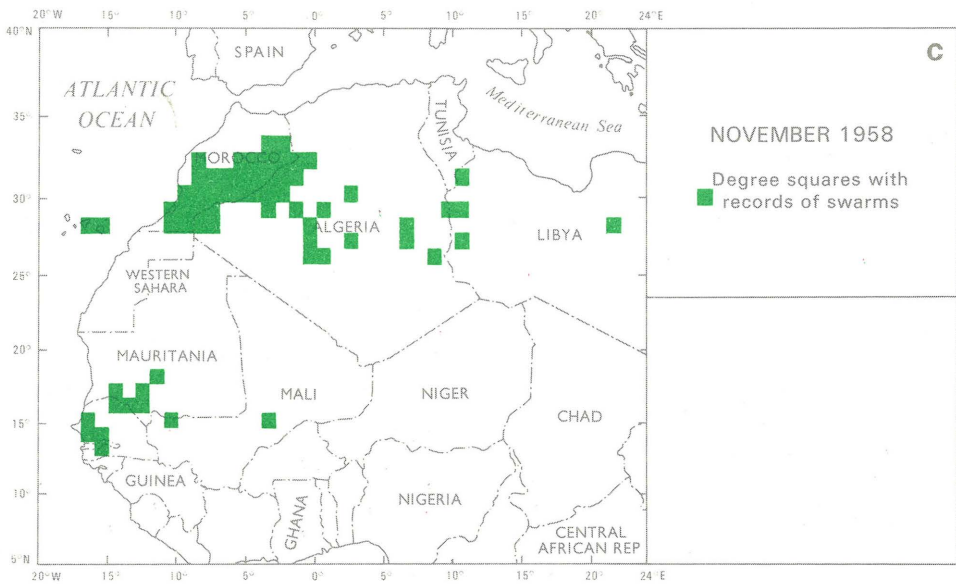
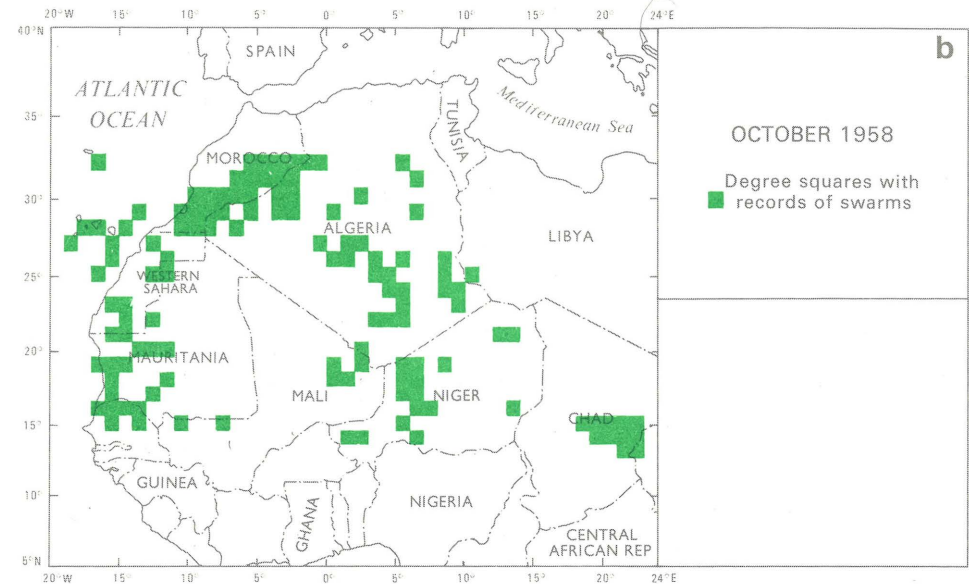
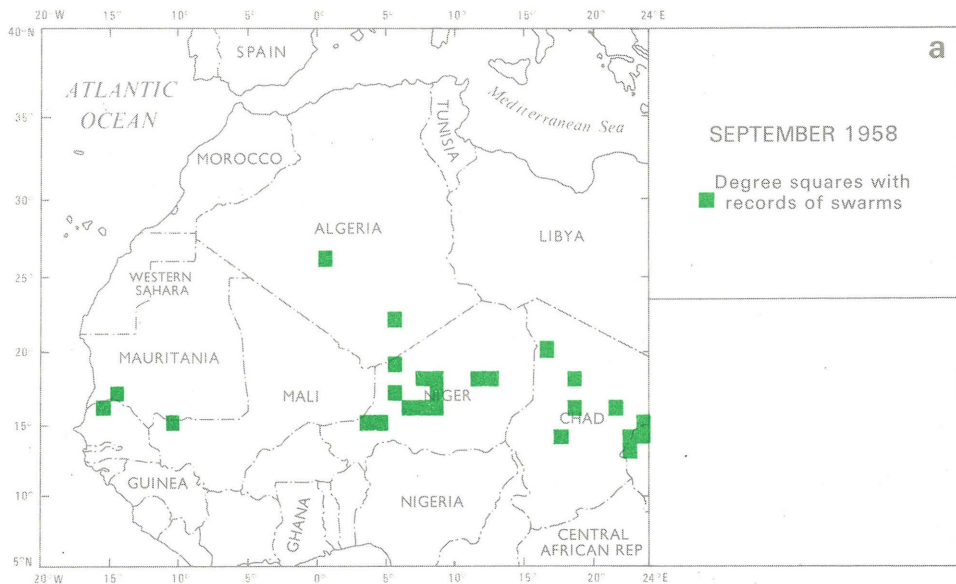


Fig. S18 (see opposite page)

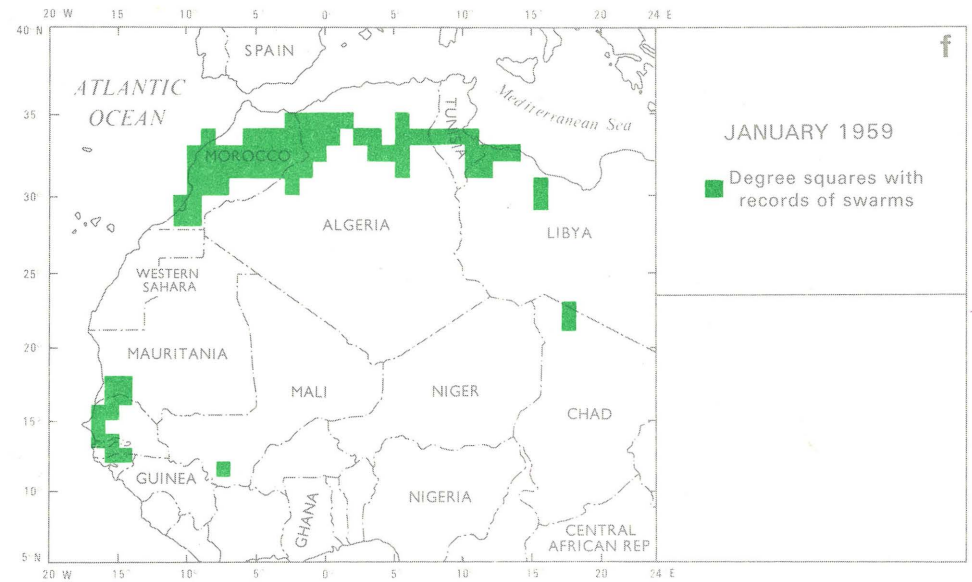
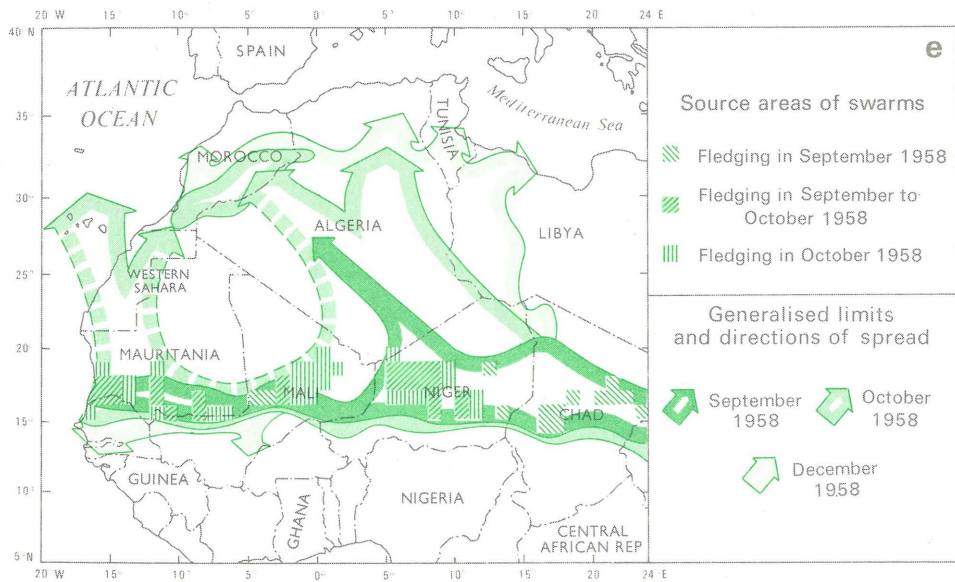


Fig. S18 a-l. 1958 SUMMER GENERATION SWARMS IN THE WESTERN REGION

Figs a,b,c,d,f,g,h,j, and k show the monthly distribution of swarms by degree squares.

Arrows on Figs. e,i and l show schematically the spread of swarms (see p 27)

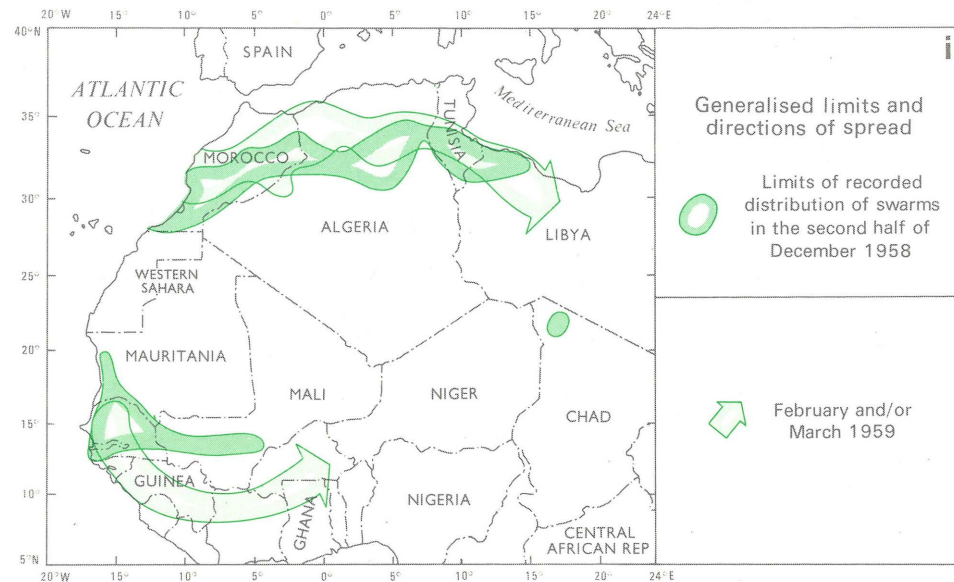
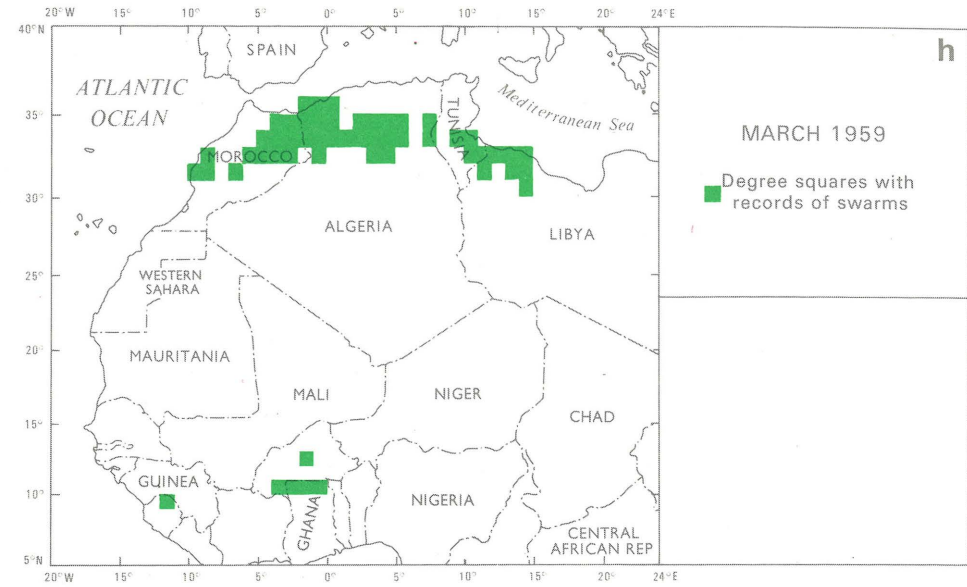
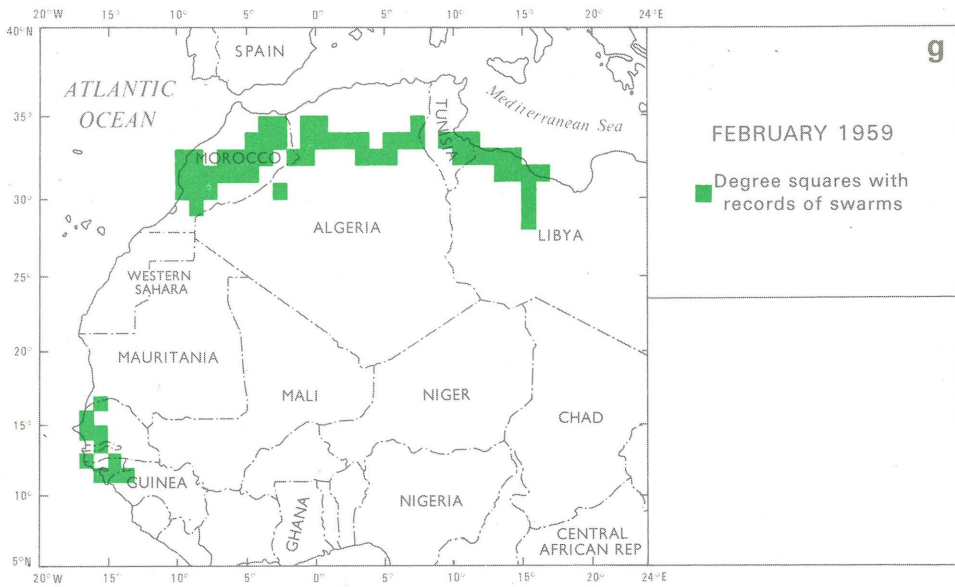


Fig. S18 (see opposite page)

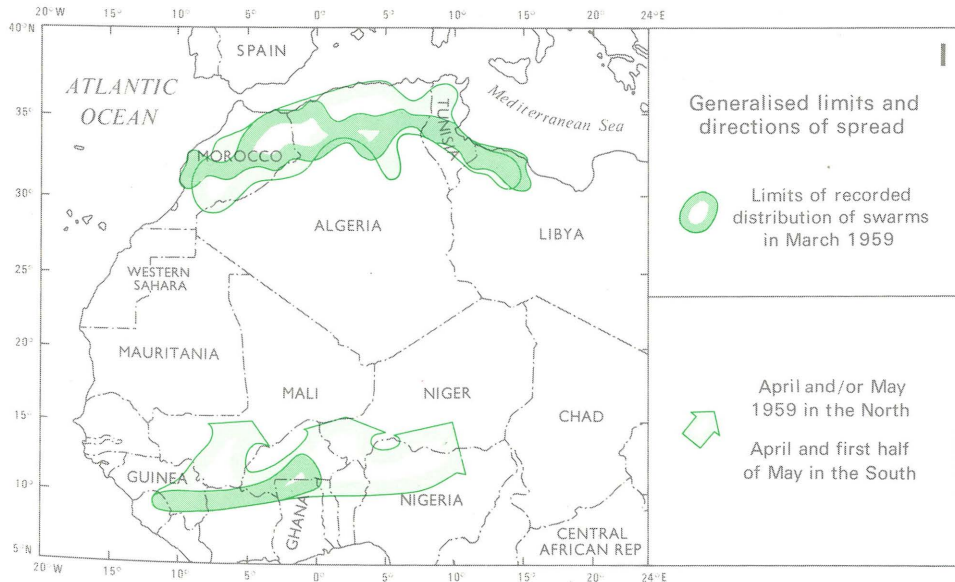
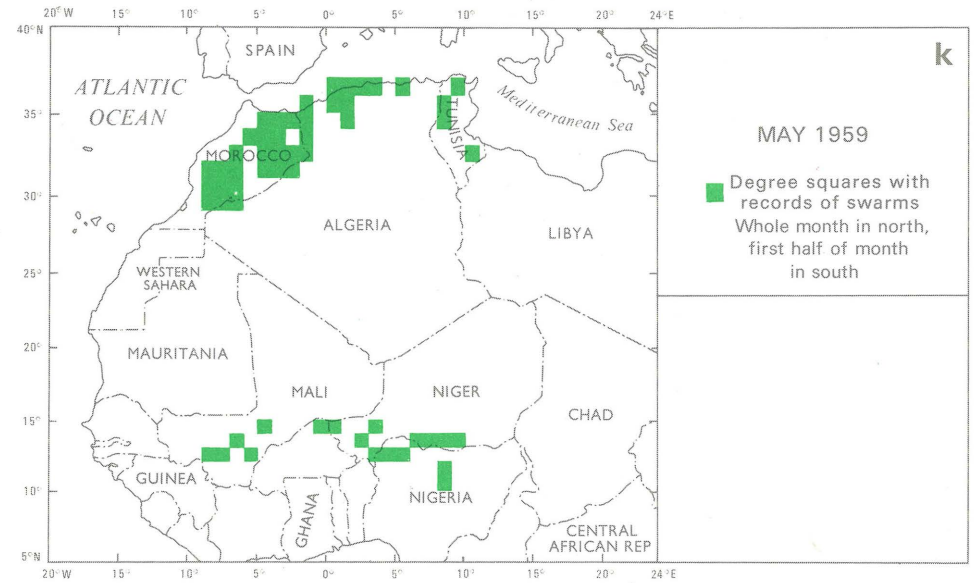
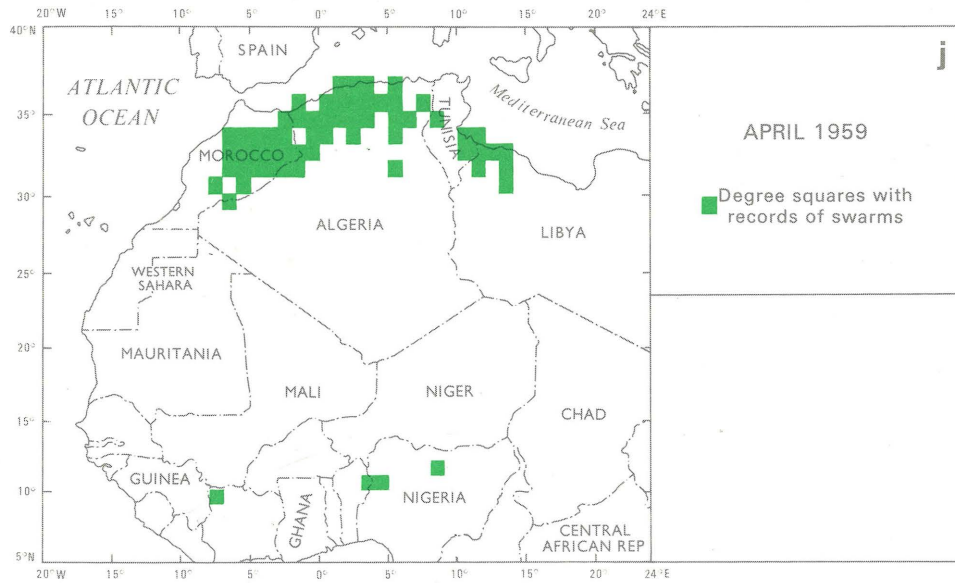


Fig. S18 a-l. 1958 SUMMER GENERATION SWARMS IN THE WESTERN REGION

Figs a,b,c,d,f,g,h,j, and k show the monthly distribution of swarms by degree squares.

Arrows on Figs. e,i and l show schematically the spread of swarms (see p 27)

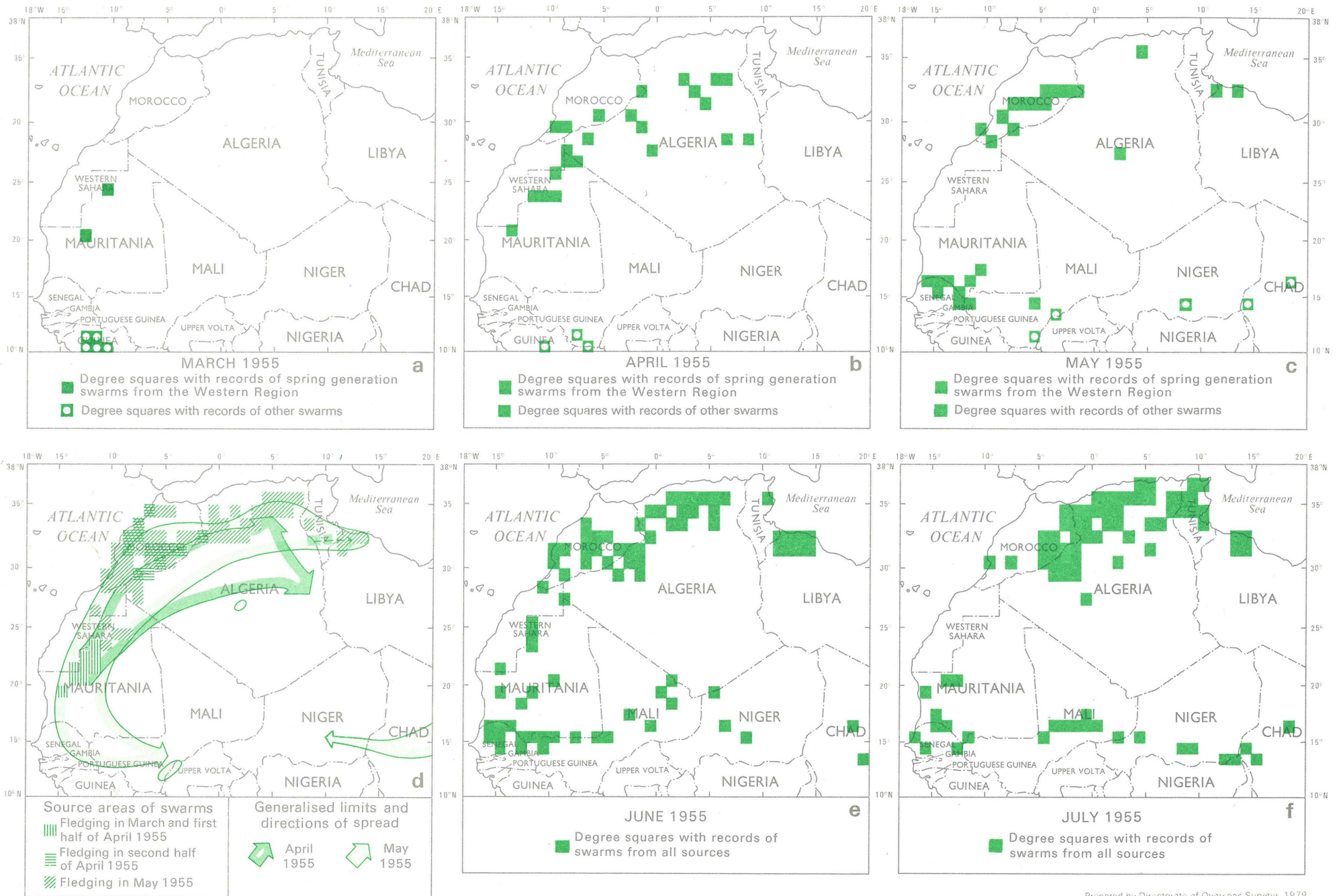


Fig. S19 (see opposite page)

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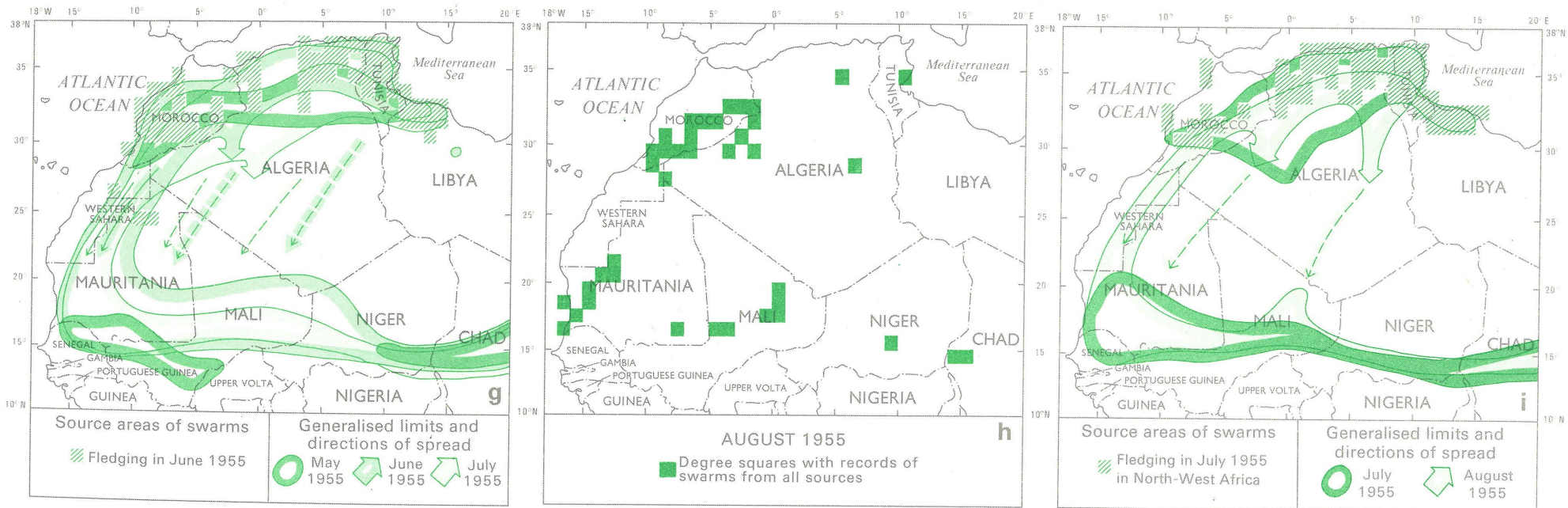


Fig. S19 a-i. 1954 SPRING GENERATION SWARMS IN THE WESTERN REGION

Figs a,b,c,e,f, and h show the monthly distribution of swarms by degree squares. Arrows on Figs d,g, and i show schematically the spread of swarms (see p 27)

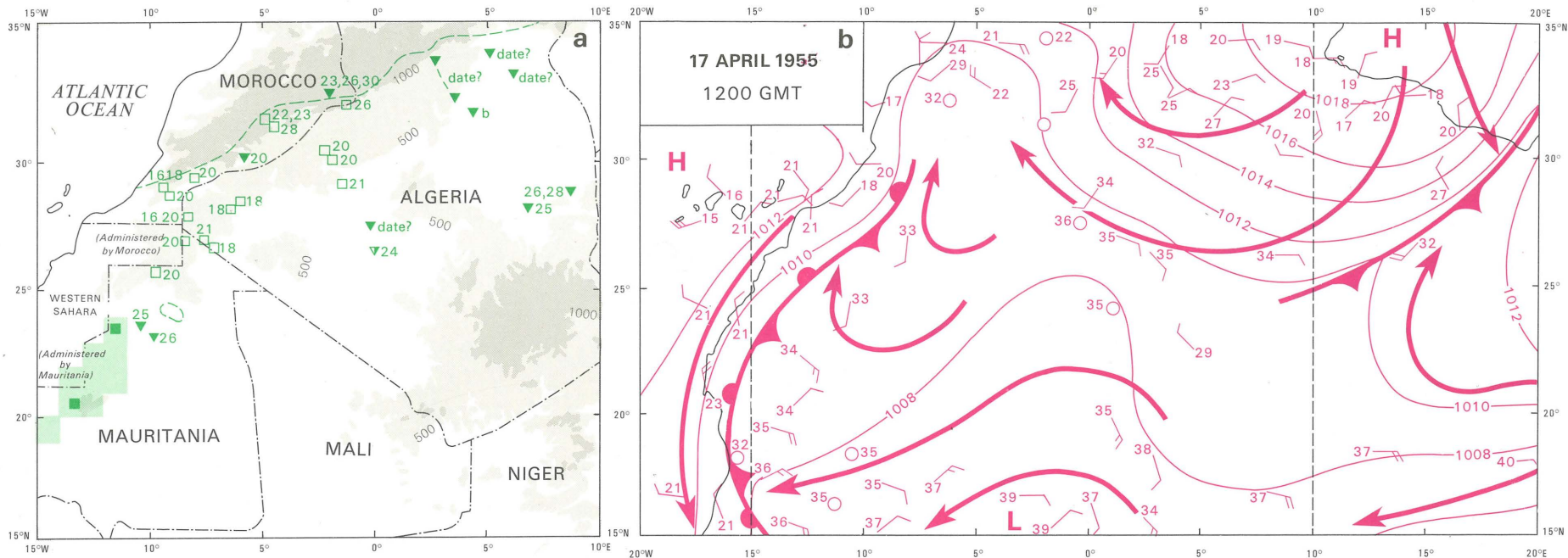


Fig. C19.1 IMMATURE SWARMS IN THE ALGERIAN SAHARA, APRIL 1955

- a** Places and dates with locust reports (see p 27)
16-26 April 1955
 - Swarms reported 1-15 April 1955
 - Southern limit of mature swarms on 15 April 1955
 - Degree squares with fledging March to mid-April 1955
- b** Weather map for 17 April 1955 at 1200 GMT
- c** Weather map for 24 April 1955 at 1200 GMT

0 500 1000 Km
 SCALE (Approx)
 Contour values are shown in metres

Prepared by Directorate of Overseas Surveys 1979