

AN UNUSUAL APPEARANCE OF DESERT LOCUST SWARMS ON THE MALABAR COAST IN OCTOBER 1952

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1. THE SPECIES OF LOCUST CONCERNED

IN October 1952 locust swarms were reported along the West Coast of Madras on a fairly wide front—extending over a stretch of nearly 300 miles—from near Mangalore (13° N. Lat.) in the north to very near Quilon (9° N Lat.) in the south. Although there was no definite mention of any date on which the swarms were first noticed, flights had doubtless occurred between the 12th and the 14th October and by the 15th most of the locusts had been killed off by birds. Locust wings are said to have been found strewn in abundance on the ground wherever flights had occurred. Apparently, the greater part of the migrating swarms had been drowned in the sea and those that reached land were in too exhausted a condition either to damage crops or even to escape the attacks of birds.

As the specimens received at Coimbatore had been provisionally identified as the Bombay Locust (*Patanga succincta* Linn), it was presumed that flights of this locust had had their origin in Bombay State, but enquiries made of the Agricultural Entomologist, Poona, in the matter elicited the information that there had been no signs either of locust breeding or of any kind of swarms in the Bombay area. As no swarms were said to have occurred even in Goa territory, the origin of the Malabar flights became involved in a sort of profound mystery, which became resolved only in July 1953, when the writer visited Coimbatore and found that the samples received were, in reality, only the pink-coloured, immature, *gregaria* phase individuals of the Desert Locust (*Schistocerca gregaria* Forsk) (Rao¹)

2. POSSIBLE ORIGIN OF THE MALABAR SWARMS

An examination of the locust bulletins issued by the Director, Locust Control in India, made it clear that no swarms had been reported at this time from any of the areas adjoining the Madras State. Locust-breeding had occurred in the desert areas of Rajasthan in August-September 1952, and locusts that had escaped destruction had been forming swarms that were flying out of Rajasthan by the end of September and the beginning of October into the Punjab areas in the north, into Uttar Pradesh and Central India to the east and into north Bombay, Kutch and Saurashtra to the south. The

FIG. 1

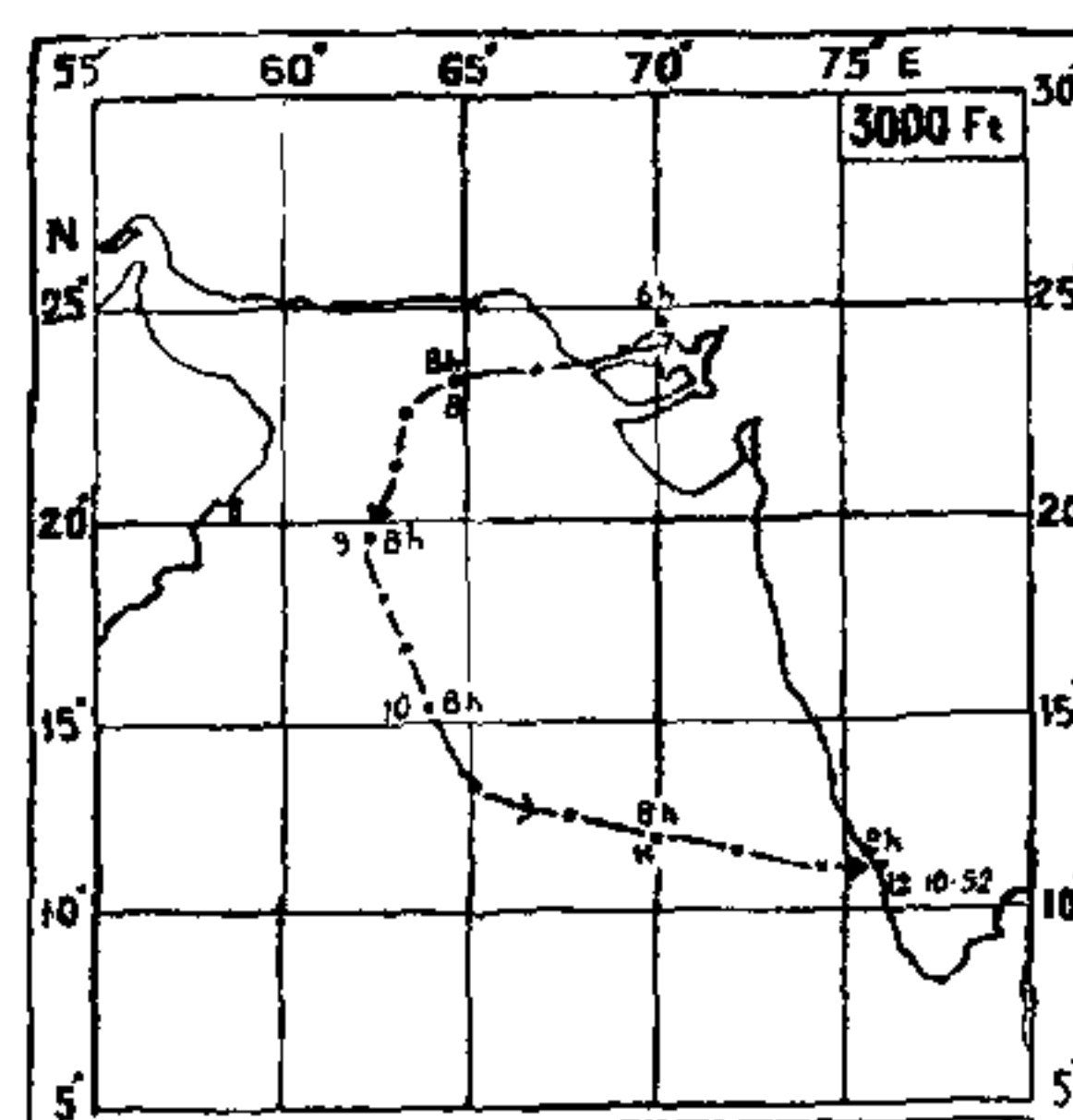


FIG. 2

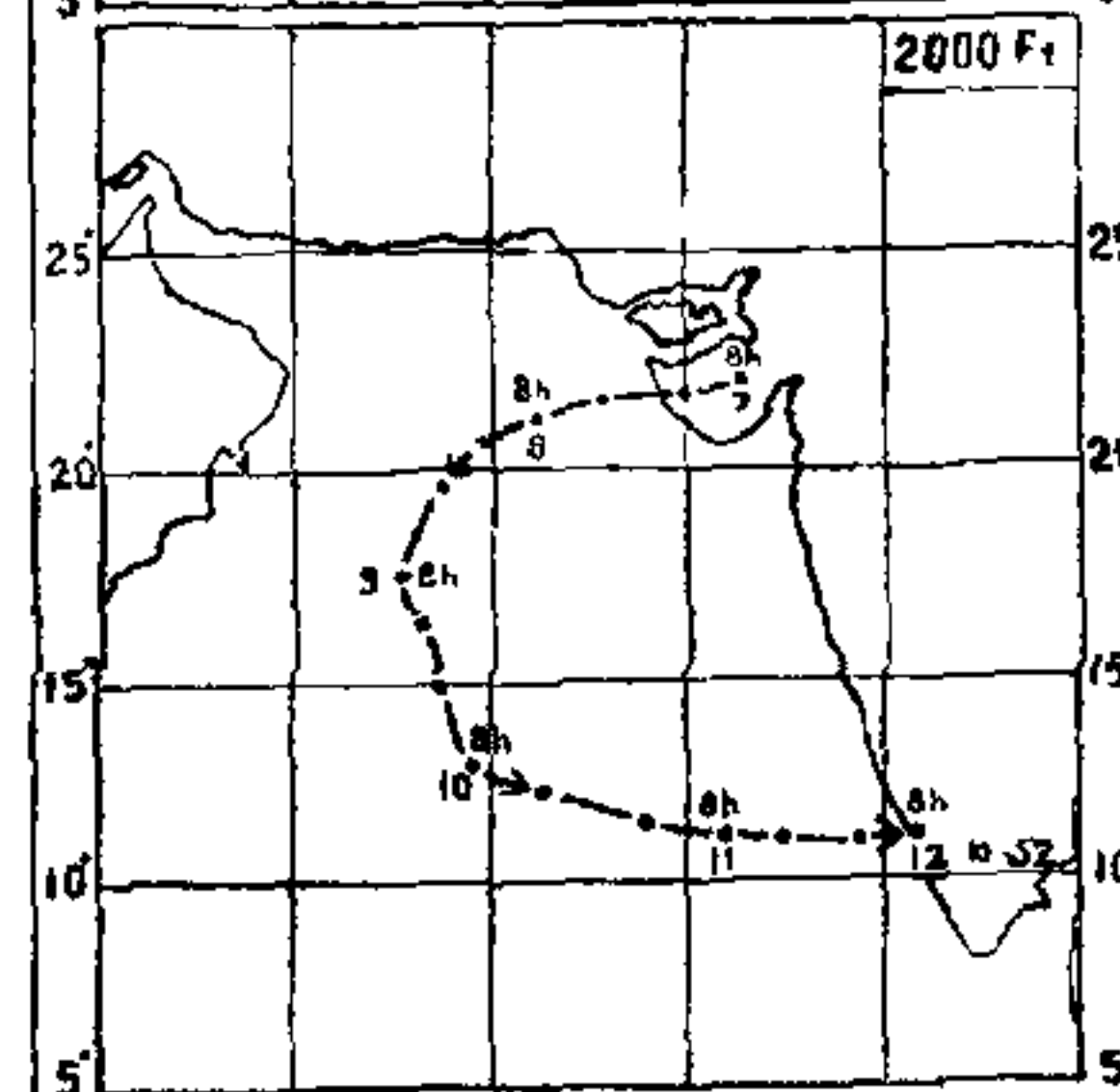
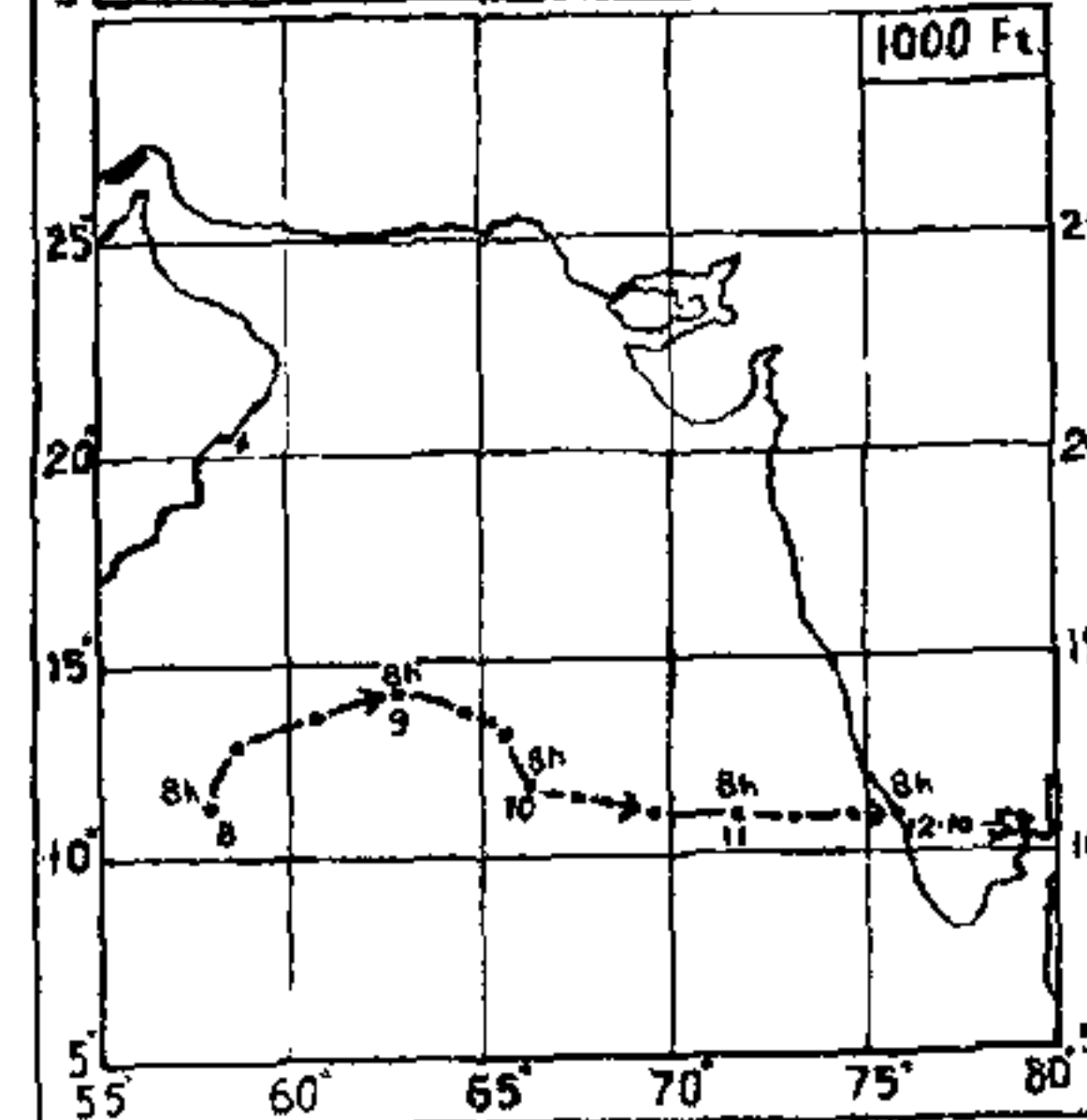


FIG. 3



FIGS. 1 to 3.—Showing the Trajectories of the probable line of flight of hypothetical locust swarms reaching Kozhikode (Calicut) at 8 a.m. on 12th October 1952 at different heights above sea-level. The lines have been worked out by tracing them back in accordance with the direction and velocity of air-flow recorded at heights of 1,000 ft., 2,000 ft. & 3,000 ft. above sea-level respectively for every period of eight hours in the areas concerned. It may be noticed that, while the trajectory at 1,000 ft. was not helpful, those at 2,000 ft. and 3,000 ft. led to the Kutch and Kathiawar areas, indicating them as places of origin.

nearest areas from which the Malabar swarms could have been derived was evidently the Kutch Coast. A cursory examination of the synoptic charts of the India Daily Weather

Arabian Sea to the west of the low pressure trough, thereby leaving the intermediate coastal area unaffected.

In this connection, attention may be drawn to the description (Waloff²) of a case of long-range migration of the Desert Locust that had occurred in October 1945 across the sea from Southern Morocco to Portugal and Spain under the influence of a depression in the Atlantic. Rainey and Waloff³ have further clearly shown that it is possible to interpret various observations recorded in respect of flights of swarms in the Gulf of Aden area with the help of trajectories of movements of air-masses and thereby trace them to their origin. With the object, therefore, of making a similar detailed study of the meteorological conditions of the period concerned, the Meteorological Office at Poona was approached for help in the matter and a visit was paid to Poona during the second week of June 1954. All available data in respect of the Malabar visitation were discussed with the officers of the Meteorological Office and their kind help secured in the matter of their correlation with recorded weather data.

3. ANALYSIS OF DATA ON LOCUST MOVEMENTS IN RELATION TO WEATHER

(a) Conditions in Rajasthan during the first week of October 1952 As a rule, monsoon withdraws from Rajasthan by the first week of September, after which this region becomes an area of drought characterised by fairly high temperatures and low air humidity—conditions uncongenial to locusts, which they usually try to escape from. The temperature and humidity conditions observed in the West Rajasthan areas between the 3rd and the 12th October 1952 are given in Table I.

TABLE I

| Dates | | Max. temp. Deg. F. | Rel. Humidity at 5-30 p.m. in % |
|-------|----|-----------------------|------------------------------------|
| Oct. | 3 | 101 to 106 | 18 to 48 |
| " | 4 | 100 to 106 | 13 to 70 |
| " | 5 | 101 to 105 | 12 to 35 |
| " | 6 | 103 to 109 | 12 to 38 |
| " | 7 | 97 to 107 | 12 to 45 |
| " | 8 | 89 to 101 | 28 to 38 |
| " | 9 | 95 to 98 | 20 to 55 |
| " | 10 | 99 to 102 | 17 to 52 |
| " | 11 | 99 to 105 | 18 to 53 |
| " | 12 | 98 to 102 | 8 to 72 |

From the above data, it would be seen that the uncongenial conditions that prevailed between the 3rd and the 7th October were conducive to the taking Off of locusts from the

FIG. 4

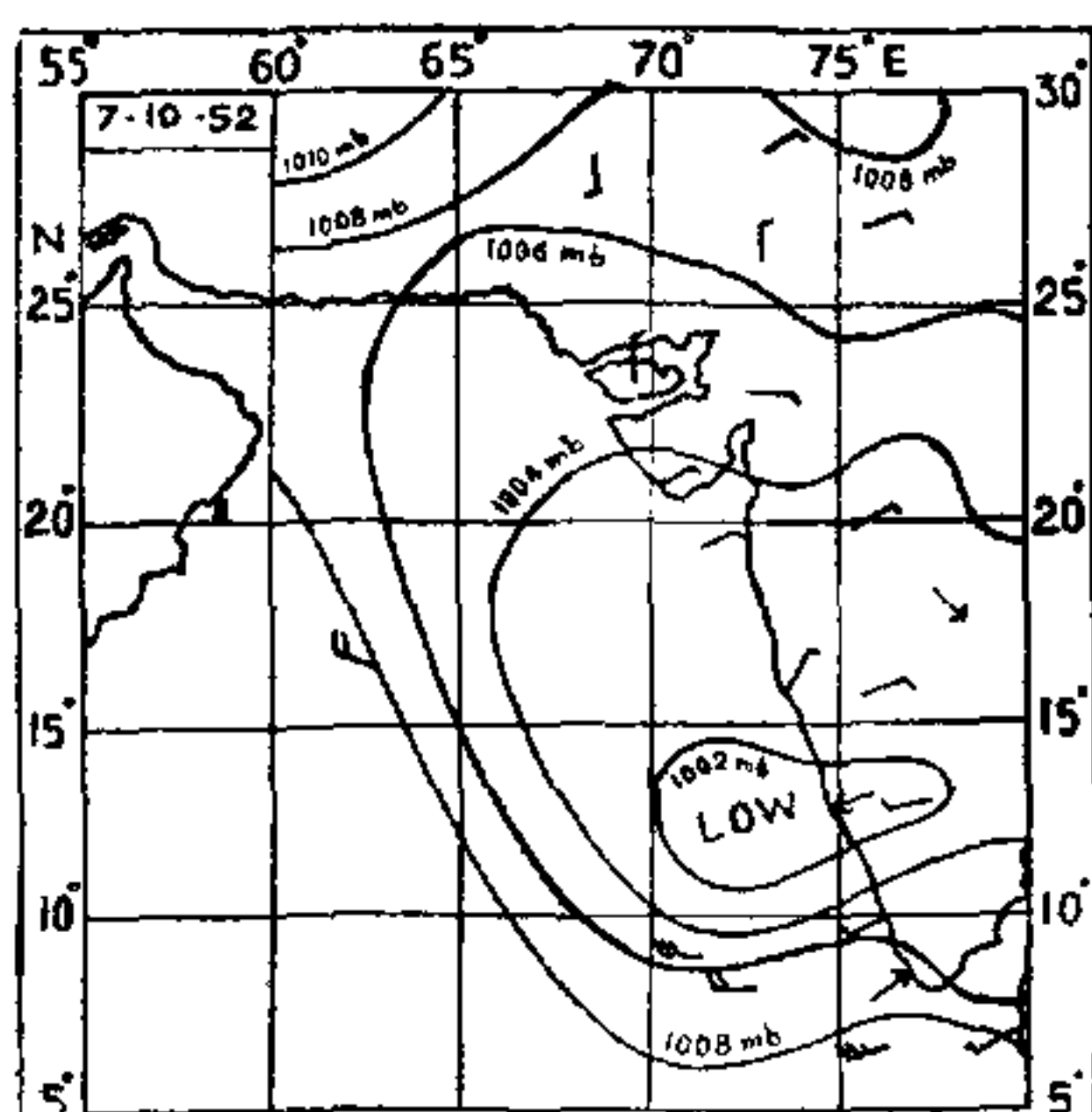


FIG. 5

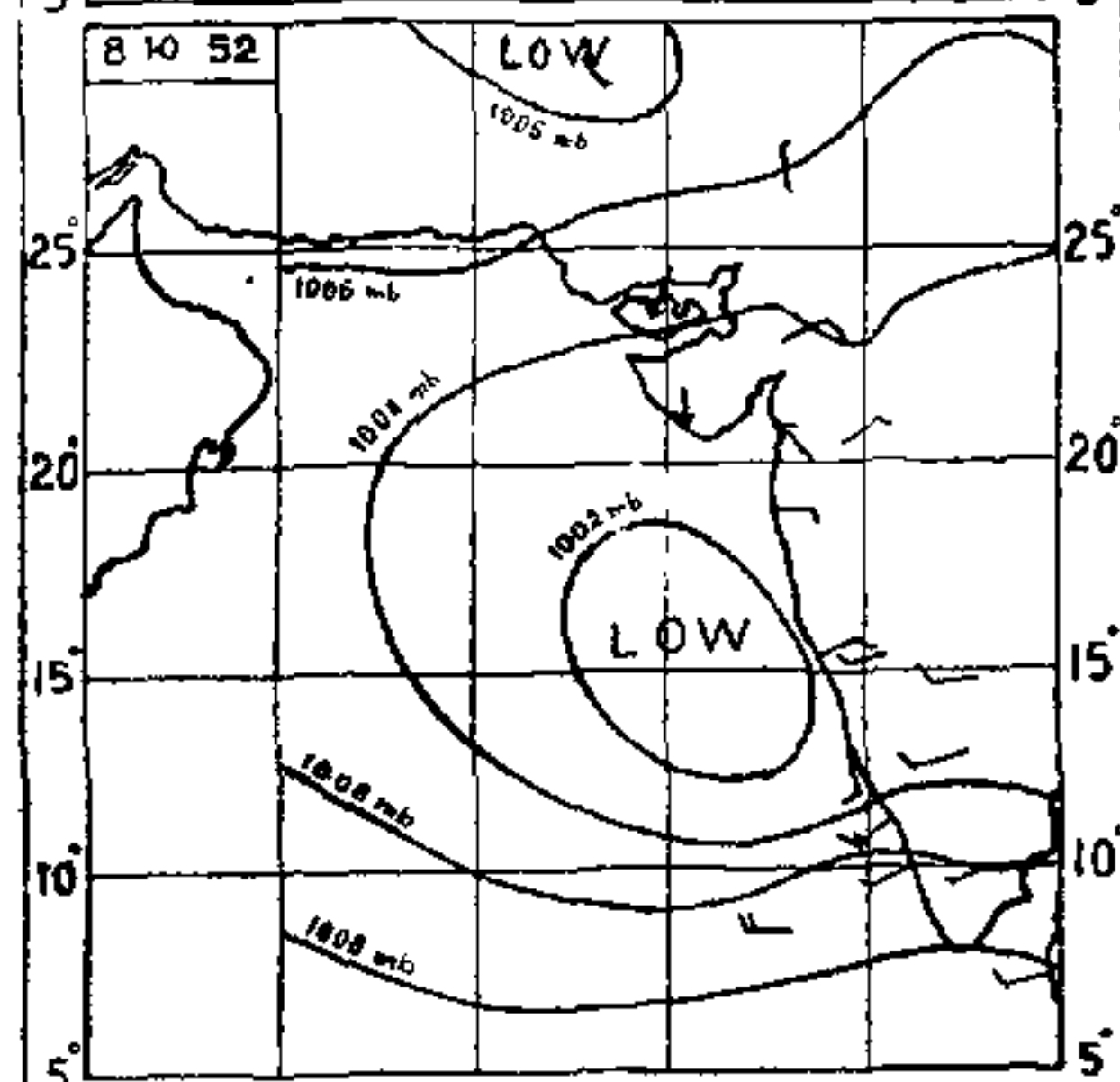
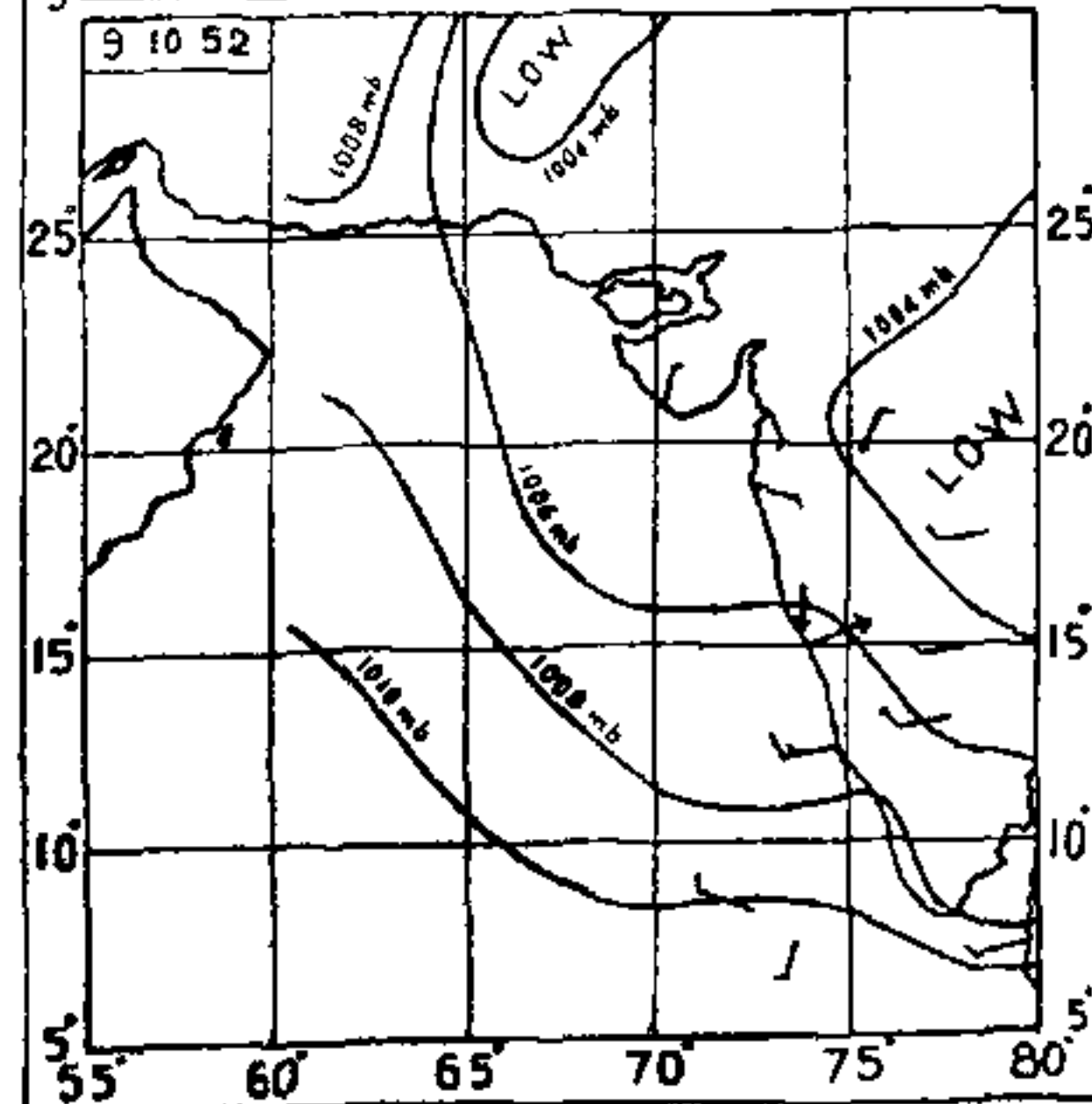


FIG. 6



FIGS. 4 to 6 —Synoptic Charts showing the pressure distribution and the isobaric patterns that prevailed on the 7th, 8th and 9th October 1952 along the West Coast of India and on the Arabian Sea. On the 7th and the 8th, a low pressure trough prevailed off the Konkan-Kanara Coast of Western India, which induced strong North-easterly winds to the west of the trough.

Reports of the period concerned indicated that the development of an incipient depression along the Konkan-Kanara coast at the end of the first week of October 1952, had possibly helped in the transference of swarms from the Kutch area to the Malabar Coast over the

area, whereas somewhat milder conditions were met with from the 8th to the 12th in Rajasthan.

(b) *Swarms recorded during the first fortnight of October 1952 in the North Bombay, Kutch and Saurashtra areas:*

(Extracted from the *Locust Bulletin of Director, Locust Control in India* for fortnight ending 15th October 1952.—Vol. III, No 19.)

North Bombay Area: Palanpur Dt.: 2nd to 11th October: Several swarms noted in Vav, Tharad, Palanpur, Deodar, Deesa, etc. Talukas; Mostly pink. Many NE to SW in direction.

Mehsana Dt.: Radhanpur Tq. 6-10 Oct. Pink Swarms. NE-SW.

Ahmedabad Dt. Viramgam Tq. 1-7 Oct. Pink swarms

Kutch Area. Bhuj Tq. 8th October. Pink swarms; NE-SW.

Khavda Tq. 3-4 Oct. Pink swarms

Adhoi Tq. 7-8 Oct. Pink swarms: NE-SW.

Abdassa Tq. 8th Oct. Pink swarm: NE-SW.

Nakhtrana Tq. First week of October Pink swarms.

Mandvi Tq. 7-9 Oct Pink swarms NE to SW. Lakhput, Mundra, Rapar, Khadir, Bachau and Anjar Talukas: 7th Oct. Pink swarms NE to SW in direction

Saurashtra Area: Halar Dist. Jamnagar Tq. 6th Oct. Pink swarms.

Khambalia Tq. 6th, 8th Oct.: N to S

It may be seen from the above that pink swarms had begun to enter the north Bombay and Kutch areas from the 3rd October and that the largest number of swarms were noted in the Kutch area on the 7th and the 8th, the direction of flights being north-east to south-west.

(c) *Possibility of Migration Flights from Kutch to Malabar.* From the data mentioned above, it is obvious that numerous locust swarms had taken off from the coastal areas of Kutch on the 7th and the 8th October 1952 and had probably been carried by the prevalent high winds over the sea in a south-western direction. As to the swarms reported on the Malabar Coast, there is no exact information as to the date on which they were first sighted, but there is little doubt that they had reached the coast between the 12th and the 14th October. As crews of steamers calling at Calicut at that period are said to have seen large sheets of drowned locusts in the sea, the swarms had evidently come flying across the Arabian Sea. The problem on hand is to find out whether by

tracing back their line of flight, their origin can be located.

Locusts are comparatively slow of flight and are incapable of covering large distances by their own efforts. It is evident, therefore, that in the present case they had been transported across the seas by the prevailing wind currents. Measurements of air-currents at different heights are being made 2 or 3 times a day, at selected points covering a large area of country and on the basis of these data, a set of lines of air-flow covering the whole area can be worked out, which may be held to be valid for about 8 hours. On the basis of these sets of lines and of the known velocity of wind, the course of flight that should have been taken by a swarm arriving at Calicut on the 12th October 1952 was successively traced back for every 8 hours. In this way, trajectories of air movements at heights of 1,000', 2,000' and 3,000' were separately plotted out and are shown in Figs 3, 2 and 1 respectively. These clearly show that the swarms had been carried at levels higher than 1,000' and very probably at heights of 2,000-3,000' above sea-level. In the case of 2,000 and 3,000', the trajectories lead to Kutch and Kathiawar areas, wherefrom they should have started on the 7th October. The peculiar curve shown by the trajectories at levels of 2,000 and 3,000' was apparently due to the influence of a well-marked low pressure system off the Konkan-Kanara Coast (the iso-baric patterns of which are shown in Figs. 4 to 6 for three consecutive days), which had prevailed in the Arabian Sea on the 7th and the 8th October 1952 (but disappeared by the 9th) and had induced strong north-easterly winds up to a height of 3,000' and above, in the northern parts of the country, especially in the Kutch-Saurashtra areas. Owing to the development of conditions of desiccation marked by a rise of temperature and a fall of humidity in the desert areas of Rajasthan during the first week of October, swarms had begun to migrate from the area by the 3rd October into Kutch and North Gujarat areas. It is obvious that the swarms found in the Kutch-Saurashtra areas had been sucked up by the strong north-easterly upper air currents that had developed on the 7th and the 8th October under the influence of the trough of low pressure off the Konkan-Kanara Coast and had been carried far out over the sea.

The records of temperatures at different levels at Veraval in Table II on the 7th, 8th and the 9th October 1952 would indicate that

the temperature distribution over the neighbourhood was favourable for convection and the consequent lifting of locusts into the free air, particularly at the time of the maximum temperature on the 8th October. Upper air temperatures were also favourable for locust flight.

TABLE II
Records of temperatures at Veraval
7-9 October 1952

| Dates | Maximum | Temp. in °F. at 20-30 hrs. L.S.T. | | | | Remarks |
|--------|---------|--------------------------------------|-----------|-----------|-----------|---|
| | | Surface | 1,000 ft. | 2,000 ft. | 3,000 ft. | |
| Oct. 7 | 87 | 82 | 90 | 87 | 84 | Inversion (stable) up to 500 ft. |
| Oct. 8 | 95 | 84 | 82 | 81 | 80 | Stable up to 4,500 ft. Super adiabatic (unstable) from 4,500 ft. to 7,500 ft. |
| Oct. 9 | 98 | 84 | 90 | 90 | 84 | Inversion up to 1,200 ft. |

On the basis of the above data, it may be surmised that an emigration of swarms of the Desert Locust had occurred from the coasts of Kutch and Saurashtra in the course of the 7th and the 8th October 1952, and that they had been carried by upper air currents across the Arabian Sea in the course of 4 or 5 days and cast on the Malabar Coast between the 12th and the 14th October. It is not unlikely, however, that the great majority of the locusts had dropped into the sea out of sheer fatigue, which would account for the large sheets of drowned locusts found in the sea. In this connection,

it may be stated that in the year 1862, there is a record of locusts having been similarly driven into the sea along the coasts of Kutch. According to the *Gazetteer of the Bombay Presidency* (Vol. V, 1880), "Rainfall in 1862 was heavy—34". The rains closed in October with a tremendous rainstorm, which not only caused damage to crops and life, but also drove locust swarms westwards out into the sea. Ship captains from Muskat and Zanzibar, some 100 miles from Mandvi found the sea covered with their dead bodies".

4. ACKNOWLEDGMENTS

The author wishes to place on record his thankfulness to Sri. V. Tirumala Rao, then Government Entomologist, Coimbatore, for kindly placing at his disposal all available data on the Malabar swarms; and to the Deputy Director-General and other officers of the Meteorological Office at Poona for help received—especially to Shri S. P. Venkiteshwaran, Director, Agricultural Meteorology, and Shri K. P. Ramakrishnan, Meteorologist, in charge of Upper Air Section for working out the air trajectories and supplying the diagrams and other information on meteorological matters. He wishes to express his gratefulness to the National Institute of Sciences in India for the grant of a special fellowship, which enabled him to visit Coimbatore in July 1953, and Poona in June 1954, for studying the present problem.

1. Rao, Y. Ramchandra, *Indian J. Ent.*, 1953, 15 (2), 126.
2. Waloff, Z., *Proc. Roy. Ent. Soc. Lond. (A)*, 1946, 21 (10).
3. Rainey, R. C. and Waloff, Z., *J. Anim. Ecol.*, 1948, 17 (2), 101.

PERFECT CRYSTALS OF PURE IRON

THE General Electric Company have reported the development of perfect crystals of pure iron, a hundred times stronger than any known metallic crystal and inherently resistant to rust. These perfect crystals represent for the first time metals that are as strong as theory predicts they should be and, as such, "provide a new and exciting dimension in metallurgy". The crystals are metallic whiskers about one thousandth of an inch thick and an inch or so in length. They were produced in the company's Research Laboratory in Schenectady, New York, by Dr. Robert L. Fullman and Arno Gatti. It is hoped that in time, applied science and technology will find a practical use for this form of metal.

Ordinarily the strength of actual crystals is a hundred times or so less than the theoretical value. Metal parts used in machinery and other equipment similarly fall far short of the strength they might theoretically have. This is on account of the irregularities in the crystal on an atomic scale. As against this, the perfect crystals which have been made are stronger than any previously known metal or alloy, and actually attain a tensile strength of nearly a million pounds per square inch.

Moreover, these tiny perfect crystal wires of pure iron do not appear to rust. Finely divided iron, or fine wires of ordinary iron, rusts almost immediately upon exposure to air. The same atomic perfection that gives them strength probably also prevents oxidation.