

APPENDIX I

REPORT OF THE SIXTH SESSION OF THE EXECUTIVE COMMITTEE
OF THE COMMISSION FOR CONTROLLING
THE DESERT LOCUST IN THE EASTERN REGION
OF ITS DISTRIBUTION AREA IN SOUTH-WEST ASIA

Held in
New Delhi, India

10 - 12 February 1971

INTRODUCTION

In accordance with the recommendation of the Sixth Session of the Commission for Controlling the Desert Locust in the Eastern Region of its Distribution Area in South-West Asia, the Director-General of the Food and Agriculture Organization of the United Nations, at the kind invitation of the Government of India, convened the Sixth Session of the Executive Committee of the Commission from 10 to 12 February 1971 in New Delhi.

The Session was opened by Dr. S.N. Banerjee, Plant Protection Adviser to the Government of India and Director, Locust Control, who welcomed the participants on behalf of the Government of India and in his capacity as Chairman of the Committee. He stressed the importance of research on the Desert Locust and stated that the Executive Committee as the expert advisory body to the Commission had an important role to perform. He hoped that the members had brought with them full information on various research projects which they had undertaken in their respective countries during the last year (1970) and emphasized the importance of coordination of research within the Member Countries of the Commission. He stated that the latest developments in the locust situation in the Indo-Pakistan desert areas provided good opportunities for intensifying research, particularly on gregarious populations. He appreciated the interest taken by FAO in coordinating the research at regional and international level and the assistance provided in the form of equipment, transport, fellowships, advisory/exchange visits and training courses.

In reply Mr. Gurdas Singh, on behalf of FAO, thanked the Government of India for their kind invitation to act as a host for the Session of the Executive Committee and for providing various facilities. He stated that the arrangements made for the Session would facilitate discussions and hoped that the Committee would be able to arrive at some useful recommendations to further the work on Desert Locust research.

Officers of the Session

Chairman: Dr. S.N. Banerjee, India

Vice-Chairman: Mr. Hayk Mirzayans, Iran

The work of drafting the report was entrusted to the FAO Secretariat. Mr. Gurdas Singh and Mr. S.S. Pruthi of the FAO Secretariat acted as Technical Secretaries.

Acknowledgments

At the close of the Session the members of the Committee expressed their thanks to the Chairman for conducting the deliberations in a very tactful manner. The Committee wished to place on record their gratitude to the Government of India for the hospitality extended and the facilities provided.

PARTICIPATION IN THE SESSION

Members of the Executive Committee

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AGENDA

1. Opening of the Session
2. Adoption of the Agenda
3. Election of the Drafting Committee
4. Coordination of the Desert Locust Research in the Region
5. Training
6. Election of the Chairman and Vice-Chairman of the Executive Committee for 1971
7. Any Other Business
8. Date and Place of Next Session
9. Adoption of the Report.

SUMMARY OF DISCUSSIONS

Coordination of Research

1. The Executive Committee reviewed the work done during 1970 in India, Iran and Pakistan. It hoped that with the return of Mr. Y.M. Saket of Iran, after successfully completing his studies for Ph.D. at the Reading University (UK), the research work at the Locust Field Research Station, Bandar Abbas, would be intensified. The Committee also considered the programme of work for 1971 to be carried out at various field research stations. A summary of the research work undertaken during 1970 and plans for 1971 is given in Annex I.

2. In India (Bikaner) research work already in progress, particularly concerning phase characteristics, was continued and finally completed. Most of it had since been published in the Technical Series issued by FAO. In addition, work was carried out on biological and behavioural aspects, light trap observations, incubation period, food preference, insecticidal trials, biotic factor studies concerning the Desert Locust (Annex I). Some interesting observations had been recorded regarding the locusts attracted to light and it had been observed that such attraction to light had no relation with the sex or physiological condition of the insects. While studying the effect of biotic factors on locust populations, it had been observed that the reptile (Uromastyx sp.) studied could not effect significant reduction in locust populations. It was also interesting to note that desert plants on which locusts normally feed contain high levels of ascorbic acid which contributes to successful growth of hoppers and adults in the desert area. It was considered necessary that further work should be continued on the various aspects mentioned above including meteorological studies in relation to locust movements.
3. The Committee reiterated its earlier recommendations on light traps observations (Fifth Session's Report, paras. 5 and 6) and recommended that this work should be continued.
4. In Pakistan both field research stations at Malir and Bhawani had undertaken quite an impressive programme of research and tackled most of the projects recommended last year. There had been considerable amount of work on various facets of egg development which might help to understand the biology of the insect better.
5. The results obtained on the laying behaviour and egg development of the Desert Locust in dieldrin treated soil had thrown some light on the causes of disappearance of the remnant populations during the following seasons in areas treated with this insecticide against swarms and hopper bands. At the same time recent trials conducted in Pakistan showed that effect of persistent insecticides on the progeny could also be responsible for the above phenomenon.
6. It was noted that some toxicological studies had been undertaken against Desert Locust adults and hoppers. In view of the concern expressed by a number of countries about the use of persistent insecticides, the Committee recommended that work should be intensified in order to find safer, equally effective and economical insecticides.
7. In view of the present locust situation, full advantage should be taken for making observations on gregarization and dissociation during the coming monsoon breeding season. This situation might allow further detailed synoptic studies and also large-scale trials of certain new insecticides.
8. It was considered necessary to undertake behavioural studies of solitary-living populations during day time. Further information on the subject would assist in detection of maximum number of locusts present in an area by aerial photography.
9. The FAO Desert Locust Control Committee, at its Fourteenth Session held in Rome in October 1970, considered a standard procedure for assessing and recording Desert Locust populations not in swarms and hopper bands and decided that it should be tried in all the countries concerned for a period of one year to begin with and requested national and regional organizations to put up suggestions for any modification of the procedure based on the experience gained.

10. The Committee emphasized that the new procedure, which had been sent to all the countries along with the standard form for reporting, should be taken up immediately by all the Member Countries of the Commission if not already done. It was further stressed that any modification considered necessary as a result of experience gained in the field should be communicated to FAO.

Fellowships

11. The Executive Committee received details of fellowships awarded under Trust Fund 123 (Annex II) and noted with satisfaction that Mr. Y. Movasagh Saket of Iran had successfully concluded his studies at the Reading University in the United Kingdom and had returned to his country. The Committee drew attention to its earlier recommendation (Report of Second Session, para. 12) concerning utilization of training received under such awards and hoped that Mr. Saket would be provided a suitable assignment in the department and the research programme in Iran would get an impetus.

12. The Committee was encouraged to know that the studies being carried out by Mr. J.S. Gill of India at the Imperial College, London, were progressing very satisfactorily and Mr. Mohammed Shafi of Pakistan had commenced his studies at the Reading University.

13. In accordance with the recommendation of the Fifth Session of the Committee (Report, para. 15), the following short-term fellowships were awarded during 1970:

Name	Country of origin	Country and type of training	Period	Remarks
Nikzada	Afghanistan	India - desert locust survey and control	3 months	completed
Sharifi	Afghanistan	India - desert locust survey and control	3 months	completed
Hayat	Afghanistan	India - desert locust survey and control	3 months	completed
Turk	Iran	Pakistan - organization and management of aerial control	4 months	completed
Hamidi	Iran	Pakistan - organization and management of aerial control	4 months	completed
Bazmrad	Iran	Pakistan - maintenance of spraying aircraft	4 months	completed

In addition, two fellowships for desert locust survey and control and two for research to Iran were being processed.

14. The Committee received the nomination of Mr. A. Soltani from Iran for advanced training in the United Kingdom and unanimously approved it subject to scrutiny of his nomination form by FAO. The fellowship would be administered by FAO and financed from the Trust Fund 123 for a period of two years to begin with.

15. It was reiterated that the same conditions would be applicable to this fellowship as to those previously granted, that the Government of Iran would ensure that Mr. Soltani, on return to Iran after completing the fellowship, would be mainly engaged on Desert Locust research or control, or both, for a minimum period of five years.

16. Mr. Gill was due to complete his fellowship in 1971 and the Committee, therefore, decided that FAO should invite nominations from the Member Governments of the Commission for advanced training fellowships for 1972 and put up such applications for consideration at the next annual session of the Committee. At the same time the Committee requested FAO to invite nominations from Member Nations of the Commission for award of short-term fellowships and exchange visits.

Exchange Visits

17. During early 1971 two exchange visits were organized for Messrs. H.A. Madani and Mehdi Saei of Iran to Saudi Arabia, DLCO-EA and FAO Headquarters under the UNDP(SF) Desert Locust Project.

Training Courses

18. The Committee noted with interest that the Department of Plant Protection, Government of Pakistan, organized a four-week training course during October/November 1970. The course included a series of lectures on various aspects of the Desert Locust and was attended by 40 national staff members. In addition, two visiting fellows from Iran also attended. It was considered that such courses were extremely useful for the anti-locust staff to keep them informed of the latest developments in locust control and research and should be organized at regular intervals.

Chairman and Vice-Chairman of the Executive Committee for 1971/72

19. The Executive Committee unanimously elected Afghanistan and Pakistan as Chairman and Vice-Chairman, respectively, for a period of approximately one year from February 1971 up to the time of the next annual session of the Executive Committee.

DATE AND PLACE OF NEXT SESSION

20. According to the recommendations of the First Session of the Commission (Report, para. 36), the annual session of the Executive Committee should normally precede the annual session of the Commission, and the date and place of the next session could be decided accordingly.

ANNEX I

A SUMMARY OF THE DESERT LOCUST RESEARCH WORK
CARRIED OUT DURING 1970 AND FUTURE PLANS

INDIA

Biological and Behavioural Studies

Diurnal activities of both adults and hoppers of desert locust in seminatural conditions during Indian winter were studied. The times of night roosting, basking, feeding and distance of displacement during day and night of the adults and fourth and fifth instar hoppers were studied. Details were being published as a separate note.

Light Trap Observations

Light trap observations with mercury vapour lamps of 125 Wts. were conducted on 59 nights of which 30 were on the waxing and 29 were on the waning side of the moon. Locusts were attracted on 13 nights. A total of 25 desert locusts and one migratory locust were attracted on 11 dark nights at air temperatures from 16 to 22.5°C and R.H. from 20 to 42%. It was observed that no locust was attracted to light when temperature was below 16°C and the light was very near and also irrespective of the state of the moon. Amongst the locusts attracted there were mature, immature, females as well as males of solitarious and transient characters.

Incubation Periods of Desert Locust in Bikaner Region

Taking into account the hourly soil temperature of three years at Bikaner Field Station, incubation durations of eggs laid in different months under natural conditions were worked out and a calendar for precasting the probable dates of emergence worked out. This could be of help in locust control strategy. This work, which commenced in previous years, was completed finally in 1970 and the results published in the FAO Technical Series.

Biometrics

(i) Besides analyzing 777 adults collected from all over the desert during 1970, which was found to be "transiens" population, the phaseology of the locusts collected in the Madasar and Kalajhanda areas, where high concentrations or band formations were noticed in the very end of the year, was separately worked out. Multi-variate analysis by combining the characters FC and EFC and FC sex-wise was done and canonical variate values of these populations both for size discriminants and phasiform characters calculated. By comparing the population with that of Stower et al and Davies (1968) estimations, it could be concluded that:

- (a) Madasar population was transitiform but close to solitariform;
- (b) Kalajhanda population was highly transitiform tending towards gregaria.

Other details would be published as a separate note.

(ii) Studies on (a) the morphometric variation in the two colour morphs of solitary hoppers of the Desert Locust and (b) a biomorphic account of some recent populations in India with special reference to Roonwal's hypothesis of swarm prediction were finalized and published in the FAO Technical Series.

Locust Food Plants

In view of the surmises that are being often made suggesting a connection between the ascorbic acid (Vit.C) in food plants and speedy maturation of the Desert Locust eating them, as also the importance attached to the ascorbic acid for the proper growth and development of hoppers and adults of locusts which are singularly helpless in the synthesis of this necessary vitamin, studies to assess the levels of ascorbic acid in about a dozen desert plants were made. A couple of laboratory food plants such as cabbage and cauliflower were also included in the assessment studies. Estimations had shown that many of the desert plants the locust had access to in the desert have a high content of this vitamin. Details of assessments etc. were being published. Further tests to establish the correlation between Vit. C and the maturation speed would be taken up.

Insecticidal Trials

Patches of advanced fifth instar hoppers were reported by the field staff in Sam sector of Jaisalmer district and this opportunity was exploited to test four new samples of insecticides available in the field station.

In some of the recent conferences of FAO, stress had been laid on the probable differences between the reaction/susceptibilities of the wild population of the Desert Locust adults and hoppers to the various insecticides and those of the laboratory bred individuals; so those field populations were tested accordingly. Experiments were conducted to test the contact and stomach toxicities of sprays of different emulsifiable concentrates of DDVP, Dursban, Lindane and Sumithion against the Desert Locust hoppers of advanced stage. Details of the experiments carried out were being analyzed and would be published in the Technical Series, but suffice it to say here that DDVP and Sumithion at 50 and 75 grams (active ingredient) and Dursban and Lindane 100 gms (active ingredient) per acre gave significantly high mortality. No residual toxicity of DDVP and Dursban was observed. Application of the spray was made by a motorized low volume knap-sack sprayer and the rates of active ingredient varied from 25 to 100 gms per acre at Murar-Kalajhanda area of Jaisalmer district.

Biotic Factors Studies

Of late there has been some stress on the role of biotic factors especially the reptilian population as an effective regulator of periodicity of locust plagues. An attempt was therefore made to assess the part played by these reptiles in the field. Uromastyx being one of the common reptiles seen in the Rajasthan desert, salient features of its bionomics and biology were attempted. The study revealed that this reptile is predominantly a vegetarian as assessed by dissecting the field specimens as also by feeding experiments. However, laboratory-caged specimens ate locust hoppers and grasshoppers readily. Unlike others, this reptile is most active in the noon/afternoon and enters the burrow by the evening. It is not nocturnal. It becomes progressively less active as winter approaches and can survive without food for long periods in winter. Its burrows are found mostly in hard or gravelly soils. Further details were under study.

Locust Meteorological Studies

Some case studies of incursion of exotic swarms during 1959 and 1968 were pursued. Results would be published on completion.

Other Locusts

The data obtained from various studies on Bombay locust, its development, biology and behaviour, etc. were collated and a comprehensive article prepared and published in the Indian Journal of Entomology. Bombay locust has been showing signs of activity in the Laccadive Islands of the Arabian Sea for the last decade.

Grasshoppers

A study of the salient developmental feature of the grasshopper Sphingonotus savigni was made at the field station, Bikaner. Its incubation period was found to vary from 11 to 17 days between 32 to 38 degree centigrade and each egg pod gave rise to 8 to 15 hoppers. In all 6 instars were observed in the nymphal period.

Accounts of some of the projects that were taken up in earlier years but completed during the year under review were written up and the following articles were published.

1. A field calendar for predetermining the emergence dates of the Desert Locust hoppers in the Bikaner region.
FAO Technical Series UNDP(SF)DL/TS/7:1-7
2. Efficacy of the neem kernel as a deterrent to the Desert Locust.
FAO Technical Series UNDP(SF)DL/TS/6:1-10
3. Studies on the factors inhibiting the feeding on citrus fruits by the Desert Locust.
FAO Technical Series UNDP(SF)DL/TS/6:11-17
4. The phase sensitivity of colour in fifth instar hoppers of the Desert Locust.
FAO Technical Series UNDP(SF)DL/TS/4:27-34
5. Morphometric differences between the two colour morphs of solitarious hoppers of the Desert Locust.
FAO Technical Series UNDP(SF)DL/TS/7:9-19
6. A biomorphic study of some recent 'unimportant' Desert Locust populations.
FAO Technical Series UNDP(SF)DL/TS/7:21-34
7. Some observations on the Bombay Locust (Patanga succincta Lin.) in India
Indian J. Ent. 31 (4):297-310
8. Phase transformation of Desert Locust (Schistocerca gregaria Forsk.) during 1963 in India.
Plant Pro. Bull. 21 (3):30.

Programme of Work for 1971/72

1. Studies on the biology (both isolated and crowded locusts), incubation period, larval period and percentage of natural mortality under different soil and temperature conditions.
2. Oviposition reactions to soils containing different concentrations of various salts (chemicals).
3. Effect of prolonged low temperature and pressure on adults and hoppers.
4. Night flying and light trap studies and analysis of accumulated data.
5. Correlation of locust activity (swarming and non-swarming population) with available meteorological data.
6. Improvements in methods of assessing locust population and analysis of data of previous trials.
7. Phenology of certain desert plants and analysis of observations made so far.
8. Toxicological studies on some newer insecticides against hoppers and adults of the locusts and important grasshoppers.
9. Studies on the natural depletion of some insecticides sprayed/dusted on soil/vegetation.
10. Phaseology of locust population during 1971/72 in relation to various biomorphic discriminators.
11. Biotic factors.
12. Studies on the biology of Bombay Locust, Migratory Locust and important grasshoppers of arid and semi-arid regions.

IRAN

At Bandar Abbas rearing work was continued under laboratory and semi-natural conditions for raising large cultures for providing material for toxicology, behaviour and other studies under semi-field conditions. The progress was satisfactory as compared with last year except that high humidity of 90-97% created some problem during summer.

Observations were recorded on the duration of different hopper stages and the number of generations in a year. Effect of soil salinity on hatching of eggs was also studied.

Rearing of Desert and Moroccan Locusts was also in progress at the Pests and Diseases Research Institute, Evin, Teheran. Studies on the biology of the two locusts and on diapause in case of the Moroccan Locust were being undertaken. Effect of sub-lethal doses of different insecticides on the progeny was also being studied.

In addition, research work was undertaken on the effect of diazinon on the fecundity of the Desert Locust eggs. Diazinon was applied in sub-lethal doses to the parents and the specimens were kept in the cage provided with tubes full of sand to enable oviposition. The eggs were successfully laid in the sand tubes and in most cases hatched successfully. The majority of the hoppers died after two days but a few reached the fledging stage. Most of the adults thus fledged were deformed with short wings. This work was still continuing and a further report would be issued in due course.

Programme of Work for 1971

1. Toxicological studies on some insecticides (Malathion U.L.V. and Acrodel U.L.V.) against Desert Locust as well as on Moroccan Locust and important grasshoppers.
2. Studies on the biology, incubation and larval periods and mortality under different soil, temperature and humidity conditions in Bandar Abbas.
3. Oviposition reactions to soils containing different concentrations of salts in Bandar Abbas.
4. Light trap studies in the Desert Locust areas in Southern Iran.

PAKISTAN

Bhawani

Population Fluctuations Around Bhawani Research Station

Regular fortnightly survey of Uthal Tehsil for studying population fluctuations revealed that locust adults usually existed along the sea coast all round the year. The population remained almost constant at 80 per square mile from January to July. After 11 inches of rainfall during August/September the population increased to about 600-1000 per square mile during October/November.

Taxonomy and Population Studies of Other Grasshoppers of Pakistan

Collection of grasshoppers at regular intervals was made to assess the population of various grasshoppers during the year to study the biology, ecology and taxonomic status. So far more than 1500 specimens had been classified.

Food Preference

Locusts were provided forty different plants to see their influence on maturation and laying. Out of the 40 plants, six were not eaten and were being identified. Further investigations regarding their anti-feeding properties were in progress.

Effect of Food Plant on Hopper Development

Locally available food plants were offered to hoppers to investigate the rate of development. A maximum of 79 days per hopper development was observed in case of hoppers fed on Ghil (local name) and a minimum of 26 days was recorded on Tribulus terrestris.

Programme of Desert Locust Research
at Bhawani for the Year 1971

1. Ecological studies on Desert Locust, population dynamics, vegetation and climatic conditions.
2. Taxonomy and biology of grasshoppers in Pakistan.
3. Locust repellents and antifeedents.
4. Effect of feeding different plants on the development of Desert Locust.
5. Behaviour of scattered locusts in the field and under semi-field conditions, grouping, migration, etc.
6. Phases of Desert Locust and its causes.

Malir

Effect of Low Temperature on the Immature Adults of Desert Locust

Adults exposed to a temperature of 10°C for a period of six hours became completely inactive and resumed normal activity after about an hour of exposure at room temperature. There seemed to be no adverse effect on maturity and egg-laying.

Effect of Cooling on the Development of Desert Locust Eggs

Eggs of different age groups varying from 1-2 days previously incubated at 31°C when exposed to a temperature of 6°C for 24-48 hours showed no ill effect when returned to 31°C except one day old eggs exposed for 48 hours which failed to hatch.

Effect of Food Deficiency on the Nymphs of Desert Locust

The nymphs which received food equal to their own body weights on alternate days took 18 days more for completing the total nymphal duration than the control group which was supplied with normal food.

Effect of Ammonium Nitrate Solution on the Egg Development of Desert Locust

Eggs derived from solitary females were incubated in soil soaked with 1% solution of ammonium nitrate. The treated eggs produced 8% more black hatchlings than the control group.

Anti-Feeding Compounds in Withania Coagulans

The plant Withania coagulans, which grows wild in abundance in Desert Locust breeding areas of Lasbela district, is not eaten by locusts. Extracts of this plant in water, ethyl alcohol, methyl alcohol, hexane, ether and chloroform were sprayed on maize leaves but these were readily eaten by locusts. It appears that the anti-feeding compound is not soluble in the above solvents. Studies were in progress with other solvents.

Effect of Food Plants on the Development of Desert Locust

Tribulus terrestris, which grows in abundance both in cultivated and desert areas, is a favourite food of the Desert Locust hoppers. It was observed that hoppers fed on this plant completed the nymphal duration in

23-26 days and laid their first pod 21 days after fledging whereas those fed on maize took 27-33 days for nymphal development and laid their first pod 46 days after fledging. The number of eggs per pod and hatching percentage was also higher in the case of locusts fed on Tribulus terrestris as compared to those fed on maize.

Influence of Aromatic Shrubs on the Sexual Maturation of the Desert Locust

It was reported by ALRC that Commiphora myrrhae triggers sexual maturity of Desert Locust. In Desert Locust breeding areas of Pakistan another species of Commiphora viz. Commiphora mukul grows abundantly. Experiments with this plant also indicated similar effect on the maturity of Desert Locust.

Blood Cells in the Developing Eggs of Desert Locust

The blood cells are found freely floating in the liquid surrounding the embryo in eggs varying in age from 4-10 days. The physiological role of these cells during embryogenesis was under investigation.

Penetration of Insecticide Through the Egg Membranes

Five-day-old eggs were separated from the pod and labelled malathion was applied directly on the egg surface. At intervals the eggs were washed in acetone to remove the adhering insecticides. Preliminary studies indicate that the insecticide could penetrate through the egg membrane. The recovery after 24 hours was estimated to be 18.3% indicating that 81.7% of the insecticide was lost (probably absorbed by the eggs).

Effect of Dieldrin Treated Soil on the Laying Behaviour and Egg Development of Desert Locust

Soil soaked with dieldrin E.C. diluted in water at the rate of 2 oz. active material per acre was filled in oviposition tubes and offered to laying Desert Locust females. Ten females laid 10 pods in the first fortnight. These pods were incubated at 31°C. Three egg pods after 4, 5, 7 days of incubation were removed from the sand; washed in water and kept in a petri dish on moist tissue paper until hatching in the incubator. It was observed that the eggs in all the groups developed normally but the resultant hatchlings died mostly during moulting and the remaining died without eating food within 24 hours after completing intermediate moult. Females which once laid in the treated soil were offered normal moist sand filled oviposition tubes. A few females deposited eggpods which also developed but resultant hatchlings in this instance also died. This shows that the females at the time of laying absorb sublethal doses of insecticides and transmit it to their progeny which caused death. This agrees with the findings of ALRC.

Dieldrin remained active in the soil for more than two months. During that period no resultant hatchling from the treated soil survived for 24 hours.

Effect of Diazinon on the Progeny of Desert Locust

Diazinon in xylene was applied to 10-12 day old females at the rate of ug/g body weight and kept in cages for laying. Only xylene was applied to control groups. It was observed that the treated group deposited fewer egg pods containing less number of eggs which hatched after incubation but all hatchlings died within 24 hours of emergence. This shows that Diazinon was also transmitted to the eggs which proved fatal to hatchlings.

Development of Desert Locust Eggs under Water

Eggs of different age groups were kept immersed under water and incubated at 32°C for varying length of time. It was observed that 1-3 and 6-8 day old eggs were susceptible to immersion as compared to eggs of all other age groups since eggs in the former group burst under water when kept for about 24 hours. Ten-twelve day old eggs were also equally susceptible. The eggs which developed normally under water showed variation in the percentage of hatching which decreased as the immersion period was increased. Eggs of all age groups when kept under water and cooled to 15°C for 24 hours behaved differently. They all developed and hatched one day late when they were removed out of water and incubated at 32°C until hatching.

Insecticidal Trials Against Desert Locust Adults and Hoppers

Ambithion 50% E.C. and Gardona 24% B.C. were further diluted to 5% in xylene and sprayed on adult locusts and third instar hoppers. Three different devices viz. Turbair sprayer (Ciba), Microcapillary applicator and Potter tower were used to apply 0.5 ml. of test insecticide on each group of 10 adults.

Likewise Ambithion 67% and Sapecron 50% L.V. concentrates were also tried. The results were compared with Diazinon which was generally used against locust swarms. From the results it was evident that in all the three test insecticides were inferior to Diazinon when the speed of action was considered.

Synoptic Studies of Locust Swarms in Tharparkar (Pakistan) during Summer 1968

Tharparkar district of Sind was free from locusts before July 1968 but in the second fortnight of July there was an influx of locust population which resulted in egg laying and breeding in this area.

There was small scale breeding in Kulanch Valley of Mekran during the spring season of 1968, and the neighbouring countries of Iran and particularly Arabia were badly infested. This resulted in migration of individual locusts to summer breeding areas of Sind in the beginning but in the second fortnight of July as swarms in Mithi tehsil of Tharparkar district.

Surface and upper air currents for the period 1 to 17 July were studied. A trough of low pressure, which had developed over the Arabian Sea off Maharashtra coast on 1 July, caused well distributed rainfall on 4 and 5 July which created favourable conditions for the concentration and breeding of locusts in Mithi tehsil. In the second fortnight of July with the passage of a well marked low pressure, south-west monsoon over the Arabian Sea was strengthened and Inter-Tropical Convergence Zone also ran close and parallel to the coast of Mekran from 8 to 13 July. However, on 14 July the I.T.C.Z. started receding southwards and on 15 July lay off the Mekran coast. During the second week, the morning air temperature at 4-AGL remained above 20 and was favourable for locust migration.

With the southward shift of I.T.C.Z., it appears that due to relatively strong north-easterly winds over Mekran coast the locusts had no alternative but to fly down-wind over the sea and settle down over the first available land in the vicinity of Mithi in Tharparkar district.

Future Programme

1. Role of water and temperature on the development of Desert Locust eggs (continued).
2. Role of different salt solutions on the egg development of Desert Locust.
3. Embryological studies in the eggs of Poeciloceru pictus.
4. Mode of action of insecticides on production and development of Desert Locust eggs.
5. Transmission of insecticides in the eggs of Desert Locust.
6. Effect of sub-lethal doses of insecticides on the progeny of Desert Locust.
7. Metabolism of insecticides by soil inhabiting organisms.
8. Use of pathogenic organisms to control locust.
9. Food preference and role of preferred food plants on fecundity and fertility of Desert Locusts.
10. Analysis of the relationship between meteorology and the movements of Desert Locust in Pakistan.

ANNEX II

DETAILS OF FELLOWSHIPS AWARDED UNDER
TRUST FUND 123

<u>Name</u>	<u>Country of Origin</u>	<u>Country and Type of Training</u>	<u>Period</u>	<u>Remarks</u>
Ahmed	Pakistan	UK - Advanced training in desert locust control and research	2 yrs.	Completed
Mohammed Sarwar Noorzai	Afghanistan	Iran - General agriculture and plant protection	3 yrs.	Could not make satisfactory progress and had to discontinue studies
Yacob Movassagh Saket	Iran	UK - Applied entomology	3 yrs.	Completed
Ajruddin Wais Formoly	Afghanistan	Iran - General agriculture and desert locust control	2 yrs.	Had to discontinue studies for health reasons
Moshirzadeh Moayedi	Iran	Pakistan - Maintenance of spraying aircraft and equipment	6 mos.	Completed
Barat Ali Jarahi	Iran	Pakistan - Maintenance of spraying aircraft and equipment	6 mos.	Completed
Abdullah Faizyar	Afghanistan	Saudi Arabia/Ethiopia - Exchange visit	1/2 mos.	Completed
M. Rouhani Najafabadi	Iran	India - 2 months field training and 1 month desert locust control	3 mos.	Completed

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ANNEX II (cont'd)

<u>Name</u>	<u>Country of Origin</u>	<u>Country and Type of Training</u>	<u>Period</u>	<u>Remarks</u>
S. Touloui Gavgani	Iran	India - 2 months field training and 1 month desert locust control	3 mos.	Completed
Aaghar Bazmrad	Iran	Pakistan - Maintenance of spraying aircraft	4 mos.	Completed
Khalil Jahed Turk	Iran	Pakistan - Aerial spraying organization	4 mos.	Completed
Bahram Hamidi	Iran	Pakistan - Aerial spraying organization	4 mos.	Completed
Ali Ahmed Naikzada	Afghanistan	India - Locust control and survey	3 mos.	Completed
Said Hezrat Sharifi	Afghanistan	India - Locust control and survey	3 mos.	Completed
Hayatullah Hayat	Afghanistan	India - Locust control and survey	3 mos.	Completed
Mir Mohammed Amiri	Afghanistan	Iran - General agriculture and desert locust control	5 yrs.	Admission awaited

APPENDIX II

TRUST FUND NO. 123

Statement of Accounts as at 31 December 1969
(expressed in US dollar equivalent)

Receipts

US\$

Balance brought forward from 31.12.68		165,678.39
Sums received in 1969 from:		
Afghanistan	2,750.00	
India	27,000.00	
Iran	50,014.53	
Pakistan	33,471.40	
		<u>113,235.93</u>
		278,914.32
		=====

Obligations 1969

	<u>Cash</u> <u>Expenditure</u>	<u>Unliquidated</u> <u>Obligations</u>	
Supplies	39,986.34	105.00	
Travel	8,267.14	100.00	
Contractual services	262.48		
Grants and subsidies	<u>16,058.91</u>	<u>25,998.73</u>	
	64,594.89	26,203.73	
Project Servicing costs:			
5% on supplies and equipment)	4,949.94	3,659.07	
12% on other items) 69,544.83	29,862.80	<u>99,407.63</u>
Unobligated cash balance			179,506.69
Unliquidated obligations			<u>29,862.80</u>
Cash balance as at 31 December 1969			209,369.49
			=====

Transport

Light
Heavy

Equipment

Sprayers and dusters
Exhaust nozzle sprayers

subject to official closing of accounts for 1970 which will take place in February 1971.

Liquid
Dust

Note: BHC dust and hand dusters are also available in the provinces and can be moved to the Dacca province in case of emergency.

APPENDIX III

TRUST FUND NO. 123

Statement of Accounts as at 31 December 1970 (provisional)
(expressed in US dollar equivalent)

Receipts

US\$

Balance brought forward from 1969	209,389.51
Sums received from the Government of Pakistan in 1970 (for the calendar year 1969)	<u>16,646.48</u>
	226,035.99

Obligations 1970:

	<u>Cash</u> <u>Expenditure</u>	<u>Unliquidated</u> <u>Obligations</u>	
Personal services	38.72	61.28	
Supplies	6.99	493.01	
Equipment	378.00	1,647.81	
Travel	4,092.94	906.64	
Contractual services	228.41	-	
Grants and subsidies	<u>14,499.71</u>	<u>24,225.94</u>	
	19,244.77	27,334.68	
Project servicing costs:			
5% on supplies and equipment	2,659.62	3,634.18	
14% on all other items	<u>21,904.39</u>	<u>30,968.86</u>	<u>52,873.25</u>
Unobligated cash balance			173,162.74
Unliquidated obligations			<u>30,968.86</u>
Cash balance as at 31 December 1970*			204,131.60 =====

* Subject to official closing of accounts for 1970 which will take place in February 1971.

APPENDIX IV

SURVEY AND CONTROL POTENTIALS
IN THE MEMBER COUNTRIES OF
THE COMMISSION

1970/71

AFGHANISTAN

The Department of Plant Protection and Quarantine, Ministry of Agriculture and Irrigation, Kabul, continued to maintain an Anti-Locust Service. The details of staff and other available resources are given below:

<u>Title and full address</u>	Department of Plant Protection and Quarantine Ministry of Agriculture and Irrigation Kabul, Afghanistan
<u>President</u>	Mr. Abdullah Faizyar
<u>Director, General Locusts</u>	Mr. Mohamed Sidique Zikri
<u>Director, Desert Locust</u>	Mr. Ali Ahmed Nekzada
<u>Technical Staff</u>	23
<u>Administrative Staff</u>	4
<u>Transport and General Service Staff</u>	45
<u>Number of Outposts</u>	5
<u>Transport</u>	
Light	20
Heavy	15
<u>Equipment</u>	
Sprayers and dusters	440
Exhaust nozzle sprayers	10
<u>Insecticides</u>	
Liquid	157 litres
Dust	1,14,000 kgs

Note: BHC dust and hand dusters are also available in the northern provinces and can be moved to the Desert Locust breeding areas in case of emergency.

INDIA

India has a permanent Locust Warning Organization as a wing of the Directorate of Plant Protection, Quarantine and Storage, in the Ministry of Food, Agriculture, Community Development and Cooperation, Government of India. The details of the Organization and the control potential available with it by way of transport, insecticides, equipment and aircraft during 1970/71 are given below:

<u>Title and Full Address</u>	(i) Directorate of Plant Protection, Quarantine and Storage, N.H. IV Faridabad (Haryana) Telegram: PROTECTION, New Delhi PROTECTION, Faridabad
	(ii) Shastri Bhavan, New Delhi
<u>Director</u>	Dr. S.N. Banerjee
<u>Assistant Director</u> (Locust Control)	Mr. P.L. Renjhen
<u>Locust Entomologist</u>	Mr. M.V. Venkatesh
<u>Deputy Locust Entomologist</u> <u>in charge Locust Sub-</u> <u>Station (Jodhpur-Rajasthan)</u>	Mr. K.R. Bhatia
<u>Deputy Locust Entomologist</u> (Headquarters)	Mr. S.C. Agarwal
<u>Other Technical Personnel</u>	138
<u>Senior Administrative and</u> <u>Transport Staff</u>	29
<u>General Service Staff</u>	185
<u>Number of Locust Outposts</u> <u>including circle and zonal</u> <u>headquarters in the scheduled</u> <u>Desert Locust areas</u>	32
<u>Transport</u>	
Light vehicles	79
Heavy vehicles	68
Tractors	7
	<u>154</u>
	154
<u>Insecticides</u>	
Liquid insecticides (oil solution and emulsifiable conc.)	53,513.57 litres
Dust and Powder	1,213,386 kgs

Ground Machinery

Power sprayers	61
Hand sprayers	63
Power dusters	182
Hand dusters	9,595
Exhaust nozzle sprayers	19
	<u>9,920</u>

Wireless Sets

54

Spray Aircraft

Government:

10 (Fixed Wing 7
Helicopter 3)

Private:

44 (Fixed Wing 23
Helicopter 21)

Note: For cultivated areas, the States maintained a large stock of power and hand operated equipment for locust and plant protection work.

IRAN

The Government of Iran continued to maintain an Anti-Locust Service in the Plant Protection and Quarantine Organization, Ministry of Agriculture, on a permanent basis. The details of staff and other resources are given below:

Title and Full Address:

Plant Protection and Quarantine
Organization
Avenue Pahlavi
31 Abdoh Stree (Opp. Ave. Aryamehr)
Teheran

Director

Mr. Hossein Amin Madani

Other Technical Staff

37

Senior Administrative and
Transport Staff

4

General Service Staff

40

Number of Permanent Outposts

6

Number of Auxiliary Outposts

10

Transport

Light vehicles 112
Heavy vehicles 20

132

Insecticides

Liquid	77,500 l.
Dust	48,000 kgs.
Carrier (Bran)	350,000 kgs.

Spray Aircraft

Super Piper Cubs	27
Cessna	3

Ground Machinery

Power sprayers	1,032
Hand sprayers	822
Hand dusters	40
Exhaust nozzle sprayers	100

Wireless Sets

22

- Note: (a) The vehicles are mostly driven by the Technical Staff.
 (b) The above vehicles are located in the Desert Locust areas but are used for plant protection work also.

PAKISTAN

Title and Full Address

Department of Plant Protection
 Ministry of Agriculture and Works
 Government of Pakistan
 Jinnah Avenue, Malir Halt
 Karachi-27

Plant Protection Adviser and Director

Dr. Heshamul Huque

Other Technical Staff

140

Administrative and General Service Staff

305

Transport

Light vehicles	92
Heavy vehicles	12

104

Insecticides

Liquid	375,890 litres
Dust	262,484 kgs

Spray Aircraft (Beaver)

10

Ground Machinery

Power sprayers	191
Hand sprayers	433
Power dusters	31
Hand dusters	246
Bait mixer	12
Exhaust nozzle sprayer	99

Wireless Sets

29

Summary of Insecticide

Bandar Abbas: 4,800 L.
 Bandar Abbas: 16,070 L.
 Karachi: 18,222 L.
 Zahedan: 18,222 L.
 Ahwaz: 8,952 L.
 Teheran: 810 L.
 Karachi: 17,288 L.

Heavy vehicles
 Light vehicles
 Tractors
 Excluded
 - Dust & powder (in 1,000 lbs)
 - Sprays (E.C. & wettable sprays) (in 1,000 lbs)
 (in 1,000 L. 1,261 for 1971)

440 9,858 202 872 11,628

10 382 1,124 221 1,322

10 30 10 40

SUMMARY

	<u>Afghanistan</u>	<u>India</u>	<u>Iran</u>	<u>Pakistan</u>	<u>TOTAL</u>
<u>Staff</u>					
Technical	26	142	38	140	346
Non-technical	49	214	44	305	612
<u>Transport</u>					
Light vehicles	20	79	112	92	303
Heavy vehicles	15	68	20	12	115
Tractors	-	7	-	-	7
<u>Insecticides</u>					
-Dust & powder (in 1,000 kgs)	114	1,213.4	48	262.5	1,637.9
-Liquids (E.C. & Oil Sol) (in 1,000 l.)	0.157	5,351.4	77.5	375.9	5,804.957
<u>Aircraft</u>	-	10	30	10	50
<u>Power driven ground machinery</u>	10	262	1,132	321	1,725
<u>Hand driven ground machinery</u>	440	9,658	862	679	11,639
<u>Wireless sets</u>	10	54	22	29	115
<u>FAO Reserve of Insecticide</u>					
Bandar Abbas:	BHC ULV 15%	-	4,500	1.	
Bandar Abbas:	Acrodel	-	16,070	1.	
Kerman:	Acrodel	-	18,225	1.	
Zahedan:	Acrodel	-	18,225	1.	
Ahwaz:	Ensodil	-	8,955	1.	
Teheran:	Diazinon 95 C	-	500	1.	
Karachi:	Dieldrin 20%	-	17,788	1.	

APPENDIX V

LIST OF WORKING PAPERS

- AGP:DL/SWA/71/1 - The Desert Locust Situation during 1970/71 and Forecast
- AGP:DL/SWA/71/2 - Desert Locust Survey and Control Activities Carried out by Member Countries
- AGP:DL/SWA/71/3 - Survey and Control Potentials in the Member Countries 1970/71
- AGP:DL/SWA/71/4 - Special Surveys
- AGP:DL/SWA/71/5 - Report of the Executive Committee
- AGP:DL/SWA/71/6 - Programme of Work and Budget for 1972