सत्यमेव जयते

Two days National Training Workshop
On Desert Locust

28th & 29th January, 2021

Government of India

Ministry of Agriculture & Farmer's Welfare
Department of Agriculture Cooperation & Farmer's Welfare
Directorate of Plant Protection Quarantine & Storage
Locust Warning Organization, Jodhpur-342001 Rajasthan (India)

Two days National Training Workshop

On Desert Locust

During 28th & 29th January, 2021

at

Locust Warning Organization,
Jodhpur-342001 Rajasthan (India)

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Introduction:

During the 32nd Session of South West Asia Commission (SWAC) [A FAO Commission for Controlling the Desert Locust in South West Asia], it was decided that the trust fund will supplement national training workshops upon request by the member country that includes workshop date, participants, trainers, subjects and detailed budget. In order to implement the same and strengthening technical skill of officials involved in desert locust related activities, India planned a Two days National Training Workshop on Desert Locust. The LWO, Jodhpur organized two days National Training workshop on 28th & 29th January 2021 (Batch-I) sponsored by FAO-SWAC at the office of LWO, Jodhpur. In this connection, a detailed program including training schedule, training date, List of participants, estimated budget etc. prepared and sent to the appropriate authorities for approval/sanction. After detailed deliberations between LWO, Jodhpur Directorate of Plant Protection Quarantine & Storage and FAO, a national training program was finalized. Various improvements suggested by FAO and the Directorate for organizing the national training program were accepted and date were finalized i.e. 28th & 29th January, 2021.

Locust Warning Organization (LWO), Jodhpur is the prime office for locust control in India. There are eleven other offices i.e. ten Locust Circle Offices (LCOs) and one Field Station for Investigations on Locust (FSIL) are governed by the LWO, Jodhpur under supervision of Directorate of Plant Protection, Quarantine and Storage, Faridabad (Haryana).

This National Training workshop was organised under the chairmanship of Dr. N. Sathyanarayana, Joint Director (PP) LC & R, Directorate of Plant Protection, Quarantine and Storage, Faridabad. The National Program Officer Mr. Rajesh Dubey from FAO India also participated as an observer of this program. Social distance was also maintained due to Covid-19 in this workshop.

Resource Persons:

In consultation with SWAC and the Directorate team of five resource persons were identified as Trainers. The programme includes Classroom and field exercises, demonstrations, practice training session, Pre and Post evaluation tests.

The nominated resource persons were advised in advance for preparation of their respective lectures and other responsibilities assigned to them for smooth conducting of the national training workshop. They have been requested to report at the training venue one day before of the commencement of the training workshop to discuss preparation and effective training. They were also advised to use latest teaching methods *viz.* best use of Power Point Presentation, White board, Posters, field exercises besides the participatory approach amongst the participants during the course of training workshop. The List of resource persons is annexed in **Annexure-I.**

Participants:

The participants for this training cum workshop were identified from different LCOs, RCIPMCs/ CIPMCs of 10 states participated in the training programme and nominations were approved by Competent Authority. Initially it was decided to choose qualified, newly appointed and some old experienced person and rest will be trained in the subsequent batches. A list of participants is annexed at **Annexure-II**.

Training Program:

Keeping in view the locust active season in India which may probably commence from June month, It was decided to organize the National Training workshop during 28th & 29th January, 2021 on Biology, Behavior , Survey , eLocust3 & RAMSES, field exercise, etc. Accordingly a detail schedule of training programme including date, time for each classroom and field activities was identified with respect to the training programme and got approved by the appropriate authorities. A copy of the programme is annexed (**Annexure-III**).

Day 1: 28/01/2021

Registration of the participants:

The National Training Workshop began with the registration of participants / resource persons. During the registration, the participants were advised to follow due precautions and guidelines of COVID-19 and provided folder, training literature, T- Shirt, cap, note pad & a pen.

Inaugural Session:

1. Inaugural session started with welcome address by Dr. Virendra Kumar, Assistant Director (PP), Locust Warning Organization, Jodhpur. In his welcome address, he encouraged all the participants to adopt participatory approach during the course training workshop. It was also emphasized that the participants use their practical experience in order to improve their skill. Then the function has started by the lighting the lamps together with Dr. N. Sathyanarayana, JD (PP), Directorate of Plant Protection, Quarantine & Storage, Faridabad, Sh. Rajesh Dubey, National Program officer, FAO India, Dr. K.L. Gurjar, Deputy Director (PP), CIB & RC, Faridabad and Dr. Virendra Kumar, AD (PP), LWO, Jodhpur.
2. Honourable Plant Protection Adviser Dr. Ravi Prakash also gave their exhortation by video conference from Directorate of Plant Protection, Quarantine & Storage, Faridabad and congratulate to all participants. He has also released the poster/banners of FAO

for farmers. He has also enumerated about the background of the national training programme and its usefulness to the participants in order to improve their skill in decision making on locust control activities. Considering the facts that many new comers have joined the locust scheme either their first entry into the Government system or transfer from other scheme, the national training programme will provide required knowledge and exposure to these new entrants in dealing with locust related work.

3. The Senior Locust Forecasting Officer (SLFO) **Mr. Keith Cressman** from FAO, Rome (Italy) has given presentation on international cooperation and current status of the locust through video conferencing.

Pre-evaluation Test:

In order to evaluate the knowledge and skills of the participants, a pre-evaluation test was conducted. The test paper comprised of questions related to biology, behavior, survey & eLocust3. All trainee participants have attempted the pre evaluation test. The comparative result of pre evaluation / post evaluation test is given at **Annexure-IV.**

Technical Session:

Classroom lectures / exercises:

During classroom technical session lecture was taken on "Desert Locust" Introduction "What are locusts" by Dr. Virendra Kumar, Assistant Director (PP), Jodhpur by using power point presentation. After that, another lecture was taken on "Life cycle of Desert Locust and phase" by Dr. Pankaj Salunke, APPO, Jodhpur by using power point presentation.

After lunch, technical session resumed with the lecture on 'Desert locust survey introduction and survey process" by Sh. Dhanne Singh Poonia, PPO, LCO, Bikaner using all the means of training techniques followed by another lecture on "Why make survey", "how to plan a survey", "how to organise a survey", "What information's to collect", "How a report survey result" by Dr. Pankaj Salunke, APPO, LWO Jodhpur. After this, another lecture was taken on the topic "An overview on eLocust 3, e Locust 3m, & RAMSES" by Sh. Chandra Shekhar sharma, APPO, RPQS, Kandla.

During the end of the session, a group discussion on locust situation as well as question answer session was held where all the trainees' participants enthusiastically participated in the session which made the atmosphere charged and interesting.

Day 2: 29/02/2021

Field exercise:

On second day of the training workshop, all the trainee participants along with Master trainers reached to the assigned field at 8.00 AM for mock drill at Uchiyarda

village of Jodhpur. Shri Chandra Shekhar Sharma, Assistant Plant Protection Officer, RPQS, Kandla conducted mock drill and field demonstration of desert locust survey with mechanic Sh. Dharma Ram, LWO, Jodhpur and Dr. Pankaj Salunke, Assistant Plant Protection Officer, LWO, Jodhpur demonstrated the use of eLocust3 in the field. This exercise lasted for three hours. After conducting field exercise all the participants as well as Master Trainers came back to the training venue for the remaining technical session.

Classroom lectures / exercises:

During pre-lunch session Dr. K. L. Gurjar, Deputy Director (PP), CIB & RC, Hqr, Faridabad explained in detail about "Migration and seasonal distribution of Desert Locust".

After lunch break another lecture taken by Dr. K. L. Gurjar, Deputy Director (PP), CIB & RC, Hqr, Faridabad on the topic of "Desert Locust Recession, upsurge, plague Declines" followed by a group discussion organized amongst the all groups where each team leader of a group has presented a brief on the two days training workshop.

Post training evaluation Test:

After completion of the technical session, a post training evaluation test was undertaken to evaluate the difference in perception & knowledge of the participants. Result of pre & post evaluation test is shown in **Annexure-IV**.

Wrap up: At the end of the National Training Workshop all the activities undertaken during the course of two days training were once again briefed to the participants and doubts were clarified on various topics related desert locust.

Conclusion:

The following observations are made on the two days National training workshop on desert locust:

1. Classroom discussions & field exercises viz. demonstration on eLocust3 and locust survey provided excellent practice training session to the participants which not only improved the skill of the participants but also sensitize them to think beyond the box on all relevant issues.
2. Pre and Post evaluation test results indicate that, participants have acquired the fresh knowledge on the relevant topics covered during the training workshop.
3. At the end of the programme, all group leaders briefed the house with improved skill and sense of satisfaction which reflects positivity of participatory approach of the training workshop.
4. The workshop offered an opportunity to improve technical skill by learning & doing method. Participants exchanged their knowledge and experience during the field exercise & group discussion session.

5. The participants expressed their keen interest more in practical session followed by classroom training and suggested to continue such training program frequently in future.
6. Entire workshop conducted in Hindi and English languages. Keeping in view of positive feedback of the participants and success of this program, it has been decided to submit a proposal for next training on “Locust Control Techniques” and other important subject.

Annexure – I

List of Resource Person

S.No.	Name of Resource Person	Designation	Headquarter
1.	Dr. K.L. Gurgar	DD (PP)	CIB&RC, Faridabad
2.	Dr. Virendra Kumar	AD (PP)	LWO, Jodhpur
3.	Sh. Dhanne Singh Poonia	PPO (E)	LCO, Bikaner
4.	Dr. Pankaj Salunke	APPO (E)	LWO, Jodhpur
5.	Sh. Chandra Shekhar Sharma	APPO (PP)	RPQS, Kandla

Annexure – II

List of Trainees

S.No.	Name of participants	Designation	Headquarter
1.	Dr. Jasveer Singh	JD (E)	RCIPMC, Faridabad
2.	Dr. Vasudha Gautam	DD (E)	CIPMC, Jaipur
3.	Dr. A.K. Bohria	DD (E)	CIPMC, Nagpur
4.	Dr. G.P. Singh	DD (E)	RCIPMC, Lucknow
5.	Sh. Mirnal Sharma	AD (WS)	CIPMC, Baroda
6.	Sh. Suresh Kapil	AD (PP)	CIPMC, Jalandhar
7.	Dr. Atul Thakare	AD (E)	RCIPMC, Nagpur
8.	Sh. Chandrabhan	AD (E)	CIPMC, Agra
9.	Sh. Sunil Singh	PPO (WS)	CIPMC, Patna
10.	Sh. Atul Sinha, PPO (PP)	PPO (PP)	CIPMC, Gaurakhpur
11.	Sh. N.K. Bhargawa	PPO (E)	CIPMC, Sriganganagar
12.	Sh. Rambir Singh, PPO (E)	PPO (E)	CIPMC, Dehradun
13.	Sh. Vijay Pal Singh, PPO (E)	PPO (E)	CIPMC, Shilong
14.	Sh. Rajesh Kumar, PPO (E)	PPO (E)	LCO, Jaisalmer
15.	Sh. Ramkumar, PPO (E)	PPO (E)	RCIPMC, Faridabad
16.	Sh. Vinod Maitraya, APPO	APPO	Locust Div. Faridabad
17.	Sh. Gopal Singh Sel, APPO	APPO	LCO, Nagaur
18.	Sh. Shri Ram Didel, APPO	APPO	CIPMC, Jaipur
19.	Sh. Chera Bhai Solanki, SA	SA	LCO, Palanpur
20.	Sh. Lalata Prasad, SA	SA	LCO, Suratgarh

21.	Sh. Ram Narayan Singh, SA	SA	LCO, Bikaner
22.	Sh. Rameshwar Lal Yadav, SA	SA	LCO, Bikaner
23.	Sh. Khushbuddin Siddiqui, SA	SA	LCO, Jaisalmer
24.	Sh. Dalip Kumar, SA	SA	LCO, Jalore
25.	Sh. Raj Kumar, SA	SA	LCO, Jalore
26.	Sh. Ram Avtar Meena, SA	SA	FSIL, Bikaner
27.	Sh. Dharmendra Singh, SA	SA	LCO, Phalodi
28.	Sh. Arun Panwar, TA	TA	LWO, Jodhpur
29.	Sh. S.P. Gupta, TA	TA	FSIL, Bikaner
30.	Sh. Kishan Lal, TA	TA	LWO, Jodhpur

Annexure - III

Schedule of Two Days Training Programme

Date	**Time**	**Agenda**
28/01/2021	09:30-10:00	Registration of participants
	10:00-11:00	Inaugural function
	11:00-11:15	**Tea Break**
	Technical Session	
	11:15-11:45	Pre-evaluation test
	11:45-12:15	Desert Locust Introduction "What are locusts" by Dr. Virendra Kumar, Assistant Director (PP), Jodhpur.
	12:15-13:00	Life cycle of Desert Locust and phase by Dr. Pankaj Salunke, APPO (E), Jodhpur.
	13:00–14:00	**Lunch Break**
	14:00-15:00	Desert locust survey introduction and survey process by Sh Dhanne Singh Poonia, PPO (E), LCO, Bikaner.
	15:00-16:00	Why make survey, how to plan a survey, how to organize a survey, What informations to collect, How a report survey result by Dr. Pankaj Salunke, APPO (E).
	16:00-16:15	**Tea Break**
	16:15-17:00	An overview on eLocust 3, e Locust 3m, & RAMSES by Sh. Chandra Shekhar sharma, APPO (PP), RPQS, Kandla.
	17:00-17:30	Group Discussion
	8:00	Arrival to Mock Drill Site
	8:00-12:00	An overview on eLocust 3, e Locust 3m, & RAMSES by Sh. Chandra Shekhar sharma, APPO (PP), RPQS, Kandla under field condition.

29/01/2021	12:00-12:30	Arrival to the lecture venue & **Tea Break**.
	12:30-13:30	Migration and seasonal distribution of Desert Locust by Dr. K.L. Gurjar, Deputy Director (PP), HQ. Faridabad
	13:30-14:30	**Lunch Break**
	14:30-15:30	Desert Locust Recession, upsurge, plague Declines by Dr. K.L. Gurjar, Deputy Director (PP), HQ. Faridabad
	15:30-16:00	Group Presentation
	16:00-16:30	Post Training Evaluation
	16:30-17:00	Certificate Distribution and closing.

Annexure - IV

Test Result: Pre & Post training evaluation

Sl. No.	Name of Participants	Pre-evaluation	Post-evaluation	Difference (+)
1.	Dr. Jasveer Singh	48	98	50
2.	Dr. Vasudha Gautam	48	95	47
3.	Dr. A.K. Bohria	23	53	30
4.	Dr. G.P. Singh	48	93	45
5.	Sh. Mirnal Sharma	13	65	52
6.	Dr. Atul Thakare	65	80	15
7.	Sh. Suresh Kapil	43	95	52
8.	Sh. Chandrabhan	40	58	18
9.	Sh. Sunil Singh	70	88	18
10.	Sh. N.K. Bhargawa	58	83	25
11.	Sh. Rambir Singh	58	75	17
12.	Sh. Atul Sinha	68	93	25
13.	Sh. Vijay Pal Singh	13	50	37
14.	Sh. Rajesh Kumar	75	95	20
15.	Sh. Ramkumar	20	68	48
16.	Sh. Vinod Maitraya	60	88	28
17.	Sh. Gopal Singh Sel	45	88	43
18.	Sh. Dharmendra Singh	43	95	52
19.	Sh. Chera Bhai Solanki	03	40	37
20.	Sh. Lalata Prasad	08	13	05

21.	**Sh. Ram Narayan Singh**	**72**	**85**	**13**
22.	**Sh. Rameshwar Lal Yadav**	**13**	**38**	**25**
23.	**Sh. Khushbuddin Siddiqui**	**50**	**80**	**30**
24.	**Sh. Dalip Kumar**	**33**	**50**	**17**
25.	**Sh. Raj Kumar**	**05**	**38**	**33**
26.	**Sh. Ram Avtar Meena**	**45**	**78**	**33**
27.	**Sh. Kishan Lal**	**55**	**90**	**35**
28.	**Sh. Sharvan Singh**	**18**	**30**	**12**
29.	**Sh. Shriram Didel**	**55**	**88**	**33**
30.	**Sh. Arun Panwar**	**60**	**93**	**33**

Annexure-V

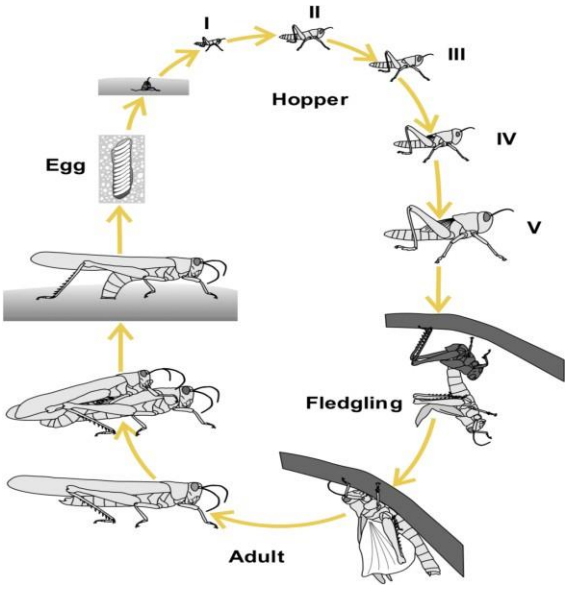
Biology of Desert Locust (Schistocerca gregaria)

Presented By,

Dr. Pankaj Salunke,
Assistant Plant Protection Officer (E)
LWO, Jodhpur

LIFE CYCLE

- Three stages: egg, nymph (hopper) and adult Eggs are
- laid by females, hatch into wingless nymphs called hoppers.
- Hoppers shed their skins five or six times called **moulting** and the stage between moults is referred to as an **instar**.
- The final moult from fifth (or sixth) instar hopper to adult is called **fledging** adult known as a **fledgling**.



Life Cycle Parameters		
Stage	Egg, Hopper, Adult	
Duration	Egg	10-15 days
	Hopper	24-96 days (36 days average)
	Adult	2.5 - 5 months
	Adult maturation	3 weeks
Hopper instars	5-6 (solitarious)	5 (gregarious)
Phases	solitarious, transient, gregarious	

Eggs

- Eggs are usually laid in moist sandy soil about 5-10 cm below the surface.
- The female lays eggs in batches called **egg pods**.
- The eggs look like rice grains and are arranged like a miniature hand of bananas.
- Fill up the hole above the eggs with a plug of froth.
- The egg pods containing fewer than 80 eggs in the gregarious phase and typically between 90 - 160 in the solitarious phase.

Hoppers

- Hoppers make their way up through the froth plug to the surface.
- Immediately moult to the first instar, then pass through five instars, shedding a skin (moulting) between each.
- At final moult (fledging), the young adult (fledgling) emerges.

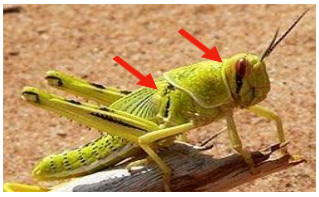
Hopper Instar

1

2

3

4



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Solitary hoppers

Instars	**5-6**
Colour	Green or greenish
Eyestripes	7
Development period	30-39 days (summer breeding) 28-48 days (cooler periods)

Gregarious hoppers

Instars	**5**
Colour	black (L1), yellow with black (L2-5)
Eyestripes	1 (L1), 2 (L2), 3 (L3), 4 (L4), 5 (L5)
Development period	25-57 days

Solitary adults

- Migrate at night, Individuals have been detected by radar up to heights of 1800m.
- low-level flights, leading to short-range displacements, as well as sustained higher- level flights, resulting in migration.
- Some solitary locusts may not migrate at all but merely move.

Adults

Fledglings and immature adults

- About ten days after fledging adult's wings to harden sufficiently so that it is capable of sustained flight.
- Adults remain immature until they encounter conditions that stimulate maturation.

Maturation

- Maturation conditions are usually associated with rain.
- Upon reaching an area where rain has recently fallen, immature adults usually start to mature.
- A mature locust will cause others to mature which may explain why maturation is well synchronized in swarms.
- Adults cannot survive for long under hot dry conditions with little to eat.
- Males usually become sexually mature before females.

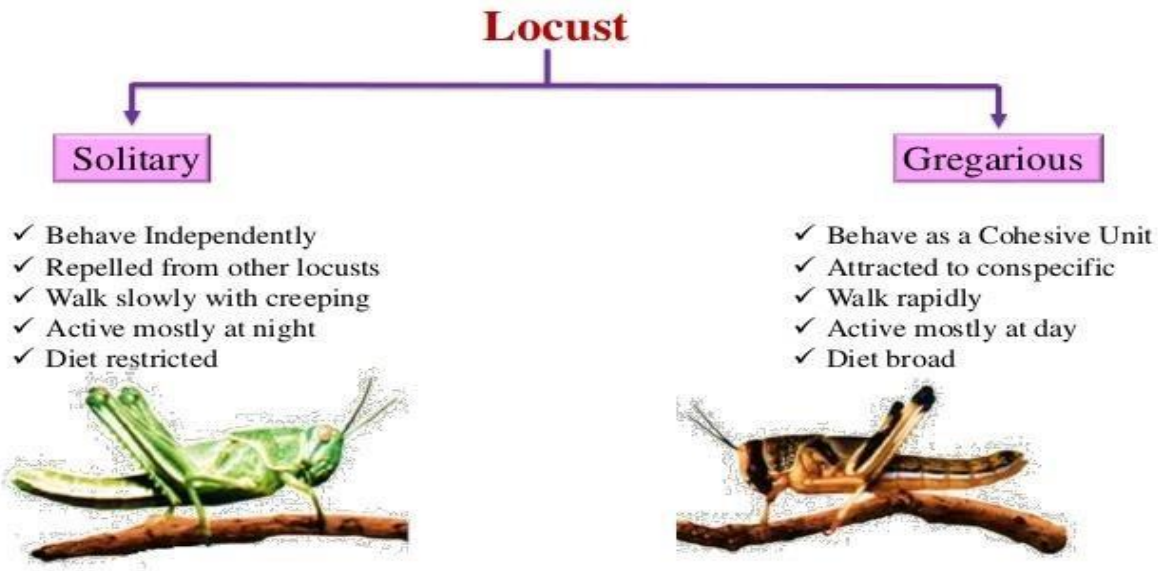
- Like hoppers, solitary adults change their behaviour in response to the environment and numbers.
- As a result of concentration, the adults start to react to each other and form groups, also indicated by a change in colour of the adult.
- **Immature** adults may be brown with traces of **pinkish colour** on their abdomen and wings whereas **mature** adults will have traces of **yellow**.

Locust Phases

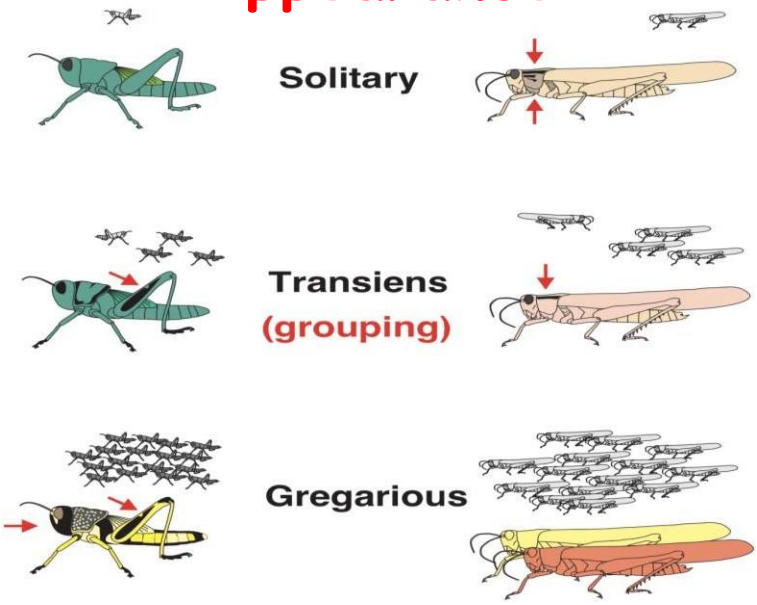
1. Solitarious- present in low densities, individual live separate from each other.

2. Gregarious – when large number of individual gather together.

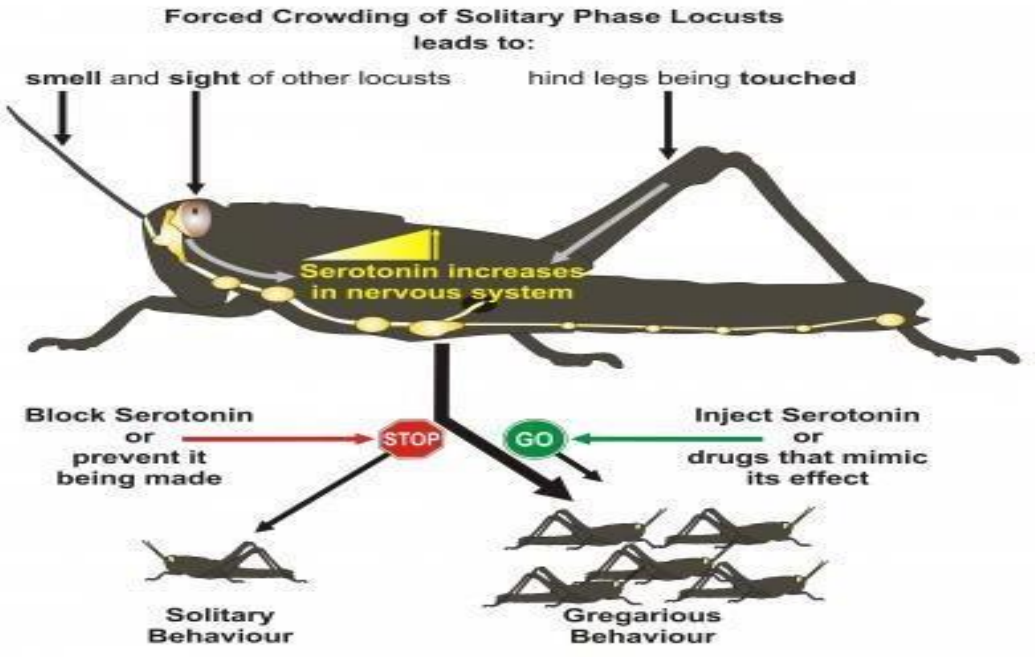
- The transition from solitarious phase to gregarious and vice versa called **transient phase** and locusts referred as **transiens.**



Appearance



- As numbers increase, their behaviour changes – they accumulate and become concentrated.
- Hoppers start to become attracted by others and form groups.
- This occurrence may also be indicated by black markings appearing on the green solitaryhopper.
- Behavioural changes occur before colour changes.
- Grouping can be considered as an intermediate step in the change between solitary phase hoppers and gregarious phase bands.



Breeding seasons

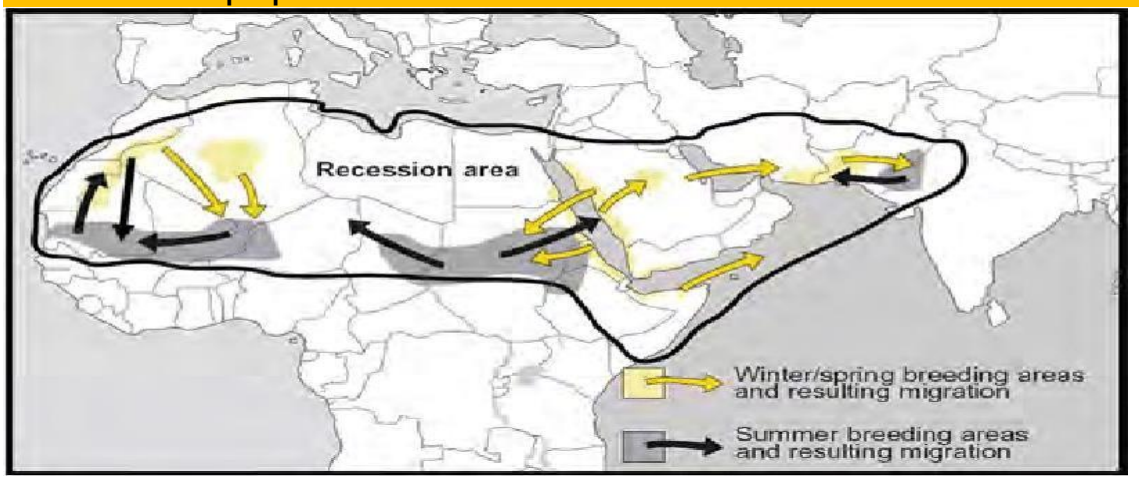
Locust season	Rainfall season	Hatching	Fledging
Spring	February – May	March – June	May – August
Summer	June – September	July – September	August – October
Winter	October – January	October – January	November – February

THANK YOU

Desert Locust Recession, Upsurges, Plagues,

Dr.K.L.Gurjar
Deputy Director(PP),CIB&RC

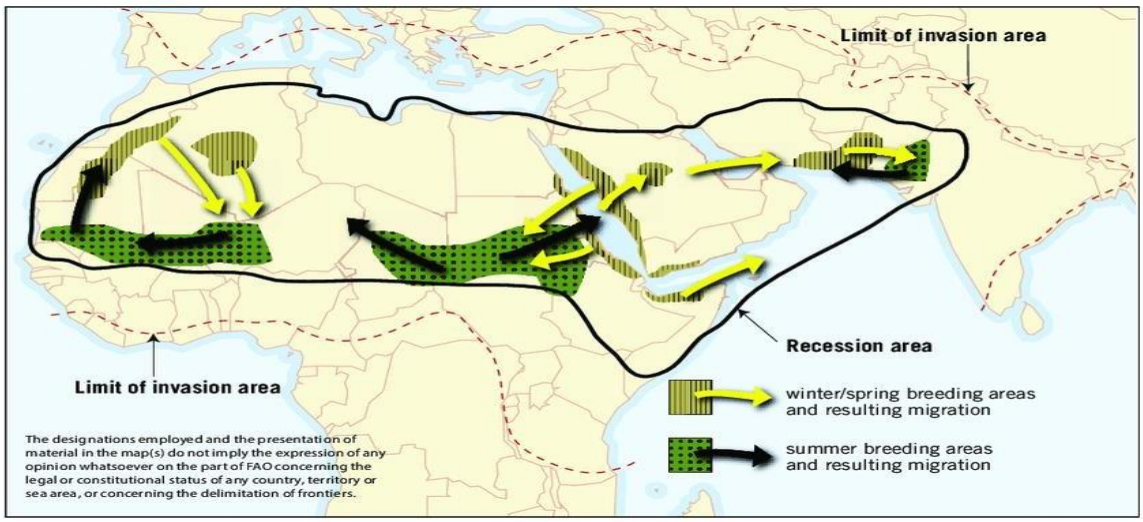
Desert locust recession area with seasonal breeding zones and population movements between them



During quiet periods (known as recessions) **desert locusts** are usually restricted to the semi-arid and arid deserts of Africa, the near east and southwest Asia .

- The Desert Locust is normally present at low densities in semi-arid or arid areas, away from major agricultural zones. Desert Locusts do not cause significant crop damage, and hopper bands and swarms are rare or completely absent. These periods are called *recessions*.
- The area within which these populations are confined and move around within is referred to as the *recession area*. It covers about 16 million km2 and includes some

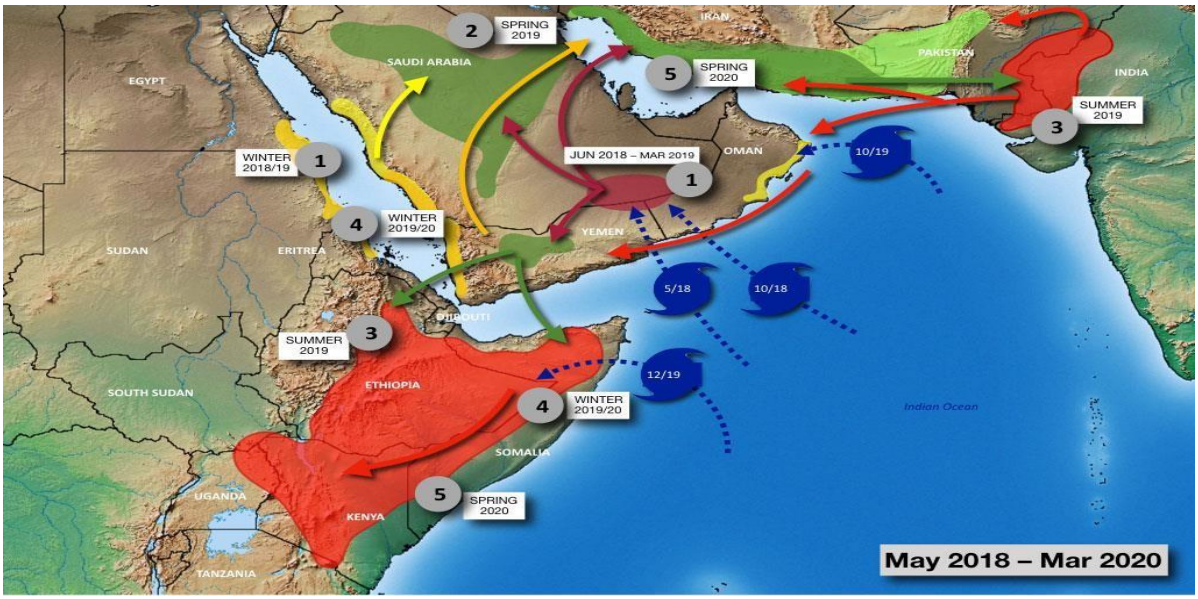
Recessions	Upsurges	Plagues	Declines
---	---	1861-67	---
1868	---	1869-81	---
1882-88	---	1889-1910	---
1911	1912	1912-19	1917-19
1920-25	1925-26	1926-34	1932-34
1935-39	1940-41	1940-48	1946-48
1948	1949-50	1949-63	1961-63
1964-67	1967-68	1968	1969
1969-72	1972-74	---	---
1975-76	1977-80	---	---
1981-85	1985	1986-88	1988-89
1990-92	1992-94	---	---
1995	1996-98	---	---
1999-	---	---	---



Upsurge

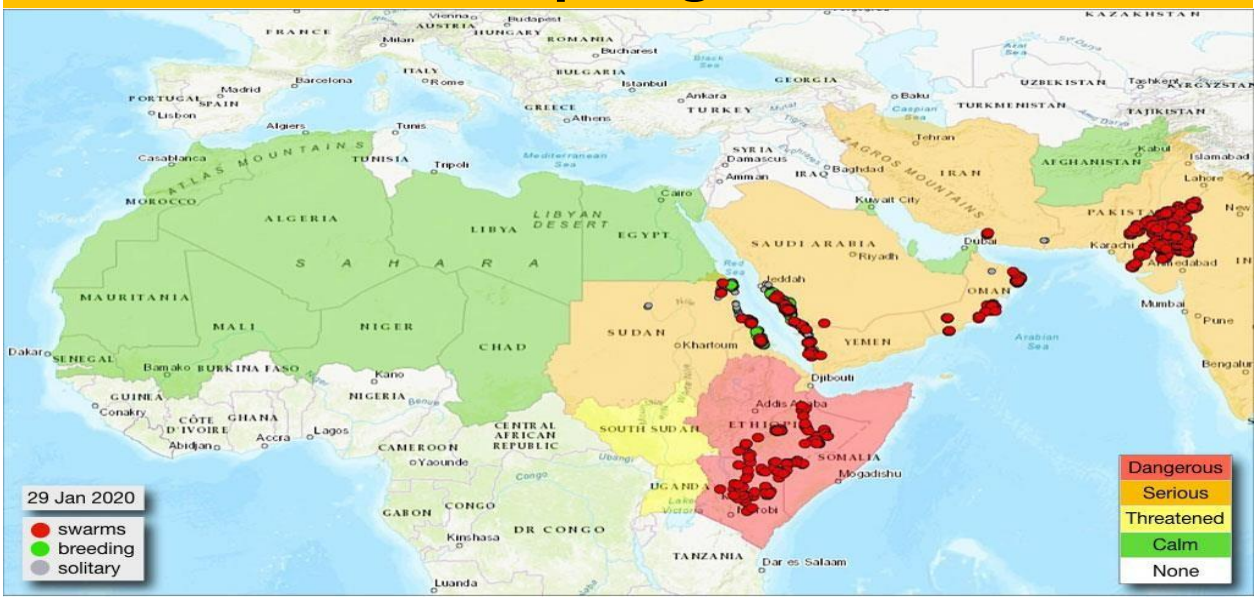
- Upsurges are a result of successful breeding over a number of generations by an initially small population. With successive generations, the proportion of the total population in bands and swarms increases until few scattered locusts remain; the total number of locusts increases as does the size and coherence of the bands and swarms. Several outbreaks that occur at the same time followed by two or more generations of transient-to-gregarious breeding can lead to an upsurge.

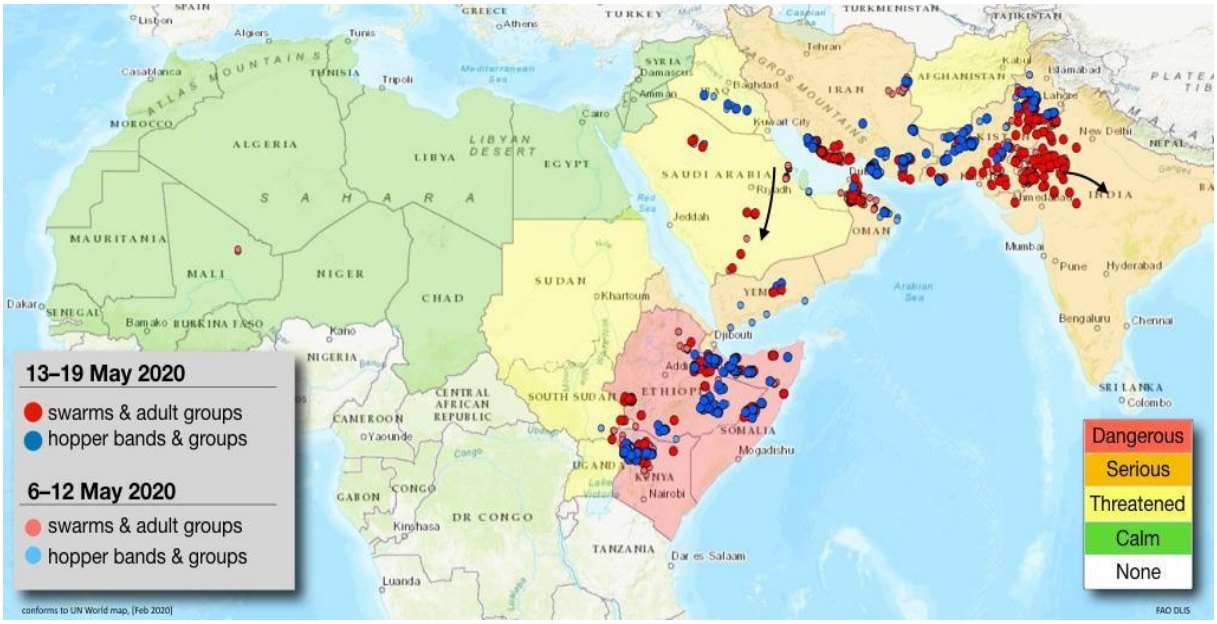
- Overview of the 2019-2020 **Desert Locust upsurge**
- An **upsurge** developed in 2019 as a result of two cyclones that brought heavy rains to the Empty Quarter on the Arabian Peninsula in May and October 2018 that was exacerbated by **Desert Locust** outbreaks along the Red Sea coast during the winter of 2018/2019.

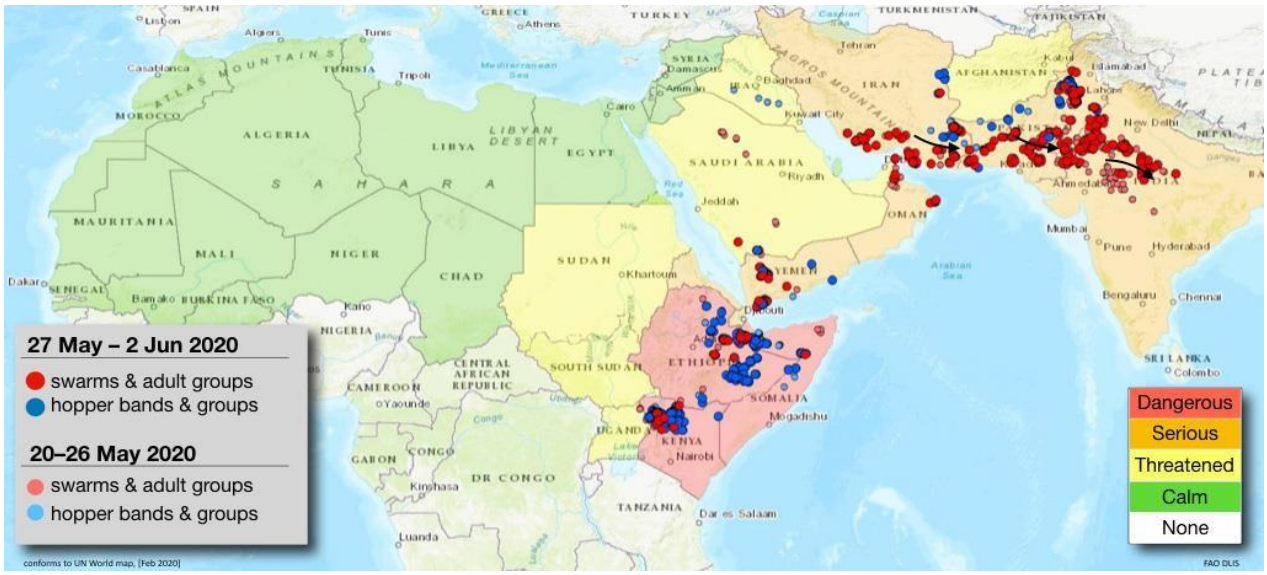


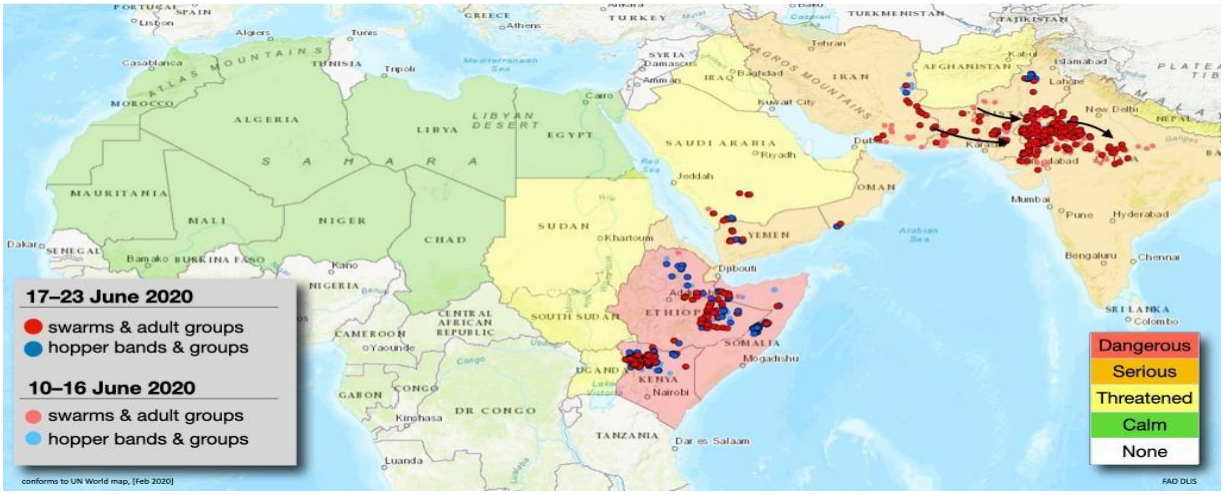
- The cyclones allowed at least three generations of unprecedented breeding in the Empty Quarter that was not detected. Swarms emigrated from these areas to spring breeding areas in the Central and Eastern regions from January to March 2019.
- Two generations of spring breeding occurred that spread to the Horn of Africa and to the Indo-Pakistan border in June.
- Three more generations occurred in the latter area as a result of the best monsoon rains in 25 years while two generations occurred in the northern Horn of Africa until the end of 2019 when a cyclone brought heavy rains to allow two more generations of breeding to June 2020, which extended into Kenya

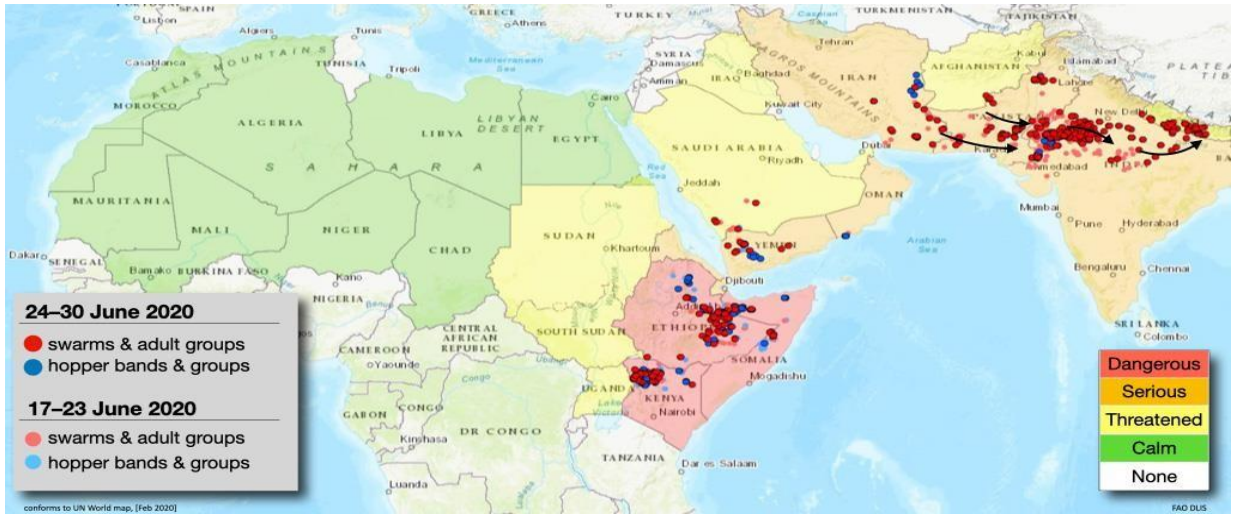
Global situation of the Desert Locust Upsurge

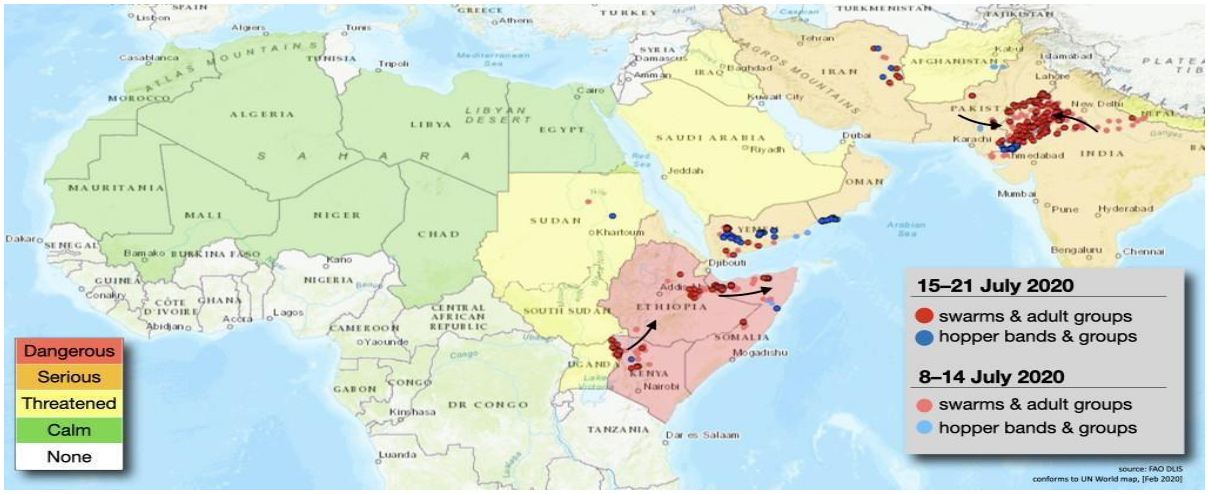


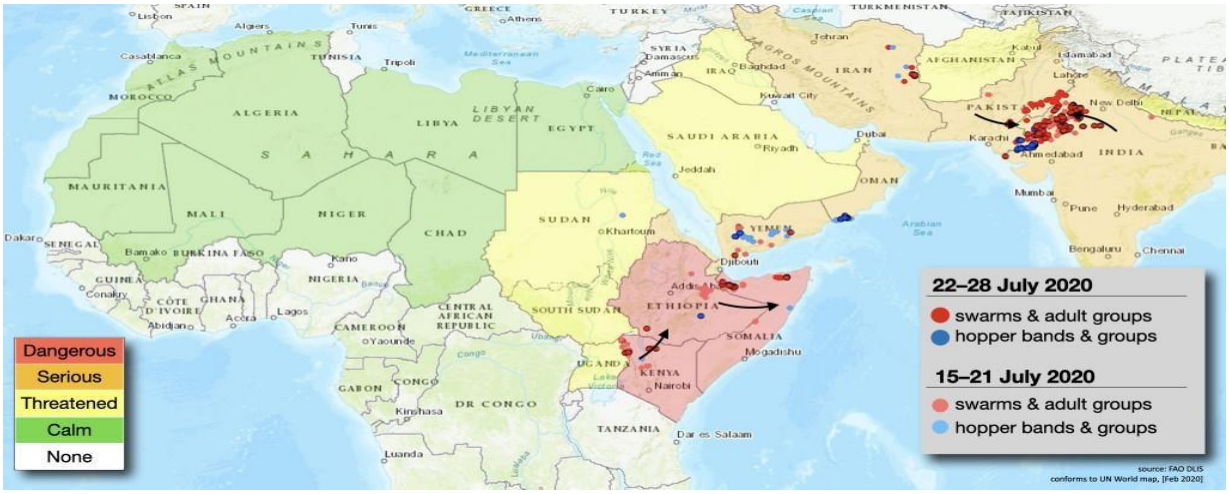


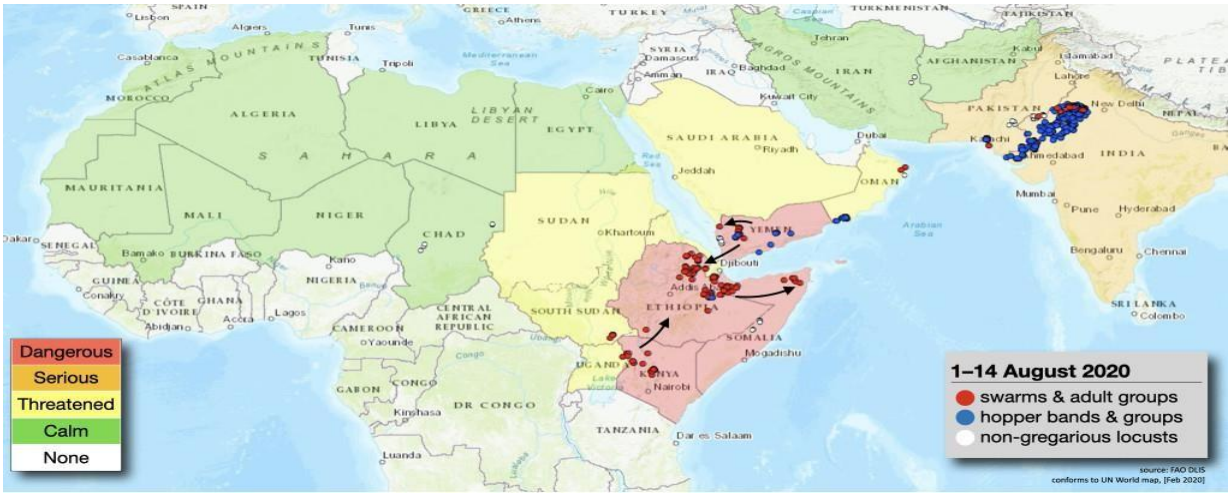

27 May – 2 Jun 2020
swarms & adult groups
hopper bands & groups
20–26 May 2020
swarms & adult groups
hopper bands & groups
Dangerous
Serious
Threatened
Calm
None
conforms to UN World map, [Feb 2020]
FAO DLIS

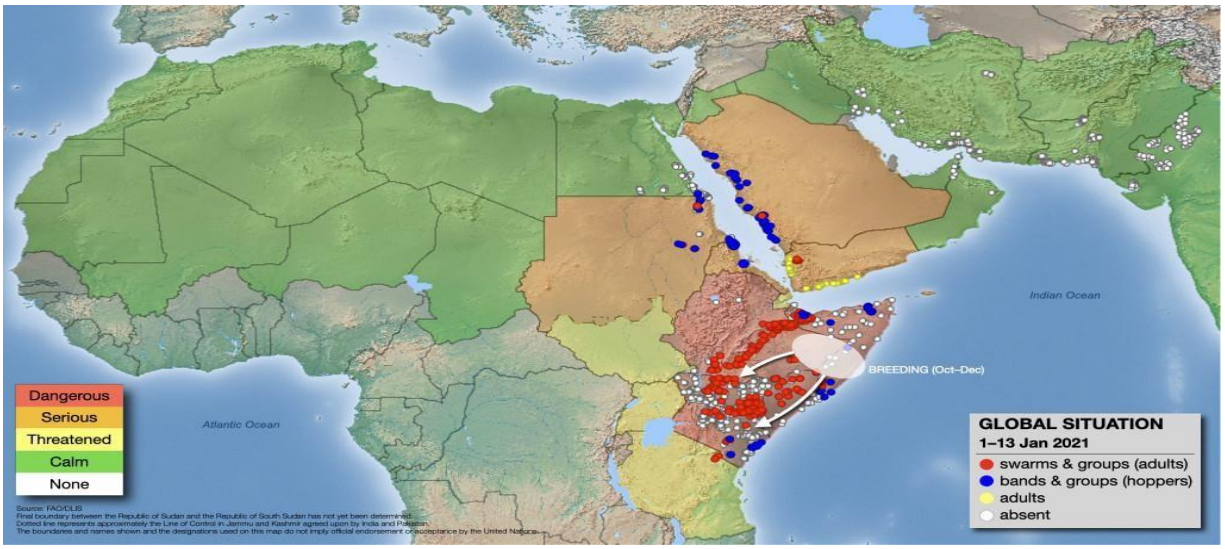

17–23 June 2020
swarms & adult groups
hopper bands & groups
10–16 June 2020
swarms & adult groups
hopper bands & groups
Dangerous
Serious
Threatened
Calm
None
conforms to UN World map, [Feb 2020]
FAO DLIS


24–30 June 2020
swarms & adult groups
hopper bands & groups
17–23 June 2020
swarms & adult groups
hopper bands & groups
Dangerous
Serious
Threatened
Calm
None
conforms to UN World map, [Feb 2020]
FAO DLIS

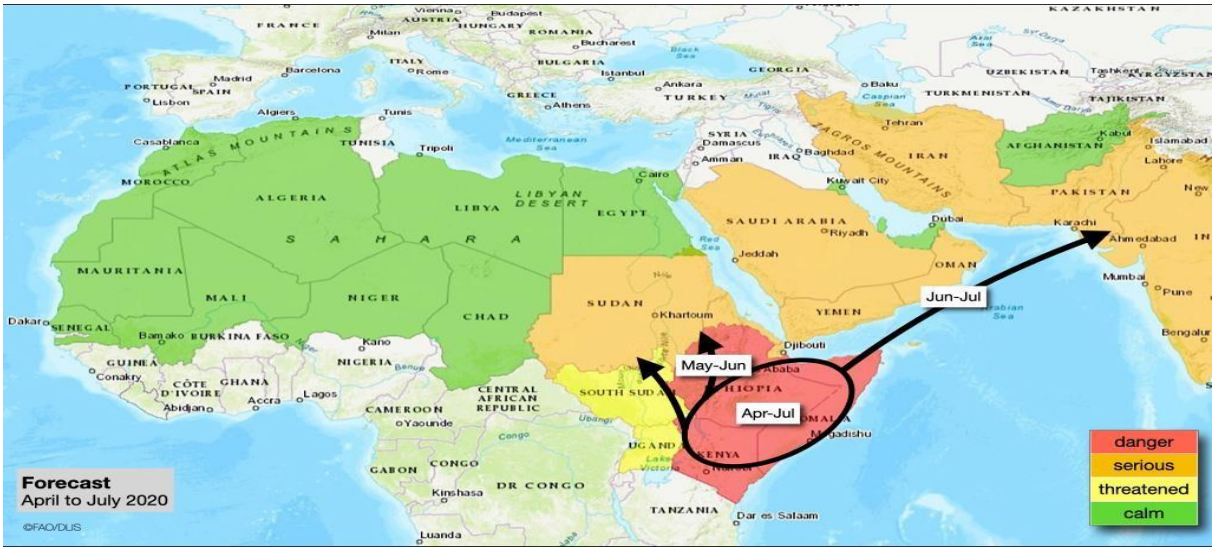

Dangerous
Serious
Threatened
Calm
None
15–21 July 2020
swarms & adult groups
hopper bands & groups
8–14 July 2020
swarms & adult groups
hopper bands & groups
source: FAO DLIS
conforms to UN World map, [Feb 2020]

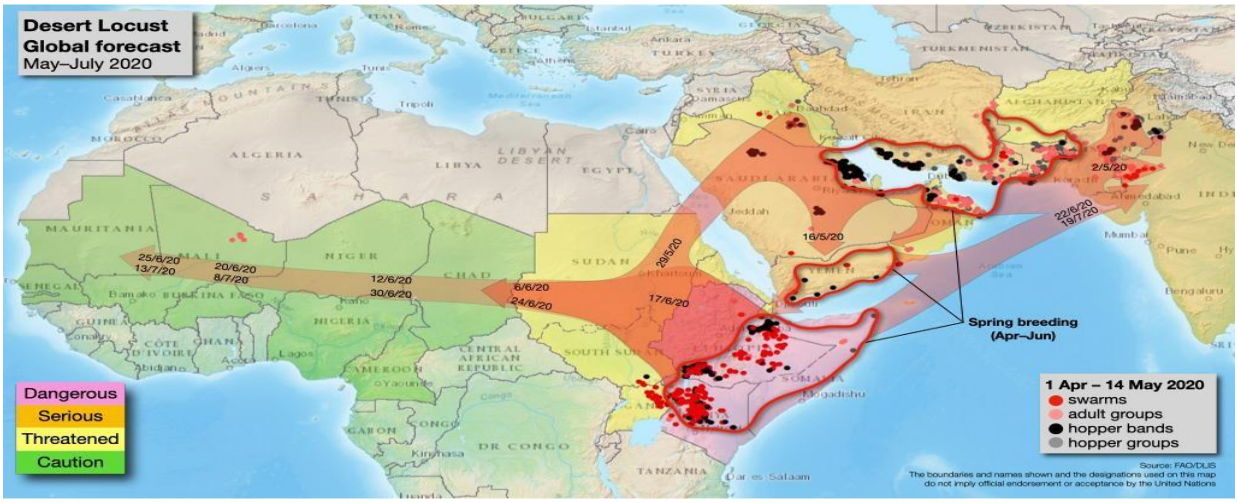

Dangerous
Serious
Threatened
Calm
None
22–28 July 2020
swarms & adult groups
hopper bands & groups
15–21 July 2020
swarms & adult groups
hopper bands & groups
source: FAO DLIS
conforms to UN World map, [Feb 2020]

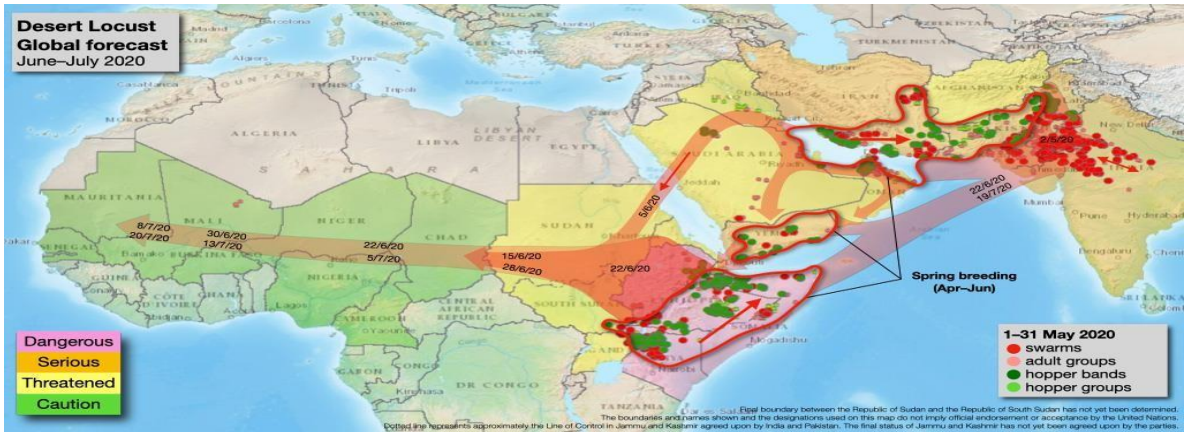

Dangerous
Serious
Threatened
Calm
None
1–14 August 2020
swarms & adult groups
hopper bands & groups
non-gregarious locusts
source: FAO DLIS
conforms to UN World map, [Feb 2020]

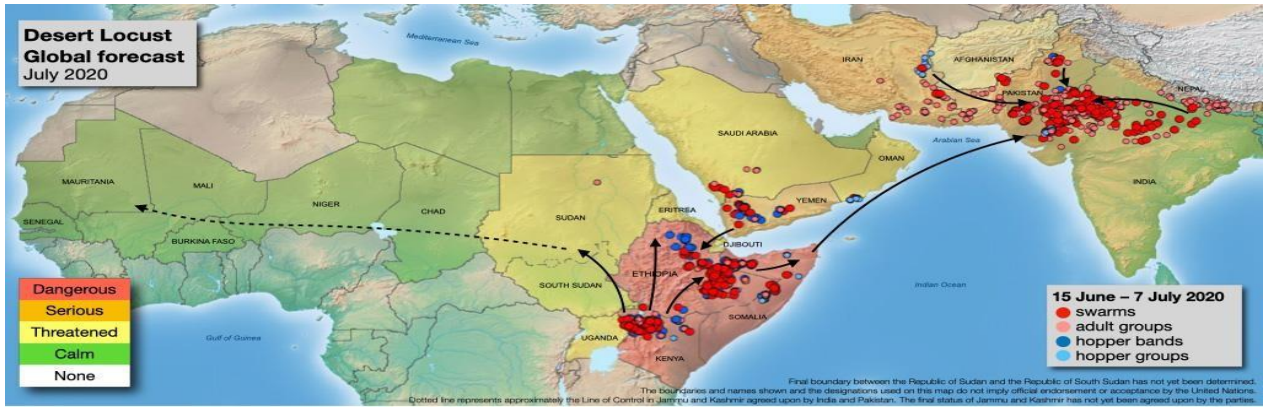


Global forecasts of the Desert Locust Upsurge




Desert Locust
Global forecast
May–July 2020
Dangerous
Serious
Threatened
Caution
25/6/20
13/7/20
20/6/20
8/7/20
12/6/20
30/6/20
6/6/20
24/6/20
17/6/20
29/5/20
16/5/20
2/5/20
22/6/20
19/7/20
Spring breeding
(Apr–Jun)
1 Apr – 14 May 2020
swarms
adult groups
hopper bands
hopper groups
Source: FAO/DLIS
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations


Desert Locust
Global forecast
June–July 2020
Dangerous
Serious
Threatened
Caution
8/7/20
20/7/20
30/6/20
13/7/20
22/6/20
5/7/20
15/6/20
28/6/20
22/6/20
5/6/20
2/5/20
22/6/20
19/7/20
Spring breeding
(Apr–Jun)
1–31 May 2020
swarms
adult groups
hopper bands
hopper groups
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations.
Dotted line represents approximately the Line of Control in Jammu and Kashmir agreed upon by India and Pakistan. The final status of Jammu and Kashmir has not yet been agreed upon by the parties.


Desert Locust
Global forecast
July 2020
Dangerous
Serious
Threatened
Calm
None
15 June – 7 July 2020
swarms
adult groups
hopper bands
hopper groups
Mediterranean Sea
IRAN
AFGHANISTAN
PAKISTAN
NEPAL
SAUDI ARABIA
OMAN
Arabian Sea
INDIA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
ERITREA
YEMEN
SENEGAL
BURKINA FASO
DJIBOUTI
ETHIOPIA
SOUTH SUDAN
SOMALIA
Indian Ocean
Gulf of Guinea
UGANDA
KENYA
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
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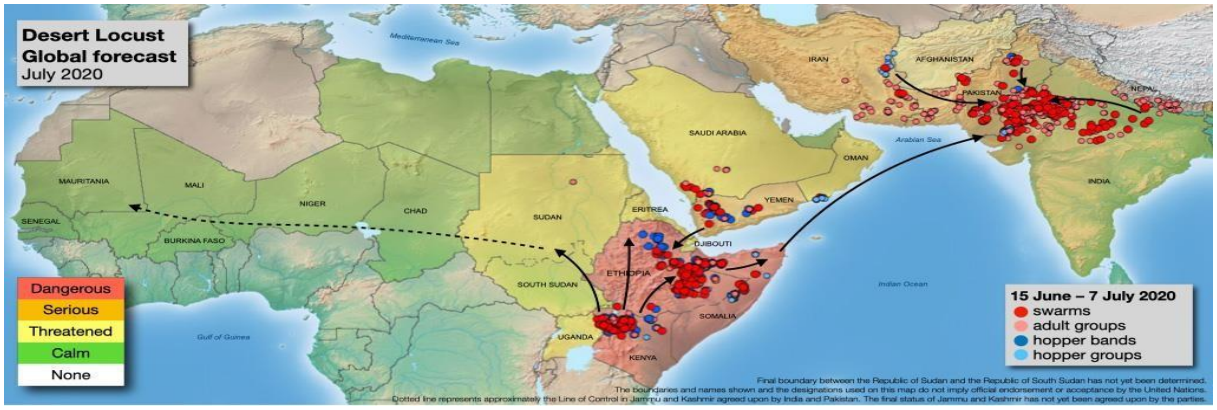
Desert Locust
Global forecast
July 2020
Dangerous
Serious
Threatened
Calm
None
15 June – 7 July 2020
swarms
adult groups
hopper bands
hopper groups
Mediterranean Sea
IRAN
AFGHANISTAN
PAKISTAN
NEPAL
SAUDI ARABIA
OMAN
Arabian Sea
INDIA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
ERITREA
YEMEN
SENEGAL
BURKINA FASO
DJIBOUTI
ETHIOPIA
SOUTH SUDAN
SOMALIA
Indian Ocean
Gulf of Guinea
UGANDA
KENYA
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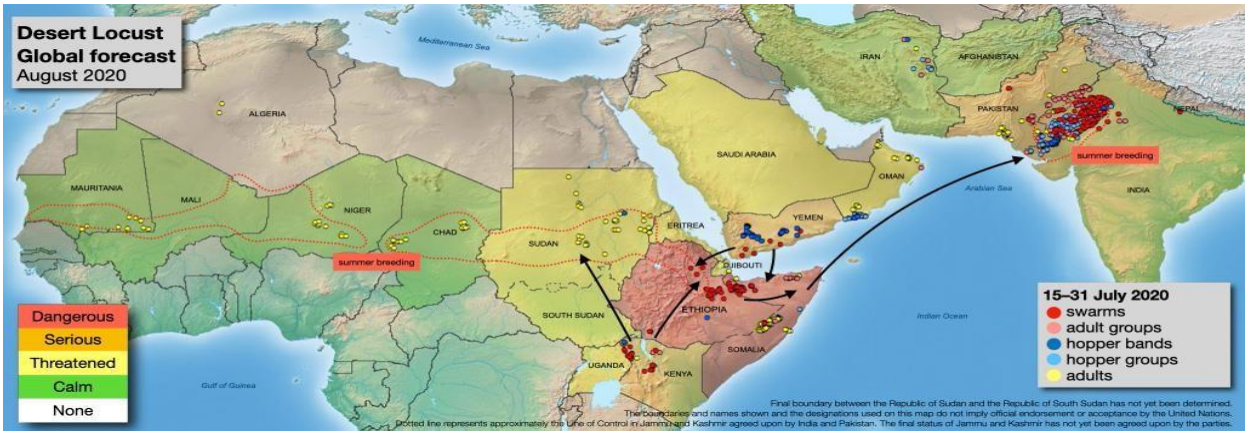
Desert Locust
Global forecast
August 2020
Mediterranean Sea
ALGERIA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
SOUTH SUDAN
summer breeding
IRAN
AFGHANISTAN
PAKISTAN
SAUDI ARABIA
OMAN
YEMEN
ERITREA
DJIBOUTI
ETHIOPIA
SOMALIA
UGANDA
KENYA
Arabian Sea
Indian Ocean
Gulf of Guinea
INDIA
Dangerous
Serious
Threatened
Calm
None
15–31 July 2020
swarms
adult groups
hopper bands
hopper groups
adults
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
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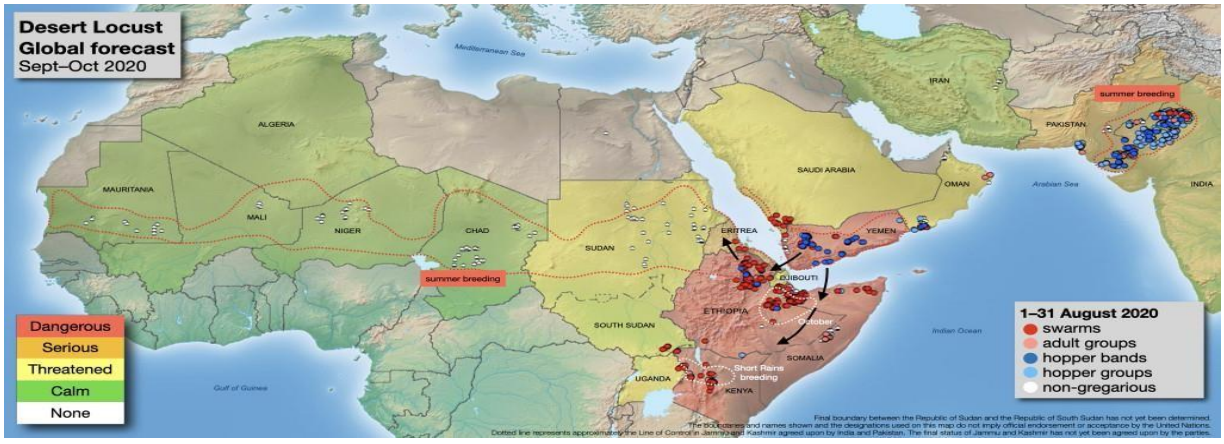
Desert Locust
Global forecast
Sept–Oct 2020
Mediterranean Sea
ALGERIA
MAURITANIA
MALI
NIGER
CHAD
SUDAN
SOUTH SUDAN
summer breeding
IRAN
PAKISTAN
SAUDI ARABIA
OMAN
YEMEN
ERITREA
DJIBOUTI
ETHIOPIA
SOMALIA
UGANDA
KENYA
October
Short Rains breeding
Arabian Sea
Indian Ocean
Gulf of Guinea
INDIA
Dangerous
Serious
Threatened
Calm
None
1–31 August 2020
swarms
adult groups
hopper bands
hopper groups
non-gregarious
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
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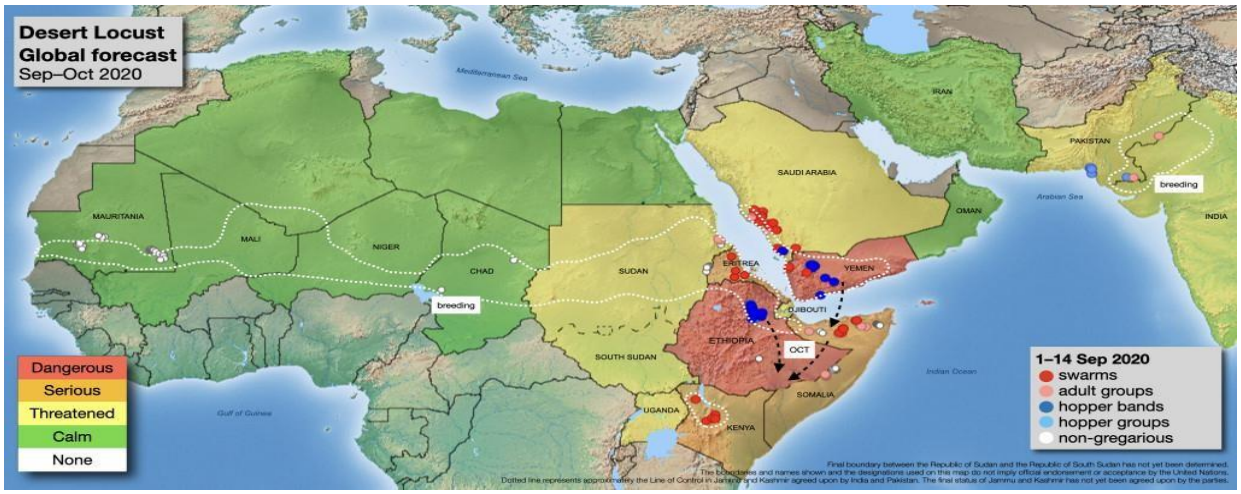
Desert Locust
Global forecast
Sep–Oct 2020
Mediterranean Sea
IRAN
PAKISTAN
SAUDI ARABIA
Arabian Sea
breeding
INDIA
OMAN
MAURITANIA
MALI
NIGER
CHAD
SUDAN
ERITREA
YEMEN
breeding
DJIBOUTI
ETHIOPIA
OCT
SOUTH SUDAN
Indian Ocean
SOMALIA
Gulf of Guinea
UGANDA
KENYA
Dangerous
Serious
Threatened
Calm
None
1–14 Sep 2020
swarms
adult groups
hopper bands
hopper groups
non-gregarious
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
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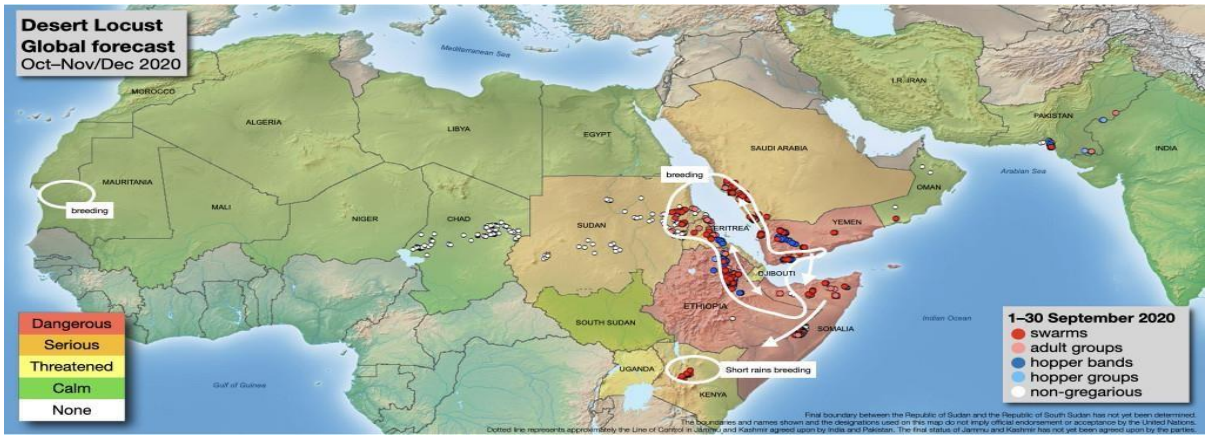
Desert Locust
Global forecast
Oct–Nov/Dec 2020
Mediterranean Sea
MOROCCO
I.R. IRAN
ALGERIA
LIBYA
EGYPT
PAKISTAN
SAUDI ARABIA
INDIA
breeding
Arabian Sea
MAURITANIA
OMAN
breeding
MALI
NIGER
CHAD
SUDAN
ERITREA
YEMEN
DJIBOUTI
ETHIOPIA
SOUTH SUDAN
Indian Ocean
SOMALIA
Gulf of Guinea
UGANDA
Short rains breeding
KENYA
Dangerous
Serious
Threatened
Calm
None
1–30 September 2020
swarms
adult groups
hopper bands
hopper groups
non-gregarious
Final boundary between the Republic of Sudan and the Republic of South Sudan has not yet been determined.
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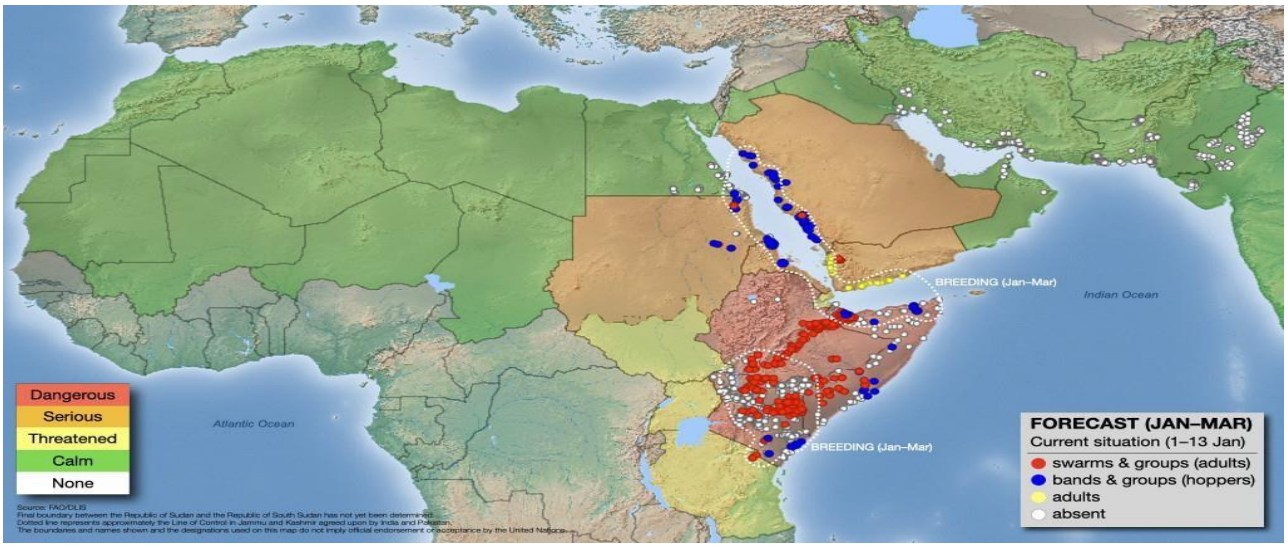


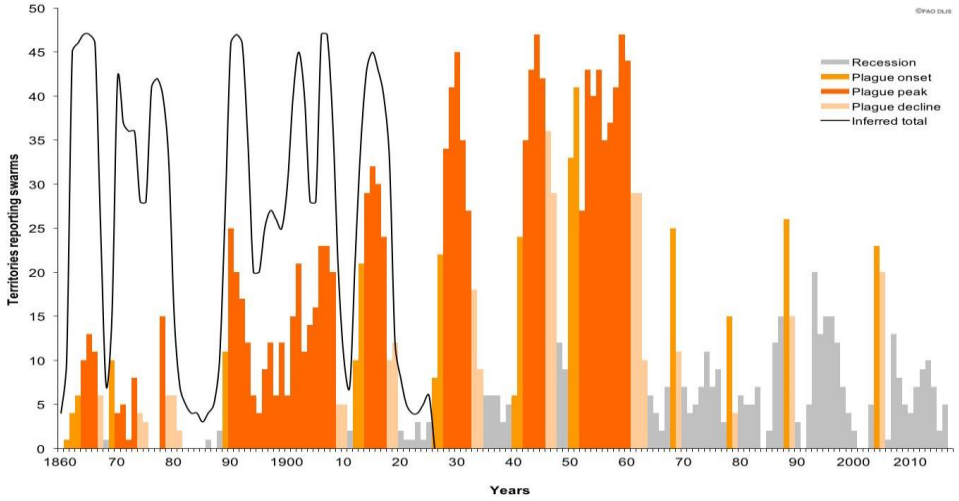
Desert Locust plagues

Plagues are periods of one or more years during which there are widespread and heavy locust infestations, the majority of which occur as bands or swarms. A plague can occur when favourable breeding conditions are present and control operations fail to stop a series of local outbreaks from developing into an upsurge that cannot be contained.A major plague exists when two or more regions are affected simultaneously.

There have been six major Desert Locust plagues in the 1900s, one of which lasted almost 13 years. The area in which plagues occur covers about 29 million sq. km and can extend across 58 countries.

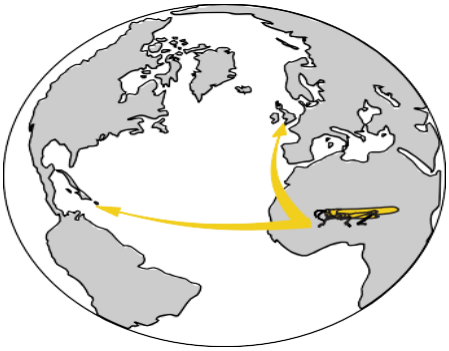
Desert Locust plagues do not occur over night; instead, it takes at least one year or more for a plague to develop through a sequence that commences with one or more outbreaks and followed by an upsurge.
Nowadays, there is sufficient warning in advance that a plague is developing so countries are no longer surprise as they were in the past. This is due to regular surveys and control operations as part of the preventive control strategy adopted by FAO and countries.

1860-2017



Decline

Plagues commonly come to an end through a combination of natural and
human factors such as large-scale migration to unfavourable habitats, failure of seasonal rains resulting in lack of food and breeding activity,



Large-scale migration to areas unsuitable for breeding

Failure of seasonal rains

Control operations

- Plagues usually decline as a result of a combination of natural factors and human intervention (see Fig.). One natural cause is failure of the rains in an area where successful breeding usually occurs. For example, the short rains in the Horn of Africa failed in 1955, which led to the first break in gregarious populations since 1950.

- Another cause is migration to areas from where either the adults or their progeny cannot return. A spectacular example is the trans-Atlantic swarm migrations of October and November 1988. Human intervention through control operations also plays a significant role in bringing plagues to an end.

- Large-scale strategies to control their gregarization process have been operated since the 1950s, most controlling outbreaks at an early stage through the use of pesticides, and an examination of historical data shows that **desert locust** plagues – widespread infestations of swarms affecting extensive areas – **declined** ...

Thank you

DESERT LOCUST SURVEY

Presented By,

Dr. Pankaj Salunke,
Assistant Plant Protection Officer (E)
LWO, Jodhpur

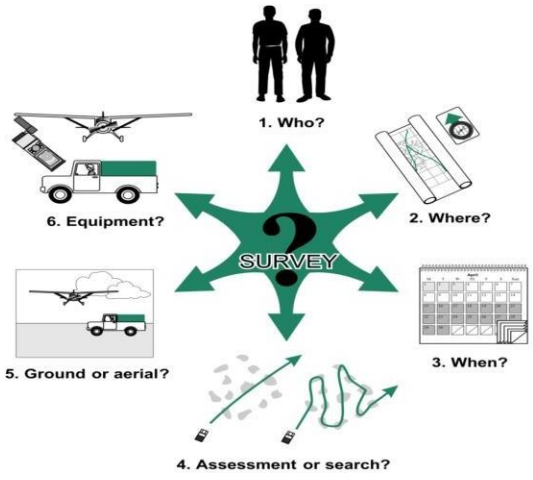
- **‘‘ Why make Survey’’**
- **‘‘ How to plan a Survey”**
- **‘‘ How to organize a survey’’**
- **‘‘ What information to collect’’**
- **‘‘ How to report survey Results’’**

WHY MAKE SURVEY

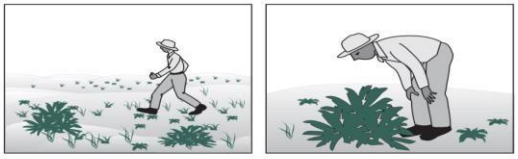
- To assess locust Situation and habitat conditions.
- Monitor changes in populations.
- Provide early warning.
- Identify control targets.
- Allow better planning.
- Make accurate forecasts.
- Inform other countries.

HOW TO PLAN A SURVEY

In order to make survey more effective, use resources as efficiently and economically as possible.



Who should make a survey



Qualified locust field officers

local scouts
extension agents
others

Where to make a survey

Places **present**

Sandy areas with green vegetation

Areas of recent rainfall

Traditional (historical) areas

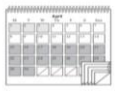
Previously reported places

Expected activity

When to make a survey

During the year

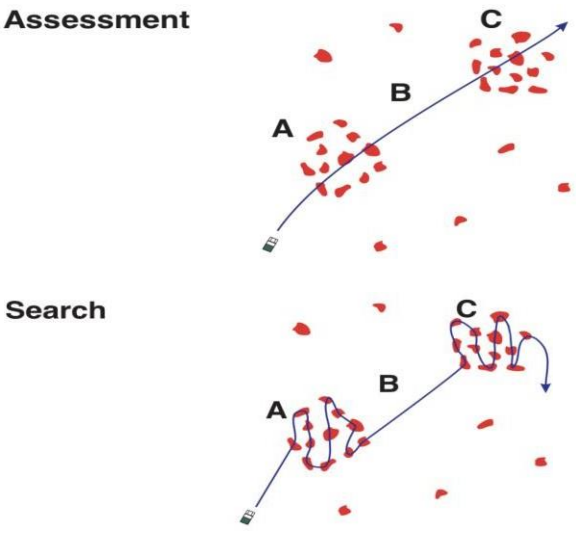

After rainfall


Regular basis
(monthly)
(seasonal)

During the day

- When temperature is 20–38°C
- From shortly after sunrise to about midday
- In the afternoon for a few hours just before sunset

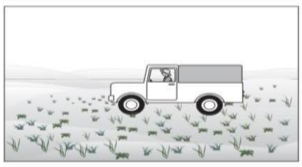
Survey types



Survey method

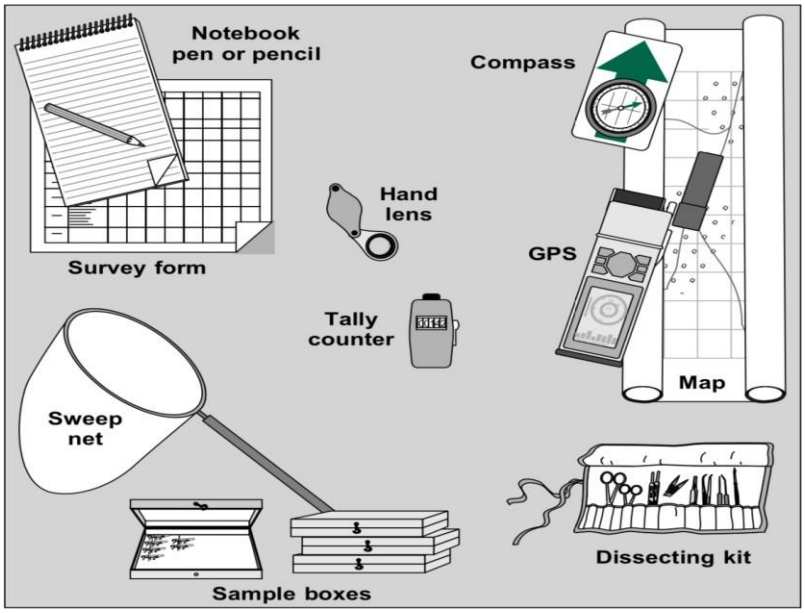
Foot transect

Vehicle transect



Aerial

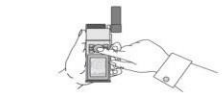
Equipments to take on survey



HOW TO ORGANIZE A SURVEY

- One Vehicle
- One Locust Field Officer per Vehicle
- Remote Areas : Two Vehicles
- Establishment of seasonal Base Camp
- Check Green Vegetation areas
- Two Vehicle : Use leapfrog method

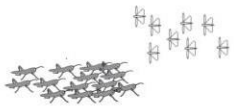
WHAT INFORMATION TO COLLECT



1. Location

2. Rainfall

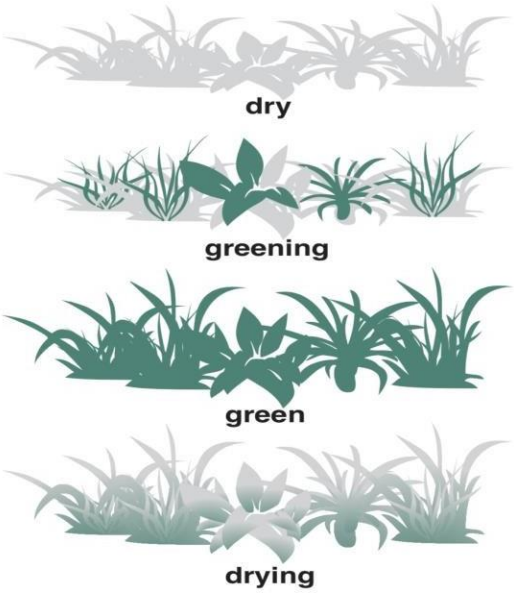
3. Vegetation and soil



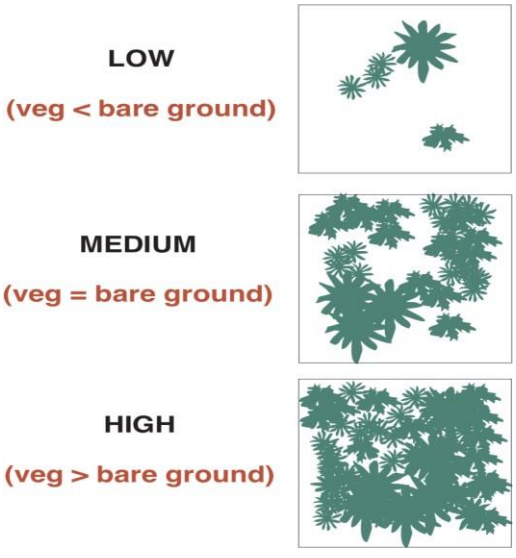
4. Desert Locust

5. Control operations

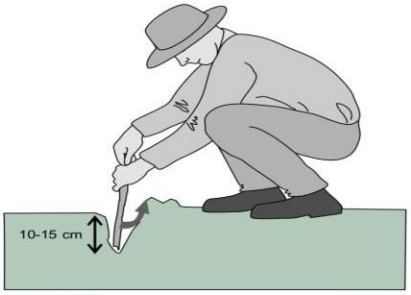
Vegetation condition



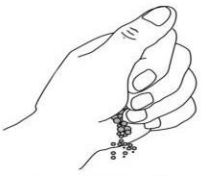
Vegetation density



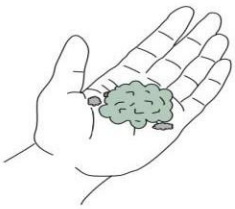
Soil moisture



1. Dig into the soil



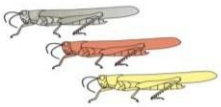
2. Squeeze some soil in your hand



3. If it stays together, the soil is moist

Locust information

1. Appearance



2. Behaviour

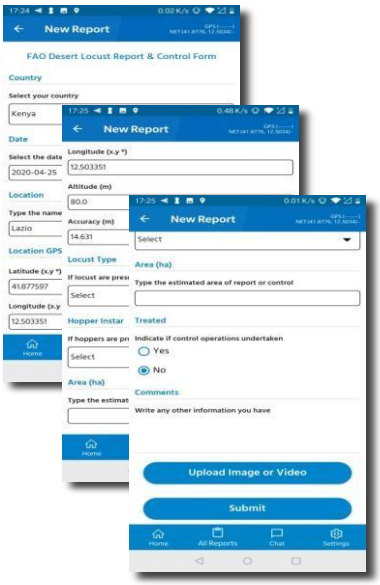
3. Maturity

4. Density & Size

HOW TO REPORT SURVEY RESULTS

eLocust3 unit

eLocust3m
- App for mobile phone app
- off/online transmission
- basic data



New report
(auto GPS, locust)

In-country chat
(data, photo, report sharing)

FAO DESERT LOCUST SURVEY AND CONTROL FORM

page ___ of ___

please send to FAO HQ by fax (+39-06-57055271) or email (eclo@fao.org)

(indicate appropriate information as required)

	SURVEY STOP	1	2	3	4	5	6
1-1	date	29.07.99	29.07.99	30.07.99	31.07.99	31.07.99	31.07.99
1-2	name	Wadi Hamid	Berika	Khor Amer	Bir Bou Ali	Shardi	Abu Qashim
1-3	latitude (N)	210255	210544	203149	200411	200159	194842
1-4	longitude (E or W)	331218	340122	342402	335512	334536	331514
2	**ECOLOGY**						
2-1	area (ha) of survey	100	250	20	100	200	50
2-2	habitat (wadi, plains, dunes, crops)	wadi	dunes	wadi	plains	plains	dunes
2-3	date of last rain	15.07.99	2 weeks ago	12.07.99	about 1 month	13.07.99	13.07.99
2-4	rain amount (mm, Low Moderate High, ?)	L M H ?	L M H ?	L M H ?	L M H ?	L M H ?	L M H ?
2-5	vegetation (dry, greening, green, drying)	greening	green	green	drying	green	greening
2-6	vegetation density (Low Medium Dense)	L M D	L M D	L M D	L M D	L M D	L M D
2-7	soil moisture (wet/dry)	W D	W D	W D	W D	W D	W D
3	**LOCUSTS**						
3-1	present or absent	P A	P A	P A	P A	P A	P A
3-2	area infested (ha)		100		100	200	
4	**HOPPERS**						
4-1	hopper stages (H123456F)	H123456F	H123456F	H123456F	H123456F	H123456F	H123456F
4-2	appearance (solitary, transiens, gregarious)	S T G	S T G	S T G	S T G	S T G	S T G
4-3	behaviour (isolated, scattered, groups)	I S G	I S G	I S G	I S G	I S G	I S G
4-4	hopper density (/site, /m2, Low Med High)		L				
5	**BANDS**						
5-1	band stage (H12345F)	H12345F	H12345F	H12345F	H12345F	H12345F	H12345F
5-2	band density (/m2 or Low Medium High)				5/m2		
5-3	band sizes (m2 or ha)				10 m2		
5-4	number of bands				5		
6	**ADULTS**						
6-1	maturity (immature, mature)	I M	I M	I M	I M	I M	I M
6-2	appearance (solitary, transiens, gregarious)	S T G	S T G	S T G	S T G	S T G	S T G
6-3	behaviour (isolated, scattered, groups)	I S G	I S G	I S G	I S G	I S G	I S G
6-4	adult density (/transect, /ha, L M H)					25/300x4m	
6-5	breeding (copulating, laying)	C L	C L	C L	C L	C L	C L
7	**SWARMS**						
7-1	maturity (immature, mature)	I M	I M	I M	I M	I M	I M
7-2	swarm density (/m2 or Low Medium High)				50/m2		
7-3	swarm size (km2 or ha)				1 ha		
7-4	number of swarms				1		
7-5	breeding (copulating, laying)	C L	C L	C L	C L	C L	C L
7-6	flying (direction, time passing)						
7-7	flying height (Low Medium High)	L M H	L M H	L M H	L M H	L M H	L M H
8	**CONTROL**						
8-1	pesticide name & formulation				Feni 96%		
8-2	application rate (l/ha or kg/ha))				0.4		
8-3	quantity (l)				25		
8-4	area treated (ha)				100		
8-5	ground or air	G A	G A	G A	G A	G A	G A
8-6	estimated % kill				80		
9	**COMMENTS**						
			area between Hamid & Berika is dry with no DL habitats	swarm seen by farmer flying southwest 2 days ago in the early morning	Control form completed	adults seen in sorghum crops; no DL outside of crops	good DL habitat which should be checked after 1 week

Was a GPS used to determine locations? yes no

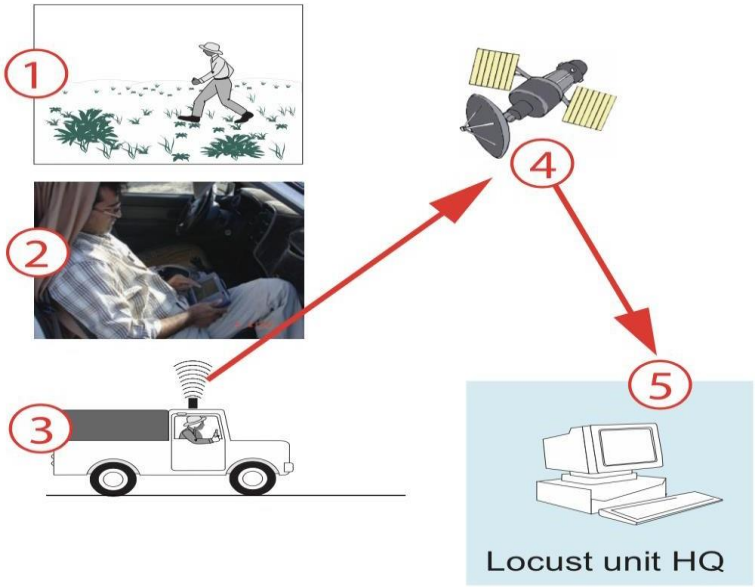
Is a brief interpretation or analysis of the results included? yes no

Country: Sudan

Locust Officer : Mohamed Abu El Hassan date : 31.7.99

cleared by : Ben Osman El Kif date : 1.8.99

Data transmission



HOW TO REPORT SURVEY RESULTS

eLocust3

- If you used eLocust3 for recording and transmitting your survey data and observations, Fill up the Survey Report in eLocust3 in the field (at Survey Stop).
- Then the data will be immediately available on the GeoFlex platform and it will be sent by email to the Locust Unit HQ during the evening.
- A copy of the data will also be saved in the eLocust3 tablet.

Survey forms

- If you recorded survey data and observations on the *FAO Desert*

THANK YOU

Migration & Seasonal Distribution of Desert Locust

Dr.K.L.Gurjar
Deputy
Director(PP),CIB&RC

Dispersal

A. Dispersal through Walking

- Immature stages of insect disperse through locomation
- Armyworm

B. Dispersal through flying

- Trivial flight
- Displacement of insects within breeding or feeding sites.
- Usually movement over short distances.
- Typically does not involve displacement of entire population.
- Butterfly feeding, lightning, bug mating

Migration

- * It involves displacement of entire population from breeding , feeding and overwintering sites.- flight.
- * Individual predispose to flight or transport.
- Eg. Non appetetial behavior- un distracted by mates, food or oviposition sites.
- Regular feature of seasonal cycle for some insects.
- Can result in substantial mortality, only a minute fraction may locate suitable habitat.

- **Migration**

- Mass movement of entire population where some insects return again to the area from which they had moved.

(Dhaliwal,2003)

What is Migration ?

1. Persistent prolonged movement.
2. Straitened course of movement.
3. Undistracted by usual stimuli.(e.g. food , mates.)
4. Distinct arrival and departure behavior.
5. Reallocation of energy in advance of migration.

Migration within boundary layer

* That altitudes at which wind speed equals to insect flight speed below the boundary layer, insect can have direct flight.
* Usually only a few meters high, flight of insect directly obserable.
* Insect control their own flight path, seem to maintain study course.

Eg. Migratory butterflies(monarch butterfly,

Migration above the boundary level.

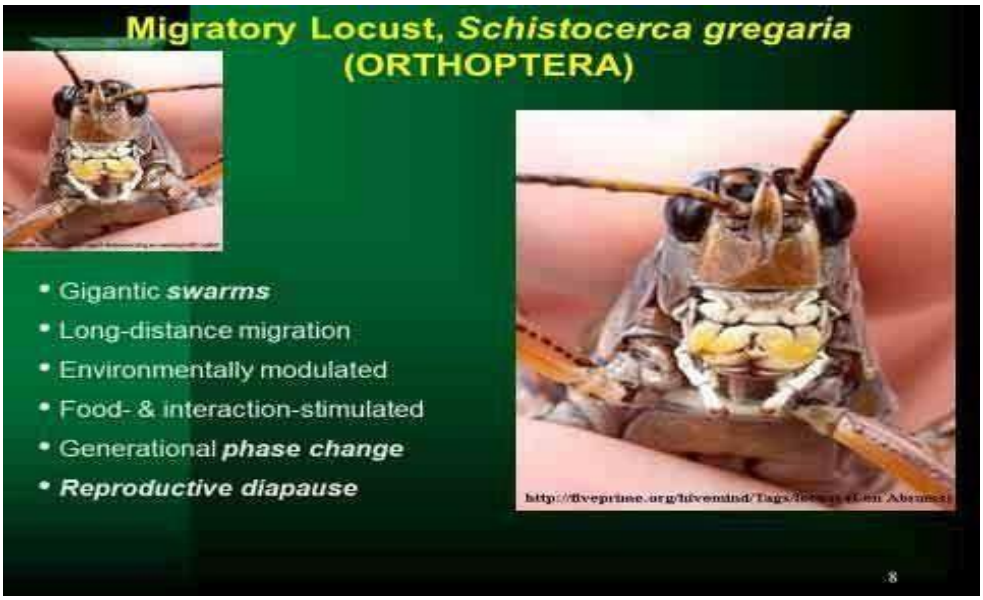
A. Usually combines flight with wind aided transport.

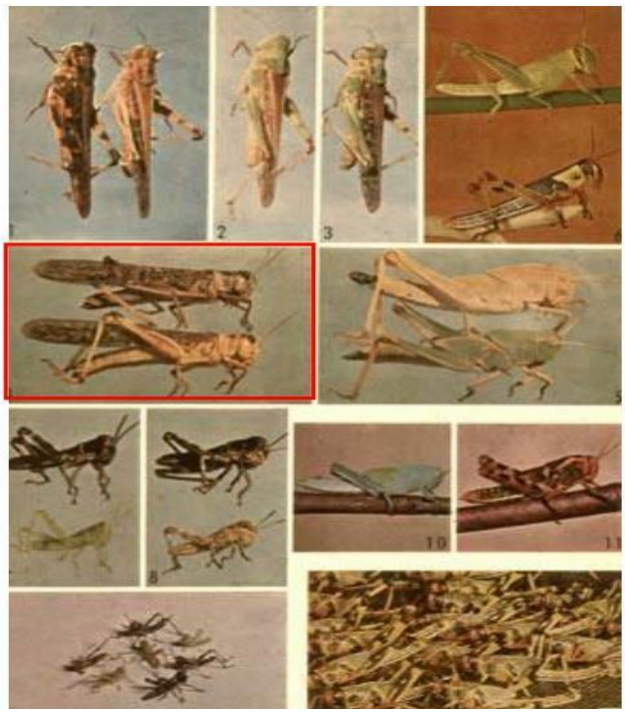
❖ Insect may not be in control of flight

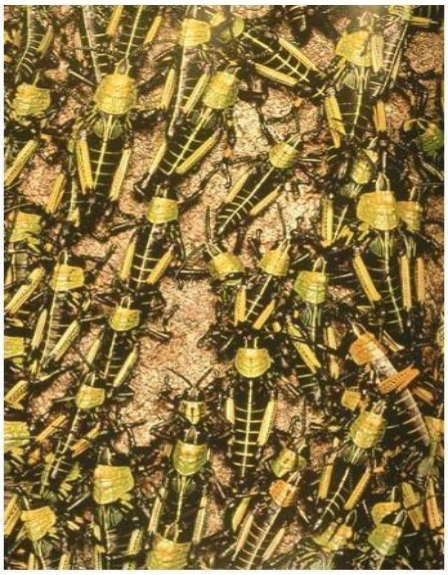
❖Transported by wind Eg: Aphids

B. Aspect of migration above the boundary level(muscular system)

Eg: Desert Locust (*Schistocerca gregaria*).







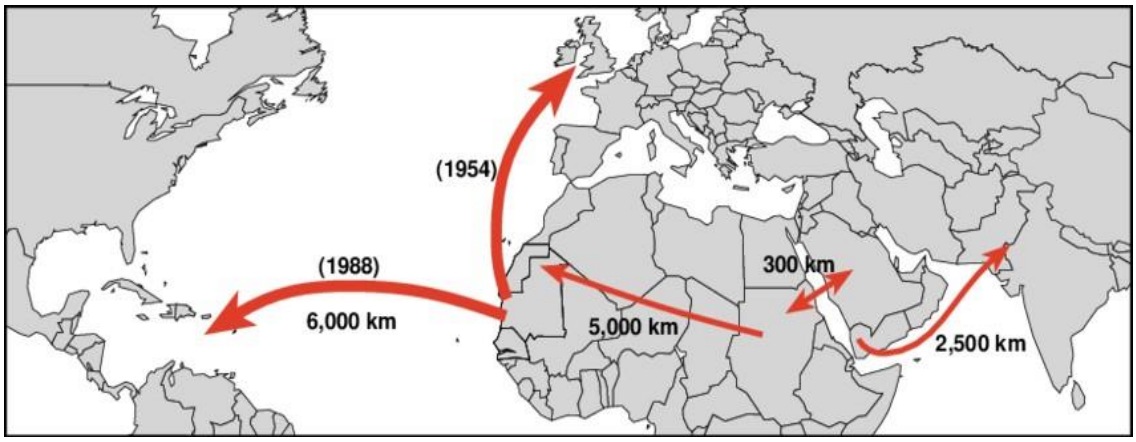
Kentromorphism: polymorphism with generational change from a sedentary to a migratory phase.

- A change brought about by environmental stimuli (high or low population density) in locusts, the larva of Lepidoptera and a few other insects, that cause coloration and pattern differences, anatomical proportions, physiology and behavioral differences; see gregaria, solitaria.

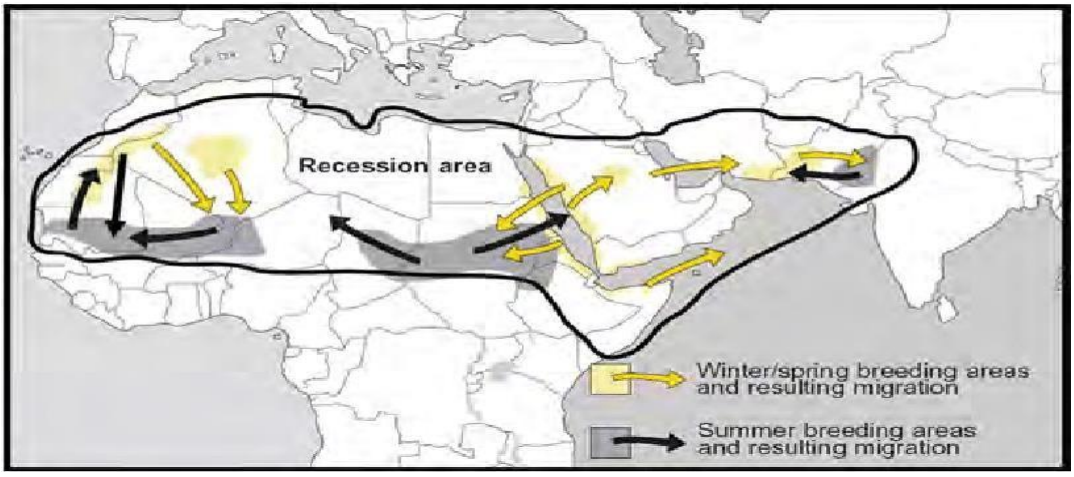
Some Migratory Locust swarms may contains hundreds of billions of insects , weighing thousands of tons.

How far and how fast can desert locust migrate.

- Desert locust usually fly with the winds at a speed of 16-19 km/hr depending on the wind. Swarm can travel up to 5-130 Km or more in a day. Locust can stay in air for long period of time. For example, Locust regularly cross the Red sea a distance of 300 Km. In the past there have been some spectacular and very long distance swarm migrations. For example from North West Africa to British Isles in 1954 and from West Africa to the Caribbean, a distance of 5,000 Km in about 10 days in 1988.Solitary Desert Locust Adults usually fly at night whereas gregarious adults(swarms) fly during the day.



Within the recession area, locusts move with the winds. These bring them into particular zones during the summer (the Sahel and the Indo-Pakistan desert) and during the winter/spring (northwest Africa, along the Red Sea and Baluchistan).



- Downwind displacement tends to bring locusts into an area during the season when rain is most likely, for example, the Sahel of West Africa and the Sudan in the summer and the Red Sea coasts in the winter. Once the rain falls, the locusts will mature and breed. By the time the new generation of adults is capable of sustained flight, the seasonal wind pattern may well have changed and breeding conditions become poor. The locusts will then migrate rapidly, often over very great distances, to another area.

- All this is true only in a very general way. Often there are movements that take place during periods of particular winds rather than coinciding with the prevailing wind flow. Moreover, rare and even unprecedented movements continue to occur. This is one reason why, in any given year, only part of the seasonal breeding area will be infested. The other major reason for unsuccessful breeding will be failure of the seasonal rains.

Spring breeding areas

- Northwest Africa
- Iran, Pakistan
- Interior of Saudi Arabia and Yemen
- Somalia Peninsula and East Africa*

Summer breeding areas

- Sudan, Eritrea, Ethiopia
- East Africa*
- Sahel, West Africa
- Indo-Pakistan border

Winter breeding areas

- Red Sea and Gulf of Aden coasts
- Somali Peninsula and East Africa*

* during plagues

Locust season	Rainfall season	Hatching	Fledging
Spring (long rains)	February – May	March – June	May – August
Summer	June – September	July – September	August – October
Winter (short rains)	October – January	October – January	November – February

Basic Biology of Locust migration

- Breeding grounds are associated with " Convergence zones" that generate predictable cyclical air movement.

1) Sedentary phase for several generations.
2) Last generation crowded, female responds to abdominal contact by stress reaction on CA, reducing JH production.
3) Eggs develop into strong-flying migratory generation.
4) Mature migrants, mutually stimulated, lift off *en masse* with wind.
5) Fly for several hours, maintain swarm by visual contact edge control .
6) Drop to feed, keep flying.
7) Finally drop for final feed, production of sedentary generation.
8) Cycle continues with return migration.

Locust

Dociostaurus marocconus	Mediterranean countries
Locusta migratoria	Europe, Africa
Schistocerca gregaria	Northern Africa and western India
Locustana paradalina and *Nomadacris septemfasciata*	southern half of Africa
Melanoplus mexicanus	mid Western United States

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- **Uvarov's phase theory, 1921 Species of migratory locust there is associated a more solitory, more sedentary grasshopper, differing often in colour, structure, physiology, and behaviour but actually a form or phase of the same species**
  - **Solitary phase**
  - **Gregarious phase**

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- Migration of locust swarms appear to be more irregular and unpredictable
- Great height many swarms fly, the wind speed is greater than the maximum speed of the insects
- Wind is determining factor in the distribution and not any power of orientation in the locusts

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Migration of adults depends on meteorological conditions

- The migration of solitary adults occurs at night, usually 20 minutes after sunset when the air temperature is above 20-22 °C and the wind is less than 7 m/s.
- It is reported that 100% of the adults take off at > 27°C and the direction of the flight is downwind.

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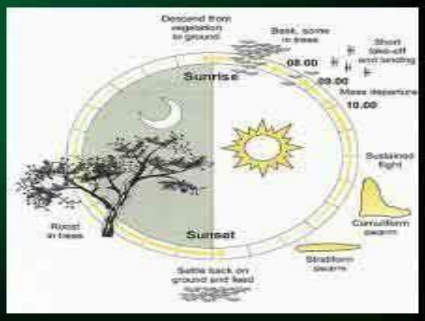
Structure of the swarms depends on meteorological conditions

Cool, overcast weather favours stratiform swarms while convective updrafts on hot afternoons promote cumuliform swarms.



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Swarms of locust

- Stratiform swarm : flat
- flying within few meters of the ground level
- Locusts are highly concentrated with densities 1-10/m^3
- Formed in absence of temperature gradient
- Cumuliform swarm : towering
  - ✓ towering 1000m above the ground
  - ✓ locusts are widely dispersed with densities 0.001-0.1/m^3
- Formed in presence of temperature gradient

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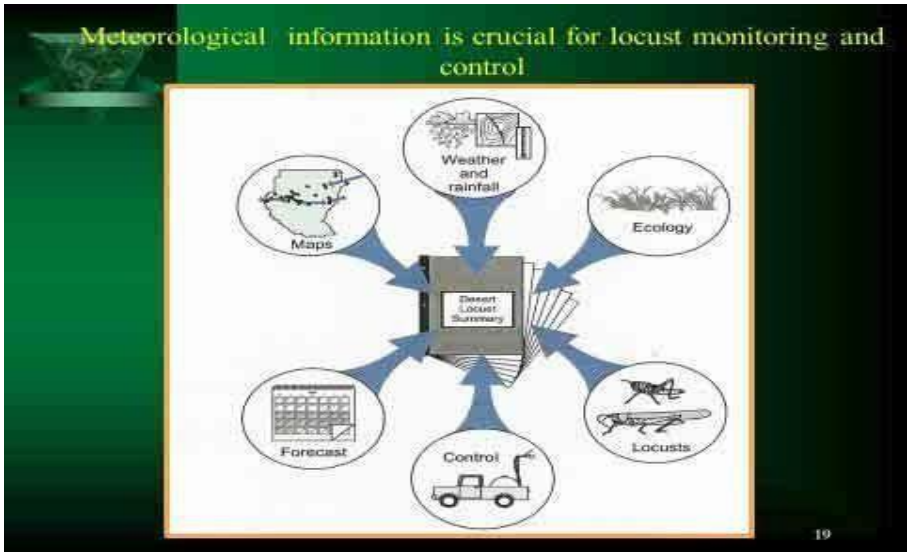
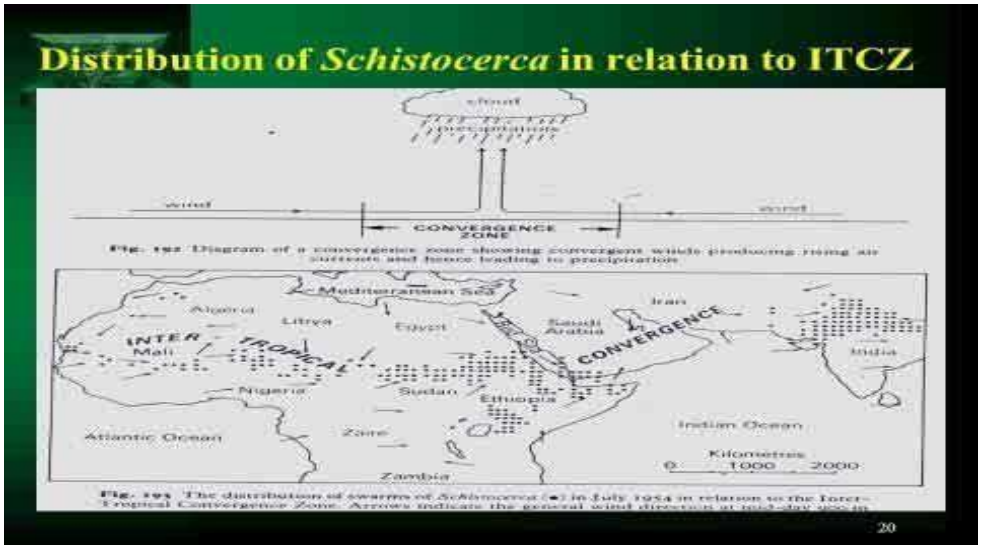
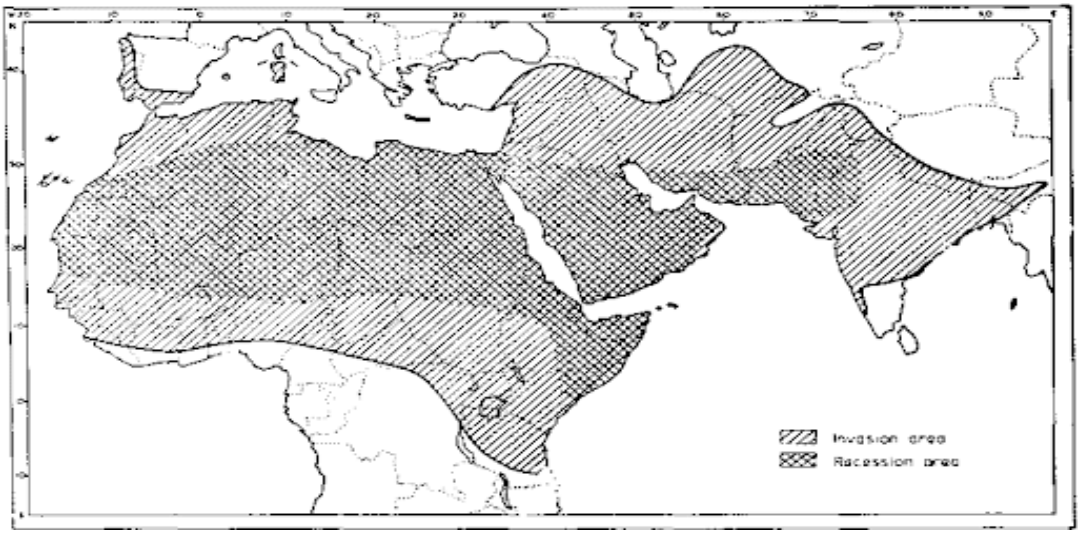

Meteorological information is crucial for locust monitoring and control
Weather and rainfall
Maps
Ecology
Desert Locust Summary
Forecast
Locusts
Control
19


Distribution of Schistocerca in relation to ITCZ
cloud
precipitation
wind
wind
CONVERGENCE ZONE
Mediterranean Sea
Algeria
Libya
Egypt
Saudi Arabia
Iran
India
INTER - TROPICAL
Mali
Nigeria
Sudan
Ethiopia
CONVERGENCE
Atlantic Ocean
Zaire
Zambia
Indian Ocean
Kilometres
0
1000
2000
20



Distribution of Desert Locust in India

Four species viz. Desert locust (Schistocerca gregaria), Migratory locust (Locusta migratoria), Bombay Locust (Nomadacris succincta) and Tree locust (Anacridium sp.) are found in India

Desert Locust

Migratory Locust

Bombay Locust

Tree Locust

- Thank you

DESERT LOCUST SURVEY INTRODUCTION AND SURVEY PROCESS

PRESENTED BY :

DHANNE SINGH POONIA
PLANT PROTECTION OFFICER (E)
LOCUST CIRCLE OFFICE
BIKANER

SURVEY PROCESS

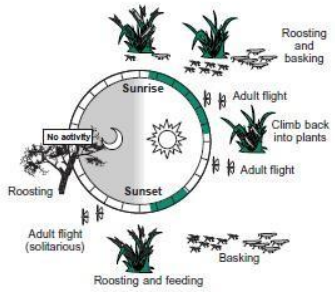
- A logical approach is required in monitoring Desert Locusts and their habitat in order to collect the maximum amount of information in the shortest possible time, using the minimum resources.

- Surveys should be planned according to the locust situation, ecological conditions in the field and the risk that populations may develop further and require additional monitoring and perhaps control.

STEPS OF SURVEY PROCESS

- 1. Who will make the survey
- 2. Determine where and when to make survey
- 3. Decide which type of survey
- 4. Decide whether the survey is to be done by ground or Aerial
- 5. Prepare the vehicle and necessary equipment.
- 6. Make the rapid assessment survey unless you know that locust are present
- 7. Collect the information and record on the survey form or elocust3
- 8. Transmit the survey report as soon as possible
- 9.If significant population is found in assessment survey , then make a search survey to identify the infested area and the control requirement
- 10.Based on the survey results , we can plan for the timing and location of next survey.

Where and when to survey during the year

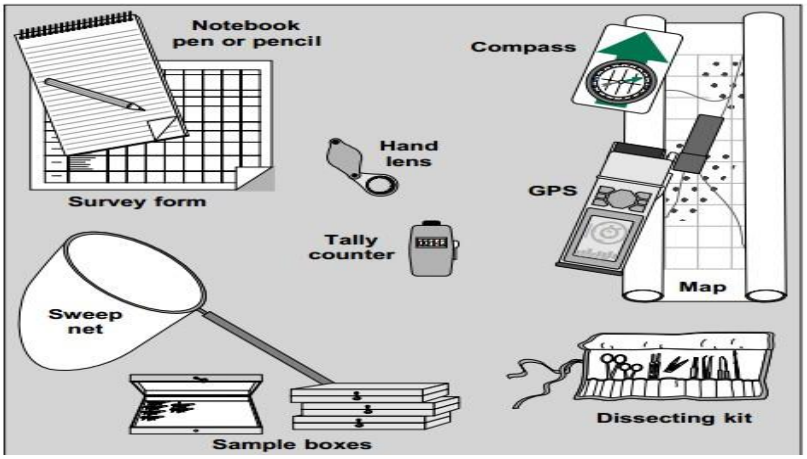


When to survey during the day
(after sunrise to about midday + late afternoon)

EQUIPMENT TO BE TAKEN ON A SURVEY

- 1. Note Book , Pen or Pencil
- 2.FAO Desert Locust Survey and Control Form
- 3. Compass
- 4. Hand Lens
- 5. Hand Tally Counter
- 6. Map
- 7. eLocust3
- 8. Global Positioning System (GPS)
- 9.Sweep Net,
- 10. Sample Box
- 11. Dissecting Kit

Some essential items that should always be taken when going on a survey.



WHAT INFORMATION TO CLLECT

- **Date and Location**
- **Rainfall**
- **Vegetation**
- **Soil moisture**
- **Locust (Present or Absent)**
- ***Appearance (Solitary or Gregarious)***
- ***Behaviour (Isolated, Scattered or Groups/Swarm)***
- ***Maturity***
- **Density**

PURPOSE OF SURVEY

- **1 To collect information to assess the locust situation and habitat conditions.**
- **2. To collect information for planning.**
- **3. Make accurate forecasts.**
- **4. To identify the control targets i.e. the area where control operation is to be undertaken.**

TYPES OF SURVEY

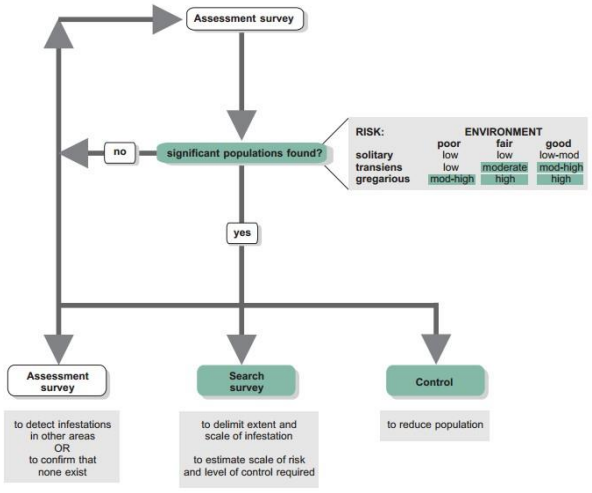
A. **ASSESSMENT SURVEY**

B. **SEARCH SURVEY**

- **ASSESSMENT SURVEY:** An assessment survey is the first type of survey. Assessment surveys are conducted to monitor the locust population and assess the suitability of the habitat for locust breeding.

- **SEARCH SURVEY**: Search surveys are conducted in the areas where significant population is present or reported in assessment survey. Search surveys are conducted to estimate the infested areas and to identify the areas that require control operation.

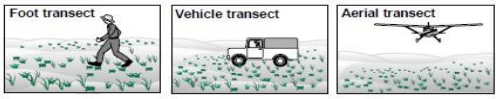
Summary of the Survey Process



low
moderate
moderate–high and high
insignificant populations: unlikely to require any further assessment
significant populations: requires additional assessment

METODS OF SURVEY

1. There are three survey methods: foot transects, vehicle transects and aerial transects.

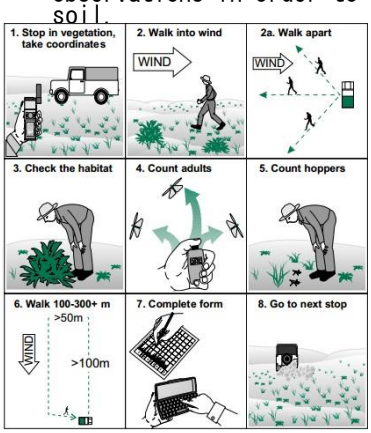


Work rate of different survey methods

	Foot	Vehicle	Aerial [1]
Distance travelled/hour	4 km	30 km	200 km
Distance travelled/day	20 km	200 km	600 km
Width of search:			
low density populations	10 m	10 m	n.a.
hopper bands [2]	0.1-2 km	0.1-2 km	0-5 km
settled swarms [2]	0.1-2 km	0.1-2 km	0-10 km
flying swarms (range)	20 km (5-50 km)	20 km (5-50 km)	30 km (5-100 km)
Area of search:			
low density populations	0.2 km²	2 km²	n.a.
hopper bands [2]	2-40 km²	20-400 km²	0-3 000 km²
settled swarms [2]	2-40 km²	20-400 km²	0-6 000 km²
flying swarms (range)	400 km² (100-1 000 km²)	400 km² (1 000-10 000 km²)	18 000 km² (3 000-50 000 km²)

[1] fixed-wing aircraft
[2] including information from local inhabitants during foot and vehicle surveys

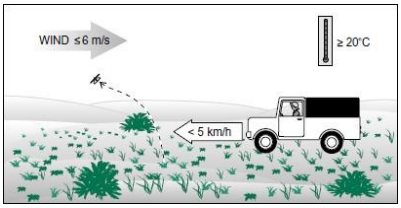
A foot transect consists of walking a certain distance in the desert and making observations in order to collect data about locusts, rainfall, vegetation and soil.



Summary of how to make a foot transect:
walk about 300 m
count adults that fly up
estimate transect width (locust disturbance)
inspect at least 10 bushes or 10 one m2 patches on the ground for hoppers
check soil moisture
count when temperature >20 C and wind <6 m/s

1. Stop in areas where locusts may be present, usually those that are sandy such as plains and dunes and close to seasonal rivers (wadis) where green annual vegetation is present. After stopping the vehicle, write down the date, the name and the latitude and longitude of the location using a global positioning system (GPS). If you do not have a GPS, determine the approximate position using a map. It may be necessary to ask a local person the name of the place.
2. Walk into the wind (upwind) or crosswind. If more than one person is making a transect, each one should go in a different direction. There is no need for two people to walk together. It is much better to go in different directions. Start by walking at least 100 m. Estimate this distance from the number of steps that you take.
3. As you walk, observe the greenness and density of the vegetation. Stop several times to check if the soil is moist. Count locusts that fly up in front and to the side, being careful not to count the same one more than once. A hand tally counter may be used. Note locust colour, behaviour and maturity. You may want to try to catch a few. Determine the width of your transect by estimating the distance in which adults are being disturbed when walking (usually about 1-4 m on either side, depending on the time of day, temperature and habitat).
4. Stop occasionally and closely inspect the ground and the vegetation for hoppers, noting what instar stage, colour, behaviour and number per bush or per square metre. Repeat this up to ten times. After walking at least 100 m, the Locust Field Officer should return to the vehicle by a different route at least 50 m away from the first route, continuing to count locusts . The results should be written down on the survey form or entered into a handheld computer before going to the next stop.

Vehicle transects



Summary of how to make a vehicle survey:

- drive upwind or crosswind for at least 1 km
- drive at a walking pace in low (4WD) gear
- count adults that fly up in front of the vehicle's hood
- keep track of the distance driven using the odometer
- count only when the temperature is above 20°C and wind speed less than 6 m/s

Vehicle transects are a useful method to determine if adults are present over a large area such as a sandy plain or within large areas of green vegetation. By counting the adults, an estimate can be made of how many are present in the transect. It is very difficult to see hoppers from a moving vehicle and therefore it is better to do this using the foot transect method.

Estimates of adults can be made from a vehicle by looking out of the front window and counting adults that fly up in front of the vehicle in a strip equal to the width of the vehicle, about 1.5 m in most cases . The vehicle must be driven at a walking pace in low gear. It should be driven upwind or crosswind to reduce the number of adults that are counted more than once. Most of the adults in the strip will fly up if it is sunny and warmer than 20 C and wind speed is less than 6 m/s (20-25 km/h). If you drive too fast (more than 5 km/h), the adults will not fly up and you will think that there are no locusts present. The transect distance should be measured using the odometer. Vehicle transects should be at least one km in length.

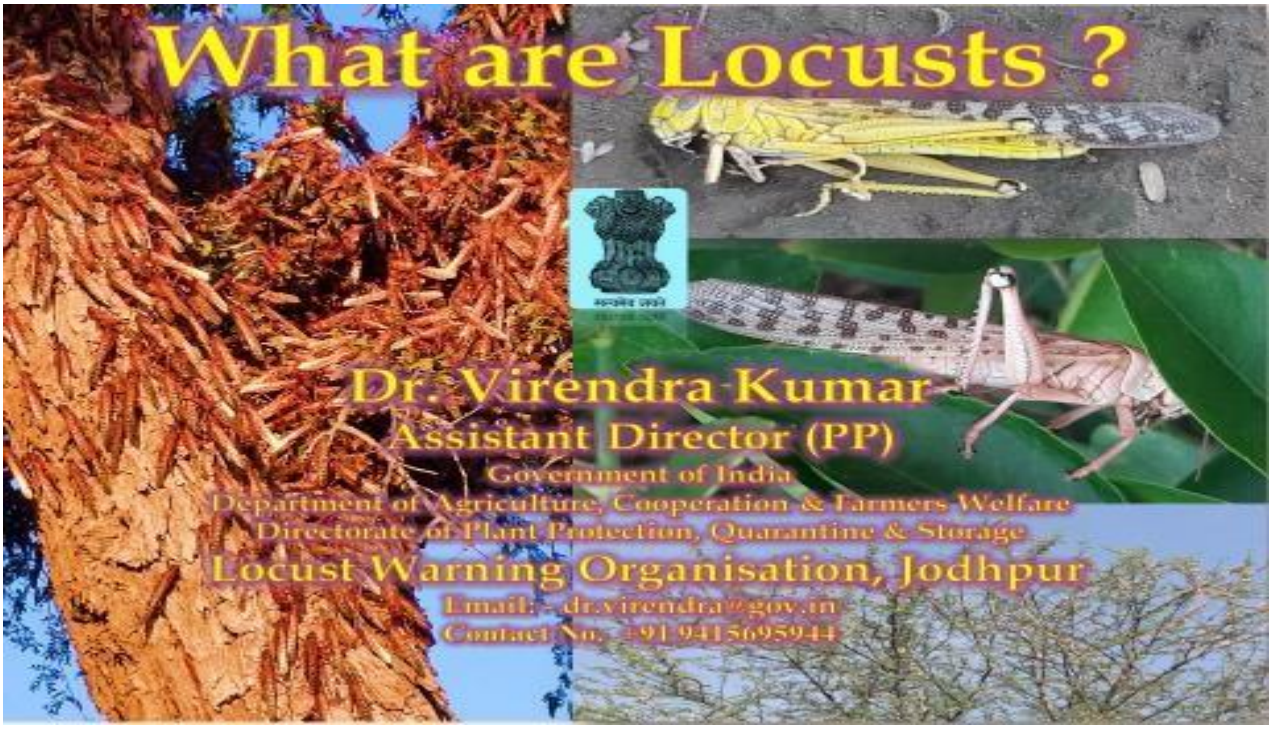
Results from vehicle transects should be noted in the comments section of the next s u rveystop on the *FAO Desert Locust Survey and Control Form*, simply stating the number of locusts seen in the distance (km) travelled, for example 10 locusts/1 km.

Vehicles can also be used to measure the sizes of settled swarms and large hopper Bands and to delimit target blocks of bands or a scattered swarm for control.

AERIAL SURVEY

Helicopters can be used to identify areas of green vegetation and locust infestations such as swarms and hopper bands from the air. They can be used to flush out moderate to high numbers of individual adults from vegetation. Helicopters can also be used to verify unconfirmed reports of infestations and visit areas that are difficult to access by vehicle. The main advantage of using a helicopter when compared to fixedwing aircraft is its ability to land almost anywhere and allow the Locust Field Officer to get out and make a foot transect in the area of interest. For identifying areas of green vegetation, the helicopter should fly about 300 metres above the ground in a straight line, similar to that for fixed-wing aircraft. Settled swarms and large hopper bands should also be visible by looking down at an angle from this height. To determine whether an area of green vegetation contains individual locust adults, the pilot should first identify the green area, then drop down to just a few metres above the ground (as low as safely possible and not higher than 5 metres above the ground), reduce the speed to 40-50 km/h and fly over the vegetation and swing the tail from side to side. This will disturb any locusts that may be present and they will fly up from about midpoint under the helicopter. The observer should look out of the window towards the rear to see if locusts fly up behind the helicopter. Upon reaching the end of the green vegetation, the pilot should increase altitude and speed.

THANK YOU



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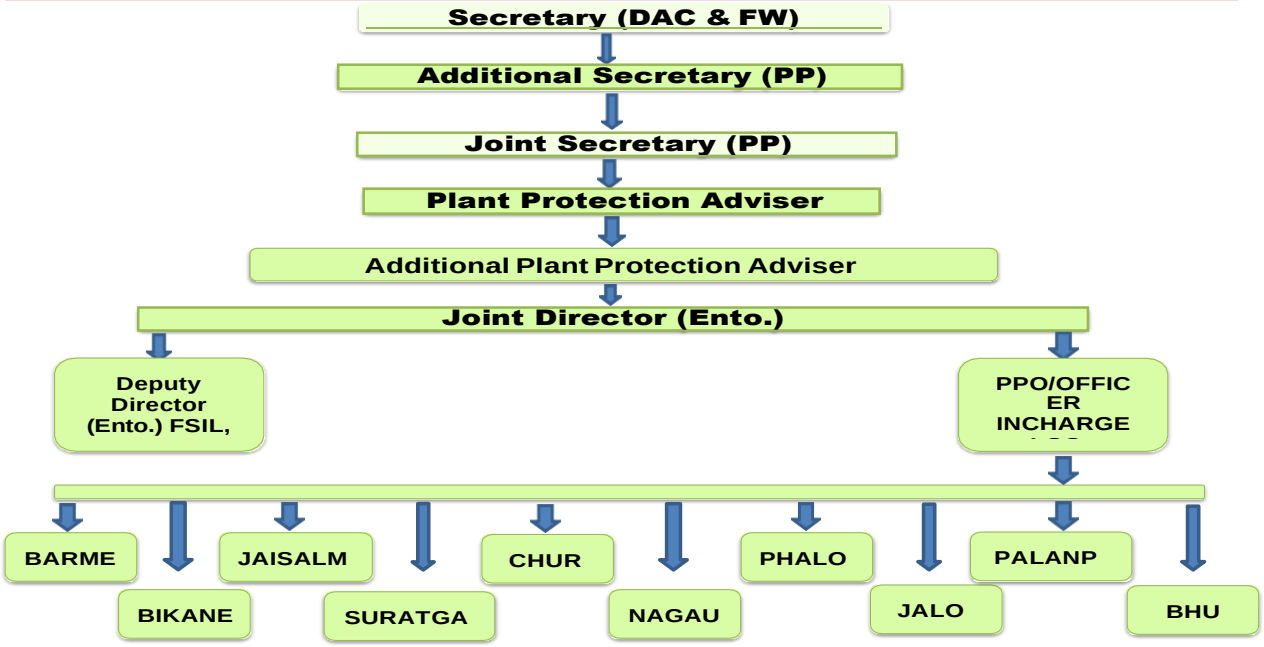

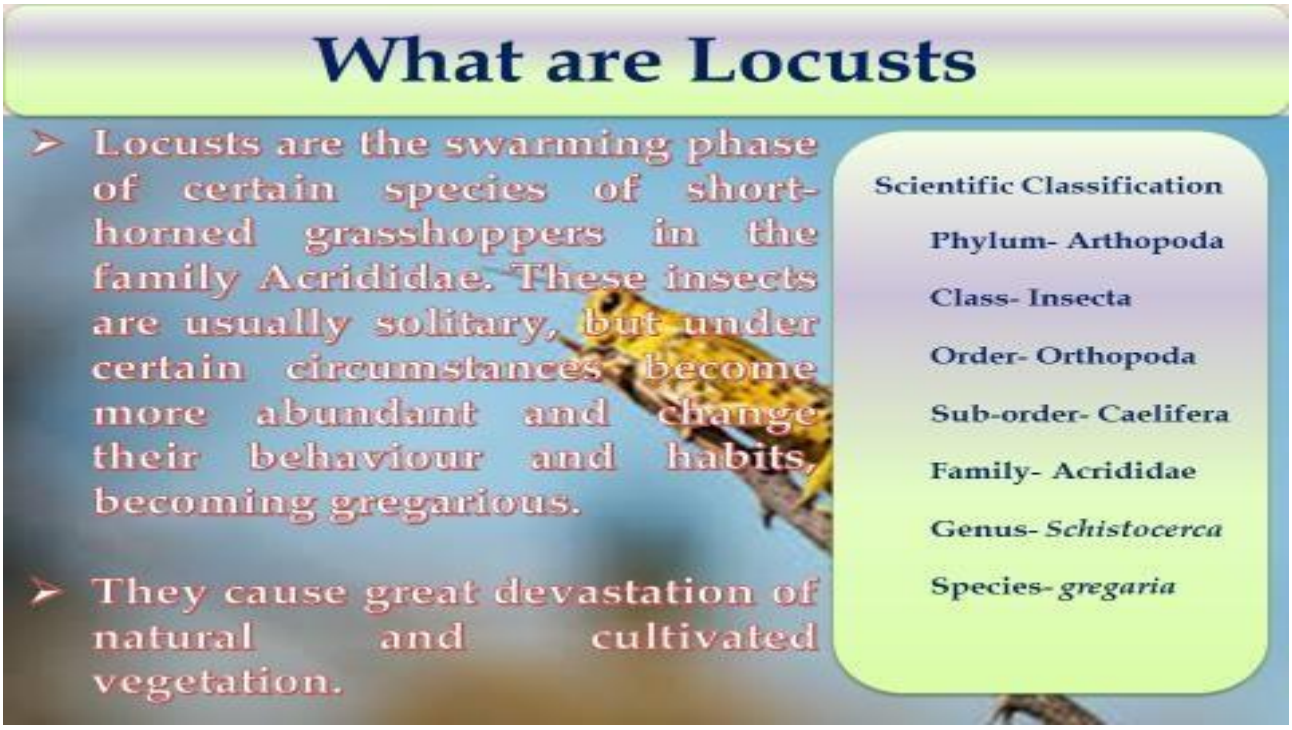

Occurrence of Locust species in the World

S. No.	English Name	Scientific Name
1.	Desert Locust	*Schistocerca gregaria*
2.	Bombay Locust	*Nomadacris succincta*
3.	Migratory Locust	*Locust migratoria manilensis;* *Locusta migratoria migratoria-oldes*
4.	Italian Locust	*Calliptamus italicus*
5.	Moroccan Locust	*Dociostaurus morocannus*
6.	Red Locust	*Nomadacris septemfaciata*
7.	Brown Locust	*Locustana pardalina*
8.	South American Locust	*Schistocerca poranensis*
9.	Australian Locust	*Chrtoicetes termenifera*
10.	Tree Locust	*Anacridium spp.*

Only four species *viz.*

1) **Desert Locust (*Schistocerca gregaria*)**
2) **Migratory Locust (*Locust migratoria*)**
3) **Tree Locust (*Anacridium spp.*) &**
4) **Bombay Locust (*Nomadacris succincta)* are found in India.**

- The Desert locust is most important pest species in India as well as in Intercontinental context.
- The invasion area of desert locust covers about 30 million sq. km which includes whole or part of nearly 64 countries.
- This includes countries like North West and East African countries, Arabian Peninsula, the southern republic of USSR, Iran, Afganistan, the Indian sub- continent.

1.Desert Locust (*Schistocerca gregaria*)

- The **desert locust** is a species of locust, a periodically swarming, short-horned grasshopper in the family Acrididae.
- The genus *Schistocerca* consists of more than 30 species, distributed in Africa, Asia, and North and South America, and many species are difficult to identify due to the presence of variable morphs.
- The desert locust is potentially the most dangerous of the locust pests because of the ability of swarms to fly rapidly across great distances. The major desert locust upsurge in 2004–05 caused significant crop losses in West Africa and diminished food security in the region.

Fig. Desert Locust

- The desert locust shows periodic changes in its body form and can change, in response to environmental conditions.
- Locusts differ from other grasshoppers in their ability to change from a solitary living form into gregarious, highly mobile, adult swarms and hopper bands, as their numbers and densities increase.
- The lifecycle of the desert locust consists of three stages, the egg, the nymph known as a hopper, and the winged adult.
- The female locust then seeks suitable soft soil in which to lay her eggs.
- She probes the soil with her abdomen and digs a hole into which an egg pod containing up to 100 eggs is deposited.

- The incubation period before the eggs hatch may be two weeks, or much longer, depending on the temperature.
- Desert locusts consume an estimated equivalent of their body weight (2 g) each day in green vegetation.
- They are polyphagous and feed on leaves, shoots, flowers, fruit, seeds, stems, and bark. Nearly all crops and non-crop plants are eaten, including pearl millet, maize, sorghum, barley, rice, grasses, sugarcane, cotton, fruit trees, date palms, banana plants, vegetables, and weeds.
- The desert locust do not eat *Calotropis*, Black plum, *Dulbergia sisso* (Shisham) and Neem.

2. Migratory Locust (*Locusta migratoria*)

- **The migratory locust is the most widespread locust species.**
- **It occurs throughout Africa, Asia, Australia and New Zealand.**
- Locusts are highly mobile, and usually fly with the wind at a speed of about 15 to 20 kilometres per hour .
- Swarms can travel 5 to 130 km or more in a day.
- swarms can vary from less than one square kilometre to several hundred square kilometres with 40 to 80 million individuals per square kilometre.
- An adult locust can consume its own weight (several grams) in fresh food per day.
- For every million locusts, one ton of food is eaten.
- In Africa, the last serious widespread plague of *this locust* occurred from 1928 to 1942.

Fig. Migratory Locust

3. Tree Locust (*Anacridium spp.*)

- These grasshoppers inhabit trees and shrubs, scrub land, and orchards in warm and bright environment.
- *Anacridium aegyptium* is one of the largest European grasshoppers. The adult males grow up to 30–56 mm long, while females reach 46– 70 mm in length.
- Their bodies are usually gray, brown, or olive-coloured, and their antennae are relatively short and robust.
- This species is a folivore, essentially feeding on leaves of various plants.

Fig. Tree Locust

4. Bombay Locust (*Nomadacris succincta*)

- **Bombay locust**, is a species of locust found in India and southeast Asia.
- It is usually a solitary insect, and it is only in India that it has exhibited swarming behaviour.
- The last plague of this locust was in that country between 1901 and 1908 and there have not been any swarms since 1927.
- Its range extends from India and Pakistan to Thailand, Malaysia, Vietnam, Japan, the Philippines and Indonesia.
- In India it breeds in June and July, in Malaysia in August and September, and in Thailand in March and April.

Fig. Bombay

5. Italian Locust (*Calliptamus italicus*)

- ***T***he **Italian locust**, is a species of 'short-horned grasshopper' belonging to the family Acrididae.
- This species is native of the steppes of Central Asia, but it is also present in Europe, and North Africa.
- These grasshoppers can be encountered from July through October.
- It is a medium-sized grasshopper characterized by a significant sexual dimorphism.
- The adult males grow up to 14–26 millimetres (0.55–1.02 in) long, while females reach 21–40 millimetres (0.83–1.57 in) of length.
- This species is quite variable in size and colour. The basic coloration of the body varies from grey to brownish- reddish.

Fig. Italian Locust

6. Moroccan Locust (*Dociostaurus morocannus*)

- It is found in northern Africa, southern and eastern Europe and western Asia.
- It lives a solitary existence but in some years its numbers increase sharply, and it becomes gregarious and congregates to form swarms which can cause devastation in agricultural areas.
- In Africa it is found in Algeria, Egypt, Libya, Morocco and Tunisia. In Europe it is found in France, Portugal, Spain, Italy and the Balkan peninsula. It is also found in the Middle East and Central Asia.
- The eggs are laid in pods with about thirty eggs each. The nymphs ("hoppers") resemble wingless adults.

Fig. Moroccan

7. Red Locust (*Nomadacris septemfaciata*)

- The **red locust** is a large grasshopper species found in sub-Saharan Africa. Its name refers to the colour of its hind wings.
- Outbreak areas have been identified in Zambia, Tanzania, Malawi, Madagascar, and Réunion.
- An entomopathogenic fungus *i.e.* *Metarhizium acridum*, has been successfully tested on both nymphs and adults of the red locust for its control.
- A swarm rarely moves more than 20–30 km in a day.
- Red locusts actively seek out moist environments such as seasonal floodplains. Grains are their primary food source.
- Swarming females often lay eggs at night. Their young immediately behave gregariously and are capable of "hopping" hundreds of metres every day.
- The last widespread plague occurred from 1930-1944, where almost all of southern Africa was invaded.

Fig. Red Locust

8. Brown Locust (*Locustana pardalina*)

- The **brown locust** is a medium- sized small locust species.
- It is found in Southern Africa and shows classic gregarious behaviour.
- Eggs are usually laid in dry soil and during the summer months will hatch approximately 10 days after 15–25 millimetres (0.6–1.0 in) of rain has fallen.
- Deltamethrin with motorised mist blowers set for ultra-low volume application is effective for its control.

Fig. Brown

9. South American Locust (*Schistocerca poranensis*)

- The **South American locust** is believed to be the most harmful of all **locusts**. **Locust** numbers started growing in Argentina, Bolivia and Paraguay in 2015, largely because of mild winters and abundant rainfall.
- Adults are equipped with much longer wings, enabling them to fly distances of around 150 km a day in huge swarms typically consisting of around 150 million locusts per square km

Fig. South American Locust

10. Australian Locust (*Chrtoicetes termenifera*)

- The **Australian plague locust** is a native Australian insect in the family Acrididae, and a significant agricultural pest.
- Adult Australian plague locusts range in size from 20 to 45 mm in length, and the colour varies from brown to green.
- The head is higher than the thorax, and the thorax has an X-shaped mark.
- Adult locusts feeding on green shoots that follow rain within 24 to 48 hours in warmer months will mature and lay eggs within 5 to 7 days of a rain event.
- After hatching, the nymphs take around 20–25 days to complete development in mid-summer.

Fig. Australian Locust

Locust affected countries of the World

Western Region

- **Mauritania**
- **Niger**
- **Algeria**
- **Mali**
- **Morocco**

Central Region

- **Ethopia**
- **Somalia**
- **Kenya**
- **Tanzania**
- **Uganda**
- **Soudi Arabia**
- **Sudan**
- **Eritrea**
- **Egypt**
- **Yemen**

Eastern Region

- **India**
- **Pakistan**
- **Afganistan**

Significant harvest losses due to Locust outbreak in the World

Locust feed on plant material; thery are polyphagous, it causes significant damages in the world. Few examples are:-

- 7 million vines, 19 % of total , in Libya (1944).
- 55000 tonnes of cereals in Sudan (1954).
- 16000 tonnes of millet and 2000 tonnes of other cereals in Senegal. (1957)
- 167000 tonnes of cereals in Ethopia (1958).
- 368000 tonnes of cereals were apparently lost in African Sahel (1974).
- In Kenya, one usually large swarm occupied an area of 2,400 sq Km. more than three times the size of New York City. Swarm typically occupy 100 square kilometres. They have ability to consume in a day the equivalent of what at least 3.5 million people would eat. (2019-20)

Locust Control in India

- **In India (1993) the total area treated by ground team as well as aerial control was 3,0,614 hectares.**
- **In India (1997) the total area treated by ground team was 18, 664 hectares.**
- **In India (2005) the total area treated by ground team was 16, 640 hectares.**
- **In India (2007) the total area treated by ground was 646 hectares.**
- **In India (2010) the total area treated by ground team was 4,700 hectares.**
- **In India (2019) the total area treated by ground team was 4,03,488 hectares.**
- **In India (2020) the total area treated by ground team as well as aerial control was 2,87,986 hectares.**

Chemical Control of Locust

List of various approved pesticides for control of Desert Locust

A. Pesticides approved used for control of Desert Locust in Scheduled Desert Area only

S. No.	Chemicals	Doses	
		a.i.(gms)/ha	Formulations (gm/ml)/ha
1.	Malathion 96% ulv	925	1000
2.	Malathion 5%DP	925	20000
3.	Fenvalrate 0.4%DP	80-100	20000-25000
4.	Quinalphos 1.5%DP	375	25000

B. Pesticides approved used for control of Desert Locust on crops, Acacia & other trees.

S. No.	Name of Pesticides	a.i.(gms)/ha	Formulations (gm/ml)/ha
1.	Chloropyriphos 20%EC	240	1200
2.	Chloropyriphos 50%EC	240	500
3.	Deltamethrin 2.8%EC	12.5	500
4.	Deltamethrin 1.25% ulv	12.5	1000
5.	Diflubenzuron 25%WP	60*	240
6.	Fipronil 5%SC	6.25	125
7.	Fipronil 2.92%EC	6.25	220
8.	Lamdacyhalothrin5%EC	20	400
9.	Lamdacyhalothrin10%WP	20	200
10.	Malathion 50% EC	925	1850
11.	Malathion 25% WP	925	3700

Biological control of Locust

- Entomopathogenic fungus of the *Metarhizium acridum & Metarhizium anisopliae* have proven to be very effective in controlling locusts, killing hoppers and adults within a week.
- Commercial brands use this kind of fungus in their powder products. Such powders are mixed with oil and sprayed.
- The fungus penetrates the locust's hard outer layer and starts feeding on the insect, sapping away its energy. The locust starts to get weaker within three days, becomes sluggish, feeds less and eventually dies.

Fig. Effect of *Metarhizium acridum on locust*

PP equipment's used in Locust Control Operation

GROUND CONTROL METHOD

1) **Tractor mounted sprayer**
2) **Fire brigade Vehicles**
3) **Ulvamast**
4) **Micronair**

AERIAL CONTROL METHOD

A. **Drones**
B. **Helicopter**


Z-3366

Annexure - VI

Inaugural Session

Annexure - VII

Exhortation of PPA and Keith Cressman, FAO

Annexure - VIII

Mock drill of Ulvamast, Micronair and e-Locust 3 at the Uchiyarda village of Jodhpur






Annexure – IX

Mock drill of Micronair and e-Locust 3

Annexure - X

Group Discussion

Annexure - XI

Distribution of training Certificate

1.

Annexure - XII

Poster Distribution

Annexure - XIII

News Publication

पत्रिका सिटीजन

राजस्थान पत्रिका
जोधपुर, रविवार, 31 जनवरी, 2021
11

टिड्डी नियंत्रण प्रशिक्षण कार्यशाला का समापन

टिड्डी हमले से निपटने की तैयारी, 40 कार्मिकों को दिया प्रशिक्षण

पत्रिका न्यूज नेटवर्क
patrika.com

जोधपुर. टिड्डी चेतावनी संगठन के तत्वावधान में दो दिवसीय टिड्डी नियंत्रण प्रशिक्षण कार्यशाला का समापन शुक्रवार को हुआ। यूएनओ के कृषि एवं खाद्य संगठन दक्षिण पश्चिमी एशिया आयोग द्वारा प्रायोजित कार्यशाला में टिड्डी से निपटने और नियंत्रण करने के तरीके बताए गए। इस समय टिड्डी का प्रकोप उत्तरी-पूर्वी अफ्रीका में अधिक है।

मार्च-अप्रेल में इसके भारत आने की आशंका है। टिड्डी चेतावनी संगठन के सहायक निदेशक डॉ वीरेंद्र कुमार ने बताया कि कार्यशाला में 40 स्थानों के अधिकारी व कर्मचारी शामिल हुए। कार्यशाला में फरीदाबाद से टिड्डी नियंत्रण प्रभारी डॉ एन सत्यनारायण, राष्ट्रीय

कार्यक्रम अधिकारी राजेश दुबे और वनस्पति रक्षा सलाहकार डॉ रवि प्रकाश ने वीडियो कॉन्फ्रेंसिंग के माध्यम से संबोधित किया। इटली की राजधानी रोम से टिड्डी नियंत्रण के वरिष्ठ पूर्वानुमान अधिकारी कीथ क्रीसमैन ने ऑनलाइन संबोधित कर टिड्डी की वर्तमान स्थिति के बारे में जानकारी दी। उप निदेशक डॉ केएल गुर्जर, डॉ वीरेंद्र कुमार, डॉ पंकज सालुंके, धन्ने सिंह पूनिया और चंद्रशेखर शर्मा ने व्याख्यान दिया। प्रतिभागियों को उचियारड़ा ग्राम में टिड्डी नियंत्रण के लिए इंग्लैंड से मंगाई गई माइक्रोनियर और अलवा मास्ट जैसी मशीनों की मॉक ड्रिल करके प्रशिक्षण दिया गया। टिड्डी नियंत्रण के लिए डाटा रिकॉर्डर लॉकस्ट-3 सॉफ्टवेयर का प्रशिक्षण हुआ।