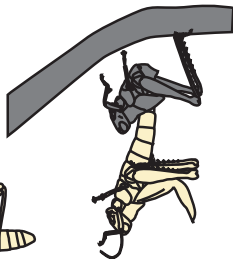
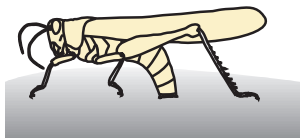
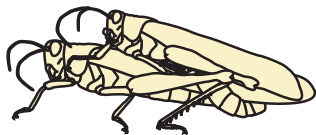




**Food and Agriculture Organization
of the United Nations**



**Standard Operating Procedures for
Desert Locust Biology and Behaviour**

Standard Operating Procedures (SOP) Desert Locust Biology and Behaviour

Food and Agriculture Organization of the United Nations
Rome, 2021

Required citation:

FAO. 2021. *Standard Operating Procedures (SOP) Desert Locust Biology and Behaviour*. Rome.

The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views or policies of FAO.

© FAO, 2021



Some rights reserved. This work is made available under the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO licence (CC BY-NC-SA 3.0 IGO; <https://creativecommons.org/licenses/by-nc-sa/3.0/igo/legalcode>).

Under the terms of this licence, this work may be copied, redistributed and adapted for non-commercial purposes, provided that the work is appropriately cited. In any use of this work, there should be no suggestion that FAO endorses any specific organization, products or services. The use of the FAO logo is not permitted. If the work is adapted, then it must be licensed under the same or equivalent Creative Commons licence. If a translation of this work is created, it must include the following disclaimer along with the required citation: "This translation was not created by the Food and Agriculture Organization of the United Nations (FAO). FAO is not responsible for the content or accuracy of this translation. The original [Language] edition shall be the authoritative edition."

Disputes arising under the licence that cannot be settled amicably will be resolved by mediation and arbitration as described in Article 8 of the licence except as otherwise provided herein. The applicable mediation rules will be the mediation rules of the World Intellectual Property Organization <http://www.wipo.int/amc/en/mediation/rules> and any arbitration will be conducted in accordance with the Arbitration Rules of the United Nations Commission on International Trade Law (UNCITRAL).

Third-party materials. Users wishing to reuse material from this work that is attributed to a third party, such as tables, figures or images, are responsible for determining whether permission is needed for that reuse and for obtaining permission from the copyright holder. The risk of claims resulting from infringement of any third-party-owned component in the work rests solely with the user.

Sales, rights and licensing. FAO information products are available on the FAO website (www.fao.org/publications) and can be purchased through publications-sales@fao.org. Requests for commercial use should be submitted via: www.fao.org/contact-us/licence-request. Queries regarding rights and licensing should be submitted to: copyright@fao.org.

Contents

Objective	1
1. Locust FAQs	2
2. Lifecycle	3
3. Egg laying	5
4. Hoppers and adults.....	6
5. Phase transformation	7
6. Hopper gregarization	9
7. Adult gregarization	10
8. Hopper band behaviour	11
9. Swarm behaviour	12
10. Swarm flight.....	13
11. Migration and breeding.....	14

Standard Operating Procedures (SOP)

Desert Locust Biology and Behaviour

Objective

The objective of the Standard Operating Procedures (SOP) for Desert Locust Biology and Behaviour is to provide a concise overview of the basic information on the biology and behaviour of the Desert Locust. This SOP is intended for use by the field staff who are involved in survey and control operations. It may also be useful for senior managers and international partners. The material is based on the **FAO Desert Locust Guidelines** where more detailed information and references are available.

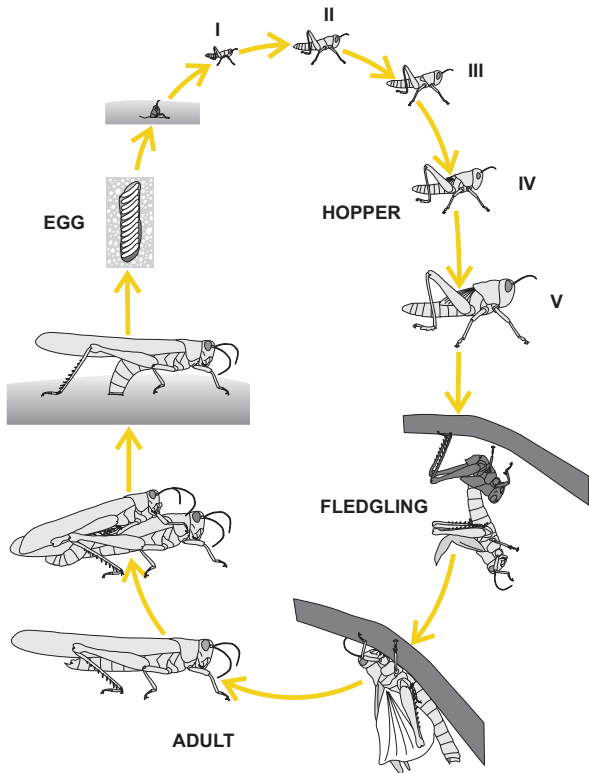
The following topics are covered:

- lifecycle
- hopper and adult behaviour
- gregarization
- migration and breeding

1. Locust FAQs

- The Desert Locust is a member of the grasshopper family but it differs from grasshoppers in several ways
- Desert Locust change their behaviour and physiology, in particular the colour and shape, in response to changes in locust density caused by the environment and reproduction
- Adult locusts can form swarms that behave as a single, cohesive unit and can migrate up to 150 km in a day
- Non-flying nymphal or hopper stage can form bands, which are a mass of hoppers that persist and move as a cohesive unit up to 1.7 km in a day
- Two states (phases): *solitarious* and *gregarious* with a transition phase called *transiens*
- Locusts normally live about three months but they can live up to nine months in cooler and drier weather
- Locusts increase about 16–20 times with every new generation of breeding. This is an exponential increase, resulting in 20 times more locusts after three months, 400 times more after six months, 8 000 times more after nine months, and so on
- A 1 km² swarm contains 40–80 million adults and can eat the same amount of food in one day as 35 000 people
- Locust adults fly in the same direction of the wind up to about 2 000 m above ground

2. Lifecycle



2. Lifecycle

Average development rates under normal conditions

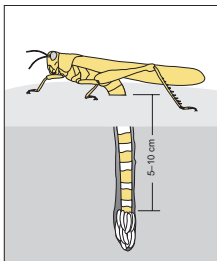
EGG: 2 weeks

HOPPER: 6 weeks

ADULT: 4 weeks

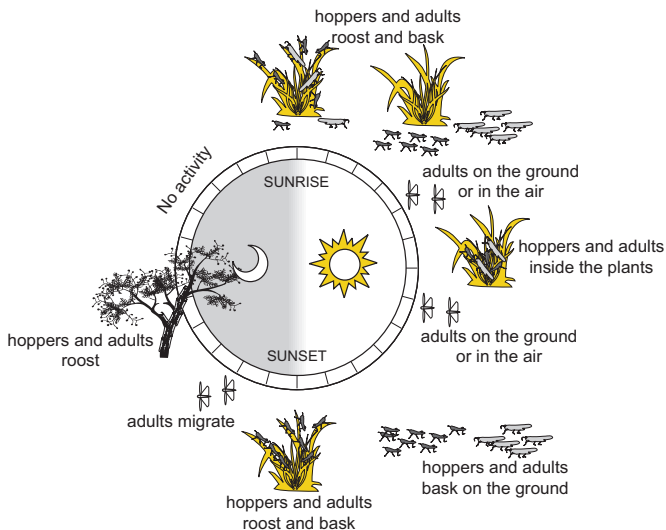
1. *Eggs*, laid by females, take about two weeks to hatch in warm weather but can hatch in 10 days when temperatures are high or take up to 65 days in low temperatures.
2. Eggs hatch into wingless larvae or nymphs called *hoppers*, which shed their skin (moult) 5–6 times, becoming bigger each time. Each moult takes about one week. Each hopper stage is called an *instar*.
3. The final moult from the wingless fifth (or sixth) instar to the winged adult is called *fledging*. The new adult (*fledgling*) has soft wings. It takes up to ten days for the wings to harden so that sustained flight and long-distance migration are possible.
4. *Adults* do not moult or increase in size but they gradually increase in weight. Initially, they are sexually immature and remain so until they encounter conditions such as rainfall that stimulate maturation. The maturation period is highly variable, depending on habitat conditions, and it may involve migration to another area where more favourable conditions exist. Under optimal conditions, adult can mature and be ready to reproduce after about three weeks but this can be prolonged for up to nine months in cold, dry weather or unfavourable habitat conditions.

3. Egg laying



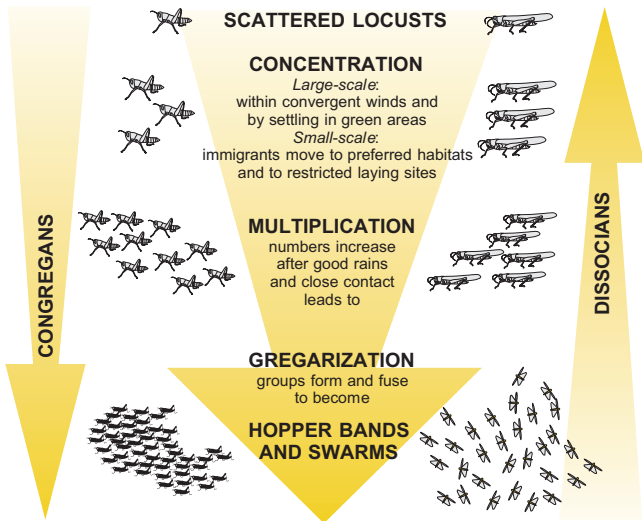
- Females lay eggs in batches (*egg pods*) usually in bare sandy soil about 5–10 cm below the surface. She will first probe the soil with her abdomen to check if the soil is moist.
- Females usually lay about 2–3 pods, each containing 90–160 eggs (solitarious phase) or 80 eggs (gregarious)
- The time between layings is about 6–11 days
- A solitarious female lays a total of about 400 eggs while a gregarious female lays about 140 eggs
- Egg mortality ranges from 5–65% due to predators, parasites, exposure, wind, floods and drought
- It can take 10–65 days for eggs to hatch; usually it takes about two weeks under normal conditions when the average temperature is about 32°C

4. Hoppers and adults



Solitarious hoppers and adults are less active under cloudy skies or in the early hours of clear cold mornings. They may seek shelter inside vegetation during extremely hot days.

5. Phase transformation



Desert Locusts are normally found as solitary individuals. As their numbers increase from breeding, they cluster into dense groups and they become gregarious. It usually takes at least two generations of breeding before locusts are fully gregarious.

5. Phase transformation

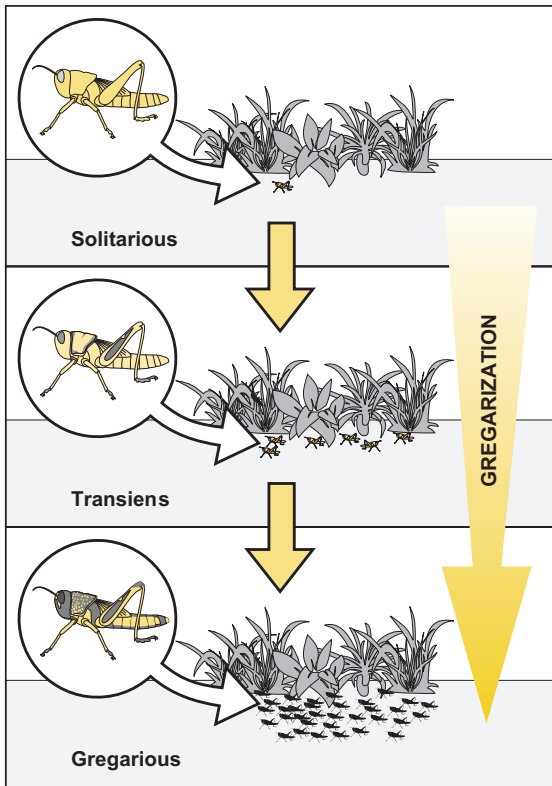
Locusts change their behaviour in response to the environment and numbers. Groups often form at the end of a breeding season when vegetation starts to dry out. This is an important indication that gregarization is under way.

	SOLITARIOUS	GREGARIOUS
Eggs per pod	90-160	80
Hatchling colour	clear	black
Hopper colour	green	yellow/black
Hopper instars	5-6	5
Hopper development	30-48 days	25-57 days
Band displacement	-	1-100 m/day
Immature adult colour	brownish	pinkish
Mature adult colour	brownish	yellow
Adult maturation	3-24 weeks	3-24 weeks
Adult flight	night-time	day

The colour of locusts in the *transiens* phase is a mixture of solitary and gregarious colours:

- **green hoppers with black markings**
- **immature brown adults with pinkish markings**
- **mature brown adults with yellow markings**

6. Hopper gregarization



7. Adult gregarization

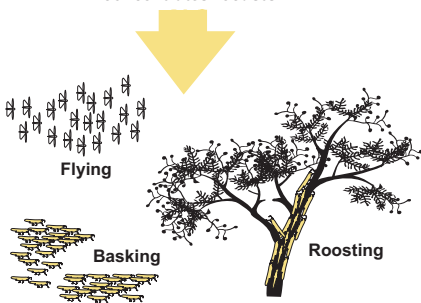
Solitary



Light brown, sandy coloured



Drying vegetation
concentrates locusts

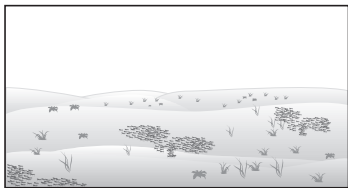


Gregarious

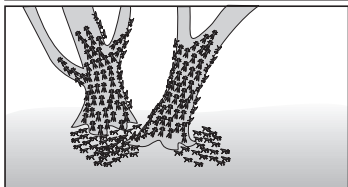


Pinkish (immature) yellowish (mature)

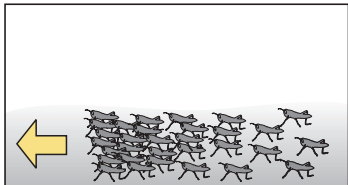
8. Hopper band behaviour



- 1** Shortly after hatching, hoppers form small dense black patches

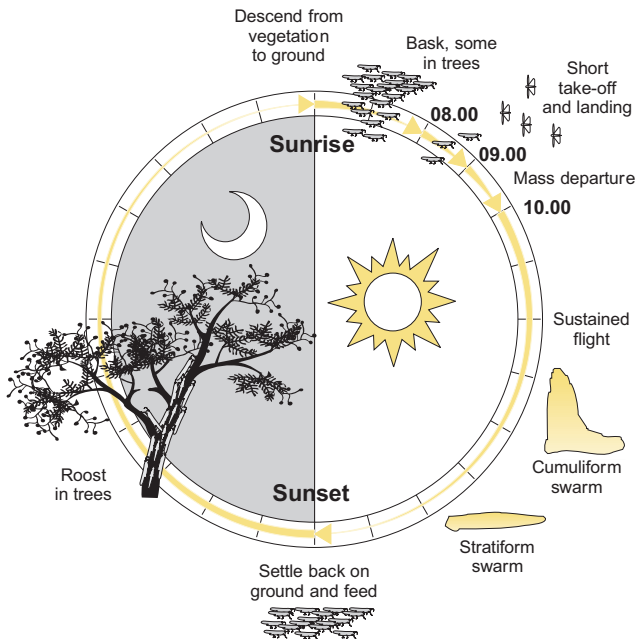


- 2** These patches merge, forming larger bands

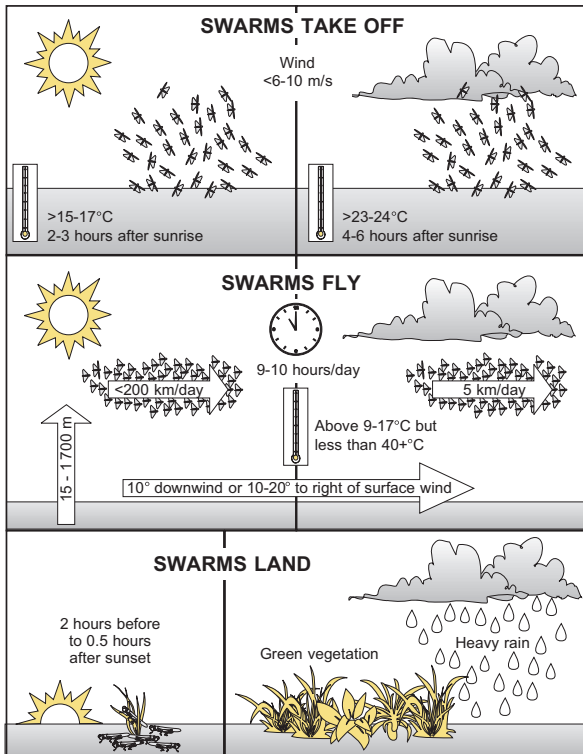


- 3** Hoppers in bands move together in the same direction

9. Swarm behaviour



10. Swarm flight



11. Migration and breeding

Summer breeding (June/July – October)

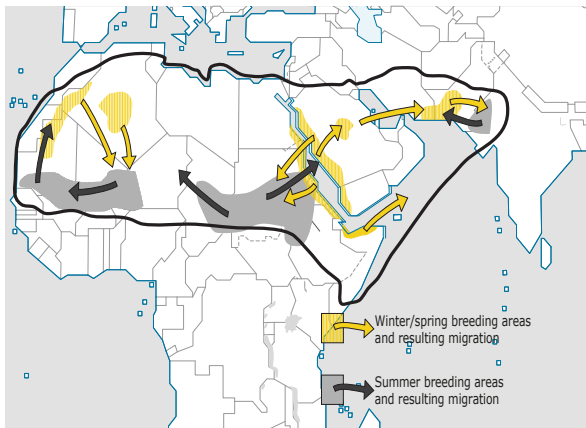
- Sahel of West Africa to Eritrea; Yemen; Indo-Pakistan border

Winter breeding (October/November – March)

- Red Sea and Gulf of Aden coastal plains

Spring breeding (March/April – June)

- Interior of Arabian Peninsula; southeast Iran and southwest Pakistan; south of the Atlas Mountains





Some rights reserved. This work is available under a CC BY-NC-SA 3.0 IGO licence