

Alarming desert locust upsurges

heading from Africa to India

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Desert locusts are among the oldest migratory pests in the World that are considered as a major threat to agriculture and mankind. Landmark invasions of this migratory pest species along the territories of Africa, Middle East Asia and South-West Asia have been witnessed over the years including the major upsurges and plagues that challenged the food security and livelihood sustainability. In 2020, desert locust situation was declared to be the worst of the three decades as it hit the large swathes of East Africa, Arabian Peninsula and South-West Asia. The congenial ecological conditions and changing climate conditions that included the higher rainfalls in parts of the Arabian Peninsula and East Africa, and severe cyclones storms in the Arabian Sea encountered during 2018-2019 have favoured the upsurge of locust. India has been constantly battling the locust invasions across the borders, particularly Rajasthan, Madhya Pradesh and Gujrat suffered remarkable damage to crops over lakhs of hectares. Regular vigil and constant updates are being received through FAO desert locust situation update and Locust Warning Organization of India, which aid in maintaining constant monitoring followed by corresponding control operations.

Keywords: Control strategies, Desert locust, Desert locust situation update, Locust invasion, Locust control bodies

Introduction to Desert locust

Of the various locust species, the desert locust, *Schistocerca gregaria* (Forsk.) (Orthoptera: Acrididae) is considered to be the most dangerous migratory pest species in the world owing to its characteristic abilities which include its voracious feeding i.e. it can eat as much as its own weight daily. An estimate compared that a single swarm (1 km² comprising of 40 million locusts) can devour the same amount of food as 35,000 people could eat in a day. Further, they can rapidly reproduce, concentrate and form swarms, which can fly up to 150 km in a day.

Distribution

The desert locust is distributed in about 20% of the earth's land surface that stretches from the North-West Africa to the Indian sub continent. During quiet period (or recession

period), solitary locust is observed in low numbers scattered along the deserts of North Africa, Middle East and Southwest Asia. This arid area is approximately 16 million km² in size. However, during a plague, swarms can also invade other countries and a greater land surface of the Earth can be affected (known as invasion area).

An alarming upsurge of desert locusts over the globe

These desert locusts pose a constant threat to food supplies especially in some part of the World's poorest and driest countries. The year 2020 constantly faced the challenges over the COVID-19 pandemic and locust devastations. Several countries across the multiple agro-climatic zones ranging from Africa, Middle East to Asia was reeling under unprecedented locust attack. The favourable ecological conditions and

changing climate conditions that included the higher rainfalls in parts of the Arabian Peninsula and East Africa, and severe cyclones storms in the Arabian Sea encountered during 2018-2019 have favoured the upsurge of locusts in these countries of origin.

It has been figured out that swarms of desert locust had originated in the Middle East and East Africa in the empty quarters of the southern Arabian Peninsula during 2018-19 winter when heavy rains created optimal conditions for breeding. Small swarms of these locusts moved into Yemen, Saudi Arabia and Iran, where lack of adequate preventive control measures resulted in their spread and by the end of 2019, swarms reached the Indo-Pakistan border from Iran, while other swarms had crossed the Red Sea to Somalia and Ethiopia.

More rains received from October to December 2019 in East Africa led to increased soil moisture, which further supported a rapid increase in their number. The United Nations Food and Agriculture Organization (UN FAO) warned that if the swarms in Kenya, Ethiopia and Somalia was left unchecked, the number of locusts in the Horn of Africa could increase to a subsequent higher level which would present an unprecedented threat to food security and livelihood sustainability in the upcoming cropping seasons/years.

In mid 2019, the locust swarms had not reached plague proportions but their number was larger than an outbreak and as swarms was forming independently in wider geographical locations, it was declared as an upsurge. However, the situation was quite alarming and poses regular threat since the ecological conditions was continuously favourable and it could lead the locust surge to plague proportions. The favourable weather conditions which included the widespread rains during late March created a situation, wherein a tremendous upsurge of locust was experienced in the following months in East Africa, eastern Yemen and southern Iran. As predicted, the swarms started maturing in East Africa during the month of April 2019.

Despite the frequent ground and aerial control operations which are in continuous operation since the beginning; the widespread rains in late March 2020 had allowed the new swarms to stay, mature and lay eggs, while a few swarms moved from Kenya to Uganda, South Sudan and Ethiopia. During May, the eggs hatched into hopper bands that formed new swarms in late June and July. A serious and threatening condition was continuously encountered in Iran where an increasing number of hopper bands continued to form along with the southern coast during these months. Further, in Pakistan, regular control operations were carried out to check hopper groups in Baluchistan, Punjab and near the Indian border. Though, the fresh incursions were encountered as expected from the spring bred

immature adults which moved as the adult groups and swarms headed towards the northern parts viz. India, Oman, UAE and Uganda. The unprecedented threat was continuously viewed over the Horn of Africa during June 2020. Further, the increased breeding witnessed in East Africa brought an increasing threat to south west Asia, where the pre-monsoon rains had triggered the breeding grounds especially in Pakistan and areas of India adjoining to Indo-Pakistan border.

Though many SW Asian countries including India may not experienced any locust insight as well as threat from the upsurge but the situation is still alarming as the breeding season is heading. Eastern Ethiopia and central Somalia are regularly experiencing substantial and widespread breeding of locust populations (FAO Desert locust Situation update, 10 December 2020). This progressive breeding will make the population surge along both sides of the Red Sea. Intensive surveys and control measures need to be ensured in these countries of origin especially Ethiopia and Somalia. Utmost vigilance and preparedness are required in Kenya, and close monitoring should continue along both sides of the Red Sea. Many of the control measures are already in progress, still vigilance and preparedness are needed on every end.

Locust invasion in India: India has witnessed locust swarms since December 2019 with many lakh hectares of farmland (Wheat, mustard and cumin) being affected by which came from Pakistan through the border areas in Rajasthan and Gujarat (Fig. 1). Some residual swarms were also encountered in border areas of Punjab and Rajasthan during February and again in May-June 2020. Though the country achieved much greater success in battling these locust attacks, the alarming situation in Africa had continuously created a sustained fear as the population of these swarms keeps on aggravating with the outset of monsoon in June. Further, the spring-bred immature adult groups and swarms that arrived in Rajasthan from the west continued

their movement towards eastern and central states of Madhya Pradesh and Maharashtra, and these movements were attributed to the western winds blowing in response to the cyclone Amphan in the Bay of Bengal.

As forecasted, successive ripples of invasions were encountered till July in Rajasthan with eastward surges across northern India. Several new swarms were in the chain of breeding in East Africa during June 2020 and the threat kept on sustaining in South-West Asia, where spring-bred swarms continued to migrate to summer breeding areas along the Indo-Pakistan border. Moreover, pre-monsoon showers received during June first week in Rajasthan and adjacent areas of Pakistan added to the breeding. Continuous monitoring and containment operations were undertaken to check these swarms that ultimately aided in battling the locust situation.

At present, the country is free from gregarious as well as solitary desert locust activity. We need to be very vigilant as the locust breeding has started in Somalia, Ethiopia and Red Sea. Intensive surveys and preparedness need to be strengthened in 2021. Monitoring will remain the prime line of defense in battling the locust situation.

Locust control bodies

Migratory locust species frequently cross national borders. Hence, different coordinating bodies have been established worldwide that regularly monitor and check locust activity. These include:

- **FAO Desert Locust Control Committee (DLCC):** A global coordinating body for locust early warning and preventive controls (HQs at Rome, Italy). The DLCC maintains a global perspective and forum on desert locust early warning, control and emergencies, and provides guidance to the three FAO regional Desert Locust Commissions- the Commission for Controlling the Desert Locust in the Western Region (CLCPRO), Central region (CRC) and South-West Asia (SWAC).
- **Desert Locust Information Service (DLIS)** of FAO monitors

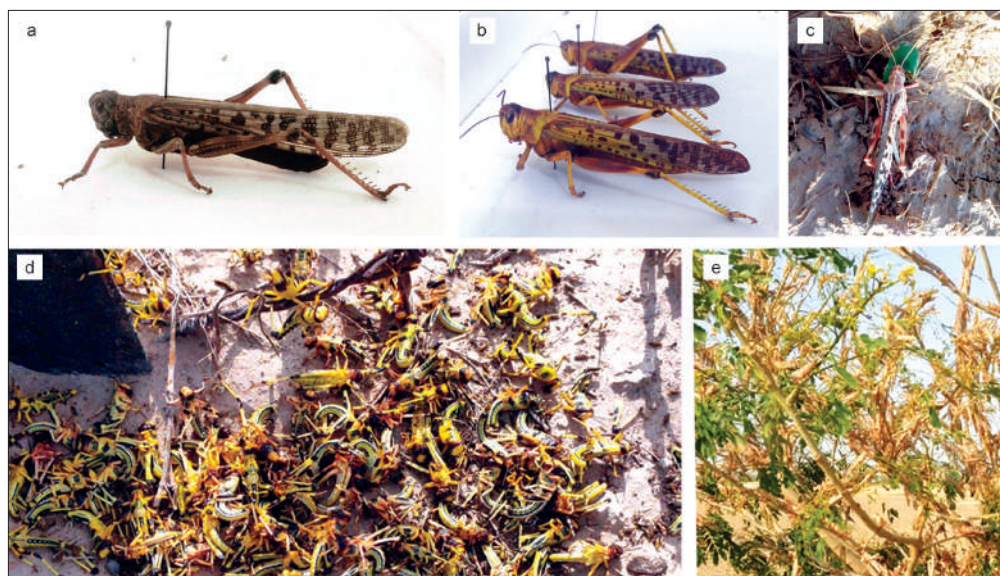


Fig. 1. The Desert locust, *Schistocerca gregaria* (Forsk.): a) immature adult (pink); b) mature adults (yellow); c) immature adult devouring the seedling d) mature adult swarm; e) adult swarm settled on a tree.

ecological conditions, weather and the desert location situation from West Africa to India and provides regular updates on locust situation.

- **Locust Warning Organization (LWO):** In India, the locust control and research is governed through LWO established in 1939 which later in 1946 was amalgamated with the Directorate of Plant Protection Quarantine and Storage (DPPQS) under Ministry of Agriculture and Farmer's Welfare. LWO monitors and controls the locust situation in Scheduled Desert Areas in Rajasthan and Gujarat. The field HQs of LWO is in Jodhpur, Rajasthan with its field station for investigation on locusts (FSIL) situated at Bikaner, Rajasthan.

Locust control strategies

The coordinated control program adopted to reduce the impact of locust outbreak may include:

1. Monitoring and surveillance
2. Proper preparedness and response plan
3. Ground and aerial control

Monitoring and surveillance:

The preventive control strategy relies on monitoring locust population dynamics, allowing more accurate forecast, and thus early warning and early reaction. Monitoring is a proactive tool to combat locust outbreaks that ensures timely

adoption of adequate control actions. DLIS monitors the locust situation through the aid of advanced Geo-positioning systems (GPS), Geographic Information System (GIS) and satellite data imagery tools. The pioneer among them is a geo-referenced tool "eLocust", which is a handheld device for monitoring and early warning system. An updated version of it is eLocust3 that records and transmits data from the field to their national locust centers via satellite. Another efficient tool developed is RAMSESv4 (Reconnaissance and Management System of the Environment of *Schistocerca*), which is an open-source geographic information system with spatial database software designed for national Desert Locust information officers in locust-affected countries.

In India, more than 2 lakh km² area comes under Scheduled Desert Area, which is under regular monitoring and locust control and research is been undertaken in this area under the supervision of LWO. The LWO in coordination with state governments and it works through its 10 Locust Circle Offices (LCO) situated in Rajasthan (Jaisalmer, Bikaner, Phalodi, Barmer, Jalore, Churu, Nagaur, Suratgarh) and Gujarat (Palanpur and Bhuj).

Preparedness and response plan:

Each country ensures its adequate preparedness to combat locust

outbreaks by adopting and standardizing its contingency plan. In India, the self-sufficiency is ensured in allocation of varied resources viz. manpower (officers, trained technicals, assistants, and drivers), transport (survey vehicles, control vehicles, heavy vehicles for the supply of pesticides and control equipments), sprayers (handheld Micro Ulva, Ulva+, vehicle mounted Ulva Mast, ULva Mast V3E and Micronair AU 8115) and others like monitoring equipments (eLocust3, eLocust 3g, RAMSESv4) and

camping etc. By June end, 2020 India was under normal locust situation and Locust Circle Offices ensured self-sufficiency in terms of knowledge, expertise, vehicles, control equipments, and personal protective equipments. Moreover, indigenous drones were developed and used in monitoring and checking locust attacks. So far, the operational capability of locust control was also boosted by the use of drones, Bell helicopter, MI-17 helicopter and the newly imported Ulvamast sprayers from the UK. Further, the following preparedness and response activities were ensured as a part of the coordinated efforts of central and state governments:

- Procurement of adequate pesticides for maintaining the buffer stock.
- Regular meetings with competent authorities for planning and action.
- Regular meetings with neighbouring countries like Pakistan to exchange information on the current locust situation and accordingly, things were prepared to combat the locust threat if any.
- The Desert Locust situation Bulletin is being issued at fortnightly intervals that provided the updates to all the stakeholders about the prevailing locust situation in the country.
- Awareness was created amongst the state functionaries, Border Security Forces, Panchayats etc., so that they

could inform regarding locust activity to the nearest locust office circle or camps or other concerned departments.

Ground and aerial control: The chief target of locust control is to destroy the respective life stages (egg, nymphs and adults) of locusts, depending upon their occurrence in the region. The first approach as practised in breeding areas is the destruction of eggs and nymphal stages for which mechanical control practices are adopted like digging of trenches around the egg laying sites to entrap the young hoppers. Even ploughing, harrowing and hand digging practices are followed to check the eggs and early nymphs.

The second important concern is to check and control the migratory and flying adult swarms. For this, constant vigilance is maintained to locate their movement along the wind direction and wait for them to descend as large swarms in cultivated areas, where the best way to tackle them includes mechanical measures like beating plates to create sound, or creating a cloud of smoke by burning refuse, etc., and finally the insecticide application employed through land or aerial vehicles that target the whole swarms in relatively short periods of time. These ground and aerial control measures are effective when the swarming adult locusts are roosting (in morning and evening). The locust population is most effectively controlled when they congregate together in bands or when the swarms are settled. According to the FAO, aerial spraying is the most effective method to reduce locust numbers. In India, foliar sprays using insecticides viz., chlorpyrifos 20EC@1,200 ml/ha, lambda cyhalothrin 5EC@400ml/ha or fipronil 5SC @125ml/ha are recommended for desert locust control. Aerial sprays with chemical pesticides like Malathion, using drones is also under practice. Moreover, Malathion 96% ULV application@1,000ml/ha is also recommended for the control of desert locust in a scheduled desert area

only.

However, there are concerns that the use of chemicals, such as widely used insecticide chlorpyrifos, could be harmful to humans and environment. Thus, alternative promising approach is the integrated locust management strategy, which exploits the biological control measures. Many natural predators such as wasps, birds and reptiles may prove effective in checking small swarms. Fungal formulations are found effective in checking locust populations. *Metarhizium anisopliae* var *acridum* developed by CABI (U.K.) has been reported very effective against desert locust and offers a large-scale solution in managing the established swarms. This product is being formulated and marketed by M/s Elephant Vert - a Swiss firm as 'Green Muscle'.

In the first few months of 2020, the FAO released tenders for the supply of a *Metarhizium acridum*-based product for Somalia, Kenya and Ethiopia. Subsequently, Eléphant Vert supplied Green Muscle™ to the authorities and spray teams applied it under the supervision of the FAO. Samples of the product have also been sent to Uganda, Pakistan and India, where the locust situation was getting worse. Some of the plant oils namely neem, linseed oil etc. also can be used to check small populations of locusts as an ecofriendly approach.

Chemical sprays will remain as the ultimate choice to contain the larger outbreaks in the invading areas so as to achieve a quick knockdown and further spread is restricted. However, while going for the chemical sprays, care should be taken to protect human beings, water bodies, natural reserves of biological resources and other non-target organisms.

SUMMARY

Regular invasions of locust swarms were witnessed from the start in 2020 along east Africa, Middle East and South-West Asia. The upsurges of swarms that were in continuous head from Africa to Indo-

Pakistan borders resulted in subsequent and frequent encounters of locusts which were witnessed in Punjab, Rajasthan, Gujarat near border areas till November 2020. Further, the wind movements moved the swarms towards Madhya Pradesh, Bihar, Delhi and Maharashtra, that had led to a real concern. Control operations were in continuation against adult and immature groups and maturing swarms in Rajasthan, Madhya Pradesh and other invading areas. Constant vigil and preparedness of locust management efforts had brought the situation under control. India has been complimented by FAO for its efforts in controlling the locust situation and for being the first country which employed drones for successful management of locusts.

Effective preventive management strategy for locust control primarily involves efficient monitoring and surveillance that employed the acquisition of an improved knowledge of the pest biology and ecology. Further, the central government (LWO, and FSIL) and state government got involved into a strong networking mode that ensured adequate preparedness to combat the subsequent wave of locust invasions in India. This brought the situation under control and till December 2019, India has not experienced any of the solitary as well as gregarious locust activity. The present global situation (FAO Desert locust Situation update, 10 December 2020) marks the initiation of locust breeding in Eastern Ethiopia and central Somalia, which is likely to bring an upsurge in locust population along both sides of Red Sea. Hence, intensive surveys and control measures need to be undertaken and adequate preparedness is to be ensured on part of each Country's end.

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