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Attack of locust in COVID-19 pandemic and their impact on farmer's income and food security

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Abstract

India combat desert locust attack amide covid 19 pandemic. The desert locust is an international transboundary pest which affect agricultural production and livelihood in many countries its migratory nature and capacity for rapid population growth present major challenges for control in particular semi-arid areas. The desert locust has capacity to cause substances damage to agriculture but the circumstances under which they will occurs or unusual. In India the locust attack mainly seen in Rajasthan, Gujrat, Uttar Pradesh, Maharashtra, Bihar, Chhattisgarh states and destroy many hector of farm land. The climate change has worsening the locust problem in India which can worsen with temperature soaring in coming season or month. A change in cyclonic invasion and unexpected rainfall leads to locust invasion and breeding. The combined crises of Covid-19 and locust is a big threat and could lead to further disaster such a famine, disease and increase in poverty. The loss of agriculture produce, discontinuing of supply chains, labour losses and in transportation due to lockdown cause disastrous impact on economy.

Keywords: Locust, Covid-19, pandemic, agriculture, food security

Introduction

Locusts are the major agricultural pests of the India as well as worlds. Out of 5000 different species of grasshopper, those which can live in two different phases viz. solitary and gregarious phase are called locusts. Out of these only nine species have been recognised as locust, three species belong to Indian subcontinent. Locust are polymorphic representing solitary and gregarious forms. The gregarious forms make large swarms which migrate over wide geographical regions and causes great devastation of forests, natural and cultivated vegetation, crops and orchards. In ancient period they were, therefore, called the 'Plague' means 'curse of God.'

Locusts are a group of several species of short-horned grasshoppers in the family Acrididae that have a swarming process. Usually these insects are solitary, but they become more abundant under certain circumstances, and change their behaviour and habits, becoming gregarious. Since the beginning of civilization, locusts and grasshoppers have been among the most devastating threats to agriculture. This group of insects contains hundreds of pest species and affects the livelihoods of one in every ten people worldwide (Latchinsky *et al.*, 2011) [1]. In the middle of the coronavirus pandemic, India has to fight another battle against the swarms of locusts that have entered the western parts of India. Swarms have already made their way into Rajasthan, Gujarat, Madhya Pradesh, Uttar Pradesh, Punjab and Maharashtra. The current locust invasion is the worst in India since 1993. As per the locust forecasting by United Nation's food and agriculture organization, the current locust outbreak is the biggest in 25 years in Ethiopia and Somalia, 27 years in India, 70 years in Kenya.

The locust attack is likely caused due to additional cyclones in the African region. The outbreak originated from two cyclones (May and Oct 2018) that allowed three generations of breeding - from June 2018 to March 2019 - in the Arabian Peninsula, and caused an 8,000-fold increase in locust numbers. The locusts currently attacking crops in India breed and matured in Iran and Balochistan in Pakistan. Still the swarms of locusts breeding in Horn of Africa are likely to reach India and Pakistan next month and could be accompanied by other swarms.

All locust-affected countries transmit data about attacks to the FAO, where the information is analysed in conjunction with the weather and habitat data and satellite imagery. The organisation also provides forecasts for locust attacks up to six weeks in advance and issues warnings for each country.

Origin of Locust swarms

Africa is heading towards a locust catastrophe wide swarm grows 500 times bigger within next four months as feared, UN warns. Rainfall expected in this coming weeks will trigger plant growth, providing food for the locusts in the area. Swarms is considered the worst outbreak to hit Kenya for 70 years and Somalia for 25 years according to UN. Horde of 360 billion insects is laying waste to farmland across the horn of Africa and Kenya. The next generation of locust is expected to swarms in April after hatching in February, exacerbating the crisis.

Phases of locust

Locusts are grasshoppers that are characterized by behavior. They are defined as several species of short horn grasshoppers of the family acrididae that have solitary and gregarious

phases. They do not belong to particular genus or sub family but are those species of grasshoppers that exhibit behavioral, morphological, physiological changes from solitary phase to migratory phase (Grzimek *et al.* 2004) [4].

The locusts are polymorphic occurring in more than one form during adult life. Uvanov (1996) proposed the famous 'phase theory.'

According to the phase theory, the locust exists into two main forms or phases – one, the gregarious phases and another solitary phase. In these phases, an individual's locust varies widely in morphological structure as well as in the behaviour. Swarming always occurs in the gregarious phase which is characteristic of migratory locust while solitary phase represents merely the grasshopper, which are often isolated and confined to their breeding locality.

The Differences between solitary and gregarious phase

Characters	Solitary phase	Gregarious Phase
Eggs	Non diapause	Diapause
Habit	Isolated	Crowded
Nymph body colour	Green, grey, brown	Black and yellow, orange bands
Adult pronotum	Longer and crested	Shorter, saddle shaped
Hind femur	Longer than forewing	Shorter than forewing
Habit	Dull	Gregarious and over active
Body temperature	Low	High
Sexual maturity	Without colour changes	With colour changes
Corpora allata	Small	large

Locust Swarm in year 2020

The first swarms were sighted along the India-Pakistan border on 11th April 2020, months ahead of the usual time of arrival. Agriculture Ministry's Locust Warning Organization (LWO) reported the first sightings in Rajasthan's Sri Ganganagar and Jaisalmer districts. In India, locusts are sighted normally during July- October along the Pakistan border. In 2019, parts of Western Rajasthan and Northern Gujarat reported swarms that caused damage to growing rabi crops. These were the first swarms reported in India since 1997. Periodic swarms of locusts has been recorded since the ancient time. The locusts can efficiently and continuously fly for 17 -18 hours a day and the swarms, as recorded travel 15 to 320 km a day during a normal migration. Overall they migrate distant regions up to hundreds and thousands of km. away from the place of origin may return back after crossing the equal distance.

One swarm in 1794 once spread in over 5000 square kilometres (Grzimek *et al.* 2004) [4].

Life History

Three development stages, egg, nymph and adult are found. Mature adults are yellowish, sluggish reluctant to fly and cluster on ground (which maturing male clings to female back) young adult bright pink, (mature turn bright yellow) pink adult are very active, causing much damage. Yellow adult is not so destructive but lay eggs giving rise to nymphs.

Egg laying start after 8-24 hour of mating in damp soil. About 500 eggs are laid per female in 5 pods. Before oviposition female bores a hole in loose sandy soil 2-4-inch-deep with its ovipositor and lays eggs in 1-4 hours and secretes frothy materials over eggs which makes pool water proof on drying and hardening. Ground used for oviposition can be easily recognised by numerous holes of pencil diameter. About 5000 eggs are found per one square yard area. Eggs period is 3-4 weeks in February – march, and 12-15 days in May –

September. Nymph are called hoppers, freshly hatched are light yellow, soon turn black (in gregarious brood). They feed on all kinds of vegetation and move in bands. Nymphal period is 6-8 weeks in spring and 3-4 weeks in summer.

Breeding season

Breeding depends upon rainfall and subsequent vegetation. Eggs are laid in damp soil. Two breeding season are observed during the year in India.

1. Spring season
2. Summer or Monsoon breeding season

Among the swarms produced in monsoon season.

Impact of Locust attack on farmer's income and food security

Locust is a polyphagous insect which destroy the all kind of crops. Due to the attack of this insect, farmers faces huge amount of economic losses. It damages on host at any stages of crop growth. At present chances of crop damage is low because farmers already harvester main rabi crops but in this year locust cause huge damage to zaid crop mainly cucurbits like bottle gourd, pumpkin, cucumber, etc. Malvacious crop like ladyfinger, Solanacious crop like chilli, brinjal tomato, leafy Vegetables like spinach, sugar crop like sugarcane and fodder crop sorghum and bajra and it also damage to ornamental plants and fruit orchards.

Government of India in month of September 2020 reported that before covid-19 pandemic during 2019-20, locust attack was reported in some districts of Rajasthan and Gujarat. Rajasthan Government has reported that a total area of 1,79,584 hectares of 8 districts of the state was affected by locust attack during 2019-20. The State Government of Gujarat has reported that crop loss due to locust attack was observed in a total area of 19,313 hectares of 2 districts of the State during the year 2019-20. During 2020-21, the locust

incursions were reported in 10 States of Rajasthan, Madhya Pradesh, Punjab, Gujarat, Uttar Pradesh, Maharashtra, Chhattisgarh, Bihar, Haryana and Uttarakhand, where operations were undertaken in coordination with State Governments for locust control. State Governments of Gujarat, Chhattisgarh, Punjab and Bihar have reported no crop losses in their States. Initially during May-June 2020, Government of Rajasthan reported crop damage of 33% and more due to locust attack in 2235 hectare area in Bikaner, 140 hectare in Hanumangarh and 1027 hectare area in Sri Ganganagar; but now, as per revised report, it has been stated that earlier submitted data was related to initial stage of crop sown in Kharif season and this area of crop loss has been re-sown by farmers. State Governments of Haryana, Madhya Pradesh, Maharashtra, Uttar Pradesh and Uttarakhand have reported crop damage of less than 33% in 6520 ha, 4400 ha, 806 ha, 488 ha and 267 ha respectively due to locust attack this year. (Press bureau of India 2020) ^[3, 6].

About 90,000 hectares in 20 districts of Rajasthan have been affected due to the locust attack. The first swarms were sighted along the India-Pakistan border on 11th April 2020, months ahead of the usual time of arrival. Agriculture Ministry's Locust Warning Organization (LWO) reported the first sightings in Rajasthan's Sri Ganganagar and Jaisalmer districts. In India, locusts are sighted normally during July-October along the Pakistan border. In 2019, parts of Western Rajasthan and Northern Gujarat reported swarms that caused damage to growing Rabi crops.

Rajasthan government's estimations that the crops were affected in more than 3.5 lakh hectares in various districts of Rajasthan and Gujarat, the damage caused by locust attacks in 2019-20 is believed to be one of the worst in India. Crops of mustard, cumin and wheat have been devastated in the two states, affecting lakhs of farmers. In Rajasthan, the worst hit districts are Jaisalmer, Barmer, Jodhpur, Jalore, Hanumangarh, Ganganagar, Bikaner and Sirohi.

The desert locust attack has wiped out crops spread over 50,000 hectares across states of Rajasthan, Gujarat, Uttar Pradesh, Punjab, Madhya Pradesh and Maharashtra. Locusts have destroyed lush green fields laden with crops like bajra, sorghum, maize, green gram, black gram, castor, wheat, cotton and vegetable crops.

The Food and Agriculture Organisation (FAO) of the United Nations is the international agency that monitors and manages locust invasions. It says a swarm of locusts, which contains about 40 million insects, can eat the same amount of food in one day as 35,000 people, 20 camels or six elephants.

Locusts are a group of several short-horned grasshoppers with a swarming mechanism in the Acrididae family. India has in the past encountered several plagues of locust, upsurge, and incursion. Nevertheless, desert locust is a solitary process, *Schistocera gregaria* F. In or around Rajasthan and Gujarat, India, has been reported from time to time. In 2019, the intense desert locust outbreaks were reported from India's northern Gujarat state. Dated 09/07/2019, 22/07/2019, 14/12/2019, three serious attacks have been recorded in North Gujarat during 2019. Locust swarm was observed in Kutch, Banaskantha, Patan, Sabarkantha & Mehsana district of north Gujarat. The Department of Agriculture in Gujarat recorded 17,000 ha of cumin, mustard, castor, chickpea, wheat and rapeseed being infested with the locust swarm. It was the largest savagery attack since 1993-94 in Gujarat and Rajasthan and has been recording estimated losses of 5-6 Crore rupees up to now. In April-May 2020, another desert

locust attack was registered in India from Rajasthan and Gujarat region. The overall outbreak evolution is defined including how locusts have been detected and regulated. There are described preventive, proactive and reactive approaches to locust control and future trends for locust management in India (Manishkumar *et al.*, 2020) ^[5].

Locusts cause damage by devouring the leaves, flowers, fruits, seeds, bark and growing spots and also by breaking down trees due to their weight when they settle in mass. There are 10 important species of locusts in the world, out of these four types of locust recorded in India viz., Desert locust (*Schistocerca gregaria* F.) is the most destructive of them, Migratory locust (*Locusta migratoria* L.) Bombay Locust (*Nomadacris succincta* L.) and Tree locust (*Anacridium rubripinum* B.B.). To the food security and livelihoods of rural communities, the effects of the invasions in the affected areas may be disastrous. Ultimately, control camps commonly cost \$1 million (Belayneh. 2005) ^[2], with the vast amounts of chemical insecticides used having significant environmental side effects.

Management of locust

Management tactics is most effective and practicable against hoppers through taken up against all stages

1. Ploughing, digging and harrowing of places where eggs are laid on large scale and destroy.
2. When swarms settle on vegetation or ground, they are beaten to death, swept together, buried in heaps
3. They can be burnt with fire torches (flame throwers) at night or early morning when sluggish.
4. Digging trenches (45 cm deep and 30 cm across) the front of marching hoppers trapping and burying in ditch dusted with chloropyrifos.
5. Neem kernel suspension serves as a deterrent to locusts.
6. Kites and crows, common mynahs are predaceous on locusts.
7. Mechanical control Methods such as digging trenches dusted with Malathion 5% DP for hoppers to fall into or beating hoppers with branches
8. Baiting - Mixing insecticide dust of Malathion 5% DP or Fenvalerate 0.4% DP with a carrier such as maize meal or wheat bran, and scattering the mixture among or in the path of the locusts (5-15 kg/ha for marching bands and over 50 kg/ha for settled hoppers and adults). Farmers should make sure that the livestock should not eat the bait.
9. Spraying of Entomopathogen *Metarhizium anisopliae* (strain IMI 330189) @ 2.5 x 10¹² conidia/ha (Oil formulation).
10. Spraying the crops with Neem based insecticides (Azadirachtin 1500 ppm) @ 5 ml/lit mixed with spreading agent like soap solution as a prophylactic measure
11. Spraying of insecticides like Malathion 50 EC @ 1.5 ml/lit or Chlorpyrifos 20 % EC @ 2.5 ml/lit during evening hours.
12. Dusting the crops with Malathion 5% DP or Fenvalerate 0.4% DP @ 25 kg/ha.

Locust swarm management in desert area:

1. Aerial spraying of ULV insecticides *i.e.*, Malathion 96% under the supervision of government functionaries during evening or night hours when the swarm get settled on vegetation

- Mechanical control Methods such as digging trenches dusted with Malathion 5% DP for hoppers to fall into or beating hoppers with branches
- Baiting - Mixing insecticide dust of Malathion 5% DP or Fenvalerate 0.4% DP with a carrier such as maize meal or wheat bran, and scattering the mixture among or in the path of the locusts (5-15 kg/ha for marching bands and over 50 kg/ha for settled hoppers and adults). Farmers should make sure that the livestock should not eat the bait.

List of approved pesticides for desert locust control: (Reported by Directorate of Plant Protection, Quarantine & Storage, Faridabad-in June 2019)

Pesticides approved used for control of desert locust in scheduled desert area only

S. No.	Chemical	Doses	
		a.i.(gms)/h	Formulation (gms/ml)/h
1.	Malathion 96 % ULV	925	1000
2.	Malathion 5 % DP	925	20000
3.	Fenvalerate 0.4 DP	80-100	20000-25000
4.	Quinolphos 1.5 DP	375	25000

Pesticides approved used for control of desert locust in desert locust n crops, acacia and other trees

S. No.	Name of pesticides	Formulations	
		a.i.(gms)/ha	(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

Note: These chemicals is only used for hoppers control

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