16-30 JUNE, 2020

Down To Earth

FORTNIGHTLY ON POLITICS OF DEVELOPMENT, ENVIRONMENT AND HEALTH

₹60.00

WORLD ENVIRONMENT DAY SPECIAL

LOCUST ATTACKS ARE BACK

Exploiting changing weather patterns, locusts are spreading to new territories and devouring crops

Fire in a gas and oil well devastates Assam's wildlife

P16

State governments dilute Forest Rights Act, threatening forest communities

P26

THE OTHER PLAGUE

Locusts have returned to India in just two months and are spreading to new territories. Has climate change added another layer of stress and uncertainty?

ISHAN KUKRETI, AKSHIT SANGOMLA, SHAGUN KAPIL, MEENAKSHISUSHMA AND VIBHA VARSHNEY

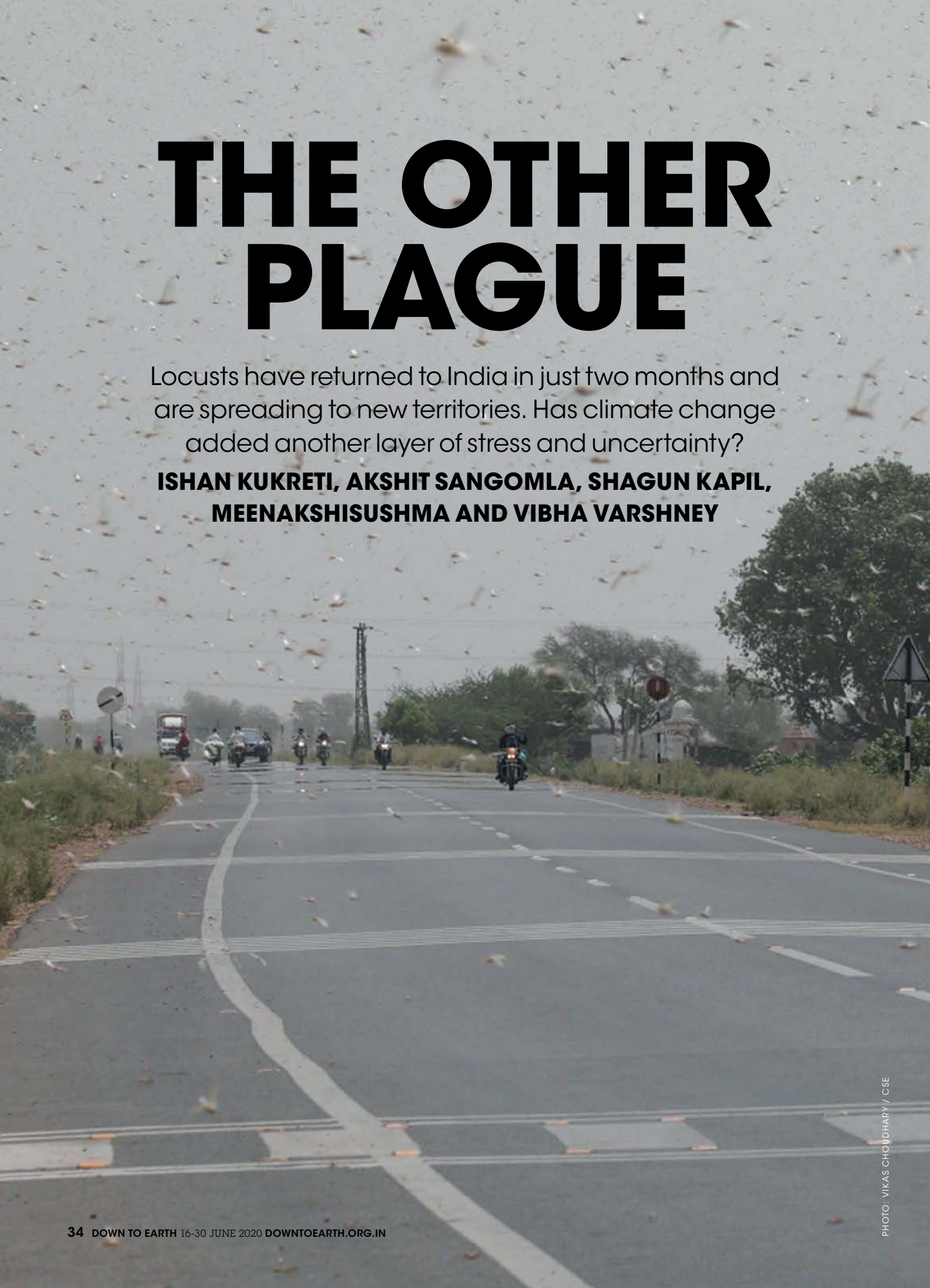


PHOTO: VIKAS CHOUDHARY / CSE

Dholpur district in Rajasthan at 11 am on May 27, 2020

PHOTO: ADITHYAN P C / CSE

^ A locust control operation at Mahar kalan in Karanpur village of Jaipur district, Rajasthan, on May 27

IT'S MAY 27. A few minutes past 11 am. *Down To Earth* reporters had just arrived in Pachgaon village, Dholpur district, Rajasthan, to enquire about desert locusts that are crossing over to India way ahead of the monsoon rain and invading new areas. As if on cue, a huge swarm, resembling a long rust-coloured low cloud, appeared from nowhere. It quickly swelled forward, taking over the sky and nearly obliterating the desert sun. Bewildered, the residents ran out of their homes and gathered in the open. But before they could get a grasp on the situation, millions of locusts started falling like hail and clung to everything that looked green. Within no minutes, the trees and bushes turned into ragged mounds of glistening brown. Some leaned over to touch the ground—tropical grasshoppers weigh about 2-2.5 gram. A few youngsters took photographs as the others stood motionless.

It was for the first time the residents had seen something like this. Soon the severity of the situation dawned on them. Some residents fetched their utensils and started beating and banging them. Ram Babu, a farm worker in his 60s, rushed to his farm to scare away the pests with a piece of cloth. He repeated the exercise for almost an hour in the 46°C heat. "I saw on the news yesterday about locust attacks in Jaipur, but did not think they would attack our village too," he said, trying to call the land owner to inform him about the attack.

The nervous clamour of people did not let the swarm stay in the village for more than 40 minutes. But during that short period, Babu lost almost one-fourth of his pumpkin crop planted on 3.5 *bigha* (0.3 ha) land. Peepul, babool and *keekar* (*Prosopis juliflora*) trees looked queer with almost bare branches and punctured leaves.

Only a few insects were fluttering

about when the district agriculture officials arrived at Pachgaon. They have been on alert since the night before and tracking the swarm with the help of their counterparts in other districts and the Locust Warning Organization (LWO)—a unit under the Ministry of Agriculture and Farmers' Welfare that runs the world's oldest national locust monitoring system. “At 5:21 am, I got a call from Karauli district that the swarm that settled on the forest for the night had started moving and the wind direction suggested they could enter Dholpur,” says Dayashankar Sharma, deputy director at the district agriculture department. His team of 25 officers soon left for the bordering villages and alerted residents to resort to *dhwani aur dhuan* (sound and smoke). At around 7.15 am, a 10-km long swarm crossed into Dholpur at Jasora village. It was moving at 25-30 km per hour. The officials were on their toes. "They were carrying insecticides but it can be sprayed only when the insects settle at night. So, they joined the residents in stoking up the fire and beating utensils," says Sharma who was waiting at Saipau village road. It was supposed to be the next stopover for the swarm. But because of smoke from nearby brick kilns, it diverted its route and entered Pachgaon.

“The ones left behind would become food for lizards or birds," says Sharma. He was relieved that his team and the others did not let the swarm settle anywhere in the district and could drive it away before sunset. Because that's the time they dread, when locusts are on the move.

This gregarious species usually flies during the day and lands just before sunset. If they settle on a farm, they devour whatever green they spot before flying out in the morning. According the UN Food and Agriculture Organization (FAO), which considers desert locusts as the "most dangerous of all migratory pest species" and runs the centralised monitoring and information service, Locust Watch, a swarm of 1 sq km contains over 40 million locusts that can eat the same amount of food in a day as 35,000 people. Farmers of Sri Ganganagar and Bikaner districts know this voracious nature of the pest only too well. The districts are part of the state's cotton growing belt where agriculture has been made possible because of the Bhakra, Indira Gandhi and Gang canals. In the months of May and June short cotton plants dot the fields in this arid region. But this year most farms wore a desolate look. Mahaveer Saran, who owns 5 ha in Beenjhbaila village, narrates how locusts have pushed his entire village into penury overnight. “A gigantic 40 sq km swarm invaded our village on May 27. Some of my neighbours ran to the market to buy firecrackers as I made calls to the agriculture office and organised people to bang utensils, but to no avail. The officials did not show up. By the time the swarm left around 12 pm the next day, they had eaten every leaf and shoot off our farms,” he says. Earlier that month, on May 10, an equally huge swarm invaded Lalawali village in Bikaner and destroyed all cotton crops in two hours.

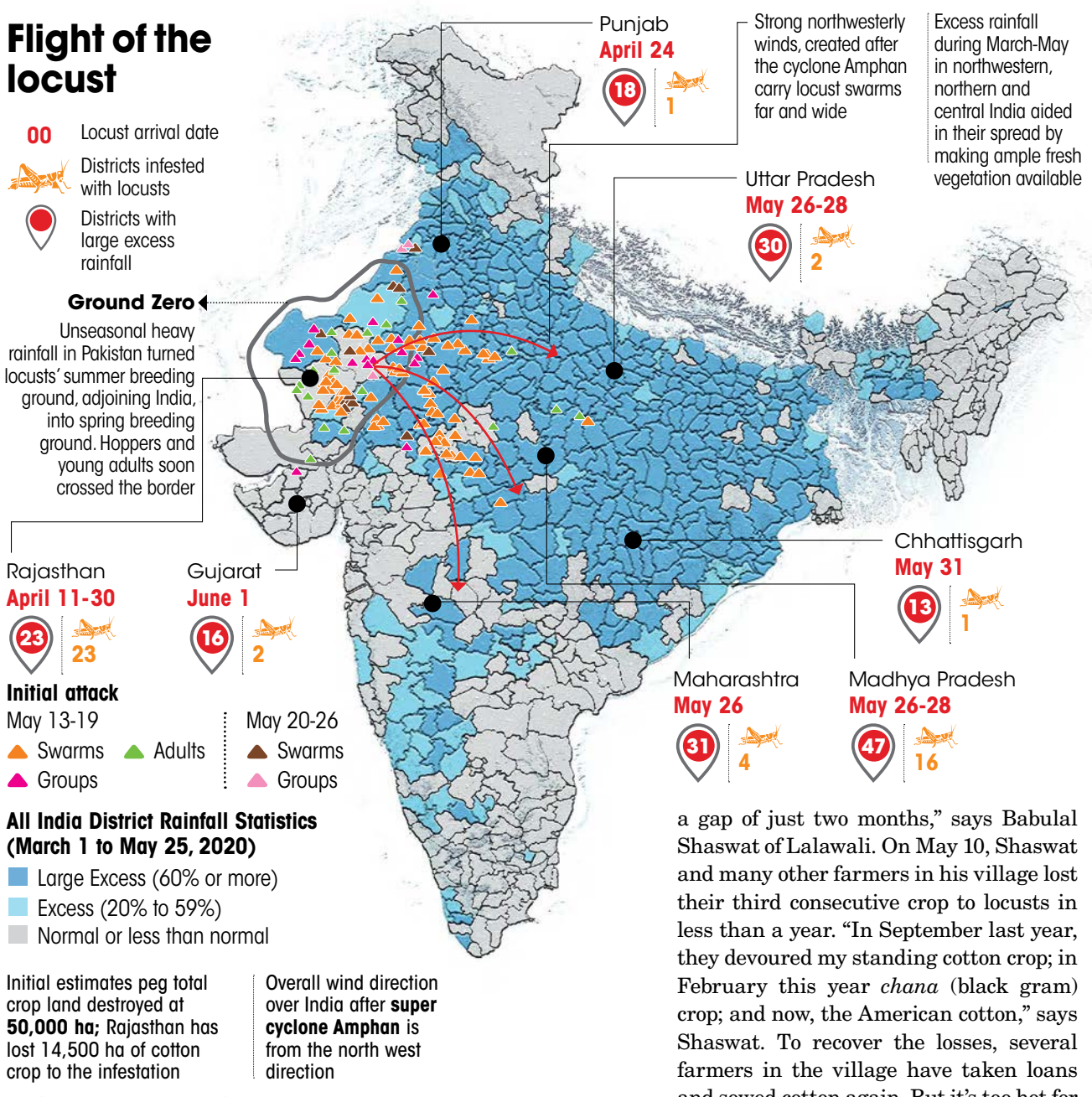
ANCIENT ENEMY

1802-1804: CROPS WERE DESTROYED BY LOCUSTS IN KUTCH, RESULTING IN WIDESPREAD FAMINE. THEY ATTACKED THE REGION AGAIN IN 1834, CAUSING ANOTHER FAMINE

Initial estimates by officials with the agriculture department shows locusts have mostly destroyed cotton crops in the state—4,500 ha in Sri Ganganagar, about 9,000 ha in Hanumangarh, 830 ha in Bikaner and 70 ha in Nagaur. On an average, every hectare produces 2,000 kg of cotton, that is sold for ₹1.20-₹1.40 lakh. Farmers say they have never seen such huge swarms and so early in the year.

This trans-border pest usually enters the scheduled desert areas of India from Africa, Gulf and Southwest Asia via Pakistan just ahead of the monsoon season for summer breeding and then returns around October and November towards Iran, Gulf and Africa for spring breeding. But this year, according to the Union agriculture ministry, they were sighted as early as April in the border districts of Rajasthan and Punjab.

Residents of Lalawali say with this



Sources: Food and Agriculture Organization; India Meteorological Department; ground reporatge

early arrival, locust attacks have become an unending ordeal for them. Last year's attack, considered a major locust invasion after almost a decade, had also begun way ahead of the season, in May 2019, and continued till February this year. Data with the ministry shows 11 districts in Rajasthan, two in Gujarat and one district in Punjab were exposed to locusts during the period. "Now, they are here again after a gap of just two months," says Babulal Shaswat of Lalawali. On May 10, Shaswat and many other farmers in his village lost their third consecutive crop to locusts in less than a year. "In September last year, they devoured my standing cotton crop; in February this year *chana* (black gram) crop; and now, the American cotton," says Shaswat. To recover the losses, several farmers in the village have taken loans and sowed cotton again. But it's too hot for the seeds to germinate. Shaswat says he is in a fix. He plans to wait till the monsoon and then sow groundnut. But people say the locusts will come back during kharif. "I do not know how I will pull through. So far, I have accumulated a loan of ₹4.5 lakh and have neither paid my instalments nor the school fees for my children since last year. My family is surviving on the remittance sent by my brothers working in Bikaner," says Shaswat, adding that

GRAPHIC: SANJIT / CSE

such an invasion had occured two to three decades ago. But this time the swarms are just too big and too aggressive.

They are also unusually pink. “Usually sexually mature, yellow-coloured locusts come first,” says B S Yadav, assistant director, agriculture department, Jaipur. They tend to stay on the ground and move less once they mate. It’s easier to spray on them and contain their spread. But this year, the presence of hoppers (freshly hatched locusts that are yet to develop wings) has been reported since April 11 and pink immature adults since April 30. These younger pests tend to settle on taller trees as compared to crops. They are like children full of energy and fly away as soon as you go near them, making it difficult to manage them, says Yadav, adding that it is unusual for the younger locusts to arrive at this time. Their behaviour has also changed because of the early arrival, says K L Gurjar, deputy director at LWO. During monsoon and winter nights, their wings get stuck due moisture or dew and they cannot fly until the sun is out. Since the weather is dry now, they are able to fly even at night, making control operations difficult.

With an ability to ditch control measures, fly high and cover long distances, these swarms are now moving beyond the scheduled desert areas, taking people by surprise and posing challenges for LWO that operates with a limited staff.

In Jaipur district, which reported massive locust attacks in the last week of May, Sachin Yogi, a 24-year-old wedding photographer, says, "I have only heard my grandfather talking about locusts." On May 26, some 30 LWO officers, armed with a drone and six ultra-low-volume sprayers, Ulvamast, chalked out a war plan of sorts along with 16 state government officials manning four fire tenders to destroy a 40 sq km swarm that had taken residence at Mahar kalan in Karanpur village. They were out on the roads all night, spraying solutions of highly toxic insecticides like chlorpyifos and lambda cyhalothrin on every tree, bush and other vegetation in the area. The drone was also employed to spray insecticides on the hillocks of the Aravallis that border the district on one side.

At the end of the operation, it was hard to tell if there was anything more than a few random locusts flying around. “The swarm, of 180 sq km in size, entered India on May 22. We destroyed a part of it at Nagaur district. The remaining came here,” said a LWO official. But as soon as sunlight hit the trees, thousands of locusts burst out of the canopies, blinded by chemical sprays yet eager to fly away.

In Uttar Pradesh, the district administration of Jhansi has carried out control operations thrice between May 22 and 27. “LWO officials have been staying in Jhansi since the district was attacked by a swarm,” says Kamal Katihar, deputy director of the district agriculture department. “While we use chlorpyrifos, they handle the highly poisonous Malathion96. Besides, we never had the need for the chemical as this is the first attack in Jhansi after 30 years,” says Katihar.

While in Uttar Pradesh locusts have invaded two districts, they have spread across 40 of the 52 districts in Madhya Pradesh just within a week after entering the state. In Hoshangabad district, deputy director of agriculture Jitendra Singh says, *moong* is close to harvest now. "So as soon as the locusts entered the district on May 23, we deployed four fire engines and sprayers mounted on tractors to spray lambda-cyhalothrin early in the morning. Crops in our district have been saved," he adds. Though the agriculture department claims it has destroyed 40 per cent of the locust population, swarms were active in eight districts, including, Bhopal in the first week of June. Some have even crossed Madhya Pradesh to reach Koriya district of Chhattisgarh on May 31. As on June 7, locusts had spread to 44 districts in seven states; control works were done on 70,728 ha; and, nine states are on high alert for a possible attack. India had never faced a locust attack of such proportion.

ANCIENT ENEMY

1810: FLIGHTS OF LOCUSTS APPEARED IN THE BENGAL PROVINCE. ON ONE OCCASION THEY APPEARED AS FAR SOUTH AS BROACH BUT DISAPPEARED WITH THE BEGINNING OF THE MONSOON OF 1812

The wind factor

Desert locusts are age-old threats. But now something is changing in the way they spread and reproduce

STAYING ALERT is one way to gain the upper hand in a battle. But understanding the changing strategy of the enemy is equally crucial, particularly if it is a trans-boundary pest with an ability to travel 150 km a day riding the wind current. Worse, in India desert locusts appear to be expanding their territory both in terms of time and space—they are now coming early, staying longer and foraying deep into the country.

FAO says much of the country's current crisis was caused by the supercyclone Amphan that made landfall on the Sundarbans on May 20. Strong northwesterly winds (that enter from northwest and move towards southeast and east) were established in its aftermath, taking locusts into places as far as Chhattisgarh in the east and Maharashtra in south. An analysis of the wind data in six north Indian cities by the International Water Management Institute, headquartered at Colombo, also shows that there has been a sharp increase in the wind speed at 10 meters above the ground from mid-May onward which has helped the locust move from Rajasthan to faraway places. As a result, Uttar Pradesh and Chhattisgarh have reported sightings of locust swarms for the first time since 1962, Maharshtra since 1974 and Madhya Pradesh and Punjab since 1993. FAO predicts locusts could soon reach Odisha and Bihar. They too have not experienced locust attacks in recent decades.

However, wind is not the only factor responsible for this unusual spread. According to FAO, even before Amphan hit the country, dry conditions prevailing in the west forced immature adult swarms to move eastward, who reached Ajmer by mid-May and Indore in Madhya Pradesh on May 21. "This is because locusts have a strong liking for tender leaves and possess a strong sense of smell for fresh vegetation," says Biswajeet Paul, principal scientist at Indian Agricultural Research Institute (IARI), New Delhi, who works on biologiocal control of insects. Since vegetation in their usual territory in northwestern states is not lush green, the swarms are moving towards states like Uttar Pradesh and Maharashtra where cyclones and heavy unseasonal rainfalls, induced by western disturbance between March and May, have initiated vegetation growth. Paul says locust swarms are just taking the help of wind currents to move in the direction of food so that they use less energy.

For an insect as big as a paper clip and that travels across continents for survival, energy is a big asset which it must save for breeding. And there are only a few weeks left for it. It is estimated that by the end of June, most swarms in the country would attain maturity. They would turn yellow and settle down for breeding. That would also be the time, when monsoon rains would sweep across northern and central India and kharif crop cycle would begin, making ample food available for them. While locusts only nibble away the leaves of mature trees, they can gobble up entire saplings in a single morning, leaving no trace of vegetation. If the infestation is not controlled now, their next generation would threaten the country's food security that largely depends on kharif crops such as rice, maize and sorghum.

ANCIENT ENEMY

1869: RAJASTHAN SUFFERED CONSIDERABLY FROM LOCUST ATTACKS. VAST SWARMS WERE ALSO OBSERVED BY SHIPS PASSING THROUGH THE RED SEA. OLD RECORDS FROM THE 19TH AND EARLY 20TH CENTURY SHOW THAT THERE HAVE BEEN LOCUST CYCLES SINCE 1869: 1869- 1881, 1889-1907, 1912-1919 AND 1926-1931

PHOTO: ADITHYAN P C / CSE

^ Cotton farm of Mahaveer Saran, of Beenjhbaila village in Sri Ganganagar district of Rajasthan. Before locusts attacked the village on May 26, young plants dotted the field

LWO officials say as on June 8, over 1,500 ha in Rajasthan's Nagaur and Bikaner districts were infested with yellow locusts.

Paul says there is a possibility that the next generation that will hatch outside the traditional territory would be fewer in number. Adult locusts require sandy soil, where they can make a hole, as deep as 10 cm, to push in their abdomen and lay eggs. This is not possible in ordinary soil. So the swarms would lay pods with fewer eggs than the usual 200 to 250. But even these small groups can cause mayhem at the local level. After all, they thrive in areas that are warm, roughly 25ºC to 40ºC, and have ample rainfall and green vegetation. When conditions are less favourable, locusts take up to six months to mature. But given the right conditions, they can breed every three months and increase 20-fold in a single generation and about 400 times in six months after two generations of breeding. This will have a disastrous impact at a time when rural areas are facing reverse migration due to COVID-19.

SO, HOW FAR FROM PLAGUE?

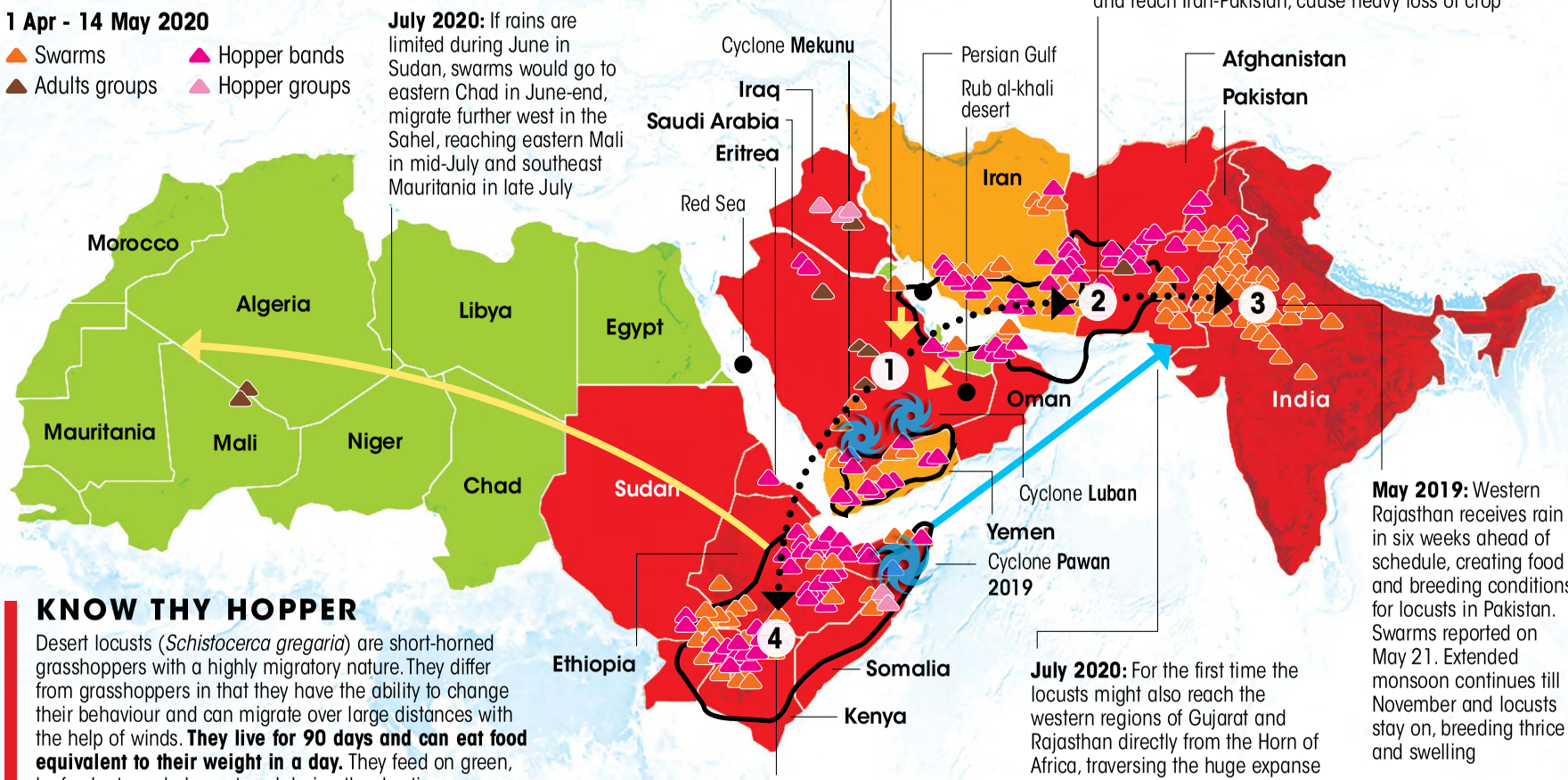
As of now, desert locusts are causing outbreaks in at least 10 other countries in the Horn of Africa and southwest Asia. Though the scale and intesity of the infestation is said to be the worst in decades, FAO describes this an "upsurge", meaning locusts have been able to breed uncontrolled for several successive seasons. In an e-mail interview, Keith Cressman, locust forecasting expert at FAO, tells DTE, "The occurrence of a locust plague depends on weather, rains, control and locust breeding before the end of the year."

However, such a declaration does not seem too far. For the past three years, Locusts have been breeding early and multiplying profusely and spreading in huge numbers due to a series of unusual and extreme climate conditions.

For instance, locusts usually return from Gujarat and Rajasthan to Pakistan and Iran between October and November. But last year, Rajasthan experienced an extended monsoon, which prompted the

GLOBAL SWARMING

Climate change-triggered events like cyclones have resulted in extended and multiple breeding seasons for locusts. They now spend most of the year in India, causing frequent attacks



KNOW THY HOPPER

Desert locusts (*Schistocerca gregaria*) are short-horned grasshoppers with a highly migratory nature. They differ from grasshoppers in that they have the ability to change their behaviour and can migrate over large distances with the help of winds. **They live for 90 days and can eat food equivalent to their weight in a day.** They feed on green, leafy plants and always travel during the day time. Congregation of adult locust is called swarm while that of nymphal locusts is called band. **An average locust swarm can have 8 million locusts and eats as much food in one day as 2,500 people or 10 elephants.** Locust grow exponentially with each generation

GRAPHIC: SANJIT / CSE

Source: Food and Agriculture Organization

swarms to stay back. By the time, they returned in February this year, they had given birth to third-generation insects. During the current infestation, their early crossover to India is also linked to unseasonal rainfall in the deserts of Pakistan, adjoining India that act as summer breeding ground for locusts. “We are seeing an increase in swarms from Pakistan this time as the locusts' spring breeding has happened right across the border. Usually spring breeding is restricted to Iran and Baluchistan,” says K L Gurjar, deputy director at LWO. Till the the end of May, at least 25 swarms had crossed over to India. Such unseasonal rain events are only going to increase in a warming world.

In Arabian Peninsula and East Africa also, locusts are multiplying profusely due to changes in a climate system, the Indian Ocean Dipole (IOD)—a natural pattern of changing temperature gradients between eastern and western portions of the Indian Ocean. Historically, this temperature difference has stayed within safe limits. But in recent years, the western side of the Indian Ocean, or the Arabian Sea, has been unusually warm as compared to the eastern side. This change, dubbed positive diapole, causes a lot of evaporation from the area and then returns as additional rain or cyclones to the region.

In 2018, IOD remained positive for most parts of the year, leading to the formation of cyclone Mekunu in May and cyclone Luban in October. They first caused severe floods in the Arabian deserts and then the growth of lush vegetation, causing locusts to congregate and breed far more rapidly than they would when food is scarce. It is said that the rain also triggered dormant locust eggs to hatch. Just nine months and three generations later, locusts had increased by 8,000 times and were ready to expand their territory.

In the summer of 2019, they jumped the Gulf of Aden and moved to Ethiopia and Somalia. That period was marked by an even stronger positive IOD, resulting in the highest eight cyclonic events in a year. The swarms enjoyed the unusually wet weather, growing even larger. Soon they swept through adjoining countries. In Kenya, where agriculture dominates the country's economy, they have caused the largest outbreak in 70 years; so far, it has lost 30 per cent of its pastureland. A study published in *Nature* on April 12, 2018, says extreme positive IOD events could double in frequency in case of 1.5°C warming above the pre-industrial levels.

ANCIENT ENEMY

1926: DESERT LOCUST APPEAR AFTER A GAP OF 6 YEARS IN SINDH AND RAJASTHAN AND BREED PROFUSELY. THE ATTACK REACHES ITS PEAK IN 1929-30 WHEN ALL PROVINCES OF NORTH WEST INDIA ARE INFESTED AND SWARMS REACH AS FAR AS ASSAM IN THE EAST AND HYDERABAD IN THE SOUTH

In March, as monsoon winds hit the region, East Africa has again received above-average rainfall. FAO says a second-generation breeding is underway there. Numerous hopper bands have formed. These young juveniles, 400 times more in number, will become voracious adults between second week of June and mid-July just as farmers begin to harvest. “The locusts, combined with the impacts of COVID-19, could have catastrophic consequences on livelihoods and food security,” said Qu Dongyu, director-general of FAO at a virtual meeting on May 22.

India, which is still struggling to flatten the COVID-19 infection curve despite imposing the world's most stringent and longest nation-wide lockdown, stares at an uncertain future. FAO warns that more swarms are forming in the spring breeding areas of Iran and Pakistan and migrating towards India ahead of the monsoon rains. “Several successive waves of invasions can be expected until July in Rajasthan with eastward surges across northern India as far as Bihar and Orissa, followed by westward movements and a return to Rajasthan on the changing winds associated with the monsoon,” it says. To compound the situation, in July, for the first time the locusts might also reach the western regions of Gujarat and Rajasthan directly from the Horn of Africa, traversing the huge expanse of the Arabian Sea. Most of them will come from northeast Somalia riding southwesterly monsoon wind. Is India prepared to handle this sudden upsurge?

How to ward off?

All the ammunitions currently in use against locusts can have serious health and environmental impacts

IN MAY 2019 when the Union and state governments were caught off-guard by the locust attack, their response was to pass the buck. Union minister of state for agriculture Kailash Choudhary during his visit to the affected areas blamed Pakistan, while the Rajasthan government complained that the Centre had not provided any help to control the menace. But the fact was since the last major locust upsurge in 1993, both the state and the Union governments had become complacent.

"LWO was on the verge of getting disbanded because no locust attack had happened in over two decades," says a district agriculture official, who does not wish to be named. As on June 2018, as many as 117 of the 250 positions were lying vacant across its 12 circle offices. "This time we were prepared," says K L Gurjar, deputy director, LWO. "Now we have more than 200 staff personnel. Last year, we had just 45 vehicles. Now, we have placed an order for 55 control vehicles and 60 ultra-low-volume spray vehicles." LWO has also improved its monitoring system and uses the eLocust2 device developed by FAO to monitor the movement of swarms on a real-time basis. Locust officers on the field enter all survey and control related data into the handheld device which then transmits the information via satellite. This is complimented by the village level data provided by agriculture supervisor, farmers and revenue officials.

However, there does not appear to be much changes in the insecticides being used. In 1993, during the last locust upsurge, LWO was using benzene hexachloride (BHC), dieldrin, fenitrothion and malathion. While the use of BHC and dieldrin has stopped after the government banned them, malathion is now the preferred insecticide by LWO. Agriculture officials who accompany them during control operations mostly use chlorpyrifos and lambda cyhalothrin. Surprisingly, on May 14, the Union agriculture ministry issued a draft proposal on the ban of 27 insecticides likely to "involve risk to human beings and animals". The list includes malathion and chlorpyrifos. Though the ministry says the insecticides can be used on locusts, it does highlight the toxic-effects of the chemicals on human health and the environment (see 'Toxic tale'). During the five weeks till June 7, LWO has used 70,700 litres of malathion during operations over 71,000 hectares across 43 districts. Between May last year to February this year, LWO had used 3,02,686 liters of malathion.

The use of insecticides in such huge quantities has raised alarm among many. M S Swaminathan, the father of Green Revolution, on June 3 took to Twitter and said: "The #locust menace is causing serious damage to agriculture. Farmers are worried. The best way to control locust invasion is spray neem seed decoction over plants. Neem is a strong repellent & also a fertilizer. I hope our farmers will manage the serious threat to crop security." Biswajeet Paul, principal scientist at IARI, says the volume of insecticides used currently is atrocious. Fire engines spray bigger droplets that hold large amount of pesticides. This will cause severe pollution. "Unfortunately, spraying of chemical insecticides is the only effective method

ANCIENT ENEMY

1929: THE GOVERNMENT OF COLONIAL INDIA REALISES THE SERIOUS PROPORTIONS OF LOCUST MENACE, AND INCLUDES THE TOPIC IN THE AGENDA OF THE BOARD OF AGRICULTURE. IN 1939, THE LOCUST WARNING ORGANISATION IS SET UP

Toxic tale | It needs 4-5 times more insecticides than used for pests to kill locusts

CHLORPYRIFOS

It belongs to the class of organophosphates, which are essentially nerve agents, attacking chemical pathways and causing a breakdown in the ability of nerves to communicate. One can be exposed to it by inhaling, eating, or getting it on the skin. Being moderately persistent in soil, it can take weeks to years to break down; can reach rivers, lakes and streams where it accumulates in the fatty tissue of fish. In surface water in urban areas and in agricultural areas, it has been found at levels potentially harmful to aquatic life. Its use is not approved in the EU.

LAMBDA CYHALOTHRIN

It belongs to the class of pyrethroid insecticides, which are known for moderate acute toxicity to humans and can cause irritation to the skin, throat, nose and other body parts. Some temporary symptoms of exposure includes skin tingling, burning and prickling feelings, particularly around the face. In severe poisoning cases, seizures and coma may occur. Its residue in agricultural or urban runoff sediment have been found to be toxic to aquatic organisms including fish and amphipods.

MALATHION 96

Being an organophosphate pesticide, it can be absorbed by all routes. It can cause numbness, tingling sensation, headache, dizziness, difficulty breathing, weakness, irritation of skin, abdominal cramps and death, depending on the exposure level. EU recognises it as an endocrine disrupter. It is however highly toxic to honeybee, earthworms and leads to soil contamination.

when desert locusts are in such large numbers," said Keith Cressman of FAO at a webinar by DTE. However, experiments over last three decades show promise.

BIO-CONTROL METHODS

At present, there are three major contenders. One is the spores of fungus *Metarhizium acridum*. When it falls on the locust, it germinates and penetrates the body of the insect. It then kills the insect both by expanding its filaments and releasing toxins on the insect. Some 70 to 90 per cent of the locust treated with it die within 14 to 20 days. In 2009. FAO recommended the use of Green Muscle™, a *Metarhizium* biopesticide by the International Institute for Tropical Agriculture. This year, FAO has ordered 4 tonnes of it to treat 80,000 ha in Somalia. The fungus has also been used in China, Australia, Brazil and African nations like Tanzania.

Locust pheromone, phenylacetonitrile, can also be used to control the swarms. It governs swarming behaviour in adult males who use it to warn other males to leave them in peace while they mate. When a minute dose is used on juvenile hoppers, it instructs them to resume solitary behaviour. However, it is being experimented. It has been found exposure to this chemical confuses the insects who often show cannibalistic behaviour.

Then we have chemicals that work as insect growth regulators (IGRS) that hinders the ability of hoppers to moult and grow properly. Ingredients of the neem tree come in this category. Its chemicals are similar to the shape and structure of locust's own hormones. When a locust's body absorbs neem compounds, these block its endocrine system and affect its behaviour and physiology. They fail to reproduce and their populations plummets. Lab experiments show neem oil can also induce "solitarisation" among them. As neem trees grow well in locust affected areas, the oil required to control the swarm can be locally produced.

There are very few takers for these methods despite proven effectiveness and low cost. Locusts attacks are only going to increase with changing climate. It's time we got our ammunition right. DTE

@down2earthindia

ANCIENT ENEMY

1993: THE LAST MAJOR LOCUST OUTBREAK, WHEN 172 INVASIONS WERE NOTED. FOLLOWING THIS, LOCUST OUTBREAKS HAPPENED IN 1997, 2005, 2010 AND 2015 AS WELL, BUT THE INTENSITY WAS MILD