Locust and grasshopper management in drylands: Can biological control be considered as a viable solution?

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CABI

- **not-for-profit** intergovernmental organisation, established by a United Nations-level agreement
- owned by **49 member countries**, which have an equal role in the organisation’s governance, policies and strategic direction
- **over 480 staff worldwide**
- addresses issues of global concern such as **food security** and **food safety**, through research and international development cooperation
- major publisher of scientific information – books, e-books, full text electronic resources, compendia and online information resources
What is the damage potential of Desert Locusts (*Schistocerca gregaria*)?

- During plagues, it can easily affect 20 percent of the Earth's land, more than 65 of the world's poorest countries, and potentially damage the livelihood of one tenth of the world's population.
- Locusts have a high capacity to multiply, form groups, migrate over relatively large distances (they can fly up to 150 km per day) and, if good rains fall and ecological conditions become favourable, rapidly reproduce and increase some 20-fold in three months.
- Locust adults can eat their own weight every day, i.e. about two grams of fresh vegetation per day. A swarm the size of Bamako, Niamey or Paris will consume the same amount of food in a single day as half the population of Mali, Niger and France respectively.

How big is the current locust outbreak in Africa?

Outbreak has reached 23 countries so far, potentially impacting 42 million people

- During quiet periods (known as recessions) Desert Locusts are usually restricted to the semi-arid and arid deserts of Africa, the Near East and South-West Asia that receive less than 200 mm of rain annually. This is an area of about 16 million square kilometres, consisting of about 30 countries.
- As of June 2020, the current upsurge is affecting countries in East Africa, the Near East, and Southwest Asia.
- Yemen is also seeing a great locust activity which is particularly problematic due to a lack of response capacity and the inaccessibility of certain areas.
How big is the locust occurrence in other areas of the world?

- **Pakistan** – Shaheed Benazirabad distract has reported 15.9 million ton losses (NLCC situation report 6th July 2020)

- **India** – 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, as of June 7, India had never faced a locust attack of such proportion ([https://www.downtoearth.org.in/news/climate-change/locust-swarms-how-the-other-plague-is-affecting-several-states-72134](https://www.downtoearth.org.in/news/climate-change/locust-swarms-how-the-other-plague-is-affecting-several-states-72134))


- **Middle East countries** – also affected

- **South America** – **Argentina** and **Brazil** are tracking a swarm of about 40 million locusts ([https://www.reuters.com/article/us-argentina-brazil-grains-locusts/argentina-brazil-monitor-massive-locust-swarm-crop-damage-seen-limited-idUSKBN23W34K](https://www.reuters.com/article/us-argentina-brazil-grains-locusts/argentina-brazil-monitor-massive-locust-swarm-crop-damage-seen-limited-idUSKBN23W34K))
How high is the impact on the economy and livelihood?

- Desert locust numbers are the worst in three generations and could cost East Africa and Yemen **$8.5 billion** this year, the World Bank has said (Geographical, July 2020)

- During the last locust outbreak from 2003 to 2005, which **impacted 20 countries**, mostly in Africa, children were less likely to go to school, and girls were disproportionately affected. This is likely to be the case again in 2020 where **women and girls are affected more** than their male counterparts [http://news.care.org/article/locust-swarms-of-biblical-proportions-put-millions-at-risk-of-starvation/](http://news.care.org/article/locust-swarms-of-biblical-proportions-put-millions-at-risk-of-starvation/)
How did it start - the search for an alternative control option?

- **LUBILOSA** = LUtte Blologique contre les LOcustes et les Sauteriaux
- 13 year (1989-2002) CABI led research programme aimed to develop a **biological alternative** to chemical control of locusts and grasshoppers
- Identified an isolate, *Metarhizium acridum* – went through all the necessary steps to **develop the commercial biopesticide** Green Muscle
- **Donors:** CIDA, DFID, DGIS, SDC, USAID
- **Partners:** CABI (Lead), IITA, GTZ, CILSS/AGRHYMET/DFPV
- **Collaborators:** the Plant Protection Services of Benin, Niger, Mali, South Africa, Sudan, Ghana, Chad, Senegal, Gambia, Burkina Faso, Agriculture and Agri-Food Canada, Universities of Basel, Reading and Bath
- **Cost:** £10.2 million

https://en.wikipedia.org/wiki/LUBILOSA
Is the biopesticide product Green Muscle recommend for use?

- The Pesticide Referee Group set up by the FAO as an independent advisory body in 1989
- At the 6th meeting in 1996, the group recommended **Green Muscle especially for use in ecologically sensitive areas**
- Expert Consultation and Risk Assessment on the Importation and **Large-Scale Use** of Mycopesticides against Locusts, Rome, 2-7 December 2001 (FAO, 2002). **Recommended use of Green Muscle**
- Currently, *Metarhizium* is the only mycopesticide recommended by FAO for use against desert locusts. There are 10 chemical pesticides recommended for use
- Most effective when used as a preventative measure i.e. on juveniles
How was the biopesticide product Green Muscle® being tested?

- Field tested in over 17 countries
- On over 17 species of grasshoppers and locusts (e.g. Senegalese grasshoppers, African rice grasshoppers, variegated grasshoppers, Sahelian tree locusts, desert locust)
- Trials demonstrated that *Metarhizium*, at a dosage of 50g/ha, could reduce grasshopper populations and locusts by 80-90% within two to three weeks
- Green Muscle® is effective against all instars, nymphs and adults of grasshoppers and locusts
1997: Mean grasshopper population density after application of *Metarhizium* at 100 g/ha and Fenitrothion at 250 g/ha on 800 ha plots.
Is the biopesticide product a viable alternative control option?

Pesticide Environmental Accounting (PEA) - External costs of pesticide used in desert locust control in Senegal, 2003-2005

Chemical average PEA costs:

<table>
<thead>
<tr>
<th>EIQ category</th>
<th>Externalities</th>
<th>(€/kg of ai)</th>
</tr>
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<tbody>
<tr>
<td>Applicator effects</td>
<td>€</td>
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<tr>
<td>Rural inhabitant effects</td>
<td>€</td>
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<tr>
<td>Consumer effects</td>
<td>€</td>
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<tr>
<td>Ground water</td>
<td>€</td>
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<td>Aquatic effects</td>
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<td>Bee effects</td>
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<td>Beneficial insect effects</td>
<td>€</td>
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<td><strong>Column totals</strong></td>
<td><strong>€</strong></td>
<td><strong>28.17</strong></td>
</tr>
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Leach et al., 2015 Spatial and Historical Analysis of Pesticide Externalities in Locust Control in Senegal - First Steps. DOI: 10.13140/RG.2.1.4543.1127
How to apply the biopesticide product?

- Ultra low volume (ULV) via hand, ground vehicle or airplane
- Oil based formulation – for Green Muscle just suspend spores in locally obtained diesel oil
- Typically 1 litre formulation per hectare
- Green Muscle recommended at 50g/ha
What personal protective equipment is required for the application?

- Fungal spores are a proteinaceous dust
- Some people, especially those who suffer from hay fever, are sensitive to breathing in the spores
- Extra care must be taken when using large quantities of spores i.e. preparing the formulations
- **Always** wear a dust mask and appropriate clothing
How to source the biopesticide product Green Muscle?

- Source of Green Muscle: Éléphant Vert
- Registered in Kazakhstan, Uzbekistan, West Africa (CSP), Madagascar
- Obtained provisional sales authorizations in Kenya, Ethiopia, Somalia, Saudi Arabia
- Under registration in Morocco, Algeria, Tunisia
- Has been registered, & needs to be renew in Sudan, South Africa, Mozambique, Zambia, Malawi, Zimbabwe, Tanzania and Yemen
- Approved and recommended by FAO and has been used in large scale in Madagascar (60 000 ha), Tanzania (10 000 ha), and Somalia (spraying on going on 80 000 ha)
Are there other biopesticide products available elsewhere?

- Green Guard®, BASF, has been used operationally since 2000, with more than 100,000 ha of locust and grasshopper infestations treated between 2000 and 2009 but this only accounts for around 10% of the area sprayed (Hunter, 2010)
- Registered in Australia
- For use in pasture crops, table and wine grapes, forage crops and non-crop areas
Questions or remarks please contact u.kuhlmann@cabi.org or b.luke@cabi.org

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