Integrated Pest Management for Locusts and Grasshoppers: Are Alternatives to Chemical Pesticides Credible? *

Author: Lecoq, Michel

Source: Journal of Orthoptera Research, 19(1) : 131-132

Published By: Orthopterists' Society

URL: https://doi.org/10.1665/034.019.0107

Integrated Pest Management for locusts and grasshoppers: are alternatives to chemical pesticides credible?*

Submitted February 22, accepted March 20, 2010

Michel Lecoq

CIRAD Acridologie, 34398, Montpellier, France. Email: michel.lecoq@cirad.fr

*Paper delivered as part of a symposium: *Integrated pest management for locusts and grasshoppers: are alternatives to chemical pesticides credible?* Antalya, Turkey, 21-25 June 2009.

Abstract

Wide use of chemical pesticides to control locust invasions is a central concern and alternatives a growing necessity. But it is not so easy to find alternatives to these chemicals and to integrate them into operational campaigns. The following paper introduced a symposium on 'Integrated pest management for locusts and grasshoppers' held at the10th Orthopterists' Society meeting in Antalya, Turkey in 2009.

We know that chemical pesticides are efficient. We have some strong indications that, for instance, Desert Locust are now better controlled, since the middle of the 60's, thanks mainly to more efficient chemical pesticides, improved application methods, better knowledge of locust ecology and implementation of a preventive control strategy supported by FAO, the Food and Agriculture Organization of the United Nations. The same conclusions can be reached regarding various locust and grasshopper problems all over the world (Lecoq 2001, 2005; Magor *et al.* 2008).

If preventive control had been more efficient in this interval, the quantity of pesticide used should have been reduced: but this has not been the case. There are still — and for diverse reasons — some invasions not controlled at an early stage. And to ensure that these invasions are quickly controlled requires a large quantity of chemical pesticides.

For 20 y, various research and development agencies have been working with affected countries to develop alternative control technologies, including a biopesticide based on the fungus *Metarhizium acridum* (ex *M. anisopliae* var. *acridum*) a fungal disease of locusts and grasshoppers (Lomer & Langewald 2001, Hunter 2005), and on a pheromone, phenylacetonitrile (PAN), that affects gregarization behavior (Hassanali *et al.* 2005, Simpson *et al.* 2005). Both products were developed specifically for Desert Locust management.

In 2003 in Sudan, a workshop was organized by FAO to promote use of mycopesticides and pheromone for Desert Locust control (Kooyman 2003). For the mycopesticide, a commercial formulation of the biological control agent has been available for some time (~ 8 y). But operational use of *Metarhizium* against the Desert Locust has been very limited so far.

During the 2003-2005 Desert Locust campaigns, and throughout the last large invasion area of the Desert Locust, only chemical pesticides were used. Control teams applied some 13 million liters of mainly organophosphate pesticides to roughly 13 million ha of land. No mycopesticides, no pheromones were used, either for preventive control or during the emergency at the height of the invasion.

As a result of this situation, a workshop was held in Saly, Senegal, in 2007, organized by FAO and held under the aegis of the Orthopterists' Society (FAO 2007). This international workshop brought together 66 participants to determine 1) what role *Metarhizium* and PAN should play in Desert Locust management and 2) what key actions were required to integrate biopesticides into operational campaigns. For that occasion, Harold van der Valk, from the Netherlands, acting as a consultant of FAO, prepared an excellent and exhaustive review of the various experiments and trials examining the efficacy of the mycopesticides against the Desert Locust, and also against various other species of locusts and grasshoppers.

The workshop recommended implementing a plan of action as quickly as possible to ensure the rapid integration of biopesticides into operational Desert Locust management, especially into preventive control campaigns. To meet this objective the workshop participants further recommended a number of specific actions including to:

1. improve the current formulation of the mycopesticide in order to facilitate its use;
2. verify the efficacy of biopesticides in the field in operational conditions;
3. accelerate the procedure for biopesticide registration in all countries concerned;
4. emphasize awareness, capacity-building and training for all stakeholders involved in Desert Locust management;
5. develop strategies to bring biopesticides into Desert Locust control operations.

Following this meeting, various developments occurred. The mycopesticide Green Muscle™ was used operationally in Yemen for Desert Locust infestations in areas that were also used for bee-keeping. During 2009, it was used with good efficacy in Tanzania for Red Locust control, as well as in Mauritania on Desert Locust and in Senegal on *Oedaleus senegalensis*, the latter event with a reduced dosage.

Two years after the Saly meeting, FAO organized another workshop in Rome in February 2009 (FAO 2009a). This meeting put forward that proof of the efficacy of the mycopesticide Green Muscle™ is sufficient and that it is now time to use it operationally. They recommended there be continued promotion of preventive control of locusts and grasshoppers, along with definition of what can reasonably be expected from Green Muscle™ as part of preventive control programs.

In March 2009, this recommendation was supported by the Desert Locust Control Committee in Rome (FAO 2009b). This Committee further recommended that Green Muscle™ should be used operationally for preventive control of Desert Locust — as much as the temperature range allowed, but always by professional teams that had been properly trained.

Obviously, during the last 20 y, a lot of progress has been made toward biological control of locusts and grasshoppers and implementation of an IPM strategy. Biological products are currently used operationally in several countries: Australia and China for instance, even if it is only for a small percentage of the areas treated. In Australia, although only 10% of all locust control is done with *Metarhizium*, the aim is to increase the level to 25%.

But some difficulties have been overcome. According to the Australian experience, it seems that temperature is not really such an important problem as was thought. In Australia the temperature range for successful use of the mycopesticide Green Guard™ was similar to that of Green Muscle™, but recent work suggests it could also be used successfully over a broader temperature range. So far as the cost of the product, the balance will shift in favor of *Metarhizium* if the fungus is used more in locust and grasshopper control, because its price will drop as the amount used is increased. This is also so if we incorporate environmental costs and pay greater attention to the cost of the "externalities" involved in using conventional pesticides.

The papers of David Hunter (pp. 133-137, this issue), Harold van der Valk, Wim Mullié (pp. 139-155, this issue) and Torto Baldwyn presented during this IPM symposium (Orthoptera Society's 10th Congress), provide further details on the recent progress made in the field, by taking an IPM approach to locusts and grasshoppers on the two main aspects of the current IPM strategy: mycopesticides and pheromones.

However, even if *Metarhizium* is seen as a cost effective and efficient option, such a use of mycopesticides, particularly in Africa, is likely to remain very limited unless regulatory or financial incentives are applied to promote its inclusion in control campaigns. And without doubt, the same conclusion applies for pheromones if their use is to be furthered.

References

FAO 2007. International Workshop on the Future of Biopesticides in Desert locust Management. Saly, Senegal, 12-15 February 2007. Food and Agriculture Organization of the United Nations, Rome.

FAO 2009. Second international workshop on the future of biopesticides for desert locust management (Rome, 10-12 February 2009). Food and Agriculture Organization of the United Nations, Rome.

FAO 2009. FAO Desert Locust Control Committee. Thirty-ninth Session. Food and Agriculture Organization of the United Nations, Rome.

Hassanali A., Njagi P.G.N., Bashir M.O. 2005. Chemical ecology of locusts and related acridids. Annual Review of Entomology 50: 223-245.

Hunter D.M. 2005. Mycopesticides as part of integrated pest management of locusts and grasshoppers. Journal of Orthoptera Research 14: 197-201.

ICIPE 2004. Optimisation, validation and transfer of pheromone technology to national locust control organizations. Phase III. First scientific and financial report (November 2003 to May 2004). ICIPE Tropical Insect Science for Development, Nairobi.

Kooyman C. 2003. Workshop on the use of Green Muscle ® (*Metarhizium anisopliae* var. *acridum*) and Desert Locust adult pheromone (Phenylacetonitrile, PAN) to control Desert Locust hopper bands. Port Sudan, 10-20 January 2003. Food and Agriculture Organization of the United Nations, Rome.

Lomer C., Langewald J. 2001. What is the place of biological control in acridid integrated pest management? Journal of Orthoptera Research 10: 335-341.

Simpson S.J., Sword G.A., De Loof A. 2005. Advances, controversies and consensus in locust phase polyphenism research. Journal of Orthoptera Research 14: 213-222.

van der Valk H. 2007. Review of the efficacy of *Metarhizium anisopliae* var. *acridum* against the Desert Locust. Desert Locust Technical Series AGP/DL/TS/34. Food and Agriculture Organization of the United Nations, Rome.