

## Role of semiochemicals in crop protection in South Asia

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Semiochemical-mediated communication affects a myriad of interactions between organisms and has been employed to manipulate the behaviour of economically important pest species providing the basis for a global €150 million per annum industry. In principle this knowledge and associated technology can be utilized to alleviate the poverty of resource-poor farmers in threshold countries. Indeed early success was achieved in Egypt with the female sex pheromone of the pink bollworm, *Pectinophora gossypiella*, being used for control by mating disruption. By 1997 almost the entire 400,000 ha crop was treated with pheromone, saving between €5.1 and €9.5 million per annum and reducing national insecticide consumption by 40%. In India, cotton sustains the livelihoods of 60 million people and accounts for 20% of exports. The pest complex is quite different from Egypt, with *Helicoverpa armigera* being the predominant pest species. IPM is promoted through the Government sponsored 'Technology Mission on Cotton' which provides a mechanism for Government tenders to procure pheromone traps and lures for use by cotton farmers; accounting for ninety percent of the 2 million sold in India. This initiative has seen improvements in quality, and yields almost doubled to over 500 kg/ha. However, in the same period the area under *Bt* cotton officially increased from 0.03 to 1.6 m ha in 2005, 18% of the total crop area; but unofficially accounts for >90% in some states.

The economic importance of Government tenders to pheromone producers and their dependence on blend importers has stifled competition. Tenders are price and not quality sensitive, resulting in farmers receiving poor quality products that undermine the IPM message promoted by NGOs and extension functionaries. Other stakeholders question the motives of SMEs and espouse the virtues of empowering farmers to use home-produced crop management solutions. Nevertheless, without an efficient private sector to produce and promote environmentally-acceptable, cost-effective and sustainable crop protection technologies in threshold countries, technology transfer will not be sustained and opportunities to alleviate poverty lost.

SMEs by their nature are innovative and flexible, but lack access to knowledge and finance. Nevertheless, SMEs have been encouraged to develop and promote packages of technologies for control of key crop pests and diseases because of increased consumer interest in pesticide-free food. This process has been greatly assisted by donor funds made available to support the development and promotion of semiochemical technologies, such as lure-and-kill for control of fruitfly, *Bactrocera cucurbitae*, and mass trapping for eggplant fruit and shoot borer, *Leucinodes orbonalis*; pests of critical economic importance to vegetable producers in the sub-continent. Control of the latter pest can account for up to €1,000/ha/annum in Bangladesh, 40% of production costs. Mass trapping is now promoted as part of a sustainable and cost-competitive package of technologies that includes the egg parasitoid, *Bracon hebetor*, and use of grafted plants with root stock resistant to bacterial wilt, yielding typical cost-benefit ratios of 1 : 2.5. To compliment these initiatives donor-funded technical assistance was provided to companies in South Asia to improve the efficacy of their technology enabling several to develop products for control of palm weevils, sugarcane borers and coffee white stem borer, *Xylotrechus quadripes*.

In related work considerable efforts were expended to control the yellow rice stem borer, *Scirpophaga incertulas*, by mating disruption in India, and while efficacious the technology was not cost-effective. In contrast, mass trapping of *S. incertulas* proved to be both efficacious and cost-effective but is only slowly being adopted in the absence of external support. Current efforts are focused on development of auto-confusion which holds considerable promise as an environmentally-acceptable alternative to insecticides being formulated in a biodegradable wax.

In South Asia semiochemicals compete with insecticides in the market-place, and while it is important to understand the issues that motivate farmers' choices of crop protection, they are primarily driven by economics and availability, as exemplified by the rapid adoption of *Bt* cotton in India. In order for resource-poor farmers in other regions, such as sub-Saharan Africa, to benefit from semiochemicals in crop protection there is a need to create an enabling framework that can deliver quality products without dependence on donor finance and in the face of competition from conventional crop protection technologies. SMEs are best placed to manufacture and market this technology but they will inevitably focus on farmers producing high value, export oriented crops. As in South Asia semiochemicals are best introduced as parts of technology packages that eliminate the need for pesticides, but to develop and validate these strategies has cost implications that will inevitably be dependent on increasingly scarce donor finance.