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Pesticide Overuse: Stop Killing the Beneficial Agents

Md. Panna Ali*

Entomology Division, Bangladesh Rice Research Institute, Gazipur-1701, Bangladesh

Abstract

Concerns about pesticide focus on insecticide resistance-but persistent changes to our intact diverse community could have more serious consequences.

Introduction

Considerable economic losses would be suffered without pesticide use and has brought significant increases in yield and economic margin [1]. In many respects, this is also a life-saving development. India, a former country of famine has quadrupled grain production since 1951 [2] and now not only feeds itself but export. In twentieth century, average US yields for 10-year periods during this century for 9 crops show that increases are from 2 to 7-fold [3]. But the assumption that pesticides are generally safe has fostered overuse and led to an increase in pest resistance to treatments [4-13] rapidly in last 5 decades [14] that should be our main concern. Suddenly, this phenomenon is not caught by the farmers' eye as a result they are misguided to apply more pesticides with high dose to combat pest frequently that induce killing more beneficial agents formerly regulate many pests in check, while the pests themselves become resistant and require higher amounts of sprays for their control [15]. Frequent use with at high concentrations, the selection of resistant insects will occur rapidly insects can develop resistance [16].

A single crop has received 3-5 times of pesticides by the course of its development period. Sometimes, it may extend 30-35 sprays [17]. Other, equally serious, long-term consequences of our intension of insecticides used have received far less attention. Insecticides kill the organisms we do want, as well as those we don't. Figure 1 state the evidence of non-target fauna is affected when pesticide applied to control pest. Evidence from lab and others hints that, sometimes, our friendly organisms never fully recover. These long-term changes to the beneficial agents within landscape may even increase host susceptibility to infestation/infection and leads to pandemic pest outbreaks. Overuse of insecticides could be fuelling the dramatic increase in insecticide resistance as a result secondary pest outbreaks occur when the use of a pesticide to reduce densities of an unwanted target pest species triggers subsequent outbreaks of other pest species.

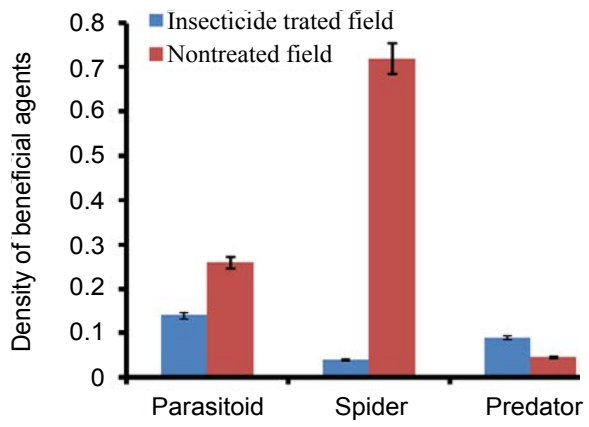

Figure 1: Effect of insecticide treatment on the mean density of the parasitoid *Diadegma insulare* and on other (spiders and predatory wasps) natural enemies of *Putella xylostella* in cabbage fields (Data source: Freddy Miranda Ortiz, 2011).

Dosed up

Could excessive prescription of insecticides be hampering natural enemies' ability to combat pest? We urgently need to investigate this possibility. And, even before we understand the full scope, there is action we should take. Beneficial agents live in and on pests/pests' habitat-constituting their biome. Hosts derive many benefits from their guests: the natural enemies that live in the biome help them to resist invading pests.

Evidence from pesticide usage can lead to toxicity issues, which may adversely affect plant growth and development. It has a possibility to break down host innate defense mechanism against pests by pesticides overuse leading vulnerable to pests. Yet no experiments have been conducted concerned about this sophisticated issue.

A sprayable insecticide diffuses through the plant sap stream as well as spread over the entire landscape and affects targeted pest and residential biota alike. And evidence is accumulating that our welcome residents do not, in fact, recover completely or are replaced in the long term by resistant organisms.

Recently, use of mixture pesticides is becoming ever so common but no detail studies on the evaluation of the direct and indirect effects of pesticide mixtures on natural enemies. Predatory mites are more sensitive to certain pesticide mixtures than when the pesticides were applied separately [18].

Collateral damage

In the early twentieth century, beneficial animals include earthworms, nematodes that help increase soil fertility, and natural enemies such as spiders, predators, parasitoids, parasites, beetles, birds, frogs and lizards were the dominant that help suppress pest populations in an agro-ecosystem. By the turn of the twenty-first century, these beneficials are very rare in nature. Other factors may be at play in the

***Corresponding author:** Md. Panna Ali, Entomology Division, Bangladesh Rice Research Institute, Gazipur-1701, Bangladesh, Tel: +8801712466223; E-mail: panna_ali@yahoo.com

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disappearance of them, but pesticide may be a culprit. Prophylactic implicated insecticides, most commonly used to treat herbivores infestations, may also eradicate beneficial creatures such as spiders in 30-75% of cases. In some cases insecticides (carbaryl+malathion) are toxic to parasitoids but not to pests [19].

In rice field, pesticides use for controlling *Scirpophaga incertulas* eradicating beneficial creatures affect the regulation of *Nilaparvata lugens* and involved in outbreaks of *N. lugens* is becoming ever so common in Asia and causes devastating losses (Plant hopper outbreaks in 2009).

There is other evidence that pesticides cause shifts in microbial composition that may bring long-term food web changes. Soil fertility is diminishing due to overuse of pesticides that affects on soil inhabitant beneficial agents. Thus disturbs an intact diverse community that generally performs better than one which has lost species [20].

Human health hazards are also strong collateral damaged of pesticides. There are strong evidences also exists for other negative outcomes from pesticide exposure including neurological, birth defects, fetal death [21] and neurodevelopmental disorder [22] An estimated half million people are poisoned by pesticides each year, 500 of whom die in China [23]. It has also significant effects on children, both in developed and developing countries. Toxic to the developing central nervous system and their effect on neurobehavioral function has only begun to be studied. Parental occupation in farming has also been linked to childhood cancers such as leukemia [24] and Ewing's sarcoma [25] and might also influence the developing endocrine system [26]. The organophosphates affect the development of some parts of the brain in children, leading to lower IQs and attention deficits and pesticide exposure could affect sex-based differentiation in certain brain regions during early childhood development [27].

Strong evidence links pesticide exposure of pregnant woman to birth defects, fetal death and altered fetal growth [21]. It was also found that offspring that were at some point exposed to pesticides had a low birth weight and had developmental defects [28]. Pyrethrins, insecticides commonly used in common bug killers, can cause a potentially deadly condition if breathed in [29].

To better understand the long-term effects of insecticide use, we need to compare the fauna of insecticide-using and insecticide-free populations. If insecticides do cause elimination of natural enemies and impact may extend over long periods of time and large areas or may last until the delicate numerical balance is reestablished. Knowledge gleaned from farms indicates that overuse is most crucial, inducing natural imbalance that is difficult to reverse later on. If pesticides are used often, the normal balance may never be achieved.

Consequently, we should reduce the use of insecticides as prophylactic method as well as other sense and explore alternative sustainable approaches like as The "Three Reductions, Three Gains" program [30]. This campaign successfully reduced famers' insecticide use by 33% in Mekong Delta [31] and 70% in some provinces [32] in Vietnam.

Professor Nguyen who warned of the strong roles that the pesticide industry play in influencing misuse. Dr Bui Ba Bong emphasized that future rice pest management will need to develop ecological based preventive systems and ways to tightly control pesticide misuse. To curb pesticide misuse, Vietnam has developed Circular # 18, a set of new regulations for marketing and distribution of pesticides to be implemented in 2012. Recently another order regarding pesticide advertising (310/BVTV-TTra dated 4 March 2012) is also issued. Such efforts to control pesticides misuse at the policy level and active implementation of ecological engineering will help restore biodiversity and resilience in the landscapes that will continue to save beneficial agents in nature.

Targeted attack

Another precautionary step would be to develop specific agents to stabilize at-risk residential microbial populations, such as effective probiotics. We also need new, narrow-spectrum insecticides to minimize collateral effects on the biota. This is a certainly huge task, which will require providing incentives for the chemical industry to develop targeted classes of insecticide and, importantly, better diagnostics that rapidly identify the problematic agent.

We may also need to start replacing what has been lost over the past few decades. Along with receiving huge number standard products, for instance, one-two days, field which has been treated could be given application of specific active ingredient of insecticide to reduce their chance of later developing side effects, then receive narrow-spectrum insecticide later in field to combat the target pest and lower the risks of killing non target fauna.

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