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Spray and Pay: Time to Live in Harmony with Nature

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ABSTRACT

Pesticides are an important potential cause of biodiversity and pollinator decline. Little is known about the impacts of pesticides on wild pollinators in the field. Approximately 90 percent of all flowering plants require pollinators to survive. In agriculture, nearly a third of pollination is accomplished by honeybees. Cucumbers, almonds, carrots, melons, apricots, cherries, pears, apples, prunes, plums, cantaloupe, onions, avocados, kiwi, blueberries, cranberries and more depend on honeybee pollination. Pesticides, alone and in combination with other factors, have had a devastating effect on honeybees and wild pollinators. Pesticides commonly found in lawn and garden products and used in agriculture are known to be hazardous to bees –some killing bees outright and others with subtle effects that reduce a bee's ability to thrive. Spraying pesticides is taking the tool of bees by four ways –lethal effects, sublethal effects, synergistic effects, food availability. Solutions to the loss of bees are clearly within our reach if we engage our communities and governmental bodies. We know how to live in harmony with the ecosystem through the adoption of sustainable practices that simply do not allow toxic pesticide use. Because our survival depends on healthy pollinators, we must do everything in our power to solve this problem.

Keywords: Decline, Pesticides, pollinator biodiversity, way-out

I. INTRODUCTION

Pollinators are an important component of biodiversity that provide a key ecosystem service through crop pollination [1, 2]. They have been proposed as indicators of ecosystem health for assessing the impacts of a pressure such as pesticides [3]. Pollinators increase plant seed set [4], fruit set [5] and fruit quality [6].There is growing concern and discussion relating to declines found in pollinators around the world [7]. Though uncertainty remains as to the global extent of this phenomenon, further investigation needs to be undertaken into the scale, magnitude and causes of the decline, and the effects on pollination services [8]. Agriculture is the primary land use in India, so its management has profound consequences for the environment and for biodiversity. Agricultural intensification is widely accepted as a cause of biodiversity decline [9]. Intensification is, however, a broad concept encompassing many factors, such as the loss of semi- natural habitat, fragmentation and increased pesticide input [10]. To understand the causes of biodiversity decline it is important to disentangle the effects of individual components of agricultural intensification. This study focused on pesticides as a driver. Pesticides have been shown to cause declines in non-target beetles [11], bees [12], birds [13] and aquatic invertebrates [14]. The area to which agro-chemicals are applied in Great Britain has increased since the 1970s, with agricultural intensification [9] and global pesticide production predicted to continue

increasing in the future [10].This study aimed to isolate the impact of an insecticide on insect pollinators in the field. Most evidence of the impact of pesticides on pollinators comes from laboratory-based toxicity tests, determining LD_{50} values for honeybees (A. mellifera). Negative effects from sub-lethal doses of insecticide have also been demonstrated [15], but field assessments are needed to understand how laboratory-derived toxicity levels relate to real effects observed in pollinator communities [16]. Information is needed on the impacts of pesticides on the wider pollinator community, such as Bombus spp. And butterflies, not just honey bees. Some field-and semi-field-based studies have been undertaken [17, 18]. However, most of the field-based studies in this area have been conducted at the field scale. Given that most systems have many chemical inputs, with varying levels of toxicity to invertebrates and that pollinators are a relatively mobile group, larger scale approaches may be more appropriate and could provide greater insight into the effects of pesticides.

II. RESULTS AND DISCUSSION

All bees within agricultural landscapes are negatively affected by the use of chemicals to control pests [19,20,21,22,23,24,25,26,27,28,29,30]. Bees can come into contact with these chemicals in many instances, for example through the flowers of crop plant(s), the respective floral resources collected, flowers within the field and adjacent habitats, and/or directly at the nest site [31,32]. There are additional risks for most cavity nesting megachilid bees as they collect, rather than secrete, nesting materials such as leaf pieces, masticated leaf fibres, mud or pebbles, which increases the risk and frequency of additional exposure to contaminants in these settings [28,31,32].These pesticides affect pollinators through different ways viz; 1. Lethal effects: many pesticides are acutely toxic to bees and result in death. Carbamates, organophosphates, synthetic pyrethroids, chlorinated cylcodienes and neonicotinoids are highly toxic to bees. 2. Sublethal effects: Pesticide levels that do not kill bees at significant rates may nonetheless have effects on performance that inhibit tasks such as olfactory learning, foraging, and reproduction, which affects hive survival.3.Synergistic effects: Often pesticides have more toxic effects in combination than alone.4.Food availability: Herbicides used in fields, along rights-of-way and in forests tend to reduce the number of flowering plants. This reduces the amount of food available for native pollinators, making their survival more difficult. This has effects throughout the food chain, as reduced pollination leads to reduced fruit on which birds and other creatures depend.

Agricultural chemicals, such as fertilizers and pesticides, are a significant part of food production, especially at the large scales in which farms operate today. In addition, current farming practices use vast quantities of water and natural soil nutrients. These practices commonly create ideal circumstances for pest outbreaks. Many natural ecosystem services such as pollination, biological pest control, soil building and maintenance, and water provision and purification are provided by adjacent natural habitat. Employing agricultural practices that manage these ecosystem services can contribute to reducing dependence on external chemical inputs for food production.

There is still strong reliance on chemicals for food production in most agricultural areas of developed countries, but several management options are available that can help maintain fruit yield and quality while minimizing the impacts of the chemicals on [33]. Organic and Integrated Fruit Production (IFP) offer many benefits over conventional orchard production and are considered to be more ecologically friendly. Integrated Fruit

Production is the production of high-quality fruit under ecologically safe methods, where an attempt is made to minimize chemical inputs and obtain the least toxic option [34, 35]. Reganold et al. [33] compared several criteria of production methods for orchard crops, and found that alternative methods of crop production were comparable, or better, than those of conventional methods. Other studies have supported this finding and have demonstrated that non-conventional methods of production, including organic farming, typically are better for beneficial insects and non-target organisms [36, 37,38].

In circumstances where pesticides, or other chemicals, must be used it is important to follow label recommendations for their proper use and timing, such as in the late evening for non-crepuscular pollination groups, night time or off-bloom times, and limit area of spraying to maximize the efficiency of controlling target groups, while keeping in mind that if there are guidelines on the label for bees, these may only be applicable to honey bees and may not be entirely relevant to wild bees. This may mean creating buffer zones for wild bee pollinators, so as to protect nesting populations from drifting spray, which can be minimized by calibrating equipment, spraying close to the crop (no aerial spraying) and spraying when there is no wind. Moreover, artificial nests should be placed where contact with chemicals is minimized [39]. The choice of chemicals used is also an important consideration. Application of pesticides should not follow a schedule, but rather be based on the presence or levels of pests (i.e. acceptable thresholds) to reduce the frequency of unnecessary spraying or application. Moreover, artificial nests should be placed where contact with chemicals is minimized [39]. The choice of chemicals used is also an important consideration. Application of pesticides should not follow a schedule, but rather be based on the presence or levels of pests (i.e. acceptable thresholds) to reduce the frequency of unnecessary spraying or application. Certainly, toxic chemicals should never be applied to the target crop during bloom. Bee-friendly products, such as lures or pheromone traps, should always be chosen in preference to chemicals with known and unacceptable toxicity.

III. CONCLUSION

The importance of insect pollination for agriculture is unequivocal, and yet global pollinator populations are in significant decline with potential consequences for pollination-dependent crop yields. Pollinators provide an essential ecosystem service by ensuring production of fruit, seeds, nuts and vegetables; pollination services are also important for biofuel and fodder cropping systems. Pesticides commonly used in agriculture are known to be hazardous to pollinators (bees and other insects) –some killing bees outright and others with subtle effects that reduce a bee's ability to thrive. Therefore, it is time to live in harmony with the ecosystem through the adoption of sustainable practices that simply do not allow toxic pesticide use. Because our survival depends on healthy pollinators, we must do everything in our power to solve this problem.

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