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The role of pesticides in Parkinson disease and Integrated Pest Management

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ABSTRACT: Pesticides are chemical substances for protecting plants from weeds, bacterial, fungal, virus diseases, nematodes and insects. Although pesticides have benefits in modern agriculture, some also have drawbacks, and can cause a variety of adverse health effects, such as affecting the nervous system (Parkinson,…) and also modern disease, top of them cancer. In this review, we updated the pesticide toxicity potential to human and highlight the pesticide's Parkinson mechanism links. Pesticides may cause acute and delayed health effects in workers who are exposed, also to all of the people may uptake daily from unorganic crops. The association of major lifestyle-related risk factors with the prevalent cases of Parkinson's disease (PD) have been shown that ongoing exposure to herbicides and pesticides may put us at a slightly increased risk of Parkinson's disease. So, alternatives to pesticides should be seriously followed of the integrated pest management strategies.

Keywords: Parkinson, Pesticides, Integrated Pest Management

INTRODUCTION

A. Risk factors for Parkinson's disease

Parkinson's disease (PD) is a common idiopathic, neurodegenerative disorder that produces slow bodily movements, muscular rigidity, frequent tremor of resting limbs, and loss of postural balance (Priyadarshi et al., 2001), and usually characterized by the presence of a-synuclein containing Lewy bodies in damaged neurons. it is the second most common neurodegenerative disease, affecting 1% of the population over 55 years of age (Lees et al., 2009). Epidemiological studies suggest that environmental as well as lifestyle-related factors may be important for the development of Parkinson's disease (PD).

Young adults rarely experience Parkinson's disease indeed, risk increases with age. People usually develop the disease around age 60 or older. Heredity is the second risk factor for Parkinson's disease. Although there is increasing evidence that genetic factors may also play a role in the etiology of PD, this likely involves interaction with environmental factors. Investigations into risk factors have provided less consistent results, nevertheless some large studies have pointed out pesticide or herbicide exposures as putative risk factors. Now days, there are many evidences that some of these chemicals do pose a potential risk to humans. No segment of the population is completely protected against exposure to pesticides and the potentially serious health effects, though a disproportionate burden is shouldered by the people of developing countries and by high risk groups in each country (Aktar *et al.,* 2009).

B. The mechanism of pesticide in Parkinson disease

PD is a disabling neurodegenerative disorder marked by progressive motor dysfunction and characterized by the loss of nigrostriatal dopamine neurons and cytoplasmic inclusions termed Lewy bodies. Although PD may be caused by single gene mutations (a-synuclein, parkin, DJ-1), genetic causes are exceedingly rare, suggesting that environmental factors or gene-environment interactions play a predominant role in the development of sporadic PD (Sanjoaquin *et al.,* 2004) A consistent finding of epidemiologic studies is an association of PD with rural living or farming as an occupation. Although this association may reflect several exposures, many studies have focused on pesticides. Overall evidence suggests that PD is associated with pesticide exposure. (Kamel *et al.,* 2007). Indeed, several epidemiological studies have identified pesticide exposure as a risk factor for PD. However, the mechanism(s) by which pesticide exposure increases the risk for PD is not clear. A number of potential mechanisms involved in the flowing. i; oxidative stress have long been implicated as pathophysiologic mechanisms underlying PD.

Genetic forms of PD associated with mutations in the alpha-synuclein, PARKIN, PINK1, or DJ-1 genes may involve these mechanisms. In experimental models, the pesticides paraquat, which causes oxidative stress induce loss of nigral dopaminergic neurons and behavioral changes associated with human PD. Nitric oxide (NO) has also been suggested as contributing to nigrostriatal injury. Inducible NO synthase is known to be increased in the substantia nigra in PD and increased NO could also elevate local oxidative stress. Although NO is an effective free radical scavenger, it can react with the superoxide radical to form the peroxynitrite anion, a potent oxidative radical. [6] ii; Another potential mechanism by which pesticides may increase the risk for PD is through disruption of mitochondrial function. Systemic reductions of complex I of the electron transport chain have been observed in muscle, platelets, and brain of PD patients. Rotenone is a naturally occurring insecticide insecticide and is a well-characterized, high-affinity specific inhibitor of complex I (NADH-dehydrogenase). iii: The other mechanism which can cause PD involves intracellular deposits of α-synuclein in the form of Lewy bodies and Lewy neurites. The etiology of this process is unknown, however, several epidemiological studies have implicated environmental factors, especially pesticides. It has been shown that several pesticides, including retention, dieldrin and paraquat, induce a conformational change in α-synuclein and significantly accelerate the rate of formation of α-synuclein fibrils in vitro. Relatively hydrophobic pesticides preferentially bind to a partially folded intermediate conformation of K-synuclein, accounting for the observed conformational changes, and leading to association and subsequent fibrillation. These observations suggest one possible underlying molecular basis for PD (Uversky and Fink 2001).

C. Integrated pest management (IPM) and the strategies to reduce the risk factors

In the process of development of agriculture, pesticides have become an important tool as a plant protection agent for boosting food production. But there indiscriminate use, apart from being an occupational hazard in the developing world, has been posing a serious threat to human health. Some of these agricultural chemicals being poisonous leave behind residue in food and thereby produce ill-effects when the concentration exceeds the safe tolerance level (Singh, 2013). In order to control this affects sustainable farming has emerged. One of the goals of the sustainable agriculture movement is to create farming systems that mitigate or eliminate environmental harms associated with industrial agriculture. Although no onset of farming practices constitutes sustainable agriculture, we brie?y describe here certain methods that enhance sustainability, i. Crop rotation (By rotating two or more crops in a field, farmers interrupt pests' reproductive cycles and reduce the need for pest control.) ii. Cover crops (Cover crops are planted to improve soil quality, prevent soil erosion, and minimize weed growth. Some cover crops can also generate income.) iii. No-till and low-till farming. iv. Soil management. v. Diversity. vi. Nutrient management. vii. Rotational grazing. viii. Integrated pest management (Prins, 2008). Integrated Pest Management (IPM) is an effective and environmentally sensitive approach to pest management that relies on a combination of common-sense practices. IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment.

An integrated pest management (IPM) system prefers bio-logic methods and uses (least-toxic) chemical pesticides only as a last resort (Fig. 1) IPM programs use current, comprehensive information on the life cycles of pests and their interaction with the environment. This information, in combination with available pest control methods, is used to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment. To keep destructive insects under control, an IPM emphasizes crop rotations, intercropping, and other methods of disrupting pest cycles, as well as plant varieties that have high resistance to pests. IPM also uses insect predators, as well as pesticides such as Bt. Future agricultural practice must aim to reduce pesticide use to a minimum. Since such an action may take some years. In the meantime, pesticides causing the most human ill health and environmental disturbance should be restricted. A minimum pesticide list may go some way towards this, but only if the safest and most effective pesticides are used in combination with ways to control their use (Eddleston *et al.*, 2002). Another way to avoid over use of dangerous chemicals in agriculture is organic agriculture. Organic agriculture is a production system that sustains the health of soils, ecosystems and people. It relies on ecological processes, biodiversity and cycles adapted to local conditions, rather than the use of inputs with adverse effects. Organic agriculture combines tradition, innovation and science to benefit the shared environment and promote fair relationships and a good quality of life for all involved. The 'push-pull' strategy, a novel tool for integrated pest management programs, involve the behavioral manipulation of insect pests and their natural enemies via the integration of stimuli that act to make the protected resource unattractive or unsuitable to the pests (push) while luring them toward an attractive source (pull) from where the pests are subsequently removed. The push and pull components are generally nontoxic. Therefore, the strategies are usually integrated with methods for population reduction, preferably biological control.

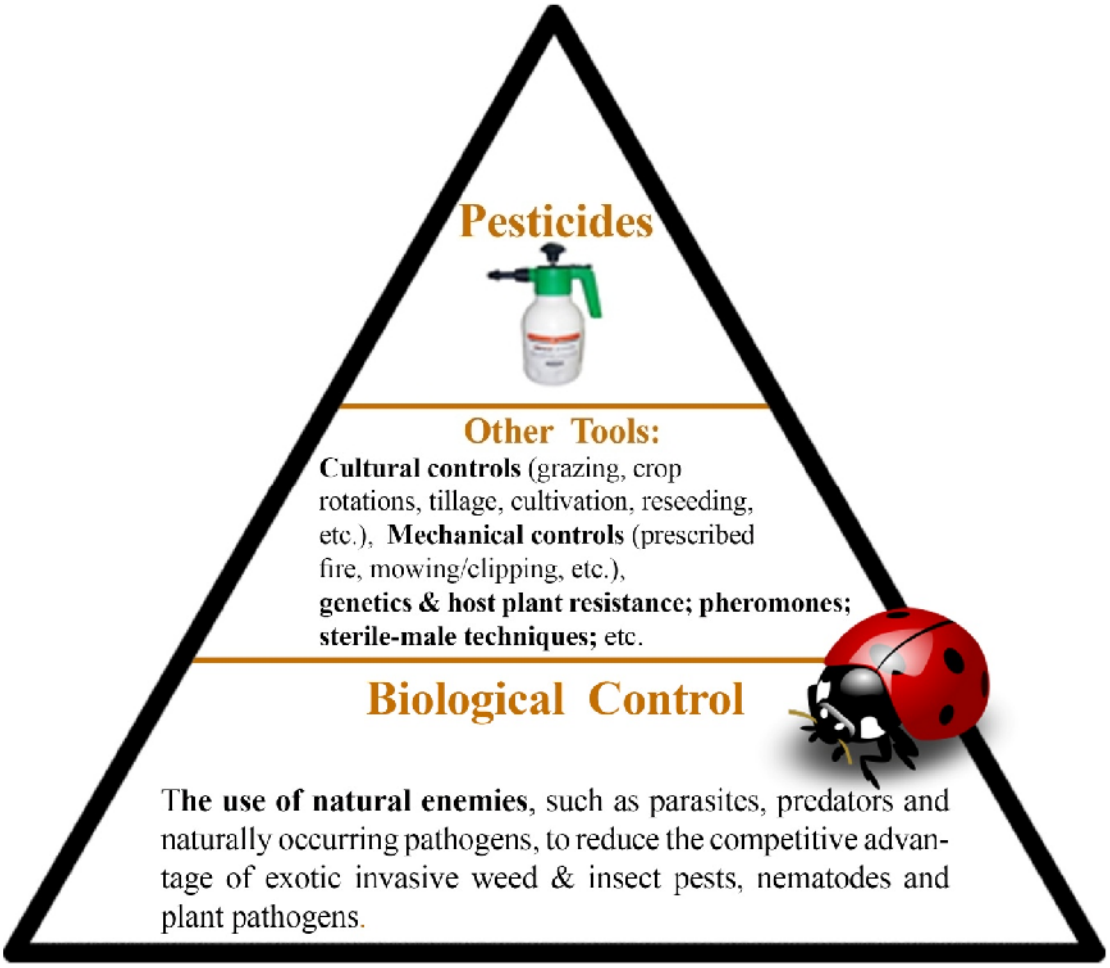

Fig. 1. The integrated pest management to reducing of pesticide using in modern agriculture. This program could replace the pesticides as a risk factor of Parkinson disease.

D. Future perspective

Recent toxicologic studies have suggested that multiple genetic and environmental factors could be involved in the etiology of modern disease including allergy, cancer and PD. There is evidence that developmental exposure to pesticides may have an increased neurodegenerative effect as well as making the SN more susceptible to subsequent adult exposure to pesticides, and that combined exposure to pesticides such as maneb and paraquat has a greater neurotoxic effect than either pesticide alone (Cantor *et al.*, 2003) Other recent studies also suggest some interaction between the neurodegenerative effects of pesticides and inflammatory proteins produced by microglia in the SN (Kutz *et al.*, 1991, Badawi *et al.*, 2000).

So, we need to changes the strategies as soon as possible. The IPM approach can be applied to both agricultural and non-agricultural settings, such as the home, garden, and workplace. IPM takes advantage of all appropriate pest management options including, but not limited to, the judicious use of pesticides.

In contrast, organic food production applies many of the same concepts as IPM but limits the use of pesticides to those that are produced from natural sources, as opposed to synthetic chemicals.

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