

A REVIEW OF THE STATUS AND FUTURE PROSPECTS OF APPLICATION OF INDIGENOUS PESTICIDAL PLANTS IN PEST MANAGEMENT IN NIGERIA

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Abstract

Plants have inherent chemical substances that serve as part of the plants' defense against plant-feeding insects and other herbivores. The use of different types of plant (wild or cultivated) has been engaged in pest management on the field, store and livestock paddock by different ethnics in Nigeria. The research into the identification of the inherent properties of the different plants adopted by traditional farmers in the country is on ebb. Despite the present call for organic agriculture based on the devastating toxicity and residual effects of synthetic pesticide on crop, animal, human and environment in Nigeria, majority of farmers still use the highly poisonous or banned substances in pest management. This paper chronologically examines the status of the use of indigenous pesticidal plant in pest management in Nigeria and proffer options that can be adopted for formulating the various pesticidal plants to botanical pesticides, for management of pest in the country.

Keywords: Pesticidal Plants, Pest management, botanical pesticide, farmers, Nigeria.

INTRODUCTION

Historical development and use of pesticides for plant protection

Prior to the discovery of organochlorine and organophosphate insecticides in the late 1930s and early 1940s, botanical insecticides were important products for pest management in industrialized countries (Lale and Mustapha, 2000). The use of pesticides, including insecticides, fungicides, herbicides, nematicides and rodenticides to protect crops from pests, helped to significantly reduce the losses and to improve the yield of crops such as corn, maize, vegetables, potatoes, cotton, as well as to protect cattle from diseases and ticks and to protect humans from malaria vectors. The world has known a continuous growth of pesticide use, both in number of chemicals and quantities,

sprayed over the fields. Insect pests have mainly been controlled with synthetic insecticides over the last 50 years. Most insecticidal compounds fall within four main classes: organochlorines, organophosphates, carbamates, and pyrethroids. Among these major classes in use today are organophosphates and carbamates. Pesticides are poisons intentionally dispersed in the environment to control pests, but they also act upon other species causing serious negative effect on non-target organisms, including humans, and the environment (FAO, 2007). This was established as was reported in Mexico, Nicaragua and Vietnam where the aquatic species, such as clams and oysters, that are important components of the diet of riverine populations, contained relatively high concentrations of DDTs, lindane, HCHs, endosulfan, toxaphene, chlorpyrifos amongst other

crop protection chemicals (Carvalho et al., 1997, 2002; Carvalho, 2005; Taylor et al., 2003; Nnamonu and Onekututu, 2015). In addition, residues of pesticides contaminate soils and water, remain in the crops, enter the food chain, and finally are ingested by humans with foodstuffs and water (Carvalho, 2005) and can in the long run lead to the problems of pesticides resistance.

Problems associated with use of Agrochemicals in Nigeria

The use of agrochemicals remains a common practice especially in tropical and South countries. Cheap compounds, such as DDT, HCH, chlorpyrifos and lindane, that are environmentally persistent, are today banned from agricultural use are still prominent in developing countries. As a consequence, persistent residues of these chemicals contaminate food and disperse in the environment. The engagement of pesticides throughout the world has increased by 50% over the last 30 years, and 2.5 million tons of commercial pesticides are now applied annually. They are aggressively promoted by large companies and government groups making up a more than \$35 billion a year industry (Nnamonu and Onekututu, 2015). The problem is, as our reliance on chemical pesticides increases (along with their cost), their effectiveness is declining. Crop yields lost to insects are greater now than they have ever been, even with increased toxicity.

Issues with use of agrochemical include:

- Conventional pesticides create secondary pest problems.
- Chemical insecticides are rarely selective and kill a large number of insects, including the good ones.
- The environment created by indiscriminate insecticide use often allows other insects not the initial pest but different insects seeking out food to rapidly increase in number because no natural enemies (beneficial insects) remain to prevent the population explosion.
- In some instances, secondary pests cause greater damage than the insects that were initially the problem

- Conventional pesticides invoke resistance.
- Insect pests have a weird ability to develop resistance to conventional insecticides.
- Currently, there are more than 500 insect pest and mite species that have shown resistance.
- In fact, some of the most destructive pests found in the garden cannot be controlled with today's chemicals.
- The economics of conventional pesticide use.
- The combination of secondary pest outbreaks, insect resistance, government regulations, and legal battles over safety and the environment have made the cost of chemical insecticides to rise dramatically.

Use of plant materials as pesticides

The botanical insecticides derived from plants and their products are better alternatives to synthetic insecticides. They are generally pest-specific, relatively harmless to non-target organisms including human. They are also biodegradable, environmentally friendly, and natural – can be used by organic growers, low residual toxicity and can be used in insecticide resistance management programs. The major purpose of using botanical insecticides is to give us insights for development of novel synthetic insecticides (Anjorin and Salako, 2009).

Status of availability of pesticidal resources in Nigeria

Nigeria vegetation has rich biodiversity abundantly blessed with trees, shrubs and herbs that are often exploited for their pesticidal potential. The bio resources have locally served as a renewable source of biodynamic products traditionally used against pests and disease pathogens of crops, animals and in humans. Global interest in plants as sources of natural pesticide and medicine is gaining prominence due to their environmental and user friendlier than synthetic chemicals (David, 2005; Aburjai et al., 2007; Sirikantaramas et al., 2008).

Available literature revealed that several ethno-botanical surveys have been made in developing countries for indigenous plants used in human and veterinary medicine (Okwute, 2006; Ssegawa and Kasenene, 2007), but the knowledge of pesticidal plants used in crop protection in Nigeria is on ebb.

Indigenous Pesticidal plants in Nigeria

A total of thirty-six species belonging to 28 families

were recorded in a study in Nigeria (Figure 1) (. Salako et al., 2014). The families with the highest percentage pesticidal species were Lamiaceae and Fabaceae with 10.71% of the total number (Figure 1). Apocynaceae, Cucurbitaceae, Euphorbiaceae and Plantaginaceae had 7.14% respectively. The results have established that plants belonging to certain families of plants are more likely to possess pesticidal activity.

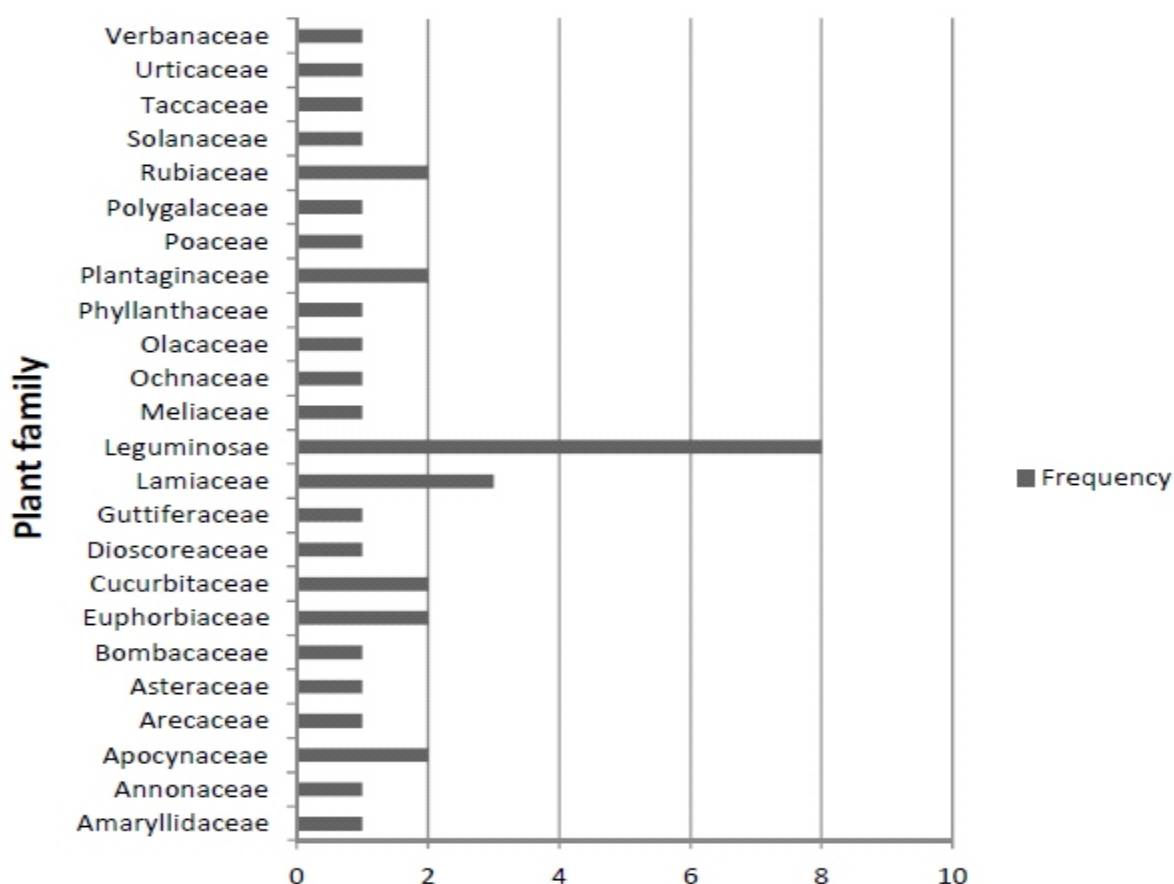


Figure 1: Major Indigenous Pesticidal family in Nigeria

Source: Salako et al., 2014

Pesticidal plants use in Nigeria

In Nigeria for example, botanical insecticides have been extracted from various plants include:

- Neem (*Azadiracta indica*),
- Pyrethrum (*Chrysanthemum cinarariaefolium*),
- Tobacco (*Nicotiana tabacum*),
- Derris (*Derris elliptica*),
- Pawpaw (*Carica papaya*),
- Tomato (*Lycopersicon esculentum*),
- Cashew nut (*Anarcardium occidentale*),
- Garlic (*Allium sativum*),
- Aligator pepper (*Aframomum melegueta*),
- Curry leaves (*Hyptis sauvolens*),

- Onions (*Allium cepa*),
- Basil (*Ocimum basilicum*),
- Bitter gourd (*Momordica charatia*),
- Ginger (*Zingiber officinale*),
- Bitter leaf (*Vernonia amygdalina*),
- Siam weed (*Chromolaena odorata*)
- Pepper fruit (*Uvaria afzelli*) and
- Country onion (*Afrostryax lepidophyllus*) (Plate 1)



Plate 1: *Afrostryax lepidophyllus* Plant and Seeds (Source: Field 2019)

Plant part used

The parts of indigenous plants that serve as pesticide include: Bulb, fruit or seeds, latex, leaf, stem or bark, root, rhizome and tubers (Figure 2).

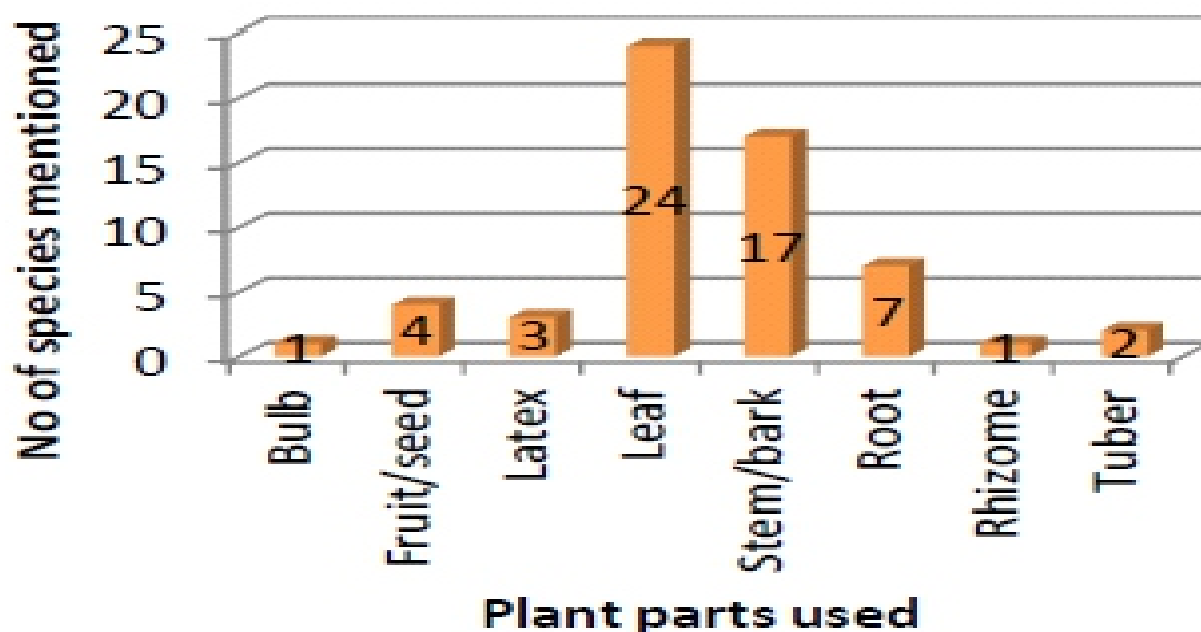


Figure 2: Plant part used as pesticide

Source: Salako *et al.*, 2014

Utilization of pesticidal plants in Industry

The biological properties of most of pesticidal plants have been tested and found to include insecticidal and repellent effects against insect pests. Some have also been found to have anti-feedant, growth regulatory, oviposition inhibitory, sterility inducing, antifungal and nematicidal properties (Abdul-azeez, 2009). Extracts of *Afrostryax lepidophyllus* have been shown to have pesticidal activity (Nnamonu and Anyam, 2014).

In industrial development of botanicals for large-scale field utilization as agricultural pesticides, there must be adequate and constant supply of candidate plants to the areas in need. This means that since plants usually grow well in areas of natural habitat, effort should be made to invest in large scale cultivation and conservation of such plants in their various localities as is the practice in the other D8 countries, China and Japan. This will be of great economic advantage in the developing countries as such programmes can lead to economic empowerment of the resource poor farmers and ultimately improve the national economy.

Conclusion and Recommendations

Increased production of food with a view to enhancing food quality and safety as well as to controlling residues of persistent pesticides in the environment is germane to attaining food security. The need to ensure the efficacy of pesticide products for their proposed use, while at the same time protecting pesticide users, consumers, crops, livestock and the environment cannot be overemphasized. This underscores the importance of recruiting 'green' pesticides and botanicals in plant protection or pest control. The use of

indigenous plant resources as pesticides are the new paradigm in the production and utilization of agrochemicals aimed at attaining food. This can be attained by promoting the utilization of botanical pesticides in Integrated Pest Management (IPM) to enhance sustainable Plant Protection in Nigeria:

- The Nigerian government should consider making favourable laws and policies to govern the processing and use of selected botanical pesticides.
- There should be a purposeful encouragement of indigenous private sector participation in the formulation, testing, registration and marketing of botanicals.
- The government should stop indiscriminate harvesting of botanical materials to meet a surge in demand.
- The government should also promote aggressive enlightenment campaigns through the efforts of both public and private sectors to create high level awareness amongst the citizenry on available green alternatives to synthetic pesticides.
- There should be the encouragement of adoption of pesticidal plant as raw materials in the industries producing pesticides in Nigeria

Finally, advocacy for and implementation of Integrated Pest Management strategies on field pests, stored product pests, structural pests and domestic pests is indispensable. Therefore, the discovery, advocacy, adoption and promotion of the use of indigenous pesticidal plants in an integrated pest management framework are most relevant and expedient.



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