Pesticidal Plants Used in Masaka District of Uganda

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The use of synthetic pesticides in developing countries is limited by both the high cost of procuring them and predominance of subsistence holdings. Resultantly, many farmers have to rely on traditional methods of pest control. Among these is the use of pesticidal plant extracts and this paper reports on the findings of a study that undertook to compile an inventory of plants that are used in pest control in one part of the developing world, namely, Masaka District of Uganda. The paper reports that the study found that thirty-six (36) plant species are used. Thirty-five (35) of these were found to belong to twenty-one (21) families. The paper adds that, of these, the Asteraceae family is the most commonly used followed by the Solanaceae family. It was noted that although some of the plants are scientifically well established (e.g. *Azadirachta indica*, *Melia azedarach,* and *Tagetes minuta*), a few are not well known (e.g. *Euphorbia tirucalli, Bidens pilosa, Vernonia amygdalina*), hence the need for research on them. Finally, it was established that some of the plants are increasingly rare, which highlights need for their conservation.

Key words: Pest Control; Pesticidal Plants; Indigenous Knowledge

Introduction

In many parts of the developing world, the use of synthetic pesticides is limited and, in many cases, entirely nonexistent. This is because their cost is beyond the means of many of the farmers in these areas. Moreover, the predominance of subsistence agricultural holdings in these areas makes the use of such pest control measures uneconom ical. Besides, in many instances, the use of these pesticides is maligned, which is aggravated by farmers' ignorance about them. Incidentally, the low utilization of these pesticides is despite the fact that most of these areas lie in tropical, and subtropical, areas, where pests and diseases are profuse throughout the year. Consequently, pests, and the diseases that they transmit, pose one of the major problems affecting agricultural production in these areas. According to FAO (2003), for example, crop loss in these areas exceeds 40%, which is higher than the world average of 30 (Oerke et al., 1994; Oerke and Dehne, 2004).

In view of the constraints hindering the use of modern pesticides, the use of traditional methods of pest control appears to offer a means of overcoming the productivity losses attributable to pests (Rates, 2001; Pei, 2001; Muhammad & Awaisu, 2008). One of these methods is the use of pesticidal plants. Though there is evidence of use of pesticidal plants in pest control as early as the 1500s (Thacker, 2002), the discovery of synthetic pesticides, in the early 1900s, tended to overwhelm their use, because of the advantages associated with the latter. For example, DDT is reported to have had a knockdown effect

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on most insects, high persistence in the environment, ease of application and having a broad spectrum (DeLong, 1948; Walker, 2000), advantages that pesticidal plants do not seem to offer.

To be put to extensive use, therefore, pesticidal plants have to be 'rediscovered', documented and evaluated (Muhammad & Awaisu, 2008). Unfortunately, information about them, and their utility, is usually exclusive to a few people, who usually withhold it from others (Ankli et al., 1999). Moreover, even in instances where those that are knowledgeable about such plants pass on their knowledge to others, this dissemination is usually oral, coming with it the limitations of oral communication including limited circulation and the possibility of loss of knowledge due to memory loss and death. Taking the case of Masaka District of Uganda, therefore, this study undertook to compile an inventory of pesticidal plants, to preserve and disseminate the knowledge about them that is available; stimulate further research on them; and promote their conservation.

Methods

The study was carried out in Masaka District, located in central Uganda (between 31º 12´ and 32º 06´E; and 0º 48´ and 1º 20´S). Data were collected from five sub-counties of the District, namely, Bigasa, Bukoto, Kitanda, Kingo and Kibinge. Masaka District shares the shore of Lake Victoria and is one of Uganda's main agricultural areas. Traversed by the equator, the District receives bimodal rainfall, with an average of 1200mm per annum; and has mild equatorial temperatures, ranging between 22 and 26ºC (Britannica online encyclopaedia). Due to the bimodal type of rainfall, the district has two growing seasons, i.e. March to May and October to December, which enables the growing of crops throughout the year. The main crops grown include Bananas (*Musa sp*), Cassava (*Mannihot esculenta*), Maize (*Zea mays*), Coffee (*Coffea sp*) and a range of tropical vegetables, fruits and cereals. Data were collected using questionnaires, interviews and observation. The survey team was made up of an agricultural officer, an agricultural extension worker and field officers. The field officers, who doubled as translators wherever need arose, were selected from the respective sub-counties. In each sub-county, twenty five (25) farmers and one agricultural extension worker were interviewed, making a total of 130 respondents. Each respondent was asked to provide information on any pesticidal plants that they knew. Thus, they provided information on the names of the plants; the pests that they are used to fight; the parts of the plants used; and the method of using the plants against pests. Thereafter, a voucher specimen was collected from the plants identified and deposited at Makerere University Herbarium, for scientific identification.

Findings

The pesticidal plants identified, as well as their families and parts used in controlling pests, are shown in Table 1.

Table 1: Pesticidal Plants Identified

Species name	Local name	Family	Part used
Abrus precatorius	*Lusiiti*	*Papilionaceae*	L, S
Allium sativum	*Katungulucumu*	*Alliaceae*	Corm
Annona muricata	*Kisitaferi*	*Annonaceae*	L, B
Artemisia annua	*Artemisia*	*Asteraceae*	L, F
Asparagus africanus	*Kadaali*	*Asparagaceae*	Spines
Azadirachta indica	*Neem*	*Meliaceae*	L, B R, F
Bidens pilosa	*Ssere*	*Compositae*	L
Capsicum frutescens	*Kamulari*	*Solanaceae*	F
Carica papaya	*Mupaapali*	*Caricaceae*	R, B
Chrysanthemum coccineum	*Pyrethrum*	*Asteraceae*	L, F
Citrus aurantiforia	*Nimawa*	*Rutaceae*	F, L
Cupressus lusitanica	*Kapripusi*	*Cupressaceae*	L, B
Cymbopogon nardus	*Mutete*	*Poaceae*	L
Datura stramonium	*	*Solanaceae*	L, F
Eucalyptus globulus	*Kalitunsi*	*Myrtaceae*	L
Eucalyptus grandis	*Kalitunsi*	*Myrtaceae*	L
Euphorbia candelabrum	*Nkukuulu*	*Euphorbiaceae*	Latex
Euphorbia tirucalli	*Nkoni*	*Euphorbiaceae*	Latex, B, ash
Jatropha curcas	*Kiryowa*	*Euphorbiaceae*	Sap, F, S
Melia azedarach	*Lira*	*Meliaceae*	L, R, B
Mucuna pruriens	*Mucuna*	*Fabaceae*	L
Nicotiana tabacum	*Taaba*	*Solanaceae*	L
Phoenix reclinata	*Mukindo*	*Palmae*	Sap
Phytolacca dodecandra	*Luwoko*	*Phytolaceae*	L, F
Ricinus communis	*Nsogasoga*	*Euphorbiaceae*	S
Schinus molle	*	*Anacardiaceae*	L, F
Solanum lycopersicum	*Enyaanya*	*Solanaceae*	F
Tagetes minuta	*Kawunyira*	*Asteraceae*	L
Tithonia rotundifolia	*Ekimyula*	*Asteraceae*	F, L
Cannabis sativa	*Njagga*	*Cannabaceae*	L, S, F
Lantana camara	*Kayukiyuki*	*Verbenaceae*	L
Tephrozia vogelii	*Muluku*	*Fabaceae*	L
Cupressus sempervirens	*Ssedero*	*Cuppressaceae*	S, L
*	*Olukomba*	*	L, F
Vernonia amygdalina	*Omululuza*	*Compositae*	L
*	*Mutanjoka*	*	L

Legend: B=Bark; F=Fruit; L=Leaves; R=Roots; S=Seeds; *Not identified

Table 1 indicates that thirty-six (36) pesticidal plants were identified. Of these, plants from the Asteraceae and Solanaceae families were commonest (four from each of the families), followed by those from the Euphorbiaceae family (three). Two of the families identified in the Table belonged to the grasses subdivision (i.e. Palmaceae and Poaceae) while the rest belonged to dicotyledonous subdivisions. Leaves were reported to be the most commonly used part of the plants, followed by fruits, seeds, barks, roots and sap. Nonetheless, several intersections of parts used were reported and *Azadirachta indica*, *Melia azedarach, Cannabis sativa* and *Jatropha carcus* were reported to be particularly potent. The pests controlled by the plants identified and methods of formulating the plants are shown in Table 2.

Table 2: Pests Controlled by the Plants Indentified and Methods of Formulating the Plants

Species name	Pest/ Disease treated	Mode of formulation
Abrus precatorius	Worms	Water extract
Allium sativum	Field and storage pests	Trap crop and water extract
Annona muricata	Fungicidal properties and insects	Water extract
Artemisia annua	Mosquitoes and flies	Water extract
Asparagus africanus	Birds, moths and bats	Physical trap/thorns
Azadirachta indica	Most insects	Water extract/crashed seeds
Bidens pilosa	Aphids	Water extract
Capsicum frutescens	Cut worms, ants, snails and storage pests	Water extract/ crashed seeds
Carica papaya	Blight and animal worms	Leaf water extract and seeds
Chrysanthemum sp	Most pests	Oil extract form leaves
Citrus aurantiforia	Insect pests	Water extract and trap crop
Cupressus lusitanica, sempervirens	Storage pests	Physical mixture and leaf oil
Cymbopogon nardus	Lepidoptera pests, beetles and aphids	Trap crop, repellent and oil extract
Datura stramonium	Insects pests	Water extract
Eucalyptus globulus	Storage pests	Water extract, physical mixture and oil extract
Eucalyptus grandis	Storage pests	Water extract, physical mixture and oil extract
Euphorbia candelabrum	Termites and cutworms	Latex spray and root effect
Euphorbia tirucalli	Aphids, safari ants and cutworms	Latex spray and ash dusting/ physical mixture
Jatropha carcas	Insect pests and animal worms	Latex spray, water extract and crushed seeds/ oil
Melia azedarach	Worms and most insects	Water extract
Mucuna pruriens	Most insects	Water extract
Nicotiana tabacum	Storage pests, soil pests, domestic pests and snake repellent	Water extract and smoke (fumigant)
Phoenix reclinata	Storage pests	Ash
Phytolacca dodecandra	Snails, insect pests and fungi	Water extract

Table 2 Continued

Species name	Pest/ Disease treated	Mode of formulation
Ricinus communis	Storage pests, domestic pests and animal worms	Water extract and crushed seed /oil
Schinus molle	Worms and storage pests	Water extract and crushed seeds
Solanum lycopersicum	Aphids, thrips and weevils	Water extract and repellent
Tagetes minuta	Nematodes and most insects	Water extract, repellent and trap
Tithonia rotundifolia	Nematodes and Aphids	Water extract
Cannabis sativa	Storage pests, insect pests, Coccidiosis and bactericide	Water extract, smoke and trap
Lantana camara	Insect pests, Storage pests	Water extract and dry leaf mixture
Tephrozia vogelii	Insect pests, Ticks, Fungi, mites and moles	Water extract and roots
Cupressus sempervirens	Bean weevils and house flies	Water extract and repellent
Orukomba	Insects and Fungi	Water extract and repellent
Vernonia amygdalina	Insect pests, Malaria parasites and worms	Water extract
Mutanjoka	Worms	Water extract

The results in Table 2 indicate that the plants that were identified were used against a wide range of pests, including weevils, storage pests, caterpillars, insects and field pests. They also indicate that water extraction was reported to be the most commonly used mode of formulating the plants. Others included the use of the plants as pest repellents; crushing of their seeds and extraction of oil; and using them as pest snares. It may be noted that many of the plants could be formulated in more than one way.

Discussion

The study identified thirty-six (36) plant species that are used in pest control in Masaka District (see Table 1). Thus, it corroborates the findings of earlier researchers (e.g. Rates, 2001; Pei, 2001; Muhammad and Awaisu, 2008) indicating that the use of traditional methods of pest control appears to offer a means of overcoming the productivity losses attributable to pests in various parts of the tropics and subtropics. Whereas some of these species belonged to well-known families (e.g. *Azadirachta indica*, *Melia azedarach*, *Jatropha curcas, Tagetes minuta, Tithonia rotundifolia, Chrysanthemum sp* (Isman, 2006)), the efficacy of some of the species (e.g. *Euphorbia tirucalli, Euphorbia candelabrum, Bidens pilosa, Vernonia amygdalina*) is not well established in the literature. Incidentally, although the farmers interviewed could identify the pests controlled by the plants identified, they could not pinpoint them at the family level, which caused the lumping of the pests identified in amorphous categories that may not help in the drawing of comparisons and scientific conclusions. This does not only reaffirm the view that pesticidal plants have to be 'rediscovered', documented and evaluated if they are to be put to extensive use (Muhammad and Awaisu, 2008) but also that there is need for further research into the pesticidal nature of the plants identified, notwithstanding the current study. Specifically, there is need for efficacy studies, to recommend the plants for extensive use in pest control.

Leaves were found to be the most commonly used part of the pesticidal plants identified (see Table 2). This is in agreement with earlier researchers (e.g. Ssegawa & Kasenene, 2007; Kamatenesi-Mugisha et al., 2007; Maregesi et al., 2007), who found leaves to be the part of plants that is most commonly used for medicinal purposes. A possible explanation for this is that, for defensive purposes, plants tend to develop and deposit secondary substances—like alkaloids (Dethier, 1980), Tanins (Bernays, 1981), Phenols (Palo, 1984) and Monoterpins (Schutte, 1984), some of which are toxic to some pests—in their body parts, especially leaves because they are more exposed to pests (Gatehouse, 2002). In fact, these are the substances used in the making of pesticides of a botanical nature. This suggests that researchers delving into pesticidal plants should pay special attention to leaves.

The interviews conducted revealed that some of the pesticidal plants (e.g. *Abrus precatorius, Phoenix reclinata,* and *Euphorbia candulubrum*) are increasingly scarce while others can no longer be obtained from the area. Thus, the study gives credence to the fears raised by Hedberg (1993) and Cox (2000), that these plants are tending towards extinction unless information about their utility is documented and the plants conserved.

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