A contribution to cabbage pest management by subsistence and small-scale farmers in the Eastern Cape, South Africa.

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Abstract

The interaction between farmers, agricultural scientists and extension workers is sometimes overlooked in agricultural entomology. In an attempt to respond to this reality this study examines some foundation of this interaction in relation to the pest management practices of subsistence and small-scale farmers and also highlights the problems that might arise in the implementation of IPM. Problems involving pests occurrence; language barriers; beliefs, knowledge and perception about insects, and visual literacy are examined. The thesis has a two-fold focus, firstly the study of pests on cabbages of subsistence farmers in Grahamstown and secondly a broader focus on other aspects such as cultural entomology, perception of insects and visual literacy specifically in relation to Xhosa speaking people in the Eastern Cape.

The most important crop for emergent farmers in the Eastern Cape are cabbages, which have a variety of pests of which diamondback moths and are the most important. Traditional pest management practices tend to influence the development of IPM programmes adopted by these farmers. Eastern Cape farmers apply periodic cropping systems, which had an effect on the population densities of diamondback moth (DBM), other lepidopteran pests and their parasitoids. Considering the maximum population densities of DBM, which were 0.2 - 2.9 larvae/plant, there were no major pest problems. The availability of parasitoids, even in highly disturbed and patchy environments, showed good potential for biological control.

Since some extension officers cannot speak the local farmers' language, a dictionary of insect names was formulated in their language (isiXhosa) to assist communication. Response-frequency distribution analysis showed that the dictionary is essentially complete. The literal translations of some names show that isiXhosa speakers often relate insects to people, or to their habitat or classify them according to their behaviour.

Farmers from eight sites in the Eastern Cape were interviewed regarding their knowledge and perception of insect pests and their control there of. To some extent, farmers still rely on cultural control and have beliefs about insects that reflected both reality and superstition. There is no difference between the Ciskei and Transkei regions regarding insect-related beliefs. Farmers generally lack an understanding of insect ecology. There is a need for farmers to be taught about insects to assist with the implementation of IPM. Leftover pesticides from commercial farms or detergents are sometimes used to manage the pests. When training illiterate or semi-literate farmers, it is important to understand their media literacy so as to design useful graphic and object training media. Generally farmers showed that they either understand graphic or object media depending on the features of the insects being looked at. These findings are discussed with regard to the potential development of IPM training material for subsistence and small-scale farmers in a community.

TABLE OF CONTENT

Preface

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Declaration

I declare that this work is my original study and has never been submitted anywhere else.

List of tables

Chapter 5

Chapter 6

List of figures

Chapter 4

Chapter 7

Chapter 1

General Introduction

Introduction

Throughout Africa, and especially in rural areas, agriculture is often the most important economic and social enterprise, and it is a key part of economic development (Dennill & Pretorius 1995). In Africa, small-scale and subsistence-oriented farmers who grow crops for the nutritional and economic survival of large households dominate the agricultural sector (Javaid *et al.* 1987, Abate *et al.* 2000, Ebenebe *et al.* 2001). Small-scale and subsistence-oriented farmers are referred to as emergent farmers (Mamase pers. comm. 2001) and on their farms, farmers grow a variety of vegetables. One of the most commonly and widely grown vegetables in the Eastern Cape Province of South Africa is cabbage, *Brassica oleracea*. The most up to date, estimate of the output and economic value of the cabbage crop in South Africa is 210 000 tons, which amounts to a value of R24 million (Dennill & Pretorius 1995). The cabbage seedlings are cultivated in nurseries and are then transplanted by most farmers in all seasons of the year (Dennill & Pretorius 1995). Given its significance, there is therefore a need to ensure effective crop protection of cabbages in South Africa from insect pests throughout the year. Good protection can be assured by initially finding the presence and/or absence of pests and natural enemies that exist on cabbage in a particular site.

Agricultural scientists and extension workers officers are often hampered in their dealings with emergent farmers by their lack of understanding of indigenous languages and traditional cultural beliefs. This thesis seeks to partially respond to this situation in the Eastern Cape through the identification of isiXhosa cultural and linguistic concepts with respect to insects. An awareness of such information is deemed critical to ensure the effectiveness of scientists and extension workers in their interaction with emergent farmers. The study focuses on emergent farmers in rural and township areas of the Eastern Cape.

Pests

A wide variety of arthropod pests feed on cabbages in South Africa. Those listed by Annecke & Moran (1982) are Hemiptera (cabbage aphid, bagrada bugs); Lepidoptera (moths and caterpillars, semi-loopers, cutworms, bollworms); Diptera (fly maggots); Coleoptera (flea beetles); Acari (mites) and many other pests that are not yet considered a serious threat. Of these insect pests, diamondback moth (DBM), *Plutella xylostella,* is the most damaging pest (Harcourt 1957, Rai *et al.* 1992, Mitchell *et al.* 1997, Shelton *et al.* 1998, Ivey & Johnson 1998). It is believed to have originated from the Mediterranean area and Asia Minor (Hardy 1938, Chu 1986), and is known to have existed in South Africa for at least 80 years (Gunn 1917). This pest is widespread throughout the country (Goodwin 1979, Lasota & Kok 1986, Dennill & Pretorius 1995). DBM is attacked by a number of parasitoids and hyperparasitoids in South Africa (Yang *et al.* 1994, Kfir 1996, Hu *et al.* 1998). Ullyett (1947) found 14 species of parasitoids in South Africa and Kfir (1997) found 23 species. DBM is active throughout the year where cruciferous crops are grown year-round (Talekar & Shelton 1993), but its rate of development is controlled by temperature (Annecke & Moran 1982, Smith & Villet 2002). The most damage caused by DBM has been on commercial cruciferous crops (Chen & Su 1986, Smith & Villet 2002, Walker *et al.* 2002). Its damage level in commercial crops is about 10 larvae/plant in Taiwan, South Africa and New Zealand (Chen & Su 1986, Smith & Villet 2002, Walker *et al.* 2002).

Talekar & Shelton (1993) have questioned the ability of DBM and its parasitoids to survive during non-cropping periods where crops are not grown all year round. The subsistence gardens in Grahamstown provided an opportunity to address the matter of investigating the population dynamics of DBM. The cabbages of subsistence farmers are harvested at any time and sometimes not replanted for several weeks and also commercial pesticides are seldom applied. Pest control for emergent farmers involves the use of traditional or adopted interventions.

Pest control

The serious damage caused by DBM and other pests on cabbage in most countries has led subsistence and small-scale farmers to employ cultural, chemical and biological control and also Integrated Pest Management (IPM) (Talekar *et al.* 1986, Lim 1986, Lasota & Kok 1986). The most common controls used by subsistence and small-scale farmers consist of cultural and chemical control. Many farmers also implicitly use biological control even though they are not consciously aware that they are. These aspects will be examined in sequence.

Cultural (Traditional) control

Traditionally, subsistence and emergent small-scale farmers have relied on cultural control methods for controlling pests (Abate *et al.* 2000). Cultural control methods are manipulations usually involving existing environmental factors, as opposed to adding new technologies such as insecticides and natural enemies (Pedigo 2002). Techniques may include farm plot location, crop rotation, intercropping, timing of weeding or the use of plants and herbs with repellent characteristics which inhibit the development of pests in addition to treating pests in response to perceived supernatural characteristics (Matteson *et al.* 1984, Abate *et al.* 2000, Pedigo 2002). Some of these traditional methods, for example the use of wood ash as a repellent (Matteson *et al.* 1984), are still a major means of controlling pest by these farmers. There are several reasons for using wood ash as a means of control on some pest problems. It is effective and cheap (Katanga & Villet 1995), it has no known mammalian toxicity, it can be applied by unskilled labourers using simple mechanical means, and lastly the ash does not deteriorate but maintains its insecticidal properties over a long period (Achiano *et al.* 1999). Ofuya (1986), Javaid & Mpotokwane (1997), Katanga & Villet (1995) and Achiano *et al.* (1999) have proved that wood and aloe ash help protect cowpea seeds and stored grain. Although the use of wood and aloe ash seems to work, it still leaves a question of whether subsistence and emergent small-scale farmers in the Eastern Cape can use these methods efficiently in controlling cabbage pests.

Chemical control

With the development of science and technology, insecticides have been developed to augment cultural control. The control measures were developed due to factors such as significant yield losses of cabbage crops, high demands for income and consumer demand for healthy-looking, damage-free cabbage. In some African countries the use of insecticides such as DDT, organophosphates, pyrethroids and carbamates has been encouraged (Matteson *et al.* 1984, Talekar & Shelton 1993, Pedigo 2002). On commercial farms some of these insecticides are still used. However, the rate of insecticide use has been low amongst emergent farmers (Matteson *et* *al.* 1984, Abate *et al.* 2000, Lim 1986) and now many pesticides have been abandoned because of, firstly, the development of pesticide resistance in DBM (Chua & Ooi 1986, Eigenbrode *et al.* 1990, Talekar & Shelton 1993, Kfir 1997); secondly, outbreaks of pests due to the use of unfavourable pesticides (Dosdall 1994); and lastly the negative impact that the pesticides have had on the habitats of natural enemies of pests (Landis *et al.* 2000, Kennedy & Storer 2000). Other disadvantages of insecticides include economic, social and health-related issues (Matteson *et al.* 1984, Abate *et al.* 2000, Pedigo 2002). Emergent farmers often cannot afford the high costs of advanced agricultural pesticides (Matteson *et al.* 1984). Insecticide residues such as DDT have been discovered in milk and other foods and in the food chains of predatory birds and other animals and plants (Pedigo 2002). Because of such problems, farmers have been advised that pesticide usage should be reduced dramatically.

Biological control

The drawbacks of chemical control have led to an interest in biological control. Biological control is defined as the manipulation of natural enemies for pest management and this is one of oldest and most effective means of achieving insect control. This control method was firmly established in the United States in 1888 (Pedigo 2002). Another objective of biological control is for the system to sustain itself. The natural enemies of insects include various vertebrates, invertebrates, and micro-organism. These natural enemies may function as parasites, parasitoids, predators or pathogens. This kind of control has shown great success with a number of pests. For example, diamondback moth has many natural enemies, such as parasitoids (Goodwin 1979, Dennil- & Pretorius 1994, Yang *et al.* 1994, Lasota & Kok 1986, Kfir 1996, Hu *et al.* 1998) from the order Hymenoptera, which have shown a high success rate in controlling pests.

Integrated Pest Management (IPM)

Recently, an alternative approach was developed due to an ever-increasing demand for good quality cabbage crops and also the increasing ineffectiveness of some control methods (Matteson 1984). Chemical control, cultural practices, trapping, biofumigation, host resistance control, modification for an effective environment, exclusion of pests, manipulation of pest reproductive capacity, and biological control are incorporated into Integrated Pest Management (IPM) (Dickson *et al.* 1986, Liss *et al.* 1986, Talekar *et al.* 1986, Biever 1996, Waage 1996, Pedigo

2002). IPM is a decision-making support system and is defined as a comprehensive pest technology that is used to combine resources to reduce the status of pests to tolerable levels while maintaining a quality environment (Pedigo 2002). This approach has had success in suppressing DBM populations amongst commercial farmers in places such as Asia and further it is environmentally friendly (Talekar & Shelton 1993). Eastern Cape subsistence farmers do not use some of these controls, especially in relation to controlling DBM on cabbage. The IPM programmes for DBM and other pests on cabbages still need to be developed and implemented, especially for emergent farmers.

There are contradictory points of view about IPM implementation. Pollard (1991) states that IPM is partially traditional agriculture with slight complexity added, implying that farmers in general have some form of understanding of it. On the other hand, information collected from small-scale farmers reveals that they often lack an understanding of IPM (van Mele *et al.* 2001). While there is no doubt about the success of this approach, Waage (1996) asked whether IPM would work with farmers with a poor understanding of insects. This means that farmers' perceptions have to be understood or the implementation of IPM might meet unexpected obstacles (Hussein 1987).

Having mentioned cabbage pest problems and the need for effective control in general, it is also important to understand things from the farmer's point of view. Sometimes some research programmes need scientists to know what has been happening in a particular site before they can start a study i.e. asking the farmers about what they know about the site, because it is assumed that they spend more time in their fields than the scientists. In most cases the scientist will talk to the farmers finding out the pests biology in general. Some issues often tend to arise, such as a lack of knowledge about insects, insect-related beliefs, low levels of understanding of visual literacy and language barriers, and hence there is a crucial need for conducting research to close the knowledge gap between farmers, agricultural scientists and extension workers to ensure better pests management.

Human issues affecting pest control

Farmers' perceptions

Perceptions are based on more than one individual's decisions at the time that any form of communication is taking place. They could be personal, and are constantly changing. Researchers and scientists should be aware that people rely on experience, concepts and values to organize, interpret and explain what they see, hear, taste, touch and smell. Mood, culture and age have an impact in interpreting what people perceive (Moore & Dwyer 1994). Other important elements that affect perception are the beliefs and attitudes of the cultures in which people are raised.

Studies of farmers' perceptions of insects show the importance of some of the above factors in shaping farmers' knowledge. Farmers from Malaysia, Zambia, Ivory Coast, Nigeria, Niger, the Sahel, Zimbabwe, Central Luzon (Philippines), Lesotho and the Mekong Delta (Vietnam) that were interviewed showed a lack of in-depth understanding of insects (Hussein 1987, Javaida *et al.* 1987, Adesina *et al.* 1994, Bottenberg 1995, Youm & Baidu-Forson 1995, Stonehouse *et al.* 1997, Chivasa *et al.* 1998, Ochou *et al.* 1998, Palis 1995, Ebenebe *et al.* 2001, van Mele *et al.* 2001). Most of them showed both weaknesses and strengths in their understanding of insects. Many subsistence farmers believed that all insects are harmful e.g. ladybirds (Palis 1998). They were not able, perceptually, to recognise insect eggs (Ochou *et al.*1998) and had little understanding of insect development (Bottenberg 1995). Nigerian farmers on the other hand were found to be excellent observers of their environment possessing vast amounts of information that actually enabled scientists to learn from them (Atteh 1984). In some places, farmers also showed some strength by knowing the insects that are of economic importance (Javaid *et al.* 1987, Hoeng & Ho 1987, Adesina *et al.*1994, Ochou *et al.* 1998, Ebenebe *et al.* 2001, van Mele *et al.* 2001). These studies serve as guidelines to those interested in encouraging the implementation of IPM.

Literature from European countries shows that there are cultural beliefs associated with certain insects that are probably taught by, or indirectly observed from, parents. This subject is referred to as cultural entomology. Cultural entomology has been poorly researched (Hogue 1987) and literature is scarce. Cultural entomology reflects the various beliefs regarding insects important to human society, but it also reflect differences between the ethnic assemblages or nations in which the beliefs appear (Hogue 1987). For example, in Minjibir village, Nigeria, destroying ant's nests in a field is forbidden because the seeds that ants collect may save a community from starvation in case of severe crop failure (Bottenberg 1995). This was believed only in this village and not in others, and revealed the experience, thoughts and values of those people about these ants. This also reflects cultural differences. As it appears that every culture has its own beliefs, it has been of interest to investigate the beliefs about insects in South Africa, especially amongst isiXhosa speakers. Rural and suburban people have traditionally believed that a particular insect will bring them something bad or good; and no person whom they consider to be an intruder can tell them that they should stop believing that. These kinds of beliefs can be difficult, but not impossible, to change. This can have a negative impact on the development of Integrated Pest Management and on the education of farmers, and thus a full documentation of people's beliefs about insects is a necessity for the development of IPM. In this study, isiXhosa speakers in the Eastern Cape were the targets of the study.

Interpretation of pictures and real images

During the survey of Matteson *et al.* (1984) it was also discovered that there was a need for effective communication between researchers, extension workers, scientists and farmers, since farmers and extension workers sometimes find pest management technology too complex for their understanding. Effective communication could take the form of verbal or written messages in the farmers' home language (Javaid *et al.* 1987) and the use of colour photographs of insects and their characteristic damage (Javaid *et al.* 1987, Ochou *et al.* 1998). However studies of perception (Moore & Dwyer 1994) showed that some farmers lack an understanding of some insects and even need to be taught how to interpret pictures.

In terms of language communication, Adam (2001) has suggested that there should be a focus on documenting multilingual dictionaries since there are difficulties in communication between people from different backgrounds. Through developing a dictionary in this thesis it is hoped to encourage and promote mother-tongue education for all South Africans. From 0.2% of the population in the Limpopo Province to 82.6% in the Eastern Cape (CSS 1996, 1997, 2000) speak isiXhosa and many are illiterate (Dowse & Ehlers 2001). It is argued that it would be useful to document an isiXhosa-English and English-isiXhosa scientific dictionary for insects to promote good communication between researchers and scientists, extension workers and farmers. The dictionary would be for those people speaking isiXhosa as their home tongue in South Africa. English would be included because it is the most common second language, providing a medium of wider communication, and it also allows speakers of different first languages to understand each other. The insects' scientific names would need to be included to overcome the ambiguity of common names.

The promotion of IPM technology for subsistence farmers, particularly with illiterate people, requires scientist and extension workers to learn which visual communication methods would be most suitable for the farmers to learn from before they implement IPM. Visual literacy varies between people and possession of it is regarded as a key social indicator of development amongst illiterate people (Burnett 1989, Dudley 1993). Visual literacy means that a person has to have the ability to understand (read) and use (write) images and to think and learn in terms of images. Visual skills are not simple; interpreting drawings is a skill that needs to be taught like reading and writing (Moore & Dwyer 1994). An individual may recognise a drawing readily and efficiently if features on the drawings are structured appropriately. It also depends on the experience of the person with the particular subject (Dowse & Ehlers 2001). For example a diagram of an insect may be informative to an entomologist or to a crop farmer while to the rest of the world it may be meaningless. Graphics and object media are being used increasingly as resources for communicating with illiterate or semi-literate people (Burnett 1989).

Pictures are used to attract attention and to reinforce information known by people, and are used on the assumption that people have some kind of basic universal language that everybody understands, which is not always the case. Dudley (1993) has stated that drawings cannot be understood without captions and captions cannot be understood without drawings. Illiterate villagers are disadvantaged both ways. Literate and semi-literate people may encounter the same situation. Estimates suggest that only 30% of the black adult population of South Africa is literate, with 25% being semi-literate and 45% illiterate (Dowse & Ehlers 2001). With semi-literate and illiterate people, problems with understanding drawings might be encountered. Jahoda & McGurk (1982) demonstrated that people did not always easily understand black and white drawings. Dowse & Ehlers (2001) have suggested that in the amaXhosa ethnic group, illustrators should work together with the culture when designing drawings that are clear illustration and that training on how to read images was needed.

Study areas

The research detailed in this thesis focussed on eight sites of the Eastern Cape (Fig 1, Chapter 3, pg 52): Grahamstown East township (33°18'S 26°32'E), Hamburg (28°25'S 24°58'E), the Kat River area (32°59'S 26°46'E), Libode (31°31'S 29°03'E), Ngqeleni (31°40'S 29°02'E), Tsomo (32°02'S 27°48'E), Butterworth (32°21'S 28°08'E), and Mdantsane (32°57'S 27°46'E).

Grahamstown East, in the township (Site A and Site B) merited special attention as a suburban area, in which insect pests presence on the crops of subsistence farmers could be studied in depth (Chapter 2). These areas were chosen because there was communal cabbage farming activity, farming activities had existed for 4 years or more, and the area was accessible.

The other study sites were classified as follows: three sites in the former Ciskei (Mdantsane, Hamburg and Kat River Area), and four in the former Transkei (Libode, Ngqeleni, Tsomo and Butterworth). The reason for choosing these areas was the fact that Ciskei and Transkei are some of the former black “homelands” of the Xhosas (Malan & Hattingh 1976, Nonyukela 1992). Most of inhabitants belong to the Nguni ethnic group and 82.6% of the population speak isiXhosa (Central Statistics Service [CSS] 1996, 1997, 2000), which coincides with the targeted population. The sites were later classified into rural (Hamburg, Kat River Area, Libode, Ngqeleni, and Tsomo) and suburban areas (Mdantsane, Butterworth and Grahamstown). The reasons to chose rural areas was to obtain the level of understanding of insects, their names and beliefs from older people with less exposure to the modern, urban environment because they are believed to retain cultural norms (White & Woods 1980), including traditional vocabularies. The people living in rural areas are considered more likely to have encountered a wider variety of insects, and to have learned their names as a result. On the other hand, some older people in the suburban areas originally came from rural areas. These study sites were chosen for several reasons: firstly, communal cabbage farming activity occurs there; farming activities had existed for 4 years or more, the areas are accessible; and finally, it was speculated that there may be differences in cultural beliefs between rural and suburban dwellers.

Aims

Based on the preceding information there is a need to focus on both the crop and the farmer. To this end, this research therefore aims to:

- investigate the seasonal occurrence and rates of parasitism of diamondback moth (DBM, *Plutella xylostella*) in subsistence cabbage crops in Grahamstown, in order to assess the intensity of need for IPM in a model subsistence framing system;
- catalogue isiXhosa insects names for standardization; to assist communication between farmers and extension officers about insects in general;
- catalogue amaXhosa beliefs associated with insects to understand the attitudes of isiXhosa-speaking people towards insects pests as a preliminary measure of the level of acceptance that IPM might meet in amaXhosa communities;
- investigate amaXhosa cabbage farmers' perceptions of insects and crop management to assist in the future development of teaching methods of IPM for subsistence and small-scale farmers in a specific community in the Eastern Cape, and to further assess the level of acceptance that IPM might meet; and
- investigate the relative literacy of amaXhosa farmers regarding two and three-dimensional images of insects, to provide preliminary background to the design of IPM teaching materails.

Scope

These studies in general are not an attempt to develop an IPM strategy but only to provide some groundwork for understanding amaXhosa subsistence farmers and their crops. Chapter 2 focuses on a model crop (cabbages) and pests (DBM) to see if biological control might work in amaXhosa emergent farmers' crops, as it has in other cabbage-growing systems overseas. The remaining chapters examine human factors that can affect the potential for IPM development in amaXhosa emergent farmers' crops.

Because the focus of Chapter 2 was on investigating a pest population and its natural enemies on a crop (cabbages) grown under subsistence conditions, Grahamstown East was chosen as an exemplary study site. No trial plots were used to demonstrate conditions in a continuous cabbage crop environment because this would not be representative of the existing subsistence systems. There were also time constraints and an unavailability of land to do such broader research. The findings in Chapter 2 imply no final conclusions about the need for IPM, but show the need for further research that will include both types of study sites.

Having examined some biological aspects relevant to the design of IPM programme the thesis then moves on to examine some social issues relevant to this topic. By adopting a cultural entomology approach, the contribution of this thesis is also to lay a basis for later designing IPM programmes and improving IPM training methods, and the support of individuals interacting with isiXhosa speakers. Other issues concerning isiXhosa insect names, beliefs and perceptions of insects and also understanding of graphic and object media were studied in communities across the Eastern Cape. Research was undertaken with IsiXhosa-speaking people, especially farmers who were over 35 years old because it was believed that they had more experience than the younger ones (Nxusani 2002). Their farming activity was also studied in order to acquire general information about relevant farming practises. This also provided details about the basic knowledge that subsistence and small-scale farmers have about insects, which can assist in the development of teaching methods of IPM in these communities.

The overall objectives of this study were to show the interaction between subsistence and/or small-scale farmers, insect pests, agricultural scientists and extension workers. This relationship also concerns pests on the cabbage crop of amaXhosa subsistence farmers focusing on diamondback moth and biological, chemical and cultural control of pests; farmers' perception; language and culture barriers; and visual literacy. All these factors might have an influence on the design and implementation of Integrated Pest Management. Therefore, this work provides the foundation on how appropriate IPM training material could possibly be developed through subsequent research and development.

THESIS PREVIEW

The underlying structure and logic of this thesis is illustrated in Fig 1, which demonstrates the base relationship between small-scale farmers, insect pests, agricultural scientists and extension workers. The numbers on the diagram represent the local farmers (1) who frequently have a problem with insect pests (2) on their crops and need scientists (3) and extension workers (4) to help them solve these problems.

Scientists conduct research such as investigating the population dynamics of the pest on a particular crop. Cabbage crops were used as a model in this study (Chapter 2), with emphasis on diamondback moth (DBM) because it is known to be a serious pest on cabbage crop grown by emergent farmers in the Eastern Cape. Chapter 2 also shows the level of parasitism of DBM by parasitoids, which helps examine whether there is a potential role for biological control. Although DBM is the most serious problem many other insects have a harmful impact on farming and the focus of the thesis then shifts to examine the perceptions and understanding, which emergent farmers have of DBM and insects in general.

In general, it is not always obvious that extension workers, who have to transfer knowledge to the farmers, know the farmers' language. It becomes extremely difficult when farmers need to be taught about specialised fields of study such as entomology. With amaXhosa farmers, this matter is partially addressed through formulating the first isiXhosa-English and English-isiXhosa dictionary of insect names (Chapter 3) in this thesis. This dictionary can help to bridge the communication gap between amaXhosa farmers and extension workers.

The small-scale farmers' decision-making process in controlling pests is influenced not only by economic and environmental concerns but also by their cultural background. Therefore, it is important for extension workers to know the farmers' background in relation to cultural beliefs about insects. In this study, amaXhosa cultural beliefs about insects have been documented (Chapter 4), with the aim of understanding the farmers' way of thinking.

For scientists to have a fuller understanding of what is happening in the field, farmers should to be interviewed regarding their perceptions and management of insect pests on their crop(s). It is important to know the traditional or adopted pest management that the farmers use because, at times, this may affect the pest populations or have no economic value. Chapter 5 demonstrates the nature of farmers' perception about insect pests and how they manage those pests.

Studying the attitudes of farmers toward insects identified the need to train them. In training, a capability to visualise graphic and object media is essential. Simplified techniques were used to find out about the visual literacy of farmers (Chapter 6) and for communication between farmers and extension workers. In South Africa, these topics are underdeveloped and therefore need to be studied. The various aspects of these studies are discussed and synthesized in Chapter 7.

The thesis thus provides preliminary foundations for the subsequent development of IPM strategies for subsistence farmers, not only for the particular cabbage crops on which the work is modelled, but also, potentially, for many vegetable crops grown under similar conditions.

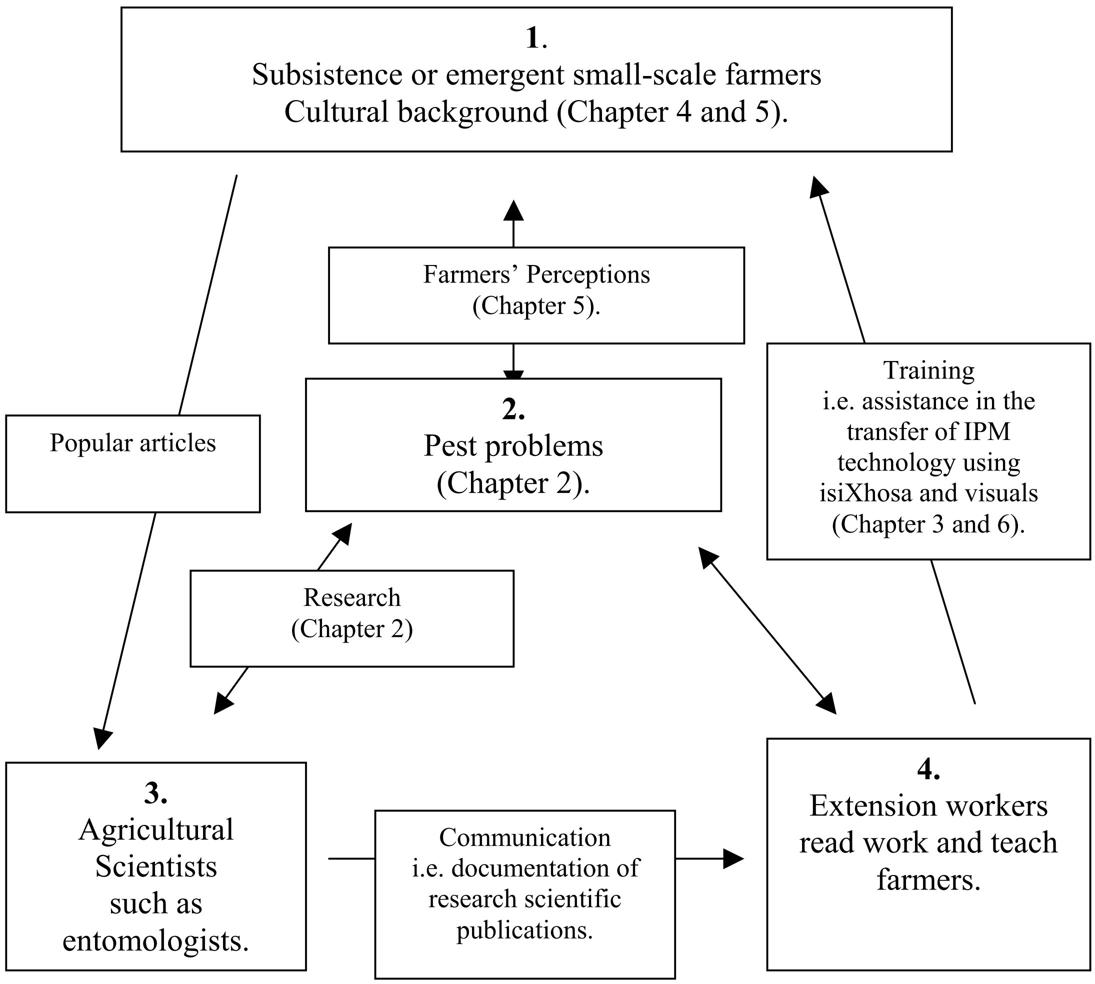

Figure 1: Diagrammatic representation of the relationship between farmers (1), scientists (3) and extension workers (4) in general. The relation is explained under the section entitled "THESIS PREVIEW".

Chapter 2

Seasonal occurrence and rates of parasitism of diamondback moth (*Plutella xylostella*) and other lepidopteran pests on subsistence cabbage crops in the Eastern Cape, South Africa.

Introduction

An annual cropping system varies in time, both within a season and across seasons, and in space, on local and regional scales (Altieri & Letourneau 1982). In agro-ecosystems this is known to have a major effect on the evolution and population dynamics of pest species (Altier & Letourneau 1982; Kennedy & Storer 2000) and their natural enemies (Landis *et al.* 2000). There are many arthropod pests such as semi-loopers, cutworms and bollworms feeding on cabbages (Annecke & Moran 1982), and their populations could be affected by environmental disturbances such as cropping systems. *Plutella xylostella* (diamondback moth, DBM) is a useful model pest that causes damage in cruciferous crops in most parts of the world (Shelton *et al.*1996, Ivey & Johnson 1998). Continuous planting of crucifers has facilitated continuous reproduction of this pest species (Talekar & Shelton 1993). It has been recorded that there is a shortage of effective natural enemies of diamondback moth due to agricultural management practices (Lim 1986), such as the use of pesticides. Talekar & Shelton (1993) suggest that research on the survival ability of diamondback moth and its rates of parasitism in a non-continuous cropping environment should be undertaken to provide more insight into its agro-ecology.

Smith & Villet's (2002) work in a continuous, commercial cabbage-growing area near Grahamstown, in the Eastern Cape Province showed that parasitism of diamondback moth averaged over 60% and could reach 100%. In many parts of the world cabbage crops are not under continuous cultivation, and periodic cropping systems may demonstrate different patterns of parasitism, especially in disrupted, patchy, subsistence crops. Bach (1988) and Fahrig & Paloheimo (1988) demonstrated that spatial arrangements of crops have an impact on the population size of some insects.

Cabbage (*Brassica oleracea*) is the most commonly grown cruciferous crop in subsistence gardens in the suburbs of Grahamstown East (i.e. the low income areas). The subsistence farmers' crops are considered patchy because the cabbages are grown in small and relatively widely separated plots. These gardens provided an opportunity to follow Talekar & Shelton's (1993) suggestion to investigate the population dynamics of *P. xylostella* and its rate of parasitism on cabbages of subsistence farmers where commercial pesticides are used less. Subsistence farmers use less commercial pesticides because the pesticides are expensive and they cannot afford to pay for them (Matteson *et al.* 1984).

The aim of this chapter was to investigate the seasonal occurrence and rates of parasitism of pests on continually disturbed subsistence cabbage crops focusing more on diamondback moth. It has been noted that seasonal occurrence and rates of parasitism of pests in a cabbage crop grown continually would be different and interesting to compare but since this does not reflect a current or potential reality and since there were social issues associated with that kind of research it was not part of the study. The social issue includes the fact that no subsistence farmer would like to have a control plot on their garden.

Material and methods

The cabbage gardens used in this study were located in two suburbs of Grahamstown, Extension 7 (site A -33°18'S 26°34'E) and Extension 8 (site B -33°18'S 26°33'E), and had an average size of 3m x 15m. These sites were chosen because there was minimal use of pesticides and more reliance on cultural control methods such as intercropping. These gardens included patches of crops such as cauliflower, onion, carrots, spinach and beetroot. The farmers also planted flowers such as marigolds around the gardens.

In each site, 30 gardens (with 20-30 cabbages each) were selected randomly for monitoring. Larvae and pupae of *P. xylostella* and other lepidopteran pests were collected from 10 randomly selected cabbages once a month in each garden at each site. These were transferred to a constant environment room kept at 20 ± 1°C and 16L: 8D photoperiod. The insects were reared to adulthood in well-ventilated petri dishes, and regularly supplied with fresh, unsprayed cabbage leaves. Dead larvae were removed and recorded, and moisture and droppings wiped away to prevent mould and diseases (Kirk 1992). The parasitoid species that emerged were identified and recorded.

Results and discussion

Crop characteristics

In these gardens, subsistence farmers had planted vegetables such as cabbage, spinach, broccoli, onion, maize, carrots, and potatoes, which were planted on the plots. Cabbage is one of the most commonly and widely grown vegetables forming the staple diet for a large portion of African countries and in the Eastern Cape, South Africa.

There were environmental disturbances caused by the subsistence farmers in the cabbage patches. Whenever they needed food, they took out a cabbage or cabbage. At times, such as Christmas, everybody's crop was harvested and not replanted for several weeks until people got government pension funds, which were used to buy seedlings again. At other times, particular gardens would have no cabbages. The reason for this were that a person taking care of the garden would be sick or find a job, and would not have time to take care of their garden. This is considered a disturbed agro-ecosystem, characterised by irregular local extinction of DBM and its parasitoids.

Diamondback moth populations' densities

The population of diamondback moth at sites A and B reached 0.2 and 2.9 larvae/plant, respectively, between March and May (Fig. 1). Dennill & Pretorius (1995) in Pretoria North, South Africa found similar results. The density of *P. xylostella* reached a maximum of 0.42 maximum during their study. The temperatures in Pretoria during the study period ranged from 10.5 to 25.8°C and contributed to the low numbers of DBM (Dennill & Pretorius 1995). This could also happen in Grahamstown because temperatures there ranged from 7.2 to 28.3°C (SA weather 2002). Shirai (2000) reported that in tropical and temperate regions, larval survival rate of DBM was not temperature-dependent, because when temperatures were between 15-30°C there were survival of the pest.

Dennill & Pretorius (1995) said the use of chemicals could have contributed to the lowest levels of pests recorded as well. The lower population levels of DBM in site A may have been caused by the use of dishwashing detergent as an insecticide by the farmers at the recommendation of the Umthathi Training Project. By comparison, Smith (pers. comm. 2002) found average infestations of 7-12 larvae/plant in a nearby commercial cabbage crops farms in Belmont Valley, which is about 25km away from Grahamstown. On these findings in site A DBM numbers were controlled with cypermethrin and pyrethroids but still the numbers were higher than on the cabbages of subsistence farmers in Grahamstown. Possibly the DBM in Belmont valley has gained resistance to the pesticides (Dennill & Pretorius 1995, Smith & Villet 2002).

Monoculture reduces the density of pest species (Talekar *et al.* 1986), which tend to explode in numbers because they have a greater potential for building up their populations under conditions of reduced competition. In general, DBM population levels were low at both suburban sites and have been affected by the patchy cabbage environment. It could have been difficult for the adult DBM to find the host plant to lay eggs because it had to wander before it could find the substrate (Waage 1979, Karieva 1985; Fahrig & Paloheimo 1988). These results agree with the hypothesis that the resource concentration is important in that herbivores are most likely to be found on and remain on host plants that are concentrated rather than widely spaced (Root & Kareiva 1984). Relating these results to the hypothesis from Kennedy & Storer (2000), changes in agro-ecosystems have a major effect on the population dynamics of pest species. In the gardens or farms of subsistence and small-scale farmers there was diversification of crops. Zhao *et al.* (1992) and Andow & Risch (1985) reported that this kind of environment lowers pest populations.

Parasitism of Diamondback moth

Despite environmental disturbances and the use of detergents, four species of parasitoids were found in both study sites (Fig. 1), namely *Cotesia plutellae* (Kurdjumov) (Braconidae), *Diadromus collaris* (Gravenhorst) (Ichneumonidae), *Oomyzus sokolowskii* (Kurdjumov) (Eulophidae) and *Diadegma mollipla* (Holmgren) (Ichneumonidae). There were very low levels of parasitism but there were distinct differences in the rates of parasitism of the four species (Table 1). There was a general trend that rate of parasitism increased with increased presence of the hosts, which suggests that parasitism as density-dependent (Goodwin 1979).

At site A from June to October there was co-occurrence of *C. plutellae* and it reached maximum average rates of parasitism of 2%. In site B there was a large difference: *C. plutellae* was at most 2%. Temperatures could have affected the parasitism of DBM by *C. plutellae*. Talekar & Yang (1991) said optimal temperatures for parasitism are between 20-30°C and temperatures in Grahamstown drop to 7.2°C. Waladde *et al.* (2001) also say *C. plutellae* has a high potential of parasitism of DBM in the absence of pesticides.

At site A from June to October, *O. sokolowskii* reached maximum average rates of parasitism of 2% and in site B 17.9%. The large difference between the sites could be that the subsistence farmers were using detergents to control pests on cabbages at site A that later affected parasitism.

In November at site A the highest percentage of *D. collaris* recorded was 5.9% and in March it was 2% in site B. The use of detergent at site B could have affected the parasitism of *D. collaris* and the opposite happened in site A. Rowell *et al.* (1990) also reported that the frequent application of insecticide was affected by the occurrence of *D. collaris* in Thailand.

Parasitism by *D. mollipla* at site B briefly averaged 6% whereas at site A it was negligible. The reason for this huge difference could lie the fact that detergent was used more at site A than in site B. Krishnamoorthy (2002) says that the use of some chemicals to control pests could be harmful on parasitoids.

The availability of all parasitoids might be due to the availability of flowers as nectar sources that increase their longevity and fecundity (Zhao *et al.* 1992; Idris & Grafius1995, 1997) but rates of parasitism were still not as high as recorded in the commercial plots around Grahamstown (Smith's & Villet 2002).

Other lepidopteran pests

Three other species of moths were found attacking cabbages, including cabbage looper (*Trichoplusia orichalcea,* Hübner)*,* cabbage moth (*Crocidolomia binotalis,* Zell.) and *bollworm* (*Helicoverpa armigera,* Hübner) (Figure 2).

Trichoplusia orichalcea: T. orichalcea was found to be a more serious pest than any other on cabbages including the diamondback moth, which is mostly found to be the most common pest in other countries (Harcourt 1957, Rai *et al*. 1992, Mitchell *et al.* 1997, Shelton *et al*. 1998, Ivey & Johnson 1998). Its densities were as high as 0.046 and 0.033 in site A and site B respectively at the beginning of March and decreased in the winter months in both study sites. Ivey & Johnson (1998) and Maltais *et al*. (1999) found similar results and suggested that cabbage looper is more of a warm-season pest and cannot withstand cool weather. In October no larvae were found and the rest of the summer months there were no host plants because most farmers had to feed their visitors. Twenty *Cotesia sesamiae* (Cameron) were the parasitoids found in *T. orichalcea* and that only occurred once.

Crocidolomia binotalis: Populations of *C. binotalis* were very limited in winter, with densities as low as 0.0033 and 0.033 at site A and site B respectively, paralleling Talekar's findings (1996). This pest generally occurred occasionally, and is found in the vicinity of Port Elizabeth (Annecke & Moran 1982).

Helicoverpa armigera: *H. armigera* was low in winter months due to complex physiological slowing down of development known as diapause (Annecke & Moran 1982).

Conclusion

The populations of *T. orichalcea, C. binotalis* and *H. armigera* seemed to be affected by the change of the seasons. However DBM and its parasitoids seemed additionally to be affected by the spatial and temporal arrangement of habitat patches over small scales. This shows that successful interaction of arthropods depends on the dynamics of the community, which means that if the pests' habitats are constantly disturbed, then there will be disturbances with the population. There also seem to be a lack of understanding of the agro-ecological concept by local farmers because their cropping system varies considerably within a region and this has an impact on the pests and natural enemies. Smith & Villet (2002) showed that if there were no patchiness populations of DBM and parasitism of diamondback moth could reach much higher levels in a continuous commercial cabbage-growing environment. This study has shown that the subsistence farmers have no major problem with these pests.

Diamondback moth is a good example of a pest that can be controlled by IPM in commercial settings, and cabbage is a common and widespread subsistence crop. They can both therefore serve as benchmark examples for the evaluation of the need and potential for IPM on subsistence crops, which is why they were examined in this thesis. The results showed that there is potential for biological control in such crops, but that other needs supersede it. The next step in this study is to evaluate some of the social factors that would affect the introduction of an IPM programme when the need for one eventually arises.

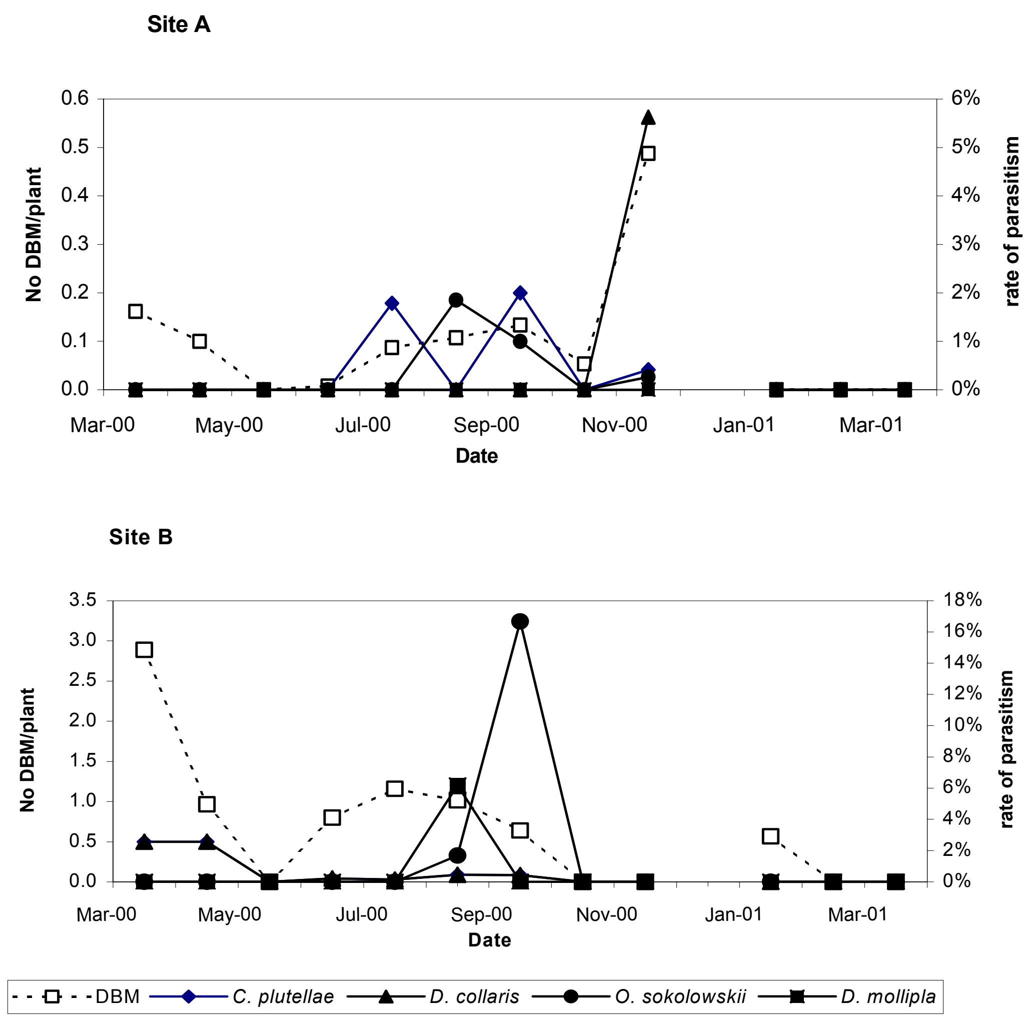

Figure 1: Densities of *Plutella xylostella* and percentage parasitism by four species of parasitoids on cabbages of subsistence farmers at Grahamstown in 2000/2001. The gaps in the graphs show where there was no crop for sampling because most farmers' crops were harvested for visitors over Christmas. Note that the scales of the two graphs are different. Many subsistence gardens at site A were sprayed with diluted dishwashing detergents.

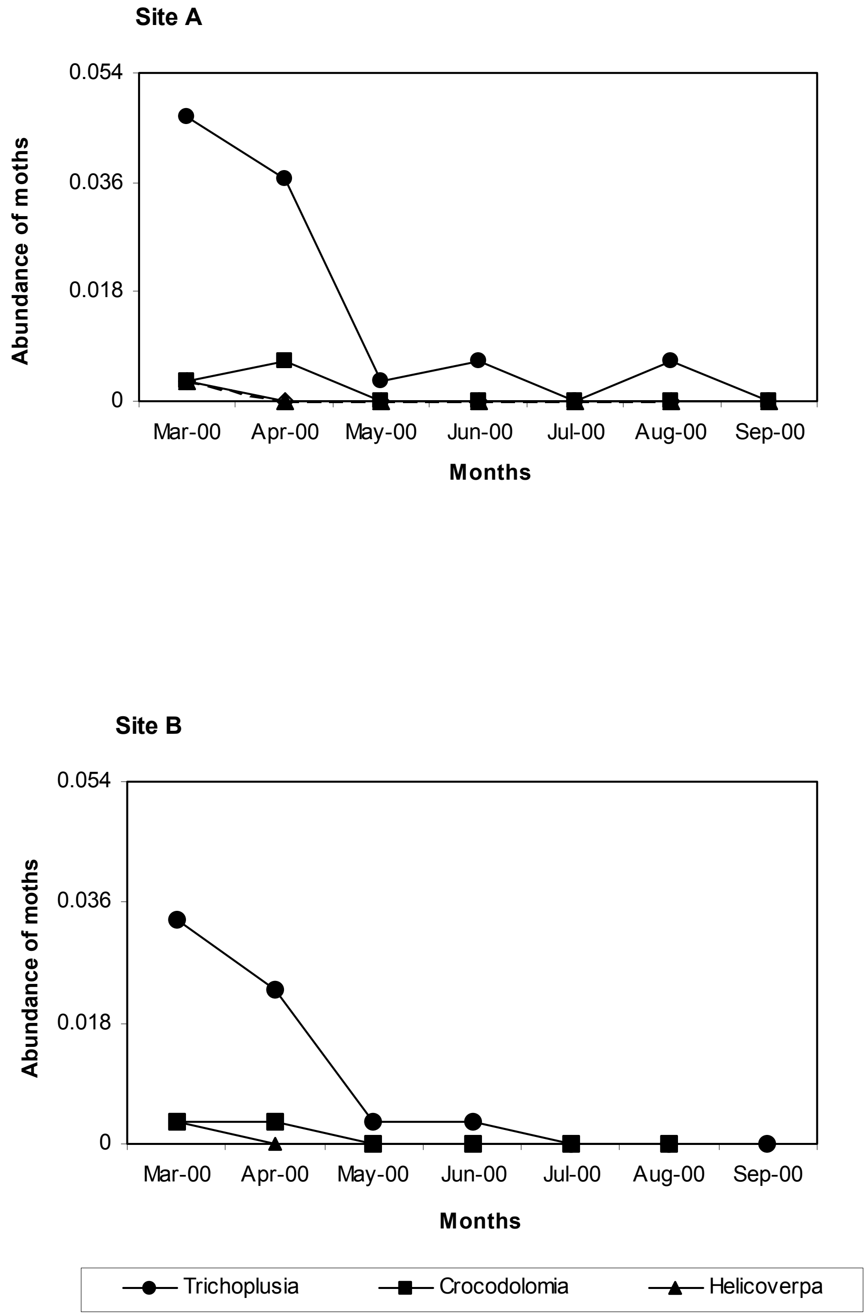

Figure 2: Average densities of *Trichoplusia orichalcea Crocidolomia binotalis* and *Helicoverpa armigera* on cabbages of subsistence farmers at Grahamstown in 2000. In October the pests were not available because the farmers had harvested their cabbages for visitors over Christmas. There is no data available for 2001 because the farmers had stopped planting because of lack of money to buy seedlings. Many subsistence gardens at site A were sprayed with diluted dishwashing detergents.

Chapter 3

IsiXhosa insect names from the Eastern Cape, South Africa

Introduction

This chapter develops and presents a list of isiXhosa names for a wide variety of South African insects, along with their English equivalents and scientific names, that serves as the basis of an isiXhosa-English translating dictionary. This list was prepared for people such as farmers, scientists and agricultural extension workers. It has been designed for practical use in situations where information about insects must be communicated e.g. in agriculture and health services. This serves as a dictionary for people who are either conversant with isiXhosa or English insect names, and also for scientists who would like to know colloquial insect names in one of the two languages. IsiXhosa is one of the Nguni languages and is the second most commonly spoken language in South Africa. At least some people speak isiXhosa as their home tongue in all nine South African provinces, ranging from 0.2% of the population in the Limpopo Province to 82.6% in the Eastern Cape (Central Statistics Service [CSS] 1996, 1997, 2000). English was included in this work because, even though the range of people speaking it as a first language is only between 0.4% in the Limpopo Province and 4.2% in the Eastern Cape (CSS 1996, 1997), it is the most common second language in the country, the most evenly distributed language, geographically (Boweman 2000) and also the science of entomology was developed in English. This language allows speakers of different first languages to understand each other. The insects' scientific names are included to eliminate the ambiguity of common names.

At a more general level, changes in a language could affect the common names of insects, leading to miscommunication about practical matters involving insects in fields such as public health and agriculture. Insect names can vary from idiosyncratic (personal names) or dialectic (regional) to widespread (standard) names, so it is important to document this kind of information. South Africa has had several language boards, which were mandated to document and standardise the indigenous languages, but little standardisation has been achieved by the isiXhosa language boards that were set up in the past, such as the African Languages Board of 1977 and the Pan South African Language Board (PanSALB) of 1995 (Silinyana 2000), which is still operating and much concerned with lexicography and terminology. The PanSALB collaborates with the Department of Arts and Culture's National Language Service Terminology group. In 2001 PanSALB set up new language-specific bodies for each of the official languages, e.g. the isiXhosa National Language Body and the English National Language Body. The focus of activity varies from body to body. It remains to be seen whether PanSALB can make a substantive difference to the status quo (Adam 2001, 2002). It is hoped that this publication will contribute to the standardisation of isiXhosa insect names for applied entomology, agricultural extension work and education programmes in South Africa.

Material and methods

Data Collection

A total of 51 isiXhosa-speaking people were interviewed in isiXhosa regarding the names of insects. They lived in eight suburban and rural areas of the Eastern Cape (Fig 1): Grahamstown (33°18'S 26°32'E), Hamburg (28°25'S 24°58'E), the Kat River area (32°59'S 26°46'E), Libode (31°31'S 29°03'E), Ngqeleni (31°40'S 29°02'E), Tsomo (32°02'S 27°48'E), Butterworth (32°21'S 28°08'E), and Mdantsane (32°57'S 27°46'E). Three sites are in the former Ciskei (Mdantsane, Hamburg and Kat River Area), and four in the former Transkei (Libode, Ngqeleni, Tsomo and Butterworth), where 96% of the population speak isiXhosa.

The interviews were structured by referring to a list of questions (Appendix A). Questionnaires were used i.e. given to farmers because they were either illiterate or semi-illiterate and also lacked an understanding of English. The isiXhosa people in some cases provided information before and without being asked.

The interviewees were all with people older than 35 years. Choice was determined by an amaXhosa cultural norm, which is embodied in the figure of speech, "inyathi ibuzwa kwabaphambili" (Mesatywa & Jordan 1971, Nxusani 2002), meaning that young people should ask their elders about indigenous knowledge. Another reason for using older people was because of the high rate of rural-urban migration in younger people in South Africa, due to the hope of getting further education and better employment on bigger cities, which affects community relationships, cultures and language. As a result, older people with less exposure to the modern, urban environment are believed to retain cultural norms (White & Woods 1980), including traditional vocabularies. Older people and those living in rural areas are also more likely to have encountered a wider variety of insects, and to have learned their names as a result. Some people in the urban areas were also included because they originally came from the rural areas.

With respect to ethical considerations, Denzin & Lincoln (1994) state that it is important to respect interviewee's dignity and privacy i.e. permission from people is needed before conducting an interview. With prior permission from farmers, interviews were recorded using a tape recorder. The use of isiXhosa when conducting the interviews helped the isiXhosa speakers to express themselves clearly. Two methods were used for the interviews. First, the respondents were individually shown line drawings of insects (graphic media), and later they were shown individually pinned standard specimens (object media) of 71 families of the most common species of insects found in Southern Africa. The farmers were asked to identify those particular insects i.e. give the names in isiXhosa and descriptions of what helped them to identify insects. They were also asked to give their age, place of origin, and level and type of education. The use of two methods of soliciting names provided a means of cross validation. Because English names were not mentioned in the interviews, this source of confusion was eliminated. The scientific and English names of the specimens were provided by professional entomologists, providing a means of validating the words that was independent of published isiXhosa-English dictionaries.

The information was later entered into a database that was designed to show insect names classified by order, family, and species (if applicable) following Scholtz & Holm (1985) and Picker *et al.* (2002), and by isiXhosa and English names. The scientific names were used to remove ambiguity about the insects' identities. The insect names from two English-isiXhosa dictionaries (Fischer *et al.* 1985, Anonymous 2001) were also added to the samples. The phraseology of these two dictionaries' definitions suggests that they were not independently compiled, but I could not trace the authors to verify this. They were treated as a single additional interview for purposes of analysing the completeness of the sample.

Analysis of survey

A statistical measure of the survey's completeness, at least for the Eastern Cape, was assessed using the species-area accumulation curve method (Clarke & Gorley 2001) as implemented in Primer 5 software. The data were first analysed using the sequence in which the samples were collected, and then using the mean of 999 random permutations of the interviews.

The insect names were also categorised into three classes: idiosyncratic (personal) names, which were defined as those given by one person or two people from the same town that discussed the name during an interview; dialectal (local) names, defined as those known by most respondents, but only in one or a few neighbouring sites; and general or standard names, collected from many respondents and/or sites. The results were shown in a response-frequency curve, which was used to assess how many more names potentially remained to be collected in each category (Fagen & Goldman 1977). The literal meanings of some insect names were translated by an isiXhosa speaker and also using an isiXhosa-English dictionary (Anonymous 2001).

The insect names were also categorised according to their significance in the amaXhosa communities in terms of agricultural, medical, domestic, and cultural importance. Names with no apparent importance were classified as such. In this chapter, "agricultural, medical and cultural" categories of insects mean insects that are believed to have a positive or negative impact on isiXhosa-speaking people and "domestic" means insects that interact with them. These categories represent insects that: affect crops (agricultural); affect health (medical); have a cultural or symbolic meaning (cultural) or have an impact on domestic life. These categories were mutually exclusive. The work of Hogue (1987), Annecke & Moran (1982), Ebeling (1975) and Service (2000) was consulted in order to make a comparable list of English common names in the same categories and these were counted in the same way. The information was then compared with the isiXhosa names.

Results and Discussion

IsiXhosa-speaking people were generous in sharing their beliefs about insects, sometimes before I asked them. Almost half of the people interviewed attended school (Table 1). Only 33.3% of people had completed extension courses, offered by the Ulutho Training Centre from Mdantsane, relating to business management (agriculture), land preparation, and garden maintenance. Thus most respondents had learned names for insects informally, rather than from formal sources.

The isiXhosa insect names collected were 151 (Tables 2 and 3), many more than are listed in the Pharos English-isiXhosa Dictionary (Anonymous 2001). There were proportionally fewer local names and more standard names in the Pharos Dictionary relative to my findings (Table 4). This is not surprising because it is a general-purpose dictionary and covers generic terms. Only five insect names were unique to the published dictionary and are considered to be personal names. Of the names in the Pharos dictionary, were 77.1% general, 17.1% were personal and 5.7% were local names.

The English-isiXhosa and isiXhosa-English sections of my work have been compiled together so that they coincide exactly. Half of the insects identified have more than one name in isiXhosa (Table 3). The response-frequency distributions (Fig. 2) show that there is not much information to be collected for the local and widespread categories of names. This was estimated by extrapolating the smoothed response-frequency distribution to the 'zero respondents' category (Fig. 2), which is the number of un-encountered names (Fagen & Goldman 1977); there were only one or two names in this category. On the other hand, the response frequency distribution of idiosyncratic insect names show that many more such names will be encountered in further surveys. The cumulative number of names collected becomes almost asymptotic (Figs. 3-4), with less than one new name in every other interview. These were largely idiosyncratic. This confirms the completeness of the sample. Within each locality, the accumulation curves also showed levelling-off (Fig. 4), indicating that samples from each site were also adequate.

The same name was sometimes given to more than one insect belonging to the same order but to a different family, except for the name "inyenzane" that was given to insects belonging to three different orders (Table 5). It is likely that insects with the same name that belong to the same order are either too difficult for the respondents to observe accurately (Bentley 1992) or the respondents have a different taxonomy to that of science. This might also have been because "inyenzane" is used as a generic term for an insect that makes a noise, but most people appear to have assumed or imagined that its colour and its behaviour are like those of the specimens they indicated. This case shows some underlying logic to the isiXhosa classification of insects, and suggests that amaXhosa people consider general features (colour, and perhaps behaviour) of insects when they are identifying them.

Bentley (1992) claimed that most people know only animals that are of economic (agricultural) and/or physical (medical) importance to them. In contrast, in the isiXhosa communities represented in this study, the insects that are most well known are those of medical and then domestic importance, followed by those of cultural and agricultural (economic) significance (Table 6). There is also a huge disparity between the numbers of names of insects that are of agricultural importance to the respondents and the actual numbers of documented insects of agricultural concern (Table 6). This suggests that Bentley's (1992) conclusion is not entirely applicable to these amaXhosa communities and also that there is a serious need in the Eastern Cape for agricultural education. Suggestions by Hogue (1987) that people knew the names of all the insects are optimistic with regard to these amaXhosa communities because according to this data, isiXhosa has very few names for insects that are of no significance to humans (Table 6).

In this study, the average number of names known per person was more than 37.2% of the total number of names of insects in isiXhosa (Table 1, Fig. 3), which suggests that many older, rural people have a fairly good knowledge of isiXhosa insect names. The data also suggest that to some degree there is a close parallel between the knowledge in the former Ciskei and Transkei areas. Table 1 also shows that the number of insect names known per person is higher in the former Transkei (with an average of 67%) than in the former Ciskei and the neighbouring towns (with an average of 56%). Fewer insect names were encountered in the Ciskei area, possibly because there are fewer insects than in the Transkei area. However, I am are aware that a sample of 51 informants may be insufficient for any strong generalization about insect names.

Directly translated meanings of insect names show that isiXhosa-speaking people tend to relate insects to people. For example, "umakhulu = grandmother" for ladybird beetles because of their slow walk; "unoposi = postman" for ladybirds because they fly from one place to another; "intonjane = bagworm" for bagworms, which, because of the grass case that it makes, resemble the traditional dress worn at a feast and dance given on a girl's arrival at young maidenhood;

“uqondovu = big round head” for king cricket because of the shape of their heads; “igumasholo = lazy” for drone bees because they are lazy bees; “umakhulu sidudu = grandmother porridge” for bulb weevils, meaning grandmother, the provider of porridge (no reason why was given) and “umntanezulu / umnambezulu / unomncencezulu = child of heaven” for praying mantises, because they often have their front legs together as if praying and normally appear to local people just after or before rain. According to informants, the name is also associated with the attractive bright colour, calmness, apparent peacefulness and harmlessness. Other isiXhosa names allude to the production of sounds or chemicals e.g. “inyenzane = lonesomeness”, for cicada because of the mournful sounds that they produce; “uxhiphu-xhiphu magwetyana = jump foam” for a stink locust, because it produces foam when you touch it; "unobhotolo = butter” for termites, because of their fatty abdomens. Thirdly, names may indicate the behaviour of the insects e.g. “iphela lenkuni = log cockroach” because of its habitat (rotten logs); "uqongqothwane = drink or eat up leftovers” for the toktokkie beetle, because it moves around and makes a noise with its abdomen.

Honeybees (*Apis mellifera* L.) are so important in amaXhosa communities that there are names for almost anything associated with them, e.g. beeswax = umthwebeba, combs with honey = ikhepheza, igebheza, icangca and amatyumza; combs lacking honey = ikhaphela, and swarms = umsinga (Anonymous 2001) and ibubu.

Conclusion

This study identifies a core vocabulary of isiXhosa insect names that is essentially complete and this is only true for the area covered for sampling. This demonstrates the ability of isiXhosa speakers to coin new names when they need them. Names exist mainly for insects of medical, domestic, cultural and agricultural significance. In many cases the names refer to the characteristics of the insects, either physical or personified. This work will assist communication between rural development workers and the communities they serve, through highlighting regional variations in the names used for insects.

The names that belong to the widespread and local categories should be standardised because a number of people are familiar with them. Idiosyncratic names could be considered for formalisation in cases where no other name already exists. It is hoped that this information will be later presented as a handbook with appropriate illustrations.

Table 1: The respondents' profiles in different isiXhosa communities in the Eastern Cape. n = sample size.

	Grahamstown (n = 7)	**Kat River Area (n = 9)**	**Hamburg (n = 5)**	**Libode (n = 8)**	**Ngqeleni (n = 7)**	**Tsomo (n = 5)**	**Butterworth (n = 5)**
Average age of respondents (years)	55.8	63.7	59.0	50.0	78.0	69.0	50.0
Median no. of years at school (and range)	0 (0-4)	7 (0-12)	7 (3-8)	0	0	0	0
% of people in the community with extension courses	0	33.3	0	0	0	0	0
Average % of names known/ person	37.9	40.6	37.2	46.2	50.0	39.3	48.9

Table 2: Alphabetical list of isiXhosa names for insects, with English and scientific names. In the isiXhosa name column, a noun is divided into a prefix (the letters in brackets) and a stem (the letters not in brackets). The prefix is in singular (first bracket) and the word in the second bracket is plural. IsiXhosa insect names are arranged in alphabetical order using the stem. Under the English common names column, the suffixes in brackets represent singular and plural. G – widespread, L - local, and P - personal names, with reference to isiXhosa.

IsiXhosa name	Status	English name	Order	Family
(is)abonkolo (izabonkolo)	L	damselfl(y) (-ies)	Odonata	Coenagrionidae
(is)aphompolo (izaphompolo)	L	black ant (-s)	Hymenoptera	Formicidae
(isi)bawu (izibawu)	G	stable fl(y) (-ies)	Diptera	Muscidae
(i)bhabhathane (amabhabhathane)	G	butterfl(y) (-ies)	Lepidoptera	All
(i)bhadi (amabhadi)	L	butterfl(y) (-ies)	Lepidoptera	All
(i)bhaloni (iibhaloni)	L	damselfl(y) (-ies)	Odonata	Coenagrionidae
(u)bhatom (oobhatom)	G	blister beetle (-s)	Coleoptera	Meloidae
(u)bhatom (oobhatom)	G	CMR beetle (-s)	Coleoptera	Meloidae
(u)bhatom (oobhatom)	G	oil beetle (-s)	Coleoptera	Meloidae
(u)bhomoyi (oobhomoyi)	P	king cricket (-s)	Orthoptera	Stenopelmatidae
(i)bhungane (amabhungane)	P	carpenter bee (-s)	Hymenoptera	Apidae
(i)bhungane (amabhungane)	P	blister beetle (-s)	Coleoptera	Meloidae
(u)bhatom (oobhatom)	G	CMR beetle (-s)	Coleoptera	Meloidae
(u)bhatom (oobhatom)	G	oil beetle (-s)	Coleoptera	Meloidae
(u)bomani (oobomani)	G	king cricket (-s)	Orthoptera	Stenopelmatidae
(u)bugosho (imigosho)	L	army ant (-s)	Hymenoptera	Formicidae
(u)bugosho (imigosho)	L	red ant (-s)	Hymenoptera	Formicidae
(u)bungqwangu (imingqwangu)	G	army ant (-s)	Hymenoptera	Formicidae
(u)bungqwangu (imingqwangu)	G	red ant (-s)	Hymenoptera	Formicidae
(u)bungxwangu (imingxwangu)	G	army ant (-s)	Hymenoptera	Formicidae

IsiXhosa name	Status	English name	Order	Family
(u)bungxwangu (imingxwangu)	G	red ant (-s)	Hymenoptera	Formicidae
(u)buxhwangu (imixhwangu)	L	army ant (-s)	Hymenoptera	Formicidae
(u)buxhwangu (imixhwangu)	L	red ant (-s)	Hymenoptera	Formicidae
(i)dengwane (amadengwane)	L	blue fl(y) (-ies)	Diptera	Calliphoridae
(i)diya (amadiya)	L	brown locust (-s)	Orthoptera	Acrididae
(i)diya (amadiya)	L	king cricket (-s)	Orthoptera	Stenopelmatidae
(i)dlinca (oodlinca)	P	king cricket (-s)	Orthoptera	Stenopelmatidae
(u)dongotshe (oodongotshe)	L	blowfl(y) (-ies)	Diptera	Calliphoridae
(u)dongwane (oodongwane)	L	blue bottles (-s)	Diptera	Calliphoridae
(isi)dunguli (izidunguli)	G	mud dauber (-s)	Hymenoptera	Sphecidae
(isi)dunguli (izidunguli)	G	potter wasp (-s)	Hymenoptera	Eumenidae
(isi)dunguli (izidunguli)	G	spider-hunting wasp (-s)	Hymenoptera	Pompilidae
(isi)dunguli (izidunguli)	G	ichneumon wasp (-s)	Hymenoptera	Ichneumonidae
(i)dzedze (amadzedze)	L	louse (lice)	Phthiraptera	Pediculidae
(i)gaxothi (amagaxothi)	P	darkling beetle (-s)	Coleoptera	Tenebrionidae
(i)gaxothi (amagaxothi)	P	cockroach (-es)	Blattodea	Blattillidae
(u)gqamanzi (ooqgamanzi)	G	dragonfl(y) (-ies)	Odonata	All
(i)gqokoqhwane (iigqokoqhwane)	G	bean weevil (-s)	Coleoptera	Bruchidae
(i)gqhwangi (amagqhwangi)	L	king cricket (-s)	Orthoptera	Stenopelmatidae
(i)gumasholo (amagumasholo)	G	honey bee drone (-s)	Hymenoptera	Apidae
(i)gxakoshe (amagxakoshe)	P	cockroach (-es)	Blattodea	Blattillidae
(u)hlabamanzi (oohlabamanzi)	P	dragonfl(y) (-ies)	Odonata	All
(isi)hlava (izihlava)	G	American bollworm (-s)	Lepidoptera	Noctuidae
(isa)hlongololo (izahlongololo)	L	black ant (-s)	Hymenoptera	Formicidae
(u)hodoshe (oohodoshe)	G	blowfl(y) (-ies)	Diptera	Calliphoridae
(is)ibawu (izibawu)	G	cicada (-s)	Hemiptera	Cicadidae
(is)ipeleti (izipeleti)	L	dragonfl(y) (-ies)	Odonata	All
(isi)khoji (izikhoji)	L	ladybird (-s)	Coleoptera	Coccinellidae
(i)kokoroshe (amakokoroshe)	G	cockroach (-es)	Blattodea	Blattillidae

IsiXhosa name	Status	English name	Order	Family
(i)kirikitsi (iikirikitsi)	L	cricket (-s)	Orthoptera	Gryllidae
(i)kritsi (iikritsi)	G	cricket (-s)	Orthoptera	Gryllidae
(u)makhulu (oomakhulu)	G	ladybird (-s)	Coleoptera	Coccinellidae
(u)makhulu sidudu (oomakhulu sidudu)	G	bulb weevil (-s)	Coleoptera	Curculionoidae
(u)masikhabi (oomasikhabi)	L	locust (-s)	Orthoptera	Pygomorphidae
(i)mbovane (iimbovane)	G	ant (-s)	Hymenoptera	Formicidae
(u)mbundane (imibundane)	G	cutworm (-s)	Lepidoptera	Noctuidae
(i)mbundlu (amabundlu)	L	bladder grasshoper (-s)	Orthoptera	Pneumoridae
(u)mbungu (imibungu)	G	caterpillar (-s)	Lepidoptera	All
(u)mbungu osikayo (imibungu esikayo)	L	cutworm (-s)	Lepidoptera	Noctuidae
(i)mbuzane (iimbuzane)	G	small fl(y) (-ies)	Diptera	Sarcophagidae
(i)mbuzane (iimbuzane)	G	adult aphid (-s)	Hemiptera	Aphididae
(u)mcinkwane (imicinkwane)	P	brown locust (-s)	Orthoptera	Acrididae
(u)mhlwa (imihlwa)	P	termite (-s)	Isoptera	Hodotermitidae
(u)mhlwa (imihlwa)	P	white ant (-s)	Isoptera	Hodotermitidae
(u)mkhonyo (imikhonyo)	G	bladder grasshoper (-s)	Orthoptera	Pneumoridae
(u)mkhuhlane (imikhuhlane)	L	locust (-s)	Orthoptera	Pygomorphidae
(u)mkhulungwane (imikhulungwane)	L	termite (-s), white ant (-s)	Isoptera	Hodotermitidae
(u)mnambezuzlu (iminambezulu)	L	praying mantis (-es)	Mantodea	Mantidae
(u)mnyekevu (iminyekevu)	P	caterpillar (-s)	Lepidoptera	All
(u)mnyiki (iminyiki)	G	american bollworm (-s)	Lepidoptera	Noctuidae
(u)mnyiki (iminyiki)	G	caterpillar (-s)	Lepidoptera	All
(i)mpehla (amampehla)	L	carpenter bee (-s)	Hymenoptera	Apidae
(u)mqathu (imiqathu)	L	praying mantis (-es)	Mantodea	Mantidae
(u)mqhwanti (imiqhwanti)	L	click beetle (-s)	Coleoptera	Elateridae
(u)mqikela (imiqikela)	L	brown locust (-s)	Orthoptera	Acrididae
(u)msundu (imisundu)	P	caterpillar (-s)	Lepidoptera	All
(u)mzondo (imizondo)	G	blister beetle (-s)	Coleoptera	Meloidae
(u)mzondo (imizondo)	G	CMR beetle (-s)	Coleoptera	Meloidae

IsiXhosa name	Status	English name	Order	Family
(u)mzondo (imizondo)	G	oil beetle (-s)	Coleoptera	Meloidae
(u)mzondo omkhulu (imizondo emikhulu)	P	longhorn beetle (-s)	Coleoptera	Cerambycidae
(i)ncukuthu (iincukuthu)	G	bedbug (-s)	Hemiptera	Cimicidae
(i)ngcongconi (iingcongconi)	G	mosquito (-es)	Diptera	Culicidae
(i)ngolwane (amangolwane)	G	chicken louse (lice)	Phthiraptera	Menoponidae
(i)ngqogoqhwane (ii iingqogoqhwane)	G	maize weevil (-s)	Coleoptera	Curculionidae
(i)ngqokoqhwane (iingqokoqhwane)	G	maize weevil (-s)	Coleoptera	Curculionidae
(i)ngqokoqwane (iingqokoqwane)	G	maize weevil (-s)	Coleoptera	Curculionidae
(i)nkanyezi (iinkanyezi)	G	firefl(y) (-ies)	Coleoptera	Lampyridae
(i)nkubabulongwe (iinkubabulongwe)	G	dung beetle (-s)	Coleoptera	Scarabaeidae
(i)nkula (iinkula)	L	dung beetle (-s)	Coleoptera	Geotrupidae
(i)nkuma (iinkuma)	L	earwig (-s)	Dermaptera	All
(i)nkumba mdodo encinci (iinkumbi mdodo encinci)	L	aphid (-s)	Hemiptera	Aphididae
(i)nkumbi (iinkumbi)	G	brown locust (-s)	Orthoptera	Acrididae
(i)nkwethu (iinkwethu)	L	aphid (-s)	Hemiptera	Aphididae
(i)nkwili (iinkwili)	G	whirligig beetle (-s)	Coleoptera	Gryrinidae
(u)nobotolo (oonobotolo)	L	termite (-s)	Isoptera	Hodotermitidae
(u)nobotolo (oonobotolo)	L	white ant (-s)	Isoptera	Hodotermitidae
(u)nochristmas (oonochristmas)	P	knocking beetle (-s)	Coleoptera	Tenebrionidae
(u)nochristmas (oonochristmas)	P	toktokkie (-s)	Coleoptera	Tenebrionidae
(u)nodanya (oonodanya)	L	firefl(y) (-ies)	Coleoptera	Lampyridae
(u)nokhinxa (oonokhinxa)	L	earwig (-s)	Dermaptera	All
(u)nomadukudwana (oonomadukudwana)	G	earwig (-s)	Dermaptera	All
(u)nomanxelana (oonomanxelana)	L	paper wasp (-s)	Hymenoptera	Vespidae
(u)nomanxezane (oonomanxezane)	G	paper wasp (-s)	Hymenoptera	Vespidae
(u)nomciligwana (oonomiligwana)	L	king cricket (-s)	Orthoptera	Stenopelmatidae

IsiXhosa name	Status	English name	Order	Family
(u)nomcilikwane (oonomcilikwane)	P	brown locust (-s)	Orthoptera	Acrididae
(u)nomeva (oonomeva)	G	sphecid wasp (-s)	Hymenoptera	Sphecidae
(u)nomeva (oonomeva)	G	thread-waisted wasp (-s)	Hymenoptera	Sphecidae
(u)nominxa (oonominxa)	P	earwig (-s)	Dermaptera	All
(u)nomkhenkce (oonomkhenkce)	L	blowfl(y) (-ies)	Diptera	Calliphoridae
(u)nomncencezulu (oonomcencezulu)	L	praying mantis (-es)	Mantodea	Mantidae
(u)nondlwana (oonondlwana)	P	thread-waisted wasp (-s)	Hymenoptera	Sphecidae
(u)noposi (oonoposi)	G	ladybird (-s)	Coleoptera	Coccinellidae
(u)nothwalimpahlana (oonothwalimpahlana)	L	termite (-s), white ant (-s)	Isoptera	Hodotermitidae
(i)ntambanani (iintambnani)	L	locust (-s)	Orthoptera	Pygomorphidae
(i)ntankumba (iintakumba)	G	flea (-s)	Siphonaptera	Pulicidae
(i)ntethe (iintethe)	G	locust (-s)	Orthoptera	Pamphagidae
(i)ntethe (iintethe)	G	grasshopper (-s)	Orthoptera	Pamphagidae
(i)ntethe (iintethe)	G	king cricket (-s)	Orthoptera	Stenopelmatidae
(i)ntethe (iintethe)	G	brown locust (-s)	Orthoptera	Acrididae
(i)ntethe yezulu (iintethe zezulu)	L	praying mantis (-es)	Mantodea	Mantidae
(i)ntimba (iintimba)	L	fishmoth (-s)	Thysanura	Lepismatidae
(i)ntlava (iintlava)	G	American bollworm (-s)	Lepidoptera	Noctuidae
(i)ntlava (iintlava)	G	stalk borer (-s)	Lepidoptera	Noctuidae
(i)ntobole (iintobole)	G	cricket (-s)	Orthoptera	Gryllidae
(i)ntonjane (iintonjane)	G	bagworm (-s)	Lepidoptera	Psychidae
(i)ntothoviyane (iintothoviyane)	G	locust (-s)	Orthoptera	Pygomorphidae
(i)totoviyane (iitotoviyane)	G	locust (-s)	Orthoptera	Pygomorphidae
(i)ntubi (iintubi)	G	termite (-s), white ant (-s)	Isoptera	Hodotermitidae
(i)ntwala (iintwala)	G	louse (lice)	Phthiraptera	Pediculidae

IsiXhosa name	Status	English name	Order	Family
(i)ntwala yehagu (iintwala zehagu)	P	pig louse (lice)	Phthiraptera	Haematopinidae
(i)ntwala yehagu (iintwala-(zehagu)	G	pubic louse (lice)	Phthiraptera	Phthridae
(i)ntwala yemithi (iintwala) (zemithi)	L	aphid (-s)	Hemiptera	Aphididae
(i)ntwala yenkukhu (iintwala-zenkukhu)	G	chicken louse (lice)	Phthiraptera	Menoponidae
(i)ntwala yokufa (iintwala) (zokufa)	P	head louse -(lice)	Phthiraptera	Pediculidae
(um)ntwan' ezulu (abantwan'ezulu)	G	praying mantis (-es)	Mantodea	Mantidae
(u)nonyevu (oononyevu)	G	paper wasp (-s)	Hymenoptera	Vespidae
(u)nonyevu (oononyevu)	G	mud dauber (-s)	Hymenoptera	Sphecidae
(u)nonyevu (oononyevu)	G	potter wasp (-s)	Hymenoptera	Eumenidae
(u)nonyevu (oononyevu)	G	spider-hunting wasp (-s)	Hymenoptera	Pompilidae
(i)nundu (amanundu)	G	fishmoth (-s)	Thysanura	Lepismatidae
(i)nyenzane (iinyenzane)	G	potter wasp (-s)	Hymenoptera	Eumenidae
(i)nyenzane (iinyenzane)	G	cicadas	Hemiptera	Cicadidae
(i)nyenzane (iinyenzane)	G	crickets	Orthoptera	Gryllidae
(i)nyiki (imimyinki)	P	stalk borer (-s)	Lepidoptera	Noctuidae
(i)nyiki (iminyiki)	P	cutworm (-s)	Lepidoptera	Noctuidae
(i)nyosi (iinyosi)	G	bee (-s), especially honey bee (-s)	Hymenoptera	Apoidea
(i)phahlothi (amaphahlothi)	L	rat-tailed maggot (-s)	Diptera	Syriphidae
(i)phela (amaphela)	G	cockroach (-es)	Blattodea	Blattellidae
(i)phela-khulu (amaphela-khulu)	P	cockroach (-es)	Blattodea	Blattillidae
(i)phela lasekhaya (amaphela asekhaya)	L	cockroach (-es)	Blattodea	Blattellidae
(i)phela laseNatal (amaphela aseNatal)	L	cockroach (-es)	Blattodea	Blattillidae
(i)phela lenkuni (amaphela eenkuni)	L	cockroach (-es)	Blattodea	Blaberidae e
(i)phela-mehlo (amaphela-mehlo)	G	cockroach (-es)	Blattodea	Blattillidae
(i)phela ndle (amaphela-ndle)	P	cockroach (-es)	Blattodea	Blaberidae

IsiXhosa name	Status	English name	Order	Family
(u)phunguphungu (oophunguphungu)	G	stem borer pupa (-e)	Lepidoptera	Noctuidae
(is)pringani (izipringani)	L	locust (-s)	Orthoptera	Pygomorphidae
(um)qathane (imiqathane)	P	brown locust (-s)	Orthoptera	Acrididae
(i)qhwangi (amaqhwangi)	L	locust (-s)	Orthoptera	Pygomorphidae
(u)qondovu (ooqondovu)	L	king cricket (-s)	Orthoptera	Stenopelmatidae
(u)gongqothwane (ooqongqothwane)	G	knocking beetle –(s)	Coleoptera	Tenebrionidae
(u)gongqothwane (ooqongqothwane)	G	toktokkie (-s)	Coleoptera	Tenebrionidae
(i)qonya (amaqonya)	L	bladder american (-s)	Orthoptera	Pneumoridae
(i)qungwane (amaqungwane)	P	honey bee worker (-s)	Hymenoptera	Apidae
(u)rhuxeshe (oorhuxeshe)	G	stalk-borer moth (-s)	Lepidoptera	Crambidae
(u)sikolipati (oosikilopati)	L	ladybird (-s)	Coleoptera	Coccinellidae
(i)tshungu (iitshungu)	L	leaf beetle (-s)	Coleoptera	Chrysomelidae
(u)tswitswi (ootswitswi)	P	cricket (-s)	Orthoptera	Gryllidae
(u)vivane (amavivane)	L	diamondback moth (-s)	Lepidoptera	Plutellidae
(i)vivingane (iivivngane)	G	diamondback moth (-s)	Lepidoptera	Plutellidae
(u)xhiphu-xhiphu magwetyana (ooxhiphuxhiphu magwetyana)	L	locust (-s)	Orthoptera	Pygomorphidae

Table 3: Alphabetical list of insects with isiXhosa names, with English and scientific names. Under the English names column, the suffixes in brackets represent singular and plural. In the isiXhosa name column, a noun is divided into prefix (the letters in brackets) and a stem (the letters not in brackets). The prefix is in singular (first bracket) and plural (second bracket). G – widespread, L – local, and P – personal names refers to the isiXhosa name column.

English name	Status	IsiXhosa name	Order	Family
adult aphid (-s)	G	(i)mbuzane (iimbuzane)	Hemiptera	Aphididae
American bollworm (-s)	G	(i)ntlava (iintlava)	Lepidoptera	Noctuidae
American bollworm (-s)	P	(u)mnyiki (iminyiki)	Lepidoptera	Noctuidae
American bollworm (-s)	G	(isi)hlava (izihalva)	Lepidoptera	Noctuidae
ant (-s)	G	(i)mbovane (iimbovane)	Hymenoptera	Formicidae
aphid (-s)	L	(i)nkumba mdodo encinci (iinkumba mdodo encinci)	Hemiptera	Aphididae
aphid (-s)	L	(i)nkwethu (iinkwethu)	Hemiptera	Aphididae
aphid (-s)	L	(i)ntwala yemithi (iintwala zemithi)	Hemiptera	Aphididae
army ant (-s)	G	(u)bungxwangu (imibungxwangu)	Hymenoptera	Formicidae
army ant (-s)	L	(u)bungqwangu (imigqwangu)	Hymenoptera	Formicidae
army ant (-s)	L	(u)buxhwangu (imixhwangu)	Hymenoptera	Formicidae
army ant (-s)	L	(u)bugosho (imigosho)	Hymenoptera	Formicidae
bagworm (-s)	G	(i)ntonjane (iintojane)	Lepidoptera	Psychidae
bee (-s) (see also carpenter bee, honey bee)	G	(i)nyosi (iinyosi)	Hymenoptera	Apoidea
bean weevil (-s)	G	(i)gqokoqhwane (iigqokoqhwane)	Coleoptera	Bruchidae
bean weevil (-s)	G	(i)gqokoqhwane (iigqokoqhwane)	Coleoptera	Bruchidae
bedbug (-s)	G	(i)ncukuthu (iincukuthu)	Hemiptera	Cimicidae
black ant (-s)	L	(isa)phompolo (izaphombolo)	Hymenoptera	Formicidae
black ant (-s)	L	(isa)hlongololo (izahlongololo)	Hymenoptera	Formicidae

English name	Status	IsiXhosa name	Order	Family
bladder grasshopper (-s)	L	(i)qonya (amaqonya)	Orthoptera	Pneumoridae
bladder grasshopper (-s)	L	(i)mbundlu (amabundlu)	Orthoptera	Pneumoridae
bladder grasshopper (-s)	G	(u)mkhonyo (imikhonyo)	Orthoptera	Pneumoridae
blister beetle (-s)	G	(u)mzondo (imizondo)	Coleoptera	Meloidae
blister beetle (-s)	G	(u)bhatom (oobhatom)	Coleoptera	Meloidae
blister beetle (-s)	G	(i)bhungane (amabhungane)	Coleoptera	Meloidae
blowfl(y) (-ies)	L	(u)nomkhenkce (oonomkhenkce)	Diptera	Calliphoridae
blowfl(y) (-ies)	L	(u)dongotshe (oodongotshe)	Diptera	Calliphoridae
blowfl(y) (-ies)	G	(u)hodoshe (oohodoshe)	Diptera	Calliphoridae
blue bottle (-s)	L	(u)dongwane (oodongwane)	Diptera	Calliphoridae
blue fl(y) (-ies)	L	(i)dengwane (amadengwane)	Diptera	Calliphoridae
brown locust (-s)	P	(u)mcinkwane (imicikwane)	Orthoptera	Acrididae
brown locust (-s)	L	(u)mqikela (imiqikela)	Orthoptera	Acrididae
brown locust (-s)	G	(i)ntethe (iintethe)	Orthoptera	Acrididae
brown locust (-s)	P	(u)nomcilikwane (oomcilikwane)	Orthoptera	Acrididae
brown locust (-s)	P	(um)qathane (imiqathane)	Orthoptera	Acrididae
brown locust (-s)	G	(i)nkumbi (iinkumbi)	Orthoptera	Acrididae
brown locust (-s)	L	(i)diya (amadiya)	Orthoptera	Acrididae
bulb weevil (-s)	G	(u)makhulu sidudu (oomakhulu sidudu)	Coleoptera	Curculionidae
butterfl(y) (-ies)	G	(i)bhabhathane (amabhabhathane)	Lepidoptera	All
butterfl(y) (-ies)	L	(i)bhadi (amabhadi)	Lepidoptera	All
carpenter bee (-s)	L	(i)mpehla (amampehla)	Hymenoptera	Apidae
carpenter bee (-s)	G	(i)bhungane (amabhungane)	Hymenoptera	Apidae
caterpillar (-s)	G	(u)mnyiki (iminyiki)	Lepidoptera	All
caterpillar (-s)	G	(u)mbungu (imibungu)	Lepidoptera	All
caterpillar (-s)	P	(u)mnyekevu (iminyekevu)	Lepidoptera	All
caterpillar (-s)	P	(u)msundu (imisundu)	Lepidoptera	All
chicken (louse) (lice)	G	(i)ntwala yenkukhu (iintwala zenkukhu)	Phthiraptera	Menoponidae

English name	Status	IsiXhosa name	Order	Family
chicken (louse) (lice)	G	(i)ngolwane (amangolwane)	Phthiraptera	Menoponidae
cicada (-s)	G	(isi)bawu (izibawu)	Hemiptera	Cicadidae
cicadas	G	(i)nyenzane (iinyenzane)	Hemiptera	Cicadidae
click beetle (-s)	P	(u)mqhwanti (imiqhwanti)	Coleoptera	Elateridae
CMR beetle (-s)	G	(u)mzondo (imizondo)	Coleoptera	Meloidae
CMR beetle (-s)	G	(u)bhatom (oobhatom)	Coleoptera	Meloidae
CMR beetle (-s)	G	(i)bhungane (amabhungane)	Coleoptera	Meloidae
cockroach (-es)	P	(i)phela lasekhaya (amaphela asekhaya)	Blattodea	Blattellidae
cockroach (-es)	G	(i)phela-mehlo (amaphela mehlo)	Blattodea	Blattellidae
cockroach (-es)	P	(i)phela ndle (amaphela ndle)	Blattodea	Blaberidae
cockroach (-es)	G	(i)phela (amaphela)	Blattodea	Blattellidae
cockroach (-es)	L	(i)phela-khulu (amaphela khulu)	Blattodea	Blattellidae
cockroach (-es)	L	(i)phela laseNatal (amaphela aseNatal)	Blattodea	Blattellidae
cockroach (-es)	L	(i)kokoroshe (amakokoroshe)	Blattodea	Blattellidae
cockroach (-es)	P	(i)gxakoshe (amagxakoshe)	Blattodea	Blattellidae
cockroach (-es)	P	(i)gaxothi (amagaxothi)	Blattodea	Blattellidae
cockroach (-es)	L	(i)phela lenkuni (amaphela eenkuni)	Blattodea	Blaberidae
cricket (-s)	P	(u)tswitswi (ootswitswi)	Orthoptera	Gryllidae
cricket (-s)	G	(i)kritsi (iikritsi)	Orthoptera	Gryllidae
cricket (-s)	L	(i)kirikitsi (iikirikitsi)	Orthoptera	Gryllidae
cricket (-s)	G	(i)ntobole (iintobole)	Orthoptera	Gryllidae
cricket (-s)		(i)nyenzane (iinyenzane)	Orthoptera	Gryllidae
cutworm (-s)	P	(i)nyiki (iminyiki)	Lepidoptera	Noctuidae
cutworm (-s)	G	(u)mbundane (imibundane)	Lepidoptera	Noctuidae
cutworm (-s)	G	(u)mbungu osikayo (imibungu esikayo)	Lepidoptera	Noctuidae
damselfl(y) (-ies)	L	(i)bhaloni (iibhaloni)	Odonata	Coenagrionidae
damselfl(y) (-ies)	L	(is)abonkolo (izabonkolo)	Odonata	Coenagrionidae
darkling beetle (-s)	P	(i)gaxothi (amagaxothi)	Coleoptera	Tenebrionidae
diamondback moth (-s)	G	(u)vivingane (amavivingane)	Lepidoptera	Plutellidae
diamondback moth (-s)	G	(i)vivingane (iivivingane)	Lepidoptera	Plutellidae
diamondback moth (-s)	L	(i)vivane (amavivane)	Lepidoptera	Plutellidae

English name	Status	IsiXhosa name	Order	Family
dragonfl(y) (-ies)	L	(is)ipeleti (izipeleti)	Odonata	All
dragonfl(y) (-ies)	G	(u)gqamanzi (oogqamanzi)	Odonata	All
dragonfl(y) (-ies)	P	(u)hlabamanzi (oohlabamanzi)	Odonata	All
dung beetle (-s)	G	(i)nkubabulongwe (iinkubabulongwe)	Coleoptera	Scarabaeidae
dung beetle (-s)	L	(i)nkula (iinkula)	Coleoptera	Geotrupidae
earwig (-s)	L	(u)nokhinxa (oonokhinxa)	Dermaptera	All
earwig (-s)	P	(u)nominxa (oonominxa)	Dermaptera	All
earwig (-s)	G	(i)nkuma (iinkuma)	Dermaptera	All
earwig (-s)	G	(u)nomadukudwana (oonomadukudwana)	Dermaptera	All
firefl(y) (-ies)	G	(i)nkanyezi (iinkanyezi)	Coleoptera	Lampyridae
firefl(y) (-ies)	L	(u)nodanya (oonodanya)	Coleoptera	Lampyridae
fishmoth (-s)	L	(i)ntimba (iintimba)	Thysanura	Lepismatidae
fishmoth (-s)	G	(i)nundu (amanundu)	Thysanura	Lepismatidae
flea (-s)	G	(i)ntankumba (iintakumba)	Siphonaptera	Pulicidae
grasshopper (-s)	G	(i)ntethe (iintethe)	Orthoptera	Pamphagidae
head (louse) (lice)	P	(i)ntwala yokufa (iintwala zokufa)	Phthiraptera	Pediculidae
honey bee (-s)	G	(i)nyosi (iinyosi)	Hymenoptera	Apidae
honey bee drone (-s)	G	(i)gumasholo (amagumasholo)	Hymenoptera	Apidae
honey bee worker (-s)	G	(i)qungwane (amaqungwane)	Hymenoptera	Apidae
ichneumon wasp (-s)	G	(isi)dunguli (izidunguli)	Hymenoptera	Ichneumonidae
king cricket (-s)	G	(u)bomani (oobomani)	Orthoptera	Stenopelmatidae
king cricket (-s)	G	(i)ntethe (iintethe)	Orthoptera	Stenopelmatidae
king cricket (-s)	L	(u)nomciligwana (oonomciligwana)	Orthoptera	Stenopelmatidae
king cricket (-s)	L	(i)gqhwangi (amagqhwangi)	Orthoptera	Stenopelmatidae
king cricket (-s)	L	(u)qondovu (ooqondovu)	Orthoptera	Stenopelmatidae
king cricket (-s)	P	(u)bhomoyi (oobhomoyi)	Orthoptera	Stenopelmatidae
king cricket (-s)	P	(i)dlinca (oodlinca)	Orthoptera	Stenopelmatidae
knocking beetle (-s)	G	(u)qongqothwane (ooqongqothwane)	Coleoptera	Tenebrionidae
knocking beetle (-s)	P	(u)nochristmas (oonochristmas)	Coleoptera	Tenebrionidae
ladybird (-s)	G	(u)noposi (oonoposi)	Coleoptera	Coccinellidae

English name	Status	IsiXhosa name	Order	Family
ladybird (-s)	L	(isi))khoji (izikhoji)	Coleoptera	Coccinellidae
ladybird (-s)	G	(u)makhulu (oomakhulu)	Coleoptera	Coccinellidae
ladybird (-s)	L	(u)sikolipati (oosikolopati)	Coleoptera	Coccinellidae
leaf beetle (-s)	L	(i)tshungu (iitshingu)	Coleoptera	Chrysomelidae
locust (-s)	L	(u)mkhuhlane (imikhuhlane)	Orthoptera	Pygomorphidae
locust (-s)	G	(i)ntothoviyane (iintothoviyane)	Orthoptera	Pygomorphidae
locust (-s)	G	(i)totoviyane (iitotoviyane)	Orthoptera	Pygomorphidae
locust (-s)	L	(i)ntambanani (iintambanani)	Orthoptera	Pygomorphidae
locust (-s)	L	(u)masikhabi (oomasikhabi)	Orthoptera	Pygomorphidae
locust (-s)	L	(isi)pringani (izipringani)	Orthoptera	Pygomorphidae
locust (-s)	L	(i)qhwangi (amaqhwangi)	Orthoptera	Pygomorphidae
locust (-s)	L	(u)xhiphu-xhiphu magwetyana (ooxhiphu-xhiphu magwetyana)	Orthoptera	Pygomorphidae
locust (-s) (see also brown locust)	G	(i)ntethe (iintethe)	Orthoptera	Pamphagidae
longhorn beetle (-s)	P	(u)mzondo omkhulu (imizondo-emikhulu)	Coleoptera	Cerambycidae
louse (lice)	L	(i)dzedze (amadzedze)	Phthiraptera	Pediculidae
louse (lice)	G	(i)ntwala (iintwala)	Phthiraptera	Pediculidae
maize weevil (-s)	G	(i)ngqokoqhwane (iinqokoqhwane)	Coleoptera	Curculionidae
maize weevil (-s)	G	(i)ngqokoqwane (iingqokoqwane)	Coleoptera	Curculionidae
maize weevil (-s)	P	(i)ngqoqoqhwane (iingqoqoqhwane)	Coleoptera	Curculionidae
mosquito (-es)	G	(i)ngcongconi (iingcogconi)	Diptera	Culicidae
mud dauber (-s)	G	(u)nonyevu (oononyevu)	Hymenoptera	Sphecidae
mud dauber (-s)	G	(isi)dunguli (izidunguli)	Hymenoptera	Sphecidae
oil beetle (-s)	G	(u)mzondo (imizondo)	Coleoptera	Meloidae
oil beetle (-s)	G	(u)bhatom (oobhatom)	Coleoptera	Meloidae
oil beetle (-s)	G	(i)bhungane (amabhungane)	Coleoptera	Meloidae
paper wasp (-s)	G	(u)nomanxezane (oonomanxezane)	Hymenoptera	Vespidae
paper wasp (-s)	L	(u)nomanxelana - (oonomanxelana)	Hymenoptera	Vespidae
paper wasp (-s)	G	(u)nonyevu (oononyevu)	Hymenoptera	Vespidae

English name	Status	IsiXhosa name	Order	Family
pig louse (lice)	P	(i)ntwala (y)ehagu -(iintwala zehagu)	Phthiraptera	Haematopinidae
potter wasp (-s)	G	(u)nonyevu (oononyevu)	Hymenoptera	Eumenidae
potter wasp (-s)	G	(isi)dunguli (izidunguli)	Hymenoptera	Eumenidae
potter wasp (-s)	G	(i)nyenzane (iinyenzane)	Hymenoptera	Eumenidae
praying mantis (-es)	L	(u)mqathu -(imiqathu)	Mantodea	Mantidae
praying mantis (-es)	L	(i)ntethe yezulu -(iintethe zezulu)	Mantodea	Mantidae
praying mantis (-es)	L	(u)nomncencezulu -(oonomncencezulu)	Mantodea	Mantidae
praying mantis (-es)	G	(um)ntwan' ezulu -(abantwana bezulu)	Mantodea	Mantidae
pubic louse (lice)	P	(i)ntwala yehagu -(iintwala zehagu)	Phthiraptera	Phthridae
rat-tailed maggot (-s)	L	(i)phahlothi -(amaphahlothi)	Diptera	Syrphidae
red ant (-s)	G	(u)bungxwangu (imibungxwangu)	Hymenoptera	Formicidae
red ant (-s)	L	(u)bungqwangu (imigqwangu)	Hymenoptera	Formicidae
red ant (-s)	L	(u)buxhwangu (imixhwangu)	Hymenoptera	Formicidae
red ant (-s)	L	(u)bugosho (imigosho)	Hymenoptera	Formicidae
small fl(y) (-ies)	G	(i)mbuzane -(iimbuzane)	Diptera	Sarcophagidae
sphecid wasp (-s)	G	(u)nomeva -(oonomeva)	Hymenoptera	Sphecidae
spider-hunting wasp (-s)	G	(u)nonyevu (oononyevu)	Hymenoptera	Pompilidae
spider-hunting wasp (-s)	G	(isi)dunguli (izidunguli)	Hymenoptera	Pompilidae
stable fl(y) (-ies)	G	(isi)bawu (izibawu)	Diptera	Muscidae
stalk borer (-s)	G	(i)nyiki (iminyiki)	Lepidoptera	Noctuidae
stalk borer (-s)	G	(i)ntlava (iintlava)	Lepidoptera	Noctuidae
stalk-borer moth (-s)	G	(u)rhuxeshe (oorhuxeshe)	Lepidoptera	Crambidae
stem borer pupa (-e)	G	(u)phunguphungu (oophungphungu)	Lepidoptera	Noctuidae
termite (-s)	L	(u)mkhulungwane (imikhulungwane)	Isoptera	Hodotermitidae
termite -(-s)	L	(u)nobotolo (oonobotolo)	Isoptera	Hodotermitidae
termite (-s)	P	(u)mhlwa (imihlwa)	Isoptera	Hodotermitidae
termite (-s)	L	(u)nothwalimpahlana (oonothwalimpahlana)	Isoptera	Hodotermitidae

English name	Status	IsiXhosa name	Order	Family
termite (-s)	G	(i)ntubi (iintubi)	Isoptera	Hodotermitidae
thread-waisted wasp (-s)	G	(u)nomeva (oonomeva)	Hymenoptera	Sphecidae
thread-waisted wasp (-s)	P	(u)nondlwana (oonondlwana)	Hymenoptera	Sphecidae
toktokkie (-s)	G	(u)qongqothwane (ooqongqothwane)	Coleoptera	Tenebrionidae
toktokkie (-s)	P	(u)nochristmas (oonochristmas)	Coleoptera	Tenebrionidae
white ant (-s)	L	(u)mkhulungwane (imikhulungwane)	Isoptera	Hodotermitidae
white ant (-s)	L	(u)nobotolo (oonobotolo)	Isoptera	Hodotermitidae
white ant (-s)	P	(u)mhlwa (imihlwa)	Isoptera	Hodotermitidae
white ant (-s)	L	(u)nothwalimpahlana (oonothwalimpahlana)	Isoptera	Hodotermitidae
white ant (-s)	G	(i)ntubi (iintubi)	Isoptera	Hodotermitidae
whirligig beetle (-s)	G	(i)nkwili (iinkwili)	Coleoptera	Gyrinidae

Table 4: The Freeman-Tukey deviates (which represent residuals from a log-linear model: Sokal & Rohlf 1981) for a cross-tabulation of word type and source (Chi-square = 15.49, p = 0.00043). L = Local, G = General, P = Personal (defined in text).

	Current study	**Pharos Dictionary**	**Total**
L	1.217954	-3.25460	-2.03664
G	-0.964320	1.84593	0.88161
P	0.050069	0.10003	0.15010
Total	0.303703	-1.30864	-1.00494

Table 5: Ambiguous classification of some insect names by isiXhosa speakers. Plurals and English translations are given in Tables 2 and 3.

IsiXhosa name	**Scientific classification**	
	Order	Family
unonyevu	Hymenoptera	Vespidae
	Hymenoptera	Sphecidae
	Hymenoptera	Eumenidae
	Hymenoptera	Pompilidae
inyenzane	Hymenoptera	Eumenidae
	Hemiptera	Cicadidae
	Orthoptera	Gryllidae
isidunguli	Hymenoptera	Eumenidae
	Hymenoptera	Pompilidae
	Hymenoptera	Sphecidae
	Hymenoptera	Ichneumonidae

Table 6: Numbers of isiXhosa and English common names for insects, classified according to their significance to humans. Categories are defined in the text.

Category	isiXhosa names	English common names
Medical	15	18[a]
Domestic	26	hundreds (around the world) [b]
Agricultural	16	103[c]
Cultural	16 (names)	about 10 orders [d]
Other	27	hundreds (around the world) [b]

[a] Service (2000), [b] Ebeling (1975), [c] Annecke & Moran (1982), and [d] Hogue (1987); the number depends on culture.

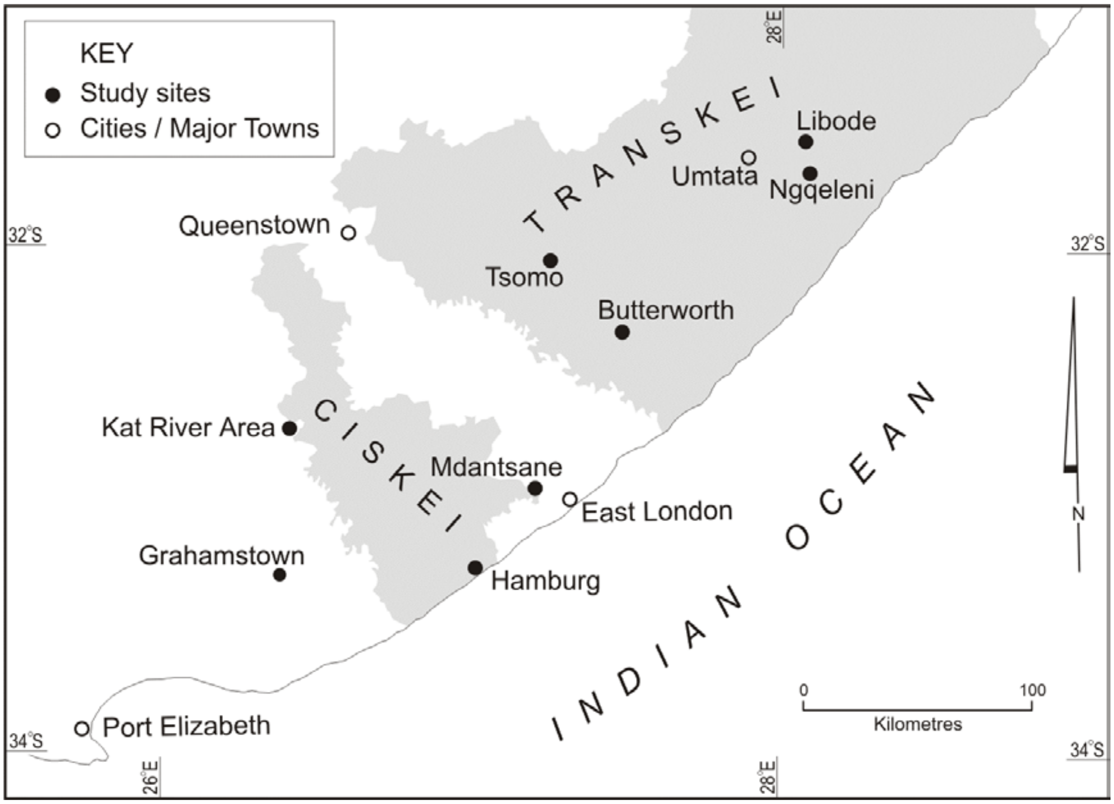

Figure. 1: Map showing the eight study sites in the Eastern Cape.

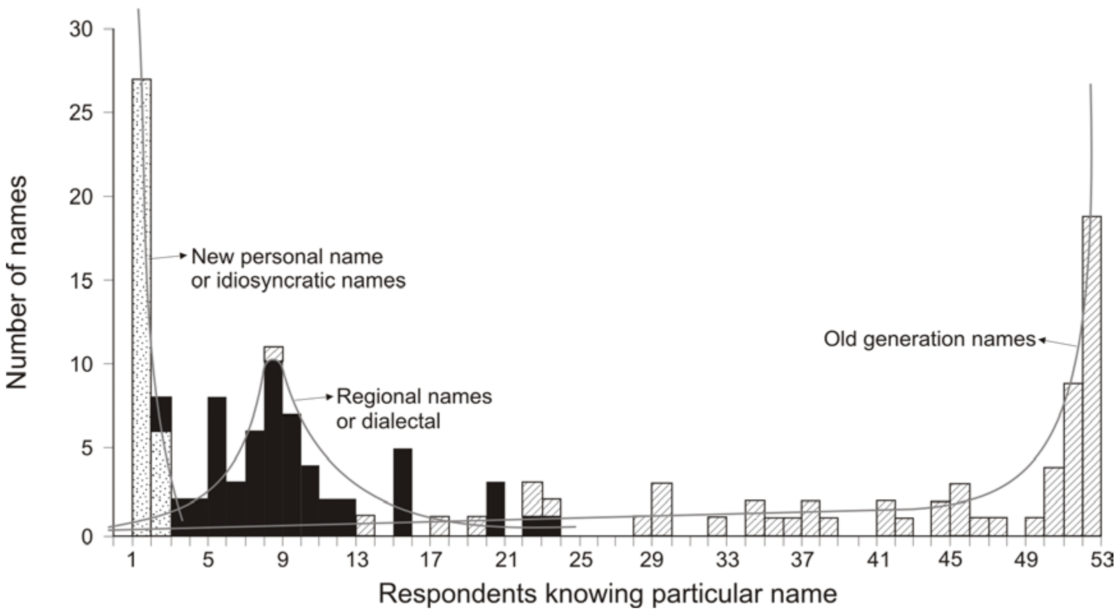

Figure. 2. Response-frequency distributions, classified into (hatched) ubiquitous or standard names, (black) regional names, and (dotted) personal names, as defined in the text. The distribution curves (fitted by eye) indicate that there was one local and one general name know by no one (i.e. these samples were essentially complete) and that there were many more idiosyncratic or personal

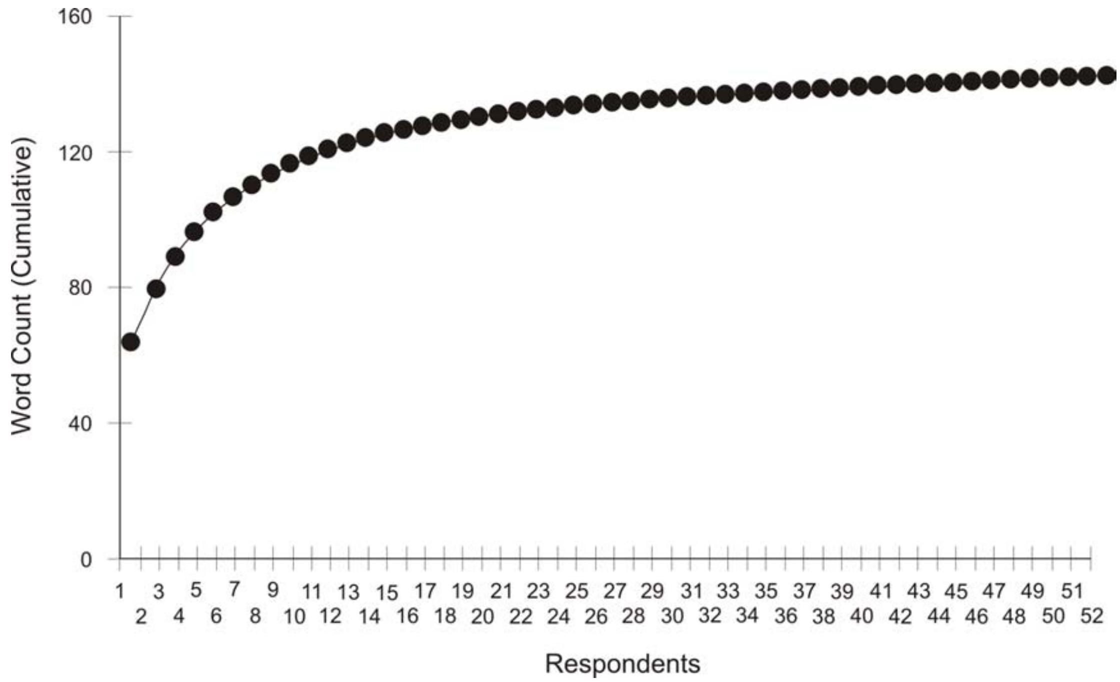

Figure. 3. Cumulative word count with increasing sampling effort, calculated from 999 permutations of the sample of respondents.

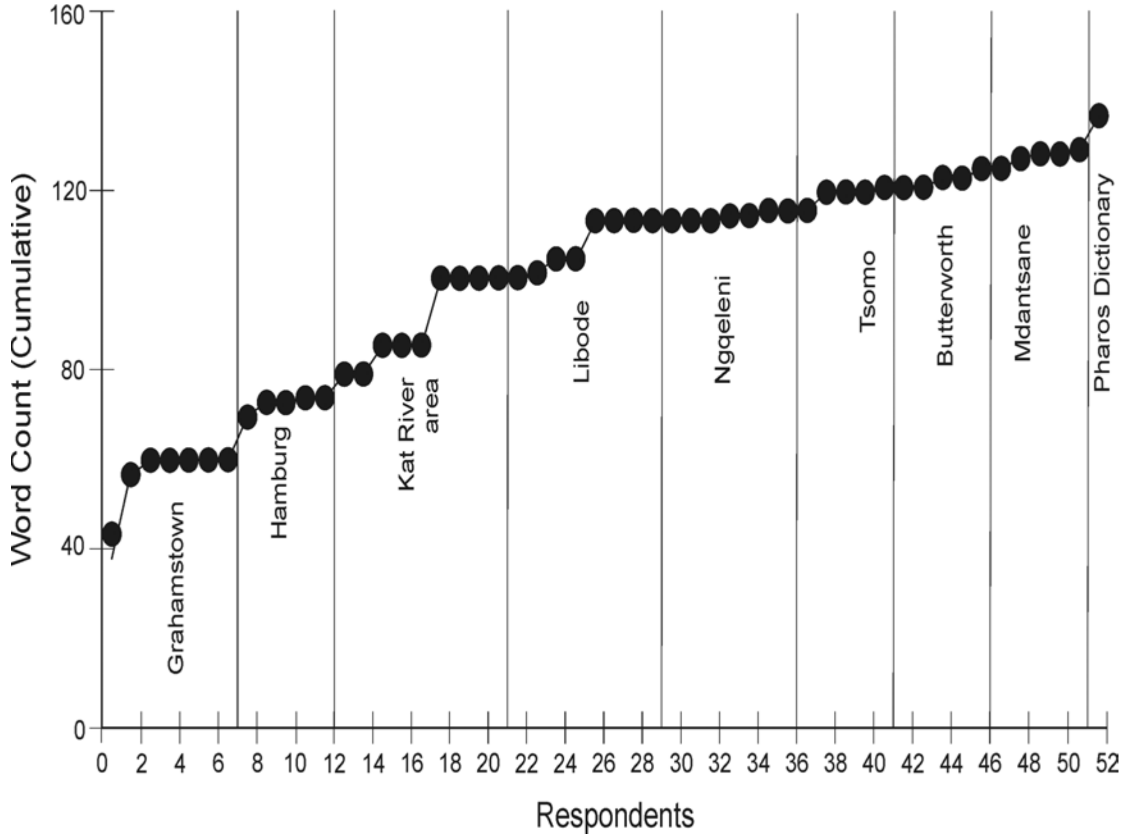

Figure. 4. Cumulative word count with increasing sampling effort, calculated from the original sequence of the sample of respondents. The lines on the graph separate different areas where the data were collected.

Chapter 4

AmaXhosa beliefs regarding insects in the Eastern Cape South Africa.

Introduction

In Africa, there are several cultures within each individual country (Radin & Marvel 1966). Each culture has their beliefs, religions and myths (Southwood 1977 & Miller 1979). Myths vary among African ethnic groups, highlighting similarities and differences in beliefs and the societies' constructions. Animals dominate many myths, suggesting the origins of land, the ability to cultivate the land, and the benefits of the existence on the land (Arnott 1972; Savory 1974). Insects such as bees and praying mantises play their part in myths, but to a lesser degree compared to other animals (Savory 1974).

There has been a change in African attitudes, myths and rituals, which reflects the relationship between people and the insects in their world (Mutwa 1996). These changes are believed to have been caused by contact of African people with other cultures (Silinyana 2000) and the modern world (Fergusson 1999). South Africa is no exception to this trend. For example, many changes and developments have occurred in indigenous languages and beliefs (Adam 2001).

It would be expected that the more people are exposed to different cultures, the more they will tend to lose their own cultural beliefs (Longmore 1958, White & Woods 1980, Mini pers. comm. 2002). Language changes in isiXhosa and changes in the transmission of traditions and external influences from one generation to another might change the isiXhosa speaker’s attitude and perception towards insects. Longmore (1958) and Fergusson (1999) have stated that in spite of the westernisation of the amaXhosa, the people still kept their upbringing. Fergusson (1999) has supported this statement by reporting that amaXhosa people interviewed in the Kat River Valley still applied some folk medicine practices, beliefs and medicine from their forefathers. This leaves the question of whether it would be the same about beliefs regarding insects.

This chapter aims to catalogue amaXhosa beliefs associated with insects in selected areas in order to understand the attitudes of isiXhosa-speaking people towards insects. Such cultural entomology will be of practical use in situations where information about insects must be communicated e.g. agricultural and health services. This will also make communication between subsistence and small-scale farmers, agricultural scientists and extension workers easier.

Materials and methods

Survey

The people who were interviewed for insect beliefs were the same as the ones
who were asked for insect names in Chapter 3.

Analysis

The insect-related beliefs were sorted into three categories: positive, which were defined as those beliefs about insects that make a positive input or are friendly; negative, defined as those that had an unconstructive impact; and neutral, the insects that do not have any real meaning to the people.

The completeness of the amaXhosa beliefs about insects was examined using the some software as was used for dictionary completeness in Chapter 3.

Results and Discussion

There seems to be an enthusiasm about some insects among isiXhosa- speaking people. They learn knowledge about the environment from their interaction with it. This is reflected in their beliefs and rituals and the way they name insects. Twenty-nine insects from the insect names were associated with cultural beliefs and these revealed people's perceptions about insects.

Religious beliefs

The people of Africa, including the amaXhosa people, are traditionally ancestor worshippers (Longmore 1958). These ancestors are referred to as spirits, and a person makes offerings to them. Interviewees believed that they still have some form of communication with ancestors through insects (Table 1). For example, this study found that the presence of army ants informed the house owners to make traditional beer for their ancestors, because the ancestors were thirsty. The arrival of bees that informed the householders to make a sacrifice by either slaughtering a cow or a sheep and also by making traditional beer. This was a way of giving thanks to the ancestors for protection from danger and also for material goods. Abate *et al.* (2000) also idnetifies an African religious point of view about insect significance. For example, the outbreaks of locusts, grasshoppers, and caterpillars were often considered as a punishment for the wrong things that the community had been doing. People in such a village had to give away clothes, food and other things to the poor in order to avoid such outbreaks.

There are cultural differences with respect to certain insects. This is illustrated by the praying mantis, which is well known by Xhosas as "umntwan'ezulu", meaning "a child of heaven" (Mabinza 1985). This creature normally appears to local people just after or before drizzle. Any form of rain to isiXhosa-speaking people is seen as a blessing from the heavens. Also, due to its attractive bright colour, calmness, apparent peacefulness and harmlessness, this creature was admired and thus earned its name. Hence, no one dares to harm it for fear of bad luck. This insect seems to be important in other cultures as well (Savory 1974). For example, the praying mantis in Lesotho is called the "ceroala nkhaona", the "potcarrier", for apparently having worn its head flat by carrying vessels upon its head; the Zulu people call it "Twala Kamba" for the same reason as the Sothos, but also blame it for any shortage of milk at early morning milking time; while Zulu herdboys who have lost a beast at once search for this little insect to point out the direction of the straying animal (Savory 1974).

Customs associated with insects

Insect's deities are also involved with rituals. Army ants and whirligig beetles have associations with puberty ceremonies in amaXhosa communities (Table 1).

Personification of insects

The interviewed amaXhosa people, showed some form of personification of insects. Some Xhosas, especially children, talked to ladybird beetles as if they were talking to a person. They use them to ask for new teeth. Adults reported a similar behaviour when they ask stem borer pupae for directions when they needed to find cows, goats and sheep in the veld. The treatment of bulb weevils also showed personification because children play with them in the hope of getting porridge from it. Such examples of personification of insects seem to be common in other cultures as well. For example, the Hopi of Northern America symbolised insects in the form of Kachina dolls (Wright 1980). This gives a general impression that emotions and context can influence, stimulate, and shape beliefs (Frijda *et al.* 2000). This also showed that some insects are perceived in the context of the place they were found.

Insects as part of magic

Insects are also associated with magic and witchcraft, which is surprising considering their small size (Abate *et al.* 2000). A few insect species are thought to be poisonous by the amaXhosa community such that even the slightest contact with them could cause sickness. For example, chicken lice; stink locusts and pubic lice are considered "send-away" medicines. If a man and his wife were living an unhappy life and the wife believed that the man was no longer interested in her, the signs would be shown by the appearance of chicken and pubic lice in the house and in pubic hair. This was later referred to as "isichitho", which means the medicine for separating two people who are in love. Longmore (1958) also reported that there is "send away" medicine elsewhere in Africa that is believed to cause the separation of two people. Faure (1944) also shown that some insects are used for other things. For instance, the pentatomid *Agonoscelis pubescens* is used as medicine to treat scab disease on camels.

Stink locusts are also believed to cause the instant appearance of pimples that are similar to the ones that were found on its thorax. The appearance of pubic lice also brings a warning sign that one has been bewitched and will have bad luck and that no one will be fond of that person.

Remedies for insect problems

A variety of interesting prophylaxes and remedies are applied against insects by the amaXhosa in the case of outbreak of stink locusts and brown locusts (Table 1). Zimbabwean farmers show similar beliefs by consulting an ancestor for an outbreak of African armyworm, *Spodoptera exempta* (van Huis 1996).

Attitudes towards insects

The beliefs associated with insects show that amaXhosa people perceive most insects negatively because negative associations. This was the most common finding, followed by neutral and lastly positive associations (Table 2). These findings support Hogue's (1987) comment that states that insects are useful for setting a variety of moods, both adverse negative, which was more common, and favourable. Out of 56 insect beliefs collected 27 were negative, 20 positive and 9 neutral (Table 2). These beliefs showed that isiXhosa speakers firmly attach themselves to part of the environment, which helps in conserving and protecting it.

There has been a tendency to believe that a certain animal belongs to a tribe and that the animal's appearance brings fortune to the particular tribe (Mutwa 1996). This is clearly illustrated by the association of a crab in the amaXhosa tribe with the clan name Radebe. Some tribes within the isiXhosa people symbolise the significance of their tribe with insects. For example, the Hlubi tribe sing praises when they see the stink locust (Table 1).

78% of the beliefs are clearly superstitions. For example, when a bedbug is seen on the wall of a house is believed that it will feed on human skin when it. Many beliefs were parallel to reality, for example, eggar moth larvae have a chemical that they emit that can cause a reacton on sensitive skin, and it is also true that no one likes being near someone with pubic lice.

One may wonder if these beliefs about insects are passed on from one generation to another. A later survey of people in the younger generation would be interesting. In this study it has been revealed that amaXhosa people believed that insects can be powerful creatures that can affect human life, whilst on the other hand, they also showed that Xhosas have a sobering, limited appreciation of insects.

Completeness of beliefs

The randomised cumulative curve (calculated from the 999 permutations) of insect beliefs collected showed levelling-off (Fig 1), which confirms the completeness of the sample. The other cumulative curve, calculated from the original sequence of the sample of respondents showed no huge difference on insect beliefs collected from Ciskei and Transkei (Figure 2). To some extent the levelling-off of the curve implies that both these regions are comprised of people that have the same cultural background.

Conclusion

These studies highlighted the fact that even though there have been many changes and developments in indigenous knowledge in South Africa (Adam 2001), people still hold some cultural beliefs about insects. These beliefs reflect both reality about insects and the existence of superstitions. These tend to govern human thinking, especially among illiterate people. The insect beliefs collected from the respondents showed completeness of the sample but most of them had negative associations. The negative beliefs, to some extent, showed those insects are considered as powerful. This of course is not the conclusion, which can be genralised to the whole of South Africa as a country, but only to the study areas and more research needs to done to test how general the findings are.

Table 1: A catalogue of the Xhosa speakers' myths and beliefs about insects. The columns are arranged to indicate the English common name, isiXhosa, scientific names (two columns) and the beliefs.

English name	isiXhosa name	Order	Family	Beliefs
Ant	imbovane	Hymenoptera	Formicidae	> A huge number of ants seen outside the house are believed to bring rain. > An appearance of ants inside the house (especially on the door frame or wall) informs the owner of the house that ancestors are thirsty and the owner has to make traditional beer.
army ant	ubuxhwangu, ubungxwangu, ubugosho	Hymenoptera	Formicidae	> This ant is believed to help in breast development if a person lets it bite on their nipples.
bedbug	incukuthu	Hemiptera	Cimicidae	> It can feed on human skin whilst it is far away from them. For example, the insect will be on the wall of the house and it will be able to feed on a person's skin.

English name	isiXhosa name	Order	Family	Beliefs
bee	inyosi, iqungwane	Hymenoptera	Apoidea	> When one bee appears in a house, it shows that a person is going to have a visitor. > When a few bees appear, they are believed to bring luck into the family. Then the family has to slaughter a goat to give thanks to the ancestors. > A large number of bees inform that a person or a family has to see a witchdoctor. The witchdoctor will tell them that the appearance of the bees is a message from their ancestors, who are in need of traditional dinner such as traditional beer. On the day of drinking the traditional beer, a witchdoctor will have to spill some beer on the floor for the ancestors and make a speech welcoming them in the house. > Appearance of a bee is also a sign of stinginess. This means that a person does not do that much for their ancestors.
blister, oil beetle	ubhatom	Coleoptera	Meloidae	> When women see this beetle, they are about to menstruate. > In the "Hlubi tribe", it tells them that the wife of the house is pregnant with a boy.

English name	isiXhosa name	Order	Family	Beliefs
blowfly, blue bottle	unomkhenkce, udongwane	Diptera	Calliphoridae	> Blowflies in the house bring bad luck such that humans or cows in either immediate or extended families are sick and going to die. When people see one in the house they have to kill the fly or take it out of the house. > A person should avoid it coming to them because it shows they are going to die.
brown locust	umcingwane	Orthoptera	Acrididae	> A treatment and prevention of these locusts is the "inqoloqhwe" dance. Unmarried girls with babies walk naked to the maize fields in a straight line, with a girl with a baby in front and another at the back. No one is allowed to laugh at these girls and if one does, one will get a fine e.g. making traditional beer for the whole community. > When these insects come it will be cloudy.
bulb weevil	umakhulu sidudu	Coleoptera	Curculionidae	> Children play with it hoping that they will get porridge from it.
carpenter bee	ibhungane	Hymenoptera	Apidae	> Some Xhosa clans believe that the carpenter bee gives them good luck and they make praises by calling it “Oobhungane” when they see it.

English name	isiXhosa name	Order	Family	Beliefs
chicken louse	ingolwane, intwala yenkukhu	Mallophaga	Menoponidae	> It is believed that this insect is a "send away" medicine. For example: > When two people get married and the in-laws or any other person in the family happen not like them. If it happens that the chicken lice appear in the couple's house and they end up divorcing or being separated, then they believe that the people who never liked them sent the chicken lice and caused their divorce or separation. The chicken lice were believed to be sent to the couple by the person who doesn't like them so that they can be separated. > When someone wants someone's job it is believed that they would send chicken lice to the person presently having the job. It is hoped that the person will leave their job without a reason.
cockroach	iphela, iphela lasekhaya	Blattaria	Blattellidae	> The house is dirty and needs to be cleaned when this kind of cockroach appears in it.
cockroach	iphela laseNatal, ikokoroshe, iphela-mehlo, iphela-khulu, igxakoshe, igaxothi	Blattodea	Blaberidae	> This kind of cockroach is believed to originate from Durban, Kwazulu Natal.

English name	isiXhosa name	Order	Family	Beliefs
cricket	ikirikitsi, tswitswi, ikritsi	Orthoptera	Gryllidae	> Some Xhosa people believe that this cricket gives them good luck. > Other Xhosa people tell them that they are going to receive bad news. > It indicates coming drought. > Symbolises on-coming rain.
earwig	unozikerana, inkuma, unokhinxa, unominxa, unomadukudwana	Dermaptera	All	> Enters human ears and causes deafness, therefore it deserves to die when a person sees it. > Cause bad luck.
eggar moth, lappet moth	iphuphu	Lepidoptera	Lasiocampidae	> If the caterpillar walks on any person's body the person will have a rash on their body.
knocking beetle, toktokkie	unochristmas	Coleoptera	Tenebrionidae	> People believe that this insect appears only at Christmas time and that it brings Christmas gifts.
ladybird	umakhulu, unoposi, isikhoji	Coleoptera	Coccinellidae	> When children (age of 5-7yrs) lose their first teeth, they have to pick up a ladybird and sing a song to it: "Makhulu, makhulu, ndicela undiph' izinyo". This song means "grandma, grandma, can you please give me another tooth". The children then let the ladybird go and throw the tooth onto the roof of their house.

English name	**isiXhosa name**	**Order**	**Family**	**Beliefs**
leaf beetle	itshungu	Coleoptera	Chrysomelidae	> If people happen to find this insect in their garden, they have to kill it or else the police will arrest them.
longhorn beetle	umzondo omkhulu	Coleoptera	Cerambycidae	> Tells girls they are about to menstruate. > Means very bad luck to the person who notices it.
louse egg/ nit	unomoyi	Phthiraptera	Pediculidae	> Signifies uncleanliness.
louse	idzedze, intwala	Phthiraptera	Pediculidae	> Signifies uncleanliness.
fly maggot	impethu	Diptera	All	> Maggots of all flies symbolise death.
praying mantis	intethe yezulu, umnambezulu, umqathu, mntwan' ezulu, unomncencezulu	Orthoptera	Mantodea	> Brings rain. > Brings good luck. > When a person sees it, they should ask for Christmas gifts.
pubic louse	intwala yehagu	Mallophaga	Phthiridae	> When a person observes a louse in their pubic hair, they have been bewitched and this has been sent, by using African magic by someone who doesn't like them. > A person with this parasite will have bad luck and no one will like them.
small fly	imbuzane	Diptera	All	> Causes sneezing in humans.
stalk borer	intlava, inyiki	Lepidoptera	Noctuidae	> A larva in the village indicates that there will be dew or frost.

English name	isiXhosa name	Order	Family	Beliefs
stem borer pupa	uphunguphungu	Lepidoptera	Noctuidae	> Stem borer pupae are used to find direction. A person picks it from the ground and says to it "Phunguphungu, where are the sheep, cattle and/or goats from home?" This insect will swing its abdomen to point to where to find them.
stink locust	intambanani, intothoviyane, umkhuhlane uxhiphu-xhiphu magwetyana, umasikhabi, ispringani, iqhwangi	Orthoptera	Pyrgomorphidae	> If any person laid a hand on this locust, they will have bad luck. > Cause huge pimples on a person's face from the liquid substance that this stink locust emits. > Brings the sun during drought. > The "Amatolo clan" believe that this insect is their totem animal and they will praise it by saying "ngomchenge, ndlangamandla, amatolo, vumba lembongo liyanuka, intothoviyane" when they see it. > In case of an outbreak of stink locusts, people have to wash their bodies with water and medicine.
whirligig beetle	inkwili	Coleoptera	Gryrinidae	> Helps during initiation by biting the private parts of men. > Used for breast development by biting the girls' nipples.

Table 2: AmaXhosa insect belief categorised according to their cultural significance. Categories are defined in the text. The tick (✔) and hyphen (-) in each column shows presence and absence of relevant beliefs respectively.

Common name	**Positive**	**Negative**	**Neutral**
ant	✔	-	✔
army ant	✔	-	-
bedbug	-	✔	-
bee	✔ ✔	✔	✔ ✔ ✔
blister, oil	✔ ✔	-	-
blowfly and blue bottle	-	✔ ✔ ✔	-
brown locust	-	✔	-
bulb weevil	✔	-	-
carpenter bee	✔	-	-
chicken louse	-	✔ ✔ ✔	-
cockroach	✔	-	-
cockroach	-	✔	-
cricket	✔	✔ ✔ ✔	-
earwig	-	✔ ✔	-
knocking beetle	✔	-	-
eggar moth/ lappet moth	-	✔	-
ladybird	✔	-	-
leaf beetle	-	✔ ✔	-
locust	✔	✔ ✔ ✔	✔
longhorn beetle	✔	✔	✔
louse	-	✔	-
louse eggs	-	✔	-
fly maggot	-	✔	✔
praying mantis	✔ ✔ ✔	-	-
pubic louse	-	✔ ✔	-
small fly	-	-	✔
stalk borer	-	-	✔
stem borer pupa	✔	-	-
whirligig beetle	✔ ✔	-	-
Percent average	20/56 = 16.07%	27/56 = 48.21%	9/56 = 35.71%

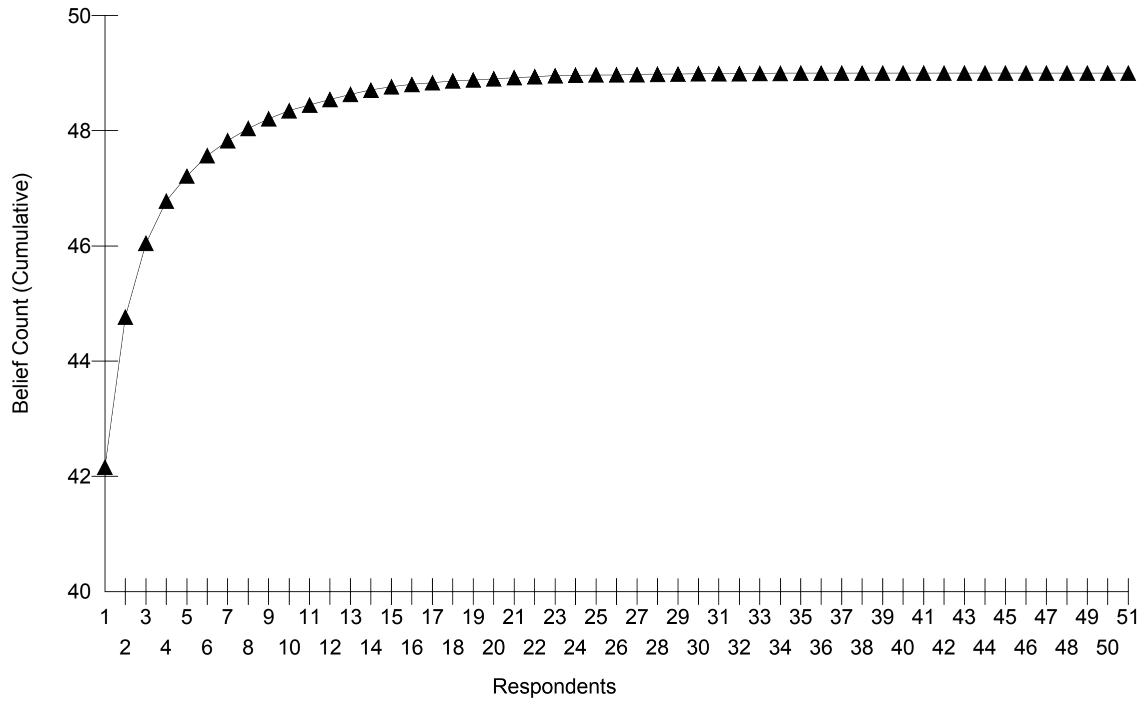

Figure. 1. Cumulative belief count with increasing sampling effort, calculated from 999 permutations of the sample of respondents. This shows that greater effort is unlikely to find new beliefs. The catalogue is therefore regarded as complete.

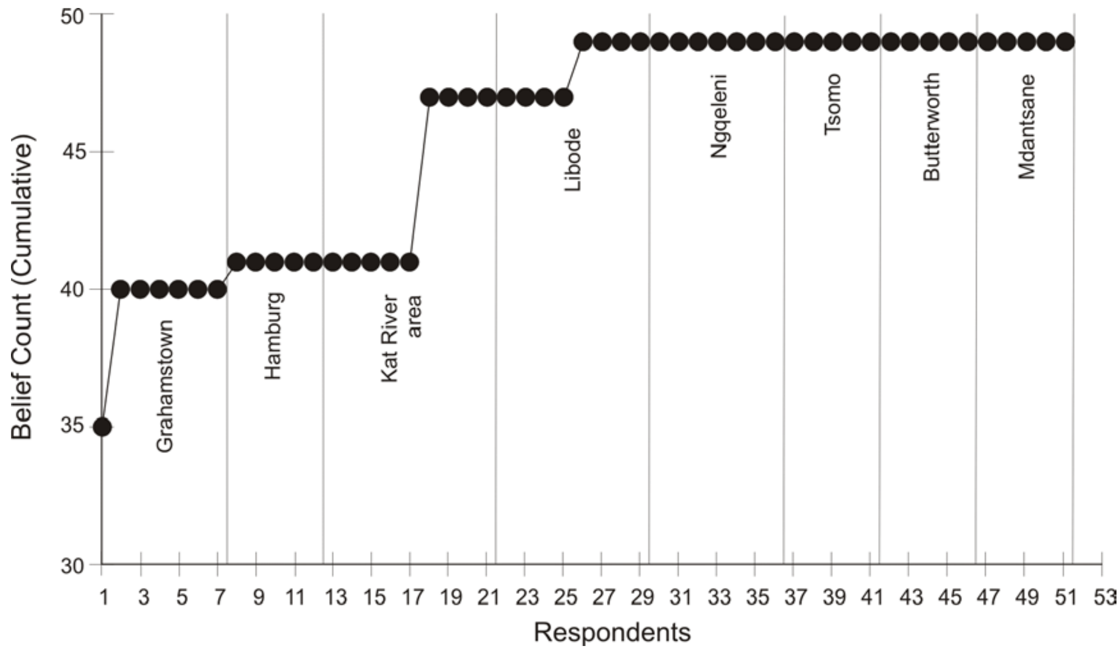

Figure 2: Cumulative beliefs count with sampling effort. This was calculated from the original sequence of the sample of respondents. The line on the graph are dividing the sample area were the data was collected. The curve shows no huge difference of insects' beliefs within areas.

Chapter 5

AmaXhosa farmers' perception about cabbage pests and insects in Eastern Cape South Africa.

Introduction

For the successful implementation of Integrated Pest Management (IPM), it is important to know what the users, in this case farmers, think about the biology of pests, ecology, their social significance and control measures (Hussein 1987, Heong & Ho 1987, Adesina *et al.* 1994). Considerable research has been done on farmers' knowledge about, and perception of, pests in Malaysia, Zambia, Ivory Coast, Nigeria, Niger, the Sahel, Zimbabwe, Central Luzon (Philippines), Lesotho and the Mekong Delta (Vietnam) (Hussein 1987, Javaid *et al.* 1987, Chitere & Molo 1993, Adesina *et al.* 1994, Bottenberg 1995, Youm & Baidu-Forson 1995, Stonehouse *et al.*1997, Chivasa *et al.* 1998, Hoeng *et al.* 1998, Hoeng & Escalada 1998, Ochou *et al.* 1998, Palis 1998, Ebenebe *et al.* 2001, van Mele *et al.* 2001). These studies have been done on pests found on rice, mango, maize, sorghum, legumes, cereal, herbal medicine, cowpea and cotton but not on cabbage. Waage (1996) showed that farmers did not recognize natural enemies of pests.

In South Africa, especially in the Eastern Cape, one of the most commonly and widely grown vegetable by subsistence-large-scale farmers is cabbage (Smith & Villet 2002). It is a dietary staple for a large portion of the country population as well as to subsistence farmers in Grahamstown (Mkize & Villet 2002) so it is important to investigate farmers' knowledge and perception of pests on their cabbage so as to provide more suitable control. The key issue is to what extent their perceptions reflect and parallel the findings of agricultural research (Atteh 1984).

In this chapter, the aim was to understand isiXhosa-speaking farmers' knowledge and perceptions of cabbage insects and pests. This will also make communication between farmers, scientists and extension workers easier.

Material and methods

Twenty six selected subsistence and small-scale farmers from two suburban and two rural areas were randomly chosen for interviews in order to acquire a detailed understanding of their knowledge and perceptions of cabbage insect pests. The people were interviewed individually in isiXhosa.

There were 12 subsistence and small-scale farmers from the suburbs and 14 from rural communities. The two suburban and the rural areas that were used in Chapter 3 (Fig. 1) were also used for this aspect of the study. These study sites were chosen for this chapter for several reasons: firstly, communal cabbage farming activity occurs there; farming activities had existed for 4 years or more and the areas are accessible; and finally, it was speculated that there may be differences in cultural beliefs between rural and suburban dwellers. For example, in the rural areas in Africa, people used to and often still do derive their medicine from herbs, trees, birds, snakes, sand, animal hair (particularly wild animals), animal organs, the genitals of monkeys and baboons, and animal fat (Longmore 1958), whereas the suburban people tend to use Western medicine because they are more likely to be close to clinics and hospitals.

The use of isiXhosa when conducting the interviews helped the isiXhosa speakers to communicate clearly about the insects found on their crops and gardens. The information from the farmers was recorded using a tape recorder after the permission of the interviewees was obtained. Asking for permission from farmers was done because it is important for a researcher to acknowledge and if necessary respect the interviewee's privacy (Denzin & Lincoln 1994). The farmers chosen were over 35 years old because it was hypothesized that they were better informed about cabbage pests, since older farmers will be more experienced in farming and be more knowledgeable about tribal beliefs. Current occupation was also a deciding factor about whom to interview because pensioners would most likely work full-time on their farms and gardens and therefore people who were working elsewhere on a full time basis were not chosen.

Two methods were used with the same farmers to enable them to share their knowledge about pests and other insects, as is illustrated in Appendix B. This was done to avoid bias and to provide cross-validation. First, I used black and white line drawings to investigate if they could recognize graphic media of insects and relate them to the insects they see in their crops and surroundings.

Secondly, I used pinned, preserved specimens of pests and other insects to investigate the farmers' recognition of the object media of insects (Appendix C). The aim of using different methods was to help the farmers identify the insects more easily through acess to two different sources with the hope that these methods would enable the farmers to share their knowledge about pests. The farmers were asked to point out the most damaging pests and to describe how they control them.

Analysis

The data from the interviews were analysed and interpreted in terms of the similarities and differences between the study sites. Following Denzin & Lincoln's (1994) approach, conclusions were based on the individual responses. Log-linear analysis was used to compare the farmers' opinion on IPM versus their locality (suburban and rural). This test was chosen because it makes multiple comparisons for proportions of the sample (Zar 1996). Freeman-Tukey deviates were then calculated to interpret which cells contributed most to the effect.

To compare the farmers' perception of insects between suburban and rural areas, a paired t-test for dependent samples was performed. When the $P<0.05$ then the results were considered to be statistically significant.

Results and Discussion

Farmers' profile

IsiXhosa-speaking people were generous in sharing what they believed about insects, sometimes even before being asked to. The average number of years spent at school in the rural areas was 7years and more, whereas in the suburbs they were 6years and less (Table 1). Only 33.3% of the interviewees in the Kat River were taught extension courses. The courses comprised business management (agriculture), land preparation, and garden maintenance. This shows that training center specialising on the development of IPM, which can be situated in the almost areas is need. Three things caused this low participation in courses. Firstly, since their source of income was from government pensions, the farmers could not afford to pay for courses. Secondly, no course was offered to many of them, and thirdly, courses may have been offered but the farmers were too old to participate. Thus, most respondents had learned the names for insects informally, rather than from formal sources. This shows that the respondents were either illiterate or semi-literate

Knowledge of pests and beneficial insects

Almost all of the farmers correctly identified at least one cabbage pest found in their garden (Table 3). In the suburban area identified pests I general and only 8.3% of the farmers could recognize diamondback moth (DBM) correctly as being a pest, however none in the rural area could. This could also be because DBM makes small, window-like structures on cabbage that are difficult for a farmer to interpret. One suburban farmer even said, “Imigqobho esekhaphetshwini asuka emimoyeni emdaka”. The direct translation means, “The window-like structures on cabbages caused by diamondback moth were from bad air”. They also believed that the lightness of the leaf was due to directly exposing the cabbages to sun light. The farmers also lack knowledge of DBM parasitoids such as *Cotesia plutellae, Diadromus collaris, Oomyzus sokolowskii* and *Diadegma mollipla*. This may be caused by the fact that they are difficult to observe (Bentley 1992) or because their effects were difficult for the farmers to understand (van Mele *et al.* 2001).

Half of the farmers in the suburban areas and 28.6% of those in the rural areas could recognise aphids. Some farmers even referred to them as “umgubo” meaning “powder” and one saw them as “ikaka yamabhabhathane” meaning “butterfly faeces”. This is noteworthy because Ochou *et al.* (1998) showed that Ugandan farmers, who were from rural areas, had little knowledge about aphids on cotton.

All of the interviewed farmers could recognise adult ladybird beetles correctly. Even though it is generally understood by scientists that ladybird beetles are beneficial insects (predators) that feed on aphids (Romoser & Stoffolano 1994), all the farmers considered them as highly damaging pests (Table 3). This was not surprising because Nigerian farmers also considered ladybird beetles as serious pests (Bottenberg 1995). This showed that ladybird beetles are easily detected, but their effect is difficult for the farmers to understand (van Mele *et al.* 2001).

The farmers recognized snails, *Helix aspersa,* in both suburban and rural areas and considered them as serious pests on cabbages (Table 3).

The majority of the farmers identified other insects such as butterflies, cockroaches, ants, crickets parasitoids, mosquitoes, bagrada bugs, fly larvae, earwigs, praying mantis, bees, ladybirds, spiders and all dragonflies as harmful insects (Table 3). The same insects were also claimed to be harmful by peasant farmers from Honduran *campesinos,* the Sahel, the Phillipines, Lesotho and Vietnam (Bentley 1992, Stonehouse *et al.* 1997, Palis 1998, Ebenebe *et al.* 2001; van Mele *et al.* 2001). These may have been considered pests because they are easily observed and can be easily associated with damage to the crop because they fly around and are easy to observe. There were two amaXhosa farmers who confidently said butterflies give birth to "impukane = a fly" and a "umakhulu = ladybird" respectively. They also included a spider, which is not an insect, and considered it a pest. Palis (1998) found similar results in that Vietnamese farmers considered spiders as insects, which are harmful. One farmer from the rural area also interpreted a "ivivingane or ivivane = a DBM adult" as a locust. Another rural farmer said that mosquitoes lay their eggs on cabbages in summer. The farmer might have misidentified a parasitoid. This impression might be due to the fact that in summer mosquitoes lay eggs in the water trapped in the cabbage leaves. The recognition of insects by suburban and rural farmers showed no statistically significance difference (Table 3).

Integrated Pest Management and education

None of the farmers interviewed knew anything about Integrated Pest Management (IPM). The comparison of the farmers' opinion on learning about IPM versus their locality showed that there were more people in the rural areas who were eager to learn about IPM than in the suburban areas and that this difference was statistically significant (Table 2). About 46.1% of the rural interviewees and only 11.5% of those in the suburban areas had interest in being taught about IPM. The reason for the difference could be that people in the rural areas are more dependent on farming and more eager to improve their crop production. They also believe that they were going to learn something new. Hussein (1987) found similar results in that small-scale farmers from rural areas in Malaysia were willing to learn pest control methods such as IPM.

By contrast, 7.7 % of interviewees in the rural areas and 11.5% of those in the suburban did not see the need to be educated about IPM. Two respondents said, “Asifuni kufundiswa ngokuba izinambuzane ezikhoyo kwizityalo zethu ziyafana nezi zazikhona kusekho osombawo bethu” meaning “We do not need training or learn more because the insects are the same as the ones that our fathers used to find on the crops” and “Ndimdala kakhulu ukuba ndingakwazi ukugcina into engqondweni yam” meaning “I am too old to keep anything on my mind now and I have a lot to do in my house rather than attend school”. Even though 7.7% of the rural sample did not see the need to learn IPM, this was still lower than in the suburban sample. This might have been caused by the fact that people in the rural area respect people form outside. Bouwer (2000) stated that it would be useful for learners to see the reward of being taught, thus the people in the suburban area do not know the use of learning IPM.

Escalada & Heong (1993) further suggested that the success of IPM programmes relies on the communication approach adopted. Waage (1996) says biological scientists need to implement IPM and that its application should depend on the community in which it is to be implemented. These studies suggest that the implementation of IPM does not depend only on scientists, as Waage (1996) stated, but also on farmers’ attitudes towards learning new things as well and participating in the IPM process. In this study, small-scale cabbage farmers in the selected suburban areas were more receptive to training than in rural areas.

Control of insects

The farmers use Sunlight liquid soap and Omo washing powder to control the pests on their cabbages (Table 4). These contain surfactants called anionic linear alkyl benzene sulfonates (LAS’s) (Moore 1975). Though there is no evidence that the surfactants work, and Vincent *et al.* (2003) claim that they have a direct and an indirect effect on soft-bodied arthropods. The farmers said that the people in charge of community projects advised them to do so. They also said that they learnt from the media, such as the radio.

The use of chemicals occurred mainly in the rural areas and few of the interviewees used an insecticide in the suburban area (Table 4). The chemicals were applied to cabbages and were not for specific pests. 14.3% of the respondents who used chemicals did not know their names, and farmers who worked on commercial farms mostly stole these. The high use of chemicals in the rural areas could have been due to the fact that Ulutho Training Centre subsidized the farmers and the chemicals were available whenever the farmers needed them. Even though it has been stated in the literature that some pesticide resistance has developed in some pests such as DBM (Chua & Ooi 1986, Eigenbrode *et al.* 1990, Talekar & Shelton 1993, Kfir 1997), some chemicals such as DDT, organophosphates, pyrethroids and carbamates were still used by some farmers.

Wood ash was used to control pests by 60% of the people in the rural area and 14.3% in the suburbs. The high percentage in the rural area was particularly caused by the fact that people in the rural area used more wood for fire. Ofuya (1986), Katanga & Villet (1995), Javaid & Mpotokwane (1997), and Achiano *et al.* (1999) proved that the wood and aloe ash method are used for the protection of cowpea seeds and stored grains. Although the use of wood and aloe ash worked on stored products, it still leaves the question of whether subsistence and small-scale farmers in the Eastern Cape who use it find it efficient on cabbage pests.

The removal of insects by hand from farmers' crops was not important to the farmers because only 14.3% of the farmers in the suburbs and none in the rural areas used it. This may have been caused by the fact that this method involves physical labour, which is demanding, and they would only kill pests that were exposed and visible at the time of assessment (Bottenberg 1995). Abate *et al.* (2000) however stated that farmers removed insects by hand generally in West Africa.

Conclusion

The studies suggest that there is lack of understanding of insects by the farmers and that there is a crucial need for more education about insects in general and IPM in particular, so as to help farmers establish whether they are harmful or beneficial for farmers' crops. The research also showed that most farmers were uneducated and still relied on extension workers for certain decisions about pest control. Zambian farmers suggested that to improve the monitoring of insect pests, they needed more extension workers to visit them and to provide suitable literature with pictures of pests (Javaid *et al.*1987). This study suggests that there should be an understanding that different people perceive things differently and that this needs to be taken into account in developing IPM training methods.

Table 1: Summary of the 26 farmers' profiles in four different Xhosa communities in the Eastern Cape. The brackets in the first row represent standard deviation and in the second row the range.

	Suburban area		**Rural area**	
	Grahamstown	Mdantsane	Hamburg	Kat River
Average age of Respondents (years)	56.8 (± 21.4)	69.5 (± 5.5)	59 (± 11.5)	63.7 (± 10.1)
Average no. of years at school	4 (0-4)	1 (0-6)	7 (5-8)	7 (3-12)
% of respondents in the sample with extension courses	0	0	0	33.3
Sample sizes	6	6	5	9

Table 2: Percentage responses to the question "Do you want training in IPM, with Freeman-Tukey (explained in Table 4 Chapter 3) deviates for a log-linear analysis of Opinion vs. Locality (Pearson Chi-square = 10.283; degree of freedom = 2; p = 0.0059).

	Do you want IPM training?			
Locality	**Yes**	**No**	**Don't know**	**Total**
Suburban	11.5 %	11.5%	77%	100%
	-1.55700	0.503250	1.54186	0.48811
Rural	46.1%	7.7%	46.2%	100%
	1.27623	-0.266579	-2.06384	-1.05419
Total	-0.28078	0.236672	-0.52198	-0.56608

Table 3. Percentage of farmers who were able to identify pests, natural enemies and other insects found on their cabbage crops. Paired t-tests to compare rural and suburban farmers gave the following p-values: correct 0.254, wrong 0.330, don't know 0.677.

	Farmers					
	Suburban area			**Rural area**		
	correct	**wrong**	**don't know**	**correct**	**wrong**	**don't know**
Cabbage pests						
diamondback moth larva	8.3	0.0	91.7	0.0	0.0	0.0
cabbage moth *Trichoplusia richalcea)*	25.0	0.0	75	14.3	7.1	78.6
aphid	50.0	0.0	50	28.6	0.0	71.4
snails (*Helix aspersa*)	58.3	0.0	41.7	57.1	0.0	42.9
bagrada bug	0.0	0.0	100	0.0	0.0	100
locust	16.7	0.0	83.3	0.0	0.0	100
natural enemies						
parasitoids	8.3	0.0	91.7	0.0	0.0	100
adult ladybird	100.0	0.0	0.0	100.0	0.0	0.0
spider	100.0	0.0	0.0	100.0	0.0	0.0
ant	0.0	0.0	100	7.1	0.0	92.9
fly larva (Calliphoridae)	0.0	0.0	100	14.3	0.0	85.7
earwig	8.3	0.0	91.7	0.0	0.0	100
praying mantis	0.0	0.0	100	14.3	0.0	85.7
Other invertebrates						
butterfly	0.0	0.0	100	57.1	0.0	42.9
cockroach	16.7	0.0	83.3	0.0	0.0	100
dragonfly	16.7	0.0	83.3	0.0	0.0	100
bee	0.0	0.0	100	0.0	0.0	100
mosquito	0.0	0.0	100	0.0	0.0	100
earwig	8.3	0.0	91.7	0.0	0.0	100
cricket	0.0	0.0	100	0.0	0.0	100
Average	20.8	0.0	0	79.1	19.6	0.3
Standard deviation	33.8	0	33.8	35.4	0.09	35.4

Table 4: Percentage of subsistence and small-scale farmers in the rural and suburban environments using particular control measures for vegetable pests.

Control Method	**Suburban area** (n = 12)	**Rural area** (n =14)
Sunlight liquid soap	60.1	20
Omo washing powder	18.1	0
Ash	14.3	60
Remove insects by hand	14.3	0
DDT	0	60
Cypermethrin	0	77.7
Methamidophos	0	77.7
Methyl parathion	0	77.7
Parathion	0	22.2
Demeton-S-Methyl	0	11.1
Pyrethrins	0	11.1
Cabaryl/Gamma-BHC	15.4	0
Unknown pesticides	14.3	0
Mean	10.5	26.2
Standard deviation	16.7	32.9

Chapter 6

An evaluation of amaXhosa farmers' recognition of insect graphics and objects.

Introduction

Farmers in places such as Malaysia, Zambia, Ivory Coast, Nigeria, Niger, the Sahel, Zimbabwe, Central Luzon (Philippines), Lesotho and the Mekong Delta (Vietnam) lack an understanding of insects in general (Hussein 1987, Javaida *et al.* 1987, Adesina *et al.* 1994, Bottenberg 1995, Youm & Forson 1995, Stonehouse 1997, Chivasa *et al.* 1998, Ochou *et al.* 1998, Palis 1998, Ebenebe *et al.* 2001, van Mele *et al.* 2001). The results in Chapter 5 have demonstrated a similar problem with regards to subsistence farmers in the Eastern Cape, South Africa. Extension workers and scientists need to teach farmers about insects' biology, ecology and social significance in order to improve the understanding of insects, especially with reference to pest control. The process of teaching farmers involves education, in which communication is fundamental. The quality and form of such education has to suit the targeted community (Dowse & Ehlers 2001). For example, it must take into account the culture, beliefs and attitudes of farmers (Feldman 1976). What methods of teaching will be most effective for a farmer who is illiterate or semi-literate?

Visual media are generally used to help to communicate new technical ideas (Moore & Dwyer 1994). Visual material is mainly used when people need to learn physical concepts such as identification or classification (Moore & Dwyer 1994). Pictures can also be used to attract attention, especially for illiterate and semi-literate people (Burnett 1989, Dudley 1993). There are two categories for effective visual media. These are graphic and object media (Locatis & Atkinson 1984, Moore & Dwyer 1994). Graphic media are identified as pictorial illustrations and object media are the real thing or representations of it.

Scientists need to understand the farmers' opinions on the interpretation of graphic and objects media, which requires skills that are similar to reading and writing. When IPM training is implemented, literacy has to be considered, since it is regarded as a key social indicator of development (Dudley 1993). Technology development and transfer requires scientist and extension workers to learn which methods will be most suitable for the target farmers before they implement them i.e. learning from the people first. Binns *et al.* (1997) highlighted the failure to raise living standards in African rural communities using a rural development approach that arose from a failure to appreciate the indigenous expertise, perceptions, understanding and ambitions of those whom the programmes are designed to assist.

This chapter aims to investigate the understanding of black and white pictures and real insects specimens by a sample of isiXhosa farmers. This information will be of practical use in situations where education about insects must be communicated e.g. agricultural and health services. This will also make communication between farmers, scientist and extension workers easier.

Material and methods

Survey

The same sample of 26 selected subsistence and small-scale farmers in Chapter 5 were interviewed to investigate graphic and object media perception. It was hypothesized that there may be a difference in educational level between rural and suburban inhabitants that might affect the level of understanding of graphics and objects.

Two methods were used with the same farmers to assist them to share their knowledge about pests and other insects. This was done to avoid bias and to provide cross-validation. First, I used black and white line drawings (Appendix B) as a graphic media to investigate if they could recognize line drawings of insects and relate them to the insects they see in their crop and surroundings.

Secondly, I used pinned, preserved specimens of insects as object media to see if the farmers could recognize the object media (Appendix C) in addition lepidopteran larvae were in bottles. The aim of using different methods was to identify the method that will best enable farmers to share their knowledge about pests and thereby to find out which method would most help farmers to learn about insects. The farmers were also asked to point out the damaging pests, checking if they could identify them correctly.

Analysis

The raw data was transformed since it showed that the variances were not homogenous and the data were not normally distributed. An arcsine transformation was chosen because the raw data were in proportions and also because this transformation makes the variance homogenous (Fry 1993). Then a paired t-test for dependent samples was used to check the difference in understanding of line drawings and real specimens of insects on suburban and rural farmers.

Results and Discussion

Difference between suburban and rural areas

The average rate of recognition of insects in both suburbs and rural areas showed that farmers understood line drawings better than the real specimens of insects. The p-values for the difference between suburban and rural understanding for graphic and object media were 0.04 and 0.01 respectively (Table 1). This means that the suburban farmers differ significantly from the rural farmers in their ability to identify insects in both media. It was hypothesized that farmers in the suburbs would interpret drawings better than the farmers in the rural area since their education was expected to be better. These results showed that the hypothesis that the rural farmers would understand line drawings less well was not applicable to the identification of insects. These studies seem to agree with Moore & Dwyer's (1994) theory that line drawings of images were more effective when the study time was limited and more realistic versions could be effective when there was more time to be spent with the learners. On the other hand Mamassian & Landy (1998) claim that human observer view a picture, photograph and or line drawings at first as 3D (object) scene totally and then latter sees them as a true situation. In this case it is possible that the farmers were viewing pictures as object media.

Cabbage pests and natural enemies

The larvae of diamondback moth (DBM), *Plutella xylostella,* were not recognized at all (Table 1). Other cabbage moths' larvae *Trichoplusia orichalcea* were recognized better in object media than in graphic media. This was apparently due to the fact that the graphic media of the moths also showed the characteristic posture of the larvae and the preserved specimens were in a different posture in the bottle. This suggests that the farmers recognise insects based on morphology but also on behavioural information.

In the suburbs, when using both graphic and object media, 64.3% of the respondents recognized aphids correctly and 14.3% did not. The people in the suburbs also showed a difference in the recognition of graphic and object media. Half of the people recognized aphids correctly as object media and only 14.3% as graphic media. Half of the farmers misidentified aphids specimens (Table 1). Ladybirds were recognised by everyone in both areas.

Differences in graphic versus object media

The farmers in the suburbs also showed a significant difference in their ability to recognize graphic and object media. This is not surprising with graphical media because Jahoda & McGurk's (1982) findings demonstrated that black and white pictures are not easy to interpret. Moore & Dwyer (1994) also said that visual skills were not trivial; interpreting photographs is a skill that needs to be taught. It is important to know the ethnic groups in respect of their cultural beliefs, because clear illustration of information could work together with the culture when designing the pictograms, and training on how to read images is essential (Dowse & Ehlers 2001).

The farmers identified insects in either graphic or object media or both. This showed that the recognition depends on the features of an insect that the farmers were looking at. Farmers also showed that they could identify an insect more easily when it was seen at least everyday, and less easily seen even when it was a problem. The ladybird beetles demonstrated this in that the farmers could identify them clearly in both graphic and object media. All the farmers had the same reaction when they saw a ladybird and said, "Esi sinambuzane siyingxaki kakhulu ekhaphetshwini" meaning, "This insect is a huge problem in cabbage crops". The farmers have shown that correct identification depends on the visualization and understanding of external features of an insect.

About 33.3% (graphic media) and 58.3% (object media) of the farmers could identify snails *Helix aspersa* (Müller) correctly in the rural area and 42.9% and 57.1%, respectively, in the suburbs. All farmers identified the snails correctly, which might mean they knew snails very well. Bagrada bugs, *Bagrada hilaris,* were rarely recognized. Only 7.1% of the farmers in the rural area could recognize them. Poor recognition of some pests seems to occur when they are rarely found in cabbage crops. The correct identification of dragonflies was low in the suburbs and none in the rural area. It was only 8.3% (graphic media) and 16.7% (object media) of the farmers who could identify it (Table 1). If farmers have poor identification of insects, then that means there will be poor management of crop.

Conclusion

These studies show that form of presentation is important when dealing with illiterate or semi-literate people. For example, mounting of insects in entomology is not going to be so obvious to a local person and therefore it is suggested that more of the actual live animals on the crop could also be used.

Teaching illiterate or semi-literate people about insects will not be an easy job. It requires a skill just like writing and reading. Even though these studies demonstrated that the farmers interviewed preferred graphic media, I would still suggest that the extension workers from community projects such as Umthathi Community Project should teach the farmers visualize understanding first in both graphic and object media. The use of both media is recommended because some farmers recognized insects in either in graphic and object media or sometimes both.

Table 1: Percentages of farmers who correctly or incorrectly identified the line diagrams or real specimens of insects. The remaining proportion of farmers did not attempt to identify the relevant animal (a "don't know" response). 2D = two-dimensional; 3D = three-dimensional are represented.

	Suburban area				**Rural area**			
	Graphics		**objects**		**graphics**		**objects**	
Cabbage pests and natural enemies	**2D (correct)**	**2D (wrong)**	**3D (correct)**	**3D (wrong)**	**2D (correct)**	**2D (wrong)**	**3D (correct)**	**3D (wrong)**
diamondback moth larva	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0
aphid	14.3	14.3	50.0	0.0	28.6	7.1	28.6	0.0
adult ladybird	100.0	0.0	100.0	0.0	100.0	0.0	100.0	0.0
cabbage moth (*Trichoplusia richalcea*)	85.7	14.3	25.0	0.0	85.7	0.0	14.3	7.1
snails	33.3	0.0	58.3	0.0	42.9	0.0	57.1	0.0
bagrada bug	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0
parasitoids	0.0	0.0	8.3	0.0	0.0	0.0	0.0	0.0
Other insects								
spider	100.0	0.0	0.0	0.0	21.4	0.0	0.0	0.0
butterfly	16.7	0.0	0.0	0.0	78.6	0.0	57.1	0.0
cockroach	33.3	0.0	16.7	0.0	0.0	0.0	0.0	0.0
ant	0.0	0.0	0.0	0.0	7.1	0.0	7.1	0.0
fly larva (Calliphoridae)	8.3	0.0	0.0	0.0	0.0	0.0	14.3	0.0
dragonfly	8.3	0.0	16.7	0.0	0.0	0.0	0.0	0.0
bee	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
mosquito	0.0	0.0	0.0	0.0	7.1	0.0	0.0	0.0
earwig	8.3	0.0	8.3	0.0	0.0	0.0	0.0	0.0
praying mantis	16.7	0.0	0.0	0.0	0.0	0.0	14.3	0.0
locust	16.7	0.0	16.7	0.0	0.0	0.0	0.0	0.0
cricket	16.7	8.3	0.0	0.0	0.0	0.0	0.0	0.0
Average	**24.6**	**1.9**	**16.2**	**0.0**	**19.9**	**0.4**	**15.4**	**0.4**
Standard deviation	**33**	**4.7**	**26.4**	**0**	**32.7**	**1.6**	**27.3**	**1.6**

Chapter 7

Conclusion: Key findings and their relevance

This study did not attempt to develop an IPM strategy but, in general, provided the foundation and constructive information for specific communities in developing the essential IPM communication and training methods for subsistence and small-scale farmers for cabbage crop management.

IPM is defined as the combination of resources to reduce the status of pests to a tolerable level while maintaining a quality environment. These studies have demonstrated that the development of IPM is not crucial in the Grahamstown Township. This is due to the almost non-existence of pest problems; unfavourable environmental conditions created for biological control; the significant existence of cultural control and carelessness in terms of pesticide use. The problems that might be faced in the development of IPM by subsistence farmers and small-scale farmers in the Eastern Cape are further discussed below.

The pest problem

The investigation of pest populations was only undertaken in the Grahamstown area (suburban) as mention in Chapter 1. These findings showed that there was no major pest problem, particularly in terms of diamondback moth, which generally is known to be a serious pest. The periodic farming of crucifers did not provide food all year round for DBM and other pests, thus reducing the risk. These results confirmed Altier & Letourneau's (1982) and Kennedy & Storer's (2000) statements that the population dynamics of pest species are affected when there is no stable environment.

Control Methods

Biological control

The availability of four species of parasitoids of DBM (Chapter 2) in the study showed that good environmental conditions, such as the presence of flowers served as sources of food to attract parasitoids as Idris & Grafius (1995 & 1997) have identified. It is also possible that the parasitoids migrate as well. This symbolises good potential for biological control.

Cultural control of insects

The subsistence and emergent small-scale farmers showed different ways of treating pests on their crops. One of the ways was the use of cultural control for brown locusts, Acrididae (Table 1, Chapter 4). Abate *et al.* (2000) also showed the use of cultural control for outbreaks of locusts, grasshoppers, caterpillars, rats and birds. Although it did not show any significance level of importance, farmers removed insects by hand.

Pesticides use

Another means of control was the use of known and unknown insecticides and detergents such Sunlight liquid soap and Omo washing powder (Chapter 5). Even though there is no information that these worked on cabbage pests, Vincent (2003) claimed that surfactants, which are the main components of detergents, have direct or indirect effects on soft-bodied arthropods.

Knowledge of insects

The farmers revealed a lack of scientific understanding of insects but have traditional beliefs about insects in general. For example, an astonishing feature that they showed was that they considered some insects harmful when they were on their crop, but according to their cultural belief the same insect is friendly (Table 1, Chapter 7, pg 90). A good example was the ladybird beetle that was associated with positive cultural beliefs (Chapter 4) and also considered to be a cabbage pest (Chapter 5). This gives an impression that emotion can influence, stimulate and shape cultural beliefs (Frijda *et al*. 2000), but at the same time this showed that some insects were perceived from the context of the place they were found at.

The poor knowledge that the farmers have, and their limited ways of controlling insects do not allow for optimistism. Though the subsistence farmers in Grahamstown do not seem to need IPM now because of the low presence levels of pests, in future however enhancing the farmers' knowledge of insects might be needed to improve management of crops and increase output. Therefore, it will be helpful to disseminate the information contained in this thesis. The next step to ask is how can IPM be developed and implemented if farmers still have the perceptions, detailed in this thesis, which are often totally different from those of science? These kinds of understanding need to be improved before anything can be done.

Training of farmers

The training of farmers is the duty of extension personel (Matteson *et al.* 1984) and it was assumed that not every extension worker placed in a certain community would be able to speak the language of that particular community. An insect dictionary was formulated (Chapter 3) to meet the needs for the good and effective communication required between extension workers and farmers. The insect name collection showed completeness of the list of insect names and these were collected before the knowledge was completely lost through westernisation. IsiXhosa speakers showed that the insects nomenclature have some set of rules and insects are given names according to their taxonomy, which is similar to the components of biological classification of scientific names (Romoser & Stoffolano 1994). IsiXhosa speakers also showed some uniqueness in naming insects, such as personifying insects.

Matteson *et al.* (1984) stated that it is important to study the attitudes and capabilities of small-scale farmers in helping with the improvement in the design and effectiveness of training. In part of this thesis has tried to make an initial contribution for the developments of IPM for illiterate and semi-literate local farmers (Chapter 6). This was triggered by the lack of understanding of insects by the farmers (Chapter 5). Though graphic media seem to be the better form of media to use, it is suggested that object media also be included when planning to teach subsistence and small-scale farmers. Dowse & Ehlers (2001) claim that pictograms should not be used as the sole communication media because they do not express the level of detail needed. Though it might not be easy, it remains important to try and use examples of the live animals when communicating with the farmers, as well when teaching about IPM. However, it should not ignore that funds for such different types of training and associated equipment might not always be available. It should also be considered that the need for IPM training depends on the extent of the pest problem that the farmers have. It might not yet be that important for subsistence farmers to be trained, as this study (Chapter 2) has demonstrated, because there were no major pest problems but if production is to be increased it will become essential. Bigger problems that the farmers experienced were mainly social such as from neighbours' chickens, goats and donkeys feeding each other crops, poor water services, the lack of seedlings when they needed them and also varying motivation levels.

In conclusion, these studies generally have demonstrated that some solutions in agriculture are like puzzles that need to be joined together to form a bigger picture, as demonstrated in the diagram in the “Thesis Preview” (Chapter 1, Fig 1). When puzzles are joined and one piece is missing, the picture will not be fully satisfactory.

Subsistence and emergent small-scale farmers’ problems are not only pest problems but also involve many other aspects that agricultural scientists and extension workers need to look at. These include matters such as insects’ ecology, perception of insects; indigenous knowledge and cultural background; language barriers; and visual literacy in the development of IPM training methods. The effective training and training methods that can accommodate the literacy of farmers can be prepared. These include uncovering insect-related beliefs by making things clear to the farmers for example; a ladybird cannot possibly bring new teeth. In terms of insect ecology making use of graphic and object media for insect demonstration is important and farmers need to be encouraged to read the outside of the containers of the pesticides on how they use them and also for what types of insects to use them for. It is also important to have handbook of insect names (dictionary) in languages that can be friendly to both the extension worker and the farmer. All these are intertwined by communication. This information will be useful in ensuring long-term agricultural training and sustainable Integrated Pest Management (IPM) and therefore it is crucial.

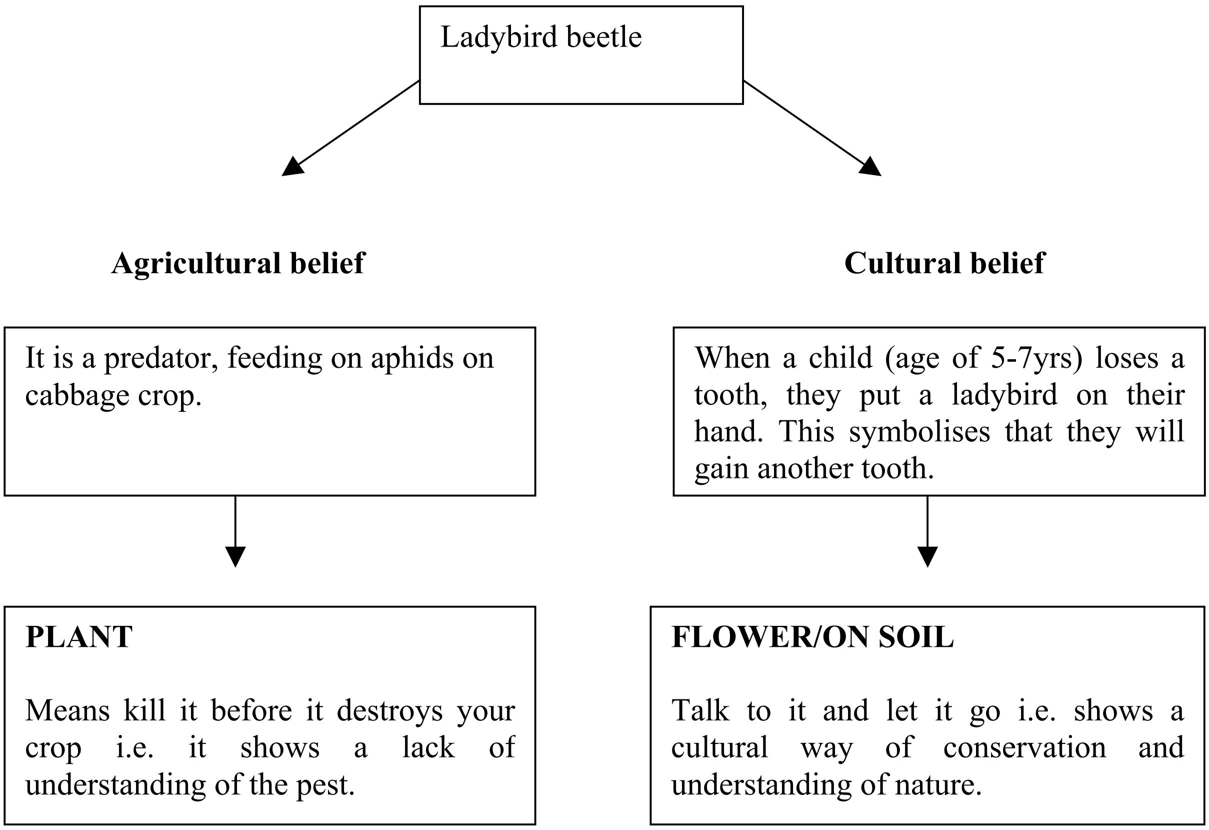

Figure 1: A simplified diagram summarizing Chapter 4 and 5 showing the farmers' perceptions towards insects.

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APPENDICES

Appendix A: List of questions used when interviewing the isiXhosa farmers and people in the Eastern Cape.

1. Location: ____________________

2. Name: ____________________

3. Gender:

Male		Female	

4. Age: __________

5. Family size being supported by fields: __________

6. Is there any person working in the house?

Yes		No	

7. If not, what is your source of food /income?

____

____

____

8. Farming activity:

Full time		Part time	

9. What crops are grown annually? and which are your main crops?

____

____

10. Who take care of farm or garden?

11. Previous farming experiences:

Enterprise	Years
Crop	
Livestock	
Both	

12. How many years have you been growing cabbages?

13. Are you growing cabbages to sell or eat?

	Other (specify)	

14. Do you grow different types of cabbages?		If yes, why?	

15. What do you think affects the quality and quantity of cabbages?

Water		Pests		Finances		Other (Specify)	

16. If pests have damaged your cabbages, what do you do with those, which are completely damaged cabbages?

live them in the field		Burn		Other (specify)	

17. If your cabbages are damaged do you live them in the field?

Yes		No		Other (specify)	

18. If yes, do you plant immediately?	

19. Which of the following pests do you have on cabbages

Method 1(a): Hand-drawn pictures of animals

Cabbage pests	Mark (T/Ξ) in an appropriate box and indicating the time it is mostly available
i) Cabbage moth	
ii) Aphids	
iii) Beetles (e.g. ladybird)	
iv) Diamondback moth	
v) Snails	
vi) Locusts	
vii) Spiders	
viii) Other	

Method 1(b): Preserved specimens of animals

Cabbage pests	Mark (T/Ξ) in an appropriate box and indicating the time it is mostly available
i) Cabbage moth	
ii) Aphids	
iii) Beetles (e.g. ladybird)	
iv) Diamondback moth	

v) Snails	
vi) Locusts	
vii) Spiders	
viii) Other (specify)	

20. Which cabbage pest(s) do you think cause the most problems on your farm/garden?

____

____

21. What control management strategies do you use to control pests on your farm /garden?

Control practise	Mark (T/Ξ) in an appropriate box and also indicate the years that the control have been used?	Indicate if it has been satisfactory or not and if not explain
1. Cultural e.g. use of ancestors		
2. Biological e.g. use parasitoids		
3. Chemical e.g. sunlight liquid soap		
4. Other (specify)		

22. When do you use control practises on your farm/garden?

Application time	Mark (T/Ξ) in an appropriate box.
i) 1st or 2nd week of planting	
ii) 1st or 2nd month of planting	
iii) When you see pests	
iv) Occasionally	
v) All the time after planting	
vi) Other (specify)	

23. What pesticide(s) do you normally use if any?

i)	v)
ii)	vi)
iii)	vii)
iv)	viii)

24. Are the pesticides effective in controlling pests?

Yes		No		Don't know	

i) If not, what do you think the problem is? Explain

ii) If yes, which pests do they normally work on? Explain

25. When applying pesticides do you know or were you told how to apply them?

Yes		No		Other (specify)	

26. Do you have to apply the pesticide more than the recommended application?

Yes		No	

27. Do you know the natural enemies of diamondback moth?

Yes		No	

25. Have you heard of Integrated Pest Management (IPM)?

Yes		No	

i) If yes, have you ever used it and how many years?

28. Education level	i) Number of years in school			
	ii) Can you read: Yes		No	
	If yes, which language(s) do you prefer:			
	iii) Can you write: Yes		No	
	If yes, which language(s) do you prefer:			
	iv) Post-school qualification:			
	where and when obtained:			

29. Did you ever receive any education about the pests?

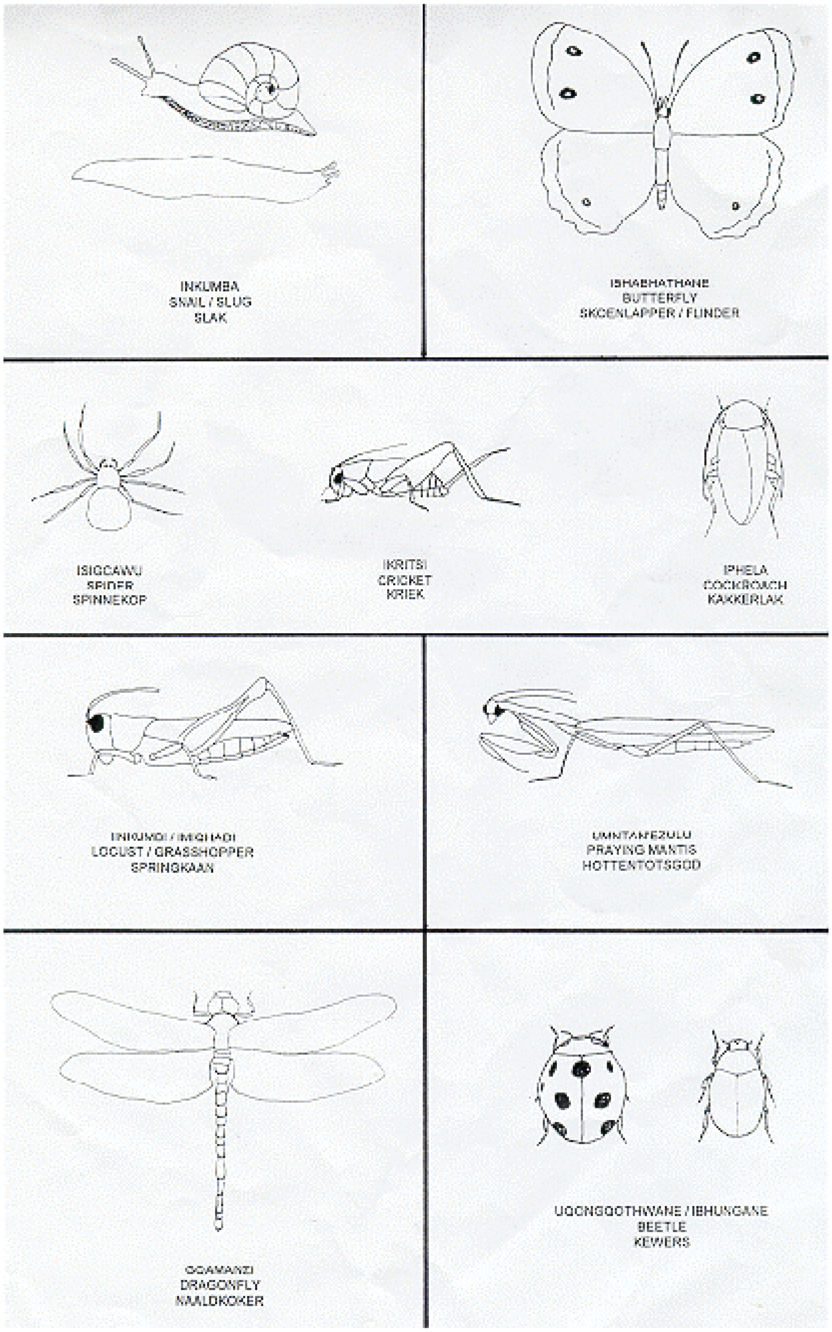
Yes		No	

i) If yes, what kind of training or education (briefly describe):

ii) How often was the education and/training done/ given to you?

30. What is your opinion about the education systems in terms of training farmers on how to control pests?

Appendix B: The line drawings of insects with their names in isiXhosa, English and Afrikaans that was shown to farmers for identification.



Appendix C: The presentation of preserved insects with their names in English and Scientific names that was shown to farmers for identification.