Insects and other invertebrates in Maltese culture and tradition

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Abstract

This thesis explores human/insect relations in Malta. It discusses how insects are culturally embedded in Malta and how human relations with insects and other invertebrates are charged with emotionality. This emotionality determines the concepts of, and relations with nature and the environment as well as the use of insects as a resource. Relations also include the control of useful, noxious and harmful insects as well as the protection and conservation of endangered species. I also investigate how insects are culturally embedded in the Maltese islands by analysing the use of insects in play, language, literature, song, and rhyme as well as their depiction in stamps and coins and how this reflects on the role of insects in contemporary Malta. I also discuss how insects are conceptualised and categorised, their use as symbols, how they shape language and their role in myths, legends and beliefs as well as in various forms of creative arts including their use in tattoos, movies, stamps and coins and how changes in the socio-politics and economy change the role of insects in Malta. Finally I look into the way insects mould perceptions of place, nature and the environment and how insects, particularly the Maltese honey bee and its products, play a role in creating and maintaining Maltese place and identity.

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Introduction

On February 22nd 2019 news broke out that the world's biggest bee had been rediscovered on a little-explored Indonesian island after being lost to science for several decades. The single female, as long as an adult's thumb was photographed and filmed and soon the images were making the rounds of the world's media. Wallace's giant bee became an instant star. This was not the only insect-related news item in 2019. Local and international media regularly feature news reports and features about insects. In the past twelve months alone, there were reports about the decline of insect numbers, invasions by alien insects, mysterious disappearances of honey bees and entomophagy as a solution to food shortages and climate change. Insects also regularly feature in movies, books and art.

Insects are also good conversation topics. Most people readily share their knowledge and experiences about insects. Some talk about their love for insects, others about their fears and insect phobias while many express their concern about the disappearance of aesthetically pleasing or useful insects. In Malta, elderly people tend to talk about the insects that they used to find and play with when they were young and which they do not see anymore. They describe it as a time when there was still a lot of countryside left and most towns and villages were still surrounded by fields and open spaces. Children thought that it was fun to play in nature and with nature. For many boys the idea of fun was to hit the butterflies with a piece of cardboard or wood and place them in a can or box and compete with other boys to see who managed to get the most butterflies. Ladybirds were placed in matchboxes, and crickets were caught in the evening and kept at home for their singing. In parts of Malta, boys used to catch hornets, pass a large needle through their eyes and attach them to wine bottle cork cap to see them going around like a mule turning a mill stone. All the captured insects died within a short time but there were always more to play with.

Today, children rarely play with insects. Most visit the countryside only occasionally and when they do, it is usually on organised trips or with their parents. They hardly ever see any of the insects that their grandparents were familiar with and when they do see them, they probably do not even recognise them. Curious children who show an interest in insects are often told that insects and other small animals are dirty, dangerous or endangered and are warned not to touch them.

Fun has been replaced by fear partly as a result of the media which since the 1950s has produced hundreds of horror films in which insects terrorise humanity and endanger the existence of civilisation which can be saved only by science and technology. The fear-mongering is being abetted by the mainstream media with stories of insect-borne diseases, alien insects and pests that threaten our health, food and wellbeing.

For the past ten years or so some Maltese news portals, sometimes abetted by naturalists/pest-controllers, have been vying with each other to come up with the most frightening stories about dangerous alien insects that are invading the Maltese islands. These include the red palm weevil, the Asian tiger mosquito, and the Oriental hornet. These sensational news features and articles are changing some insects into veritable enemies. The Health Department has even advised those living in the Maltese islands that to avoid contact with the Asian tiger unless they need to go out they should stay inside with all doors and windows closed between dawn and dusk and if they need to go out they should wear long sleeved shirts and long-legged trousers.

Insects play an important role in human life; much larger than one would expect from creatures of such diminutive proportions. They play different roles in different societies and at different times they can elicit love, fear or disgust. For this thesis I investigated the cultural significance of insects in Malta. I chose human/insect relations because of an interest in insects which started in early childhood. From an early age I was already keeping insects, especially caterpillars which I cared for to find out what imago would emerge from its pupa. With my first salary I bought a camera to be able to photograph insects. I have also written hundreds of articles about all aspects of nature including insects and have had a book published on Maltese fauna and flora (Portelli, 2008). This thesis is a continuation of an MA in Maltese Studies dissertation in which I explored the role of commercial insects in Maltese culture and tradition. After finishing my MA dissertation, I decided that there were so many unanswered questions that I should continue my research on human/insect relations in Malta at PhD level.

During the past fifty years growing importance has been given to research about the role of insects in human life. One area of research, ethno-zoology was defined by Bye and Zigmond in 1976 as the area of study that attempts to illuminate in an ecologically revealing fashion human interactions with and relations to their environment. Nabhan (2001) included "any cultural community's means of recognizing linguistically and influencing any fundamental relationship, among plants, animals and their habitats through time" (p. 145) thereby including such plant and animal interactions as that between flowers and their pollinators, seeds and their dispersal agents and larval host plants and their larvae. It is a discipline with roots in the first relationships between humans and animals and looks into the historical, economic, socio-anthropological aspects of these relations. It is thus part of the study of human culture and society. The discipline uses the methods used in both social and biological sciences (Alves & Souto, 2015).

Literature about human/insect relations can be categorised into a number of areas, some of which overlap. A considerable amount of research has been carried out on the emotions elicited by insects particularly fears, phobias and disgust with little actual research on love for insects. Fear and disgust in humans are essential for their survival. Research into these emotions generally focuses on the emotional triggers and mechanisms, with fewer studies on their individual and social impacts and on their cultural significance. Some studies view these emotions via evolutionary and cultural experiences such as Lockwood (2013), an entomologist who did not limit himself to scientific explanations but rendered humanistic accounts and artistic perspectives, inspired by personal experiences, to try and give meaning to these strong emotions which can swing from one extreme to another depending on individual experiences which are often influenced by societal and cultural norms. Reactions to insects range fear and disgust to love.

In most people the extreme emotionally-charged reactions elicited by some insects are driven primarily by disgust which is often camouflaged by and mistaken for fear. Disgust is a strong all-encompassing emotion which McGinn (2011) argued, is unique to adult humans who are aware of the notions of life and death which are implicit in the conceptual underpinnings of disgust. McGinn concluded that "the emotion of disgust plays a vital role in many cultural formations, powering and shaping them" (p.225). For him disgust had an important component in the formation of the human psyche.

Love of insects has been studied by individuals looking among others, at naturalists, professional and non-professional entomologists and beekeepers. The main thrust on this subject is based on Wilson's biophilia hypothesis in which the author expounded the idea that humans have an affinity for life while describing biophilia as "the innate tendency to focus on life and lifelike processes" (Wilson, 1984 p.1). This gives humans an evolutionary advantage. Wilson's hypothesis has been criticised notably because the term 'life and lifelike processes' covers most objects including machines (Lockwood, 2013). Several authors such as Moore and Kosut (2013) have looked at the links of beekeepers with their bees, with some of them immersing themselves completely in the world of beekeeping to better understand the emotional links between the beekeepers and their bees. Basing their work on participatory observation the two authors convincingly argued that the power of bees goes beyond the food cycle and other practicalities as bees are both feared and revered, continuing that how we define, visualise and interact with bees clearly reflects our changing social and ecological landscape.

Another emotion, fear, is also crucial for mammalian evolution as it serves a biologically useful function as it protects from danger and is in fact found throughout the human population (Öhman, 1986). Fear induces an aversive reaction which results in an animal taking flight or to fight (Öhman and Mineka, 2001). Eliminating fear would lead to disaster including the possibility of extinction (Godwin, 1983). On the other hand, phobias are persistent, extreme, and seemingly unreasonable fears which are triggered by particular objects or situations and result in avoidance of dangerous situations. While phobias might appear unreasonable, they probably also have survival value for mammals and perhaps other vertebrates by keeping them away from dangerous situations such as predators and/or their hiding places. This would explain the origin of phobias in humans and why these fears seem unreasonable and beyond cognitive control (Godwin, 1983).

Seen this way one can understand why phobias are extremely common and why the most common phobias, biophobias, are triggered by natural objects (Marks, 1987). While phobias could have survival value for animals they often have a negative impact on human lives. Phobias are socially significant but their effects often lie hidden from public view as sufferers know that their phobias can lead to stigmatisation. Phobias have been studied extensively by psychologists, but their presence in an individual does not necessarily indicate a strong neurotic tendency (Gray, 1971). Several attempts have been made to explain the origins and causes of animal phobias and many experiments have been carried out by psychologists working mostly in clinics and laboratories. The results of these experiments were then extrapolated to real-life situations and in many cases could not be validated externally (Smith & Davidson, 2006).

Some authors have focused their attention on love for insects which are which are considered as a resource. Many species are of inestimable value as they can be both commercial and non-commercial resources especially those which are used as pollinators, as agents of biological pest control, for the production of silk and as food including honey bees and silk worms and persons working with these insects are emotionally linked to them (Lindberg, 1989).

Based on their utility insects have been divided into four categories. The first category consists of those insects which are utilised as a means of production. These include honey bees, silk worms, lac and dye insects and aesthetic insects. The second category consists of insects utilised as food and for therapeutic purposes such as bees, bumble bees and fly maggots. The third category consists of insects used in forensic science and the fourth category consists of insects of ecological importance such as predators and parasites of insect pests and insects used in recycling (Lokeshwari & Shantibala, 2010). A recent addition is the use of insects in recreation and tourism, a subject discussed by several experts in Lemelin (2013). In this work, the authors look at such topics as butterfly watching and dragonfly hunting as well as their connection to larger issues of biodiversity and conservation and provide an interdisciplinary perspective into the industry of insect recreation.

In some societies, insects are an important source of food. Entomophagy represents a traditional food category in many cultures of the world. (Chakravorty et al., 2011) but little research has been carried out on the value of insects as food (DeFoliart, 1997). Things are changing now because population growth and increasing food consumption together with a possible decline in food production because of climate change, the energy crisis, decreasing soil fertility, and an increase in pests and plant diseases are bringing to the forefront the need for insect consumption around the world (Gahukar, 2011). Insects could become an important source of animal protein (Ramos-Elorduy, 2009) and could help mitigate man-made and natural problems including increased food prices, non-availability of foods, lack of purchasing power of consumers, and disparity in food distribution (Gahukar, 2011).

Some insects such as the locust can be gathered directly from the wild while others would require the development of technology to mass produce them (DeFoliart, 1979). Insects rearing is feasible as they can be easily reared in small spaces and in a short period. Edible insects need not be fed grains so rearing is more environmentally friendly than traditional livestock (Oonincx et al., 2010).

Insect eating reflects regional, historical and socio-cultural differences. While some people relish insects others dislike them or find them disgusting (Nonaka, 2009). In areas where insects are abundant they can be mass collected in a short time. During periods of food shortage, particularly in low-income areas, insects might be the only food available (Gahukar, 2011). Sometimes entomophagy is said to be important only to the poor but in reality, people eat insects for their delightful taste and because they enjoy collecting them and as a result in several countries they often have a high commercial value (Nonaka, 2009).

Whether one eats or does not eat insects is important because what we eat defines an individual or group, as it is an integral part of the social identity and psychological ownership of a social group. A community thus depends on the type of environment, locality and the ecosystem in which it is found as this can be either very rich or limited in species that can be eaten (Nonaka, 2009; Ramos-Elorduy, 2009). Food patterns are also determined by rules made by parents, chefs, industry and the all-important mass media. Mass media has an important role in promoting entomophagy in western society while at the same time reducing its prestige in others (Eldouroy, 2009). While what is eaten in a culture does have symbolic value, symbolism is a result of what is eaten, meaning that what is good to eat has more practical benefits than food that is bad to eat. Some foods are hardly worth the effort to harvest and prepare because preparing them comes at the expense of other more advantageous food items. Major cuisines thus reflect the ecological restraints and opportunities in the environment (Harris, 1985). In other words in some parts of the world people do not eat insects because there are no insects to eat especially when one takes into consideration that nowadays, particularly in the western world, there is a surplus of food, food is easily accessible and that it does not require significant energy expenditure to secure it. Furthermore there is a large variety of food available including some foods which are very appealing and calorically denser than any food in nature (Rozin, 2005).

The symbolic value of insects is not restricted to food as symbolism also arises from morphological or behavioural attributes such as those found in bees which are often seen as a symbol of the soul and ants which symbolise hard work. To exploit their symbolic value insects have been depicted in artistic works since early times although depiction in art takes place also as an appreciation of their aesthetic value (Kritsky and Cherry, 2000). Early artists faced technical challenges in depicting details of minute creatures which were overcome with the invention of magnifying glasses and microscopes which saw realistic images of insects and the change from religious to secular art. In the late nineteenth century, the advent of impressionism brought about a resurgence of symbolism which continued with the advent of computer-generated art. Insects are also regularly represented in movies. Initially their appearances were limited to animated movies but as equipment improved live insects made it to the screen often with dramatic impact (Berenbaum, 1995).

A number of authors have looked at human/insect relations from an ethnographic and/or anthropological point of view. Brian Morris (2004) carried out a systematic study of human/insect relations in Malawi. His work provides a comprehensive account of the insect knowledge in Malawi and the role that insects play in the culture and ecology of Malawi. The work is a result of years of participant observations in an insect-rich country where insects have a profound effect on everyday life. In spite of the particular culture and ecology of Malawi, many aspects of the connections between humans and insects are similar to those found in many other countries including so called westernised societies.

Other authors take a different approach when investigating insect/human relations. Hugh Raffles (2010) explores the ties that bind humans with the myriads of insects that live in proximity to humans through a series of essays in history, science, anthropology, economics, philosophy and popular culture. Similarly May Berenbaum (2000) takes a different look at insects as she looks at them first through the eyes of a human and conversely looks at the world through the eyes of insects.

Human-insect studies belong to the field of ethno-entomology which in itself is a branch of ethnozoology. This field of study is concerned with humankind's use of insects in medicine, as food, poison and aphrodisiac, in divination, recreation, myths or sayings as well as about constructions, classifications and experiences of nature. It is also about the knowledge of insects, specifically focussing on their perceived relationship as causes or vectors of diseases (human, non-human animal, plant pests), on the biology and emic toxicity of insects and on collection techniques all of which give rise or are the result of emotions and feelings which have inspired and provoked particular behaviour in humans. In many societies these emotions and feeling are also the result of encounters with other small invertebrates such as spiders, snails, ticks, worms and scorpions which are often classed as insects by non-biologists and as a result many ethno-entomologists include these species in their studies (Kutalek, 2011).

In the 1980s Charles Hogue introduced the term cultural entomology, which he defined as "the branch of investigation that addresses the influence of insects (and other terrestrial arthropods, including arachnids, myriapods, etc.) in literature, language, music, the arts, interpretive history, religion, and recreation" (Hogue, 1987 p. 181). He separated cultural entomology from ethno-entomology which according to him is solely concerned with insect/human interactions in so-called primitive societies. Furthermore, economic or applied entomology which are concerned with survival are not cultural entomology while the study of insects in art and history is considered as cultural entomology (Hogue, 1987).

Cultural entomology investigates the influences of insects on human life as seen through the arts and humanities. Posey (1986) wrote that although cultural anthropologists usually restrict their studies to "advanced" industrialised and literate societies and that these used to maintain that human/insect relations of so called "primitive" or "non-civilised" societies were the domain of ethno-entomology, he did not agree with such an artificial division as it implies an ethnocentric we/they bias built upon assumptions of fundamental differences between 'primitive' and 'civilised' classification and thought. In this thesis, in agreement with Posey, I will argue that no such divisions exist in Malta as human/insect relations do not fit into any simple category but are a complex of emotional interactions embedded within the various cultures found in the Maltese islands. Furthermore two different entomologies, vernacular and technical were found to be working concurrently but independently of each other in Malta.

To investigate these relations, I first explored the emotional aspect of human/insect relations. I love insects. So do others, including many naturalists, beekeepers and entomologists but many people do not. Many are afraid and disgusted by them. Some are so afraid of them that they suffer from an insect phobia. I then explored the keeping, control and conservation of insects. I continued with an investigation of the vernacular entomology which is concerned with the way insects are culturally embedded in Malta through language, literature, art and music as well as the role of insects as determinants of social space.

This thesis is the fruition of a lifetime interest in insects but during the past six years I immersed myself in the insect world. Apart from reading widely I looked at data and observed human interactions with insects under different circumstances.

This research has brought about a new understanding of human emotions in relation to insect life. It focused on the diversity of ways in which the people of Malta relate to insects and other invertebrates including the importance of bee keeping in the history and social life of the people of Malta especially to its contribution to Maltese culture and the sense of identity of the people of Malta.

The thesis is organised in a way that the chapters reflect the main areas of interaction that were observed during the research. The first chapter gives relevant information about the Maltese islands and the people living there. It puts the research within a physical, social, political and historical context. The chapter includes information about the history of the study of insects including technical entomology and the role of NGOs in entomology and insect conservation.

Chapter two is a detailed description of the research design and methodology used in this study while chapter three is an investigation of the various emotions elicited by insects. Entomophilia is a strong pleasurable emotion that is experienced by persons who generally exhibit a love for nature not just insects. Fear and disgust are strong overlapping emotions that have been studied extensively because of their impact on human behaviour. Several theories have been proposed to explain the mechanisms of these emotions. Much of this research has been carried out by psychologists as these professionals often meet persons suffering from the effects of biophobias.

In chapter four I investigate the of keeping, control, and conservation of insects particularly those used as a mode of production as well as the control of harmful insects and finally the conservation and protection of rare and endangered species.

Chapter five is a study of the vernacular entomology that is the way insects are culturally embedded in Malta. To analyse vernacular entomology I discuss the role of insects in language, literature, art and media. I also look at different form of classification including concepts, categorisations and how these influence the way the people of Malta think about insects as well as the role of insects in myths, legends and beliefs and how children play with insects. I also discuss how these changed over time as a result of various socio, cultural, economic and political changes that have taken place in Malta.

In chapter six I look at the way people in Malta produce and experience space via insects and how insects are used to create a narrative of environmental transformation and how they are mediators of various places including places of childhood, regionality, nationality, and locality while the honey bee has spatialized memory, nostalgia, nationhood, and tradition. I also investigate how insect-mediated place, changes in response to changes in the socio-political, economic and natural environment such as with the disappearance of loved insects and the arrival of alien insects. Finally I discussed how the presence of feared and unwelcomed insects outside and inside the home changes the sense of place.

1 Contexts

This chapter is divided into two parts each of which contains background information that provides context to the thesis. Part I provides a brief overview of the geographical, historical, political and social aspects of the Maltese islands while Part II contains a description of the research design and methodology used for this study.

1.1 The Maltese Islands – Land and people

The Maltese archipelago consists of three inhabited islands (Malta, Gozo and Comino) and several small uninhabited islands. The archipelago lies 80 km south of Sicily, 290 km east of Tunisia and 355 km north of Libya. The combined area of the three largest islands is 315.6 km² (Schembri, P. J., 1994). At the end of 2017 the estimated total population stood at 475,701, up by 3.3 per cent when compared to 2016. The population increase was mainly due to net migration (immigration less emigration). The population density was 1,934 persons per km^2.[1] Furthermore over 2.6 million tourists visited the Maltese islands in 2018.[2]

The national language of Malta is Maltese, a Semitic tongue. Unlike other Semitic languages, Maltese is written in the Latin alphabet, with the addition of special characters to accommodate certain Semitic sounds.[3] Over the centuries, the Maltese language was influenced by Romance languages with which the Maltese came in contact with as a result of a succession of southern European rulers. More recently it was also heavily influenced by English which together with Maltese is an official language of Malta. In the past two decades, new groups of foreign nationals from

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1 https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_C5/Population_and_Migration_Statistics/Documents/2018/News2018_107.pdf

2 https://nso.gov.mt/en/News_Releases/View_by_Unit/Unit_C3/Tourism_Statistics/Pages/Inbound-Tourism.aspx

3 Ċ, ġ, ħ, għ, ż.

European and non-European countries, settled in Malta and this has vastly increased the cultural diversity as well as the number of languages spoken in Malta.[4] Most Maltese are Catholic and participate in religious services related to their faith. Although Roman Catholicism is the state religion, freedom of religion is guaranteed by the Constitution. In more recent years both secularisation and minority religions are increasing as many people from various ethnic groups settle down on the island.[5]

In 2012, the land cover of the Maltese Islands was distributed as follows: agricultural land 51.3 %, artificial areas 29.3 %, natural areas 18 %, forest 0.7 % and other 0.6 %. The Maltese countryside is characterised by small-sized and fragmented agricultural land parcels and a diversity of semi-natural habitats. The main human interventions that inevitably contribute to changing the face of the countryside include agriculture, developments outside the development zone (ODZ) and quarry activity. Utilised Agricultural Area increased between 2005 and 2013 from 10,254 hectares to 11,690 ha. Land was used mainly for the cultivation of forage crops. Organic agriculture played a relatively small role in Maltese agriculture with a share of approx. 0.2% (21.27Ha) placing Malta's organic agriculture below the EU average.[6]

Up to April 2018 several protected areas had been declared under the Environment Protection Act including twenty-two Areas of Ecological Importance, forty-one Areas of Ecological Importance and Sites of Scientific Importance, one National Park, three Nature Reserves, thirty-five Special Areas of Conservation (International Importance) and seven Special Areas of Conservation (National Importance). None of these areas was set up specifically to protect insects.[7]

[4] https://eacea.ec.europa.eu/national-policies/eurydice/content/population-demographic-situation-languages-and-religions-49_en
[5] https://eacea.ec.europa.eu/national-policies/eurydice/content/population-demographic-situation-languages-and-religions-49_en
[6] https://agriculture.gov.mt/en/agric/Pages/organicfarming.aspx
[7] https://era.org.mt/en/Pages/Database-on-Designated-Areas-in-National-Law.aspx

The development of natural areas is seen by many as one of the major threats to environment in the Maltese islands. Environmental NGO's have been campaigning for many years to protect such areas by lobbying as well as by organising regular protests and events calling for the protection of the environment.[8]

The Environment Protection Act of 2016 is the main piece of legislation for the protection of the environment. The main aim of this legislation is to protect, preserve and improve the environment, and ensure that the well-being of the environment is maintained. Through this Act, the Minister responsible for the environment is given the power to publish regulations which fall under the Act. This legislation covers all of the thematic environmental areas including waste, water, air quality, biodiversity and nature protection, environmental noise, environmental assessment, amongst others. The Environment & Resources Authority (ERA) is the competent authority for most, but not all, of the Subsidiary Legislation under the Environment Protection Act.[9] A number of insects and arthropods are legally protected through subsidiary legislation. These will be discussed in other chapters.

The Plant Protection Directorate is responsible for plant health including import and export of plants, plant pests, and plant produce. The work of the directorate focuses particularly on the prevention and control of pest species by promoting appropriate measures for their control.[10] Large areas of some crops, especially areas used for forage crops are not treated with any plant protection products. On the other hand, crops such as potatoes and vines are extensively treated. The use of insecticides is an important aspect in citrus and stone fruit cultivation. In fact, 98.7% and 90.5% of the areas treated with citrus and stone fruit are sprayed with some form of insecticide. On average crops received 3.3 insecticide treatments with citrus and stone fruit

[8] http://www.independent.com.mt/articles/2018-06-30/local-news/Demonstration-in-favour-of-the-environment-in-Valletta-6736192745

[9] https://eracms.gov.mt/en/Pages/Legislation%20under%20Environment%20Protection%20Act%20(CAP%20549).aspx

[10] https://agriculture.gov.mt/en/phd/Pages/about_us.aspx

receiving on average 5.0 and 4.4 treatments respectively.[11] Pesticide usage in Malta follows a typical pattern under a Mediterranean climate. Insecticides are used throughout the whole of the agricultural year, although its usage reaches a maximum in the June/July period.[12]

In Malta insects are culturally appropriated in two radically different ways. The two systems, popular and technical entomology are qualitatively different from each other and each has its own value systems. They are based on a different knowledge system and they are not interested in each other.

The two systems are not connected directly but in places where they meet they create friction which was described by Tsing (2005) as "the awkward, unequal, unstable and creative qualities of interconnection across differences (p.4). In this chapter friction appears at various points as the two forms of entomology are discussed.

Vernacular entomology does not need a concept of nature is not based on a universal notion of nature. It uses folk classification of animals which is not based on the Linnaean system of classification. To investigate vernacular entomology I looked at insects in play, language, literature, song, rhymes and myths as well as their depiction in stamps and coins and how this reflects on the role of insects in Malta. To achieve this, I discuss insects in contemporary Malta, including different forms of classification mainly ethno-biological and folk both of which make use of concepts and categories, and how language gives expression to myths, legends and beliefs in insects as well as the ability to discuss insect-related subjects such as weather prediction, belief in spontaneous generation, and symbolism which is especially

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[11] https://nso.gov.mt/en/publicatons/Publications_by_Unit/Documents/B3_Environment_Energy_Transport_Agriculture_Statistics/Plant_Protection_Products_2007.pdf

[12] PLANT PROTECTION PRODUCTS USAGE ON CROPS IN MALTA 2007. National Statistics Office, Malta, 2008

important in prose and poetry. Insects in art are also discussed particularly their use in tattoos, movies, stamps and coins.

1.2 History

The earliest inhabitants arrived in Malta from Sicily. The first concrete evidence of human habitation dates back to around 5,000 BC that is, in the early Neolithic period when humans had already adopted agriculture. Before the arrival of the first inhabitants from Sicily, the islands were probably covered with trees most of which were removed by the Bronze Age Period (c. 2,500 BC) to make way for grazing and agriculture. The initial inhabitants were replaced by other waves of immigrants from Sicily each of which left its mark on Maltese prehistory particularly the Temple Period (3,500 BC - 2,500 BC) which was followed by the Bronze and Iron Periods which lasted till the 7th Century BC when the islands were occupied by the Phoenicians (Trump, 2002). The islands then fell under Punic influence following which Malta was occupied by the Romans and Byzantines (Bonanno, 2005). In 870 the islands were conquered by the Arabs who held on to Malta until the arrival of the Norman Count Roger in 1091 (Dalli, 2006). The Arab presence which lasted until the 13th century left an indelible mark particularly on the Maltese language which developed during this period from a medieval variety of dialectal Arabic. Malta is today the only living vestige of dialectal Arabic spoken on European soil albeit with centuries of influences from Indo-European languages, principally Italian and more recently English. As a result, Maltese and Arabic today are not mutually comprehensible (Borg, A. 1994).

The arrival of the Normans resulted in a cultural and political connection with Sicily which lasted throughout the Middle Ages. During this time the Islands passed through Norman and Hohenstaufen rule, the Angevins and the Aragonese (Dalli, 2006). In 1530 Malta was handed over as fief to the Hospitaller Order of St. John by Charles V, the Habsburg King of Spain and Holy Roman Empire (Cassar, 2000).The

Knights of St John changed Malta in many ways, firstly by transforming it into a European state, modernising it and developing its infrastructure, providing work for the inhabitants. They influenced the Maltese many of whom, particularly those who shared the urban areas with the Knights, adopted various aspects of the Knights' lifestyle. In 1798, Napoleon Bonaparte ousted the Knights and attempted to establish a new form of government which found immediate resistance. This resulted in an uprising against the French and with the backing of a naval blockade by the British fleet the Maltese managed to force the French out of Malta (Frendo, 1994).

In 1813 Malta became a British colony. The British influenced Malta in many ways especially in administration, politics, economy and education but despite their efforts to anglicise the Maltese, they found it next to impossible to entirely replace centuries of Italian influence. This all changed during the second World War when Fascist Italy aligned itself with Nazi Germany against the British and sent aeroplanes to bomb the Maltese islands. By the end of the war the Maltese had changed sides and were more willing to be influenced by British way of life including in the use of the English language. In 1964 Malta became an independent state and began to participate in international fora while developing its manufacturing and tourism industries. In 1974 Malta became a republic and in 1979 the last British forces left the Maltese islands (Frendo, 1994).

On 1st May 2004 Malta joined the European Union (EU). With membership, Malta formally adopted the EU's body of laws which included directives and regulations for the protection of nature and the environment.[13] Malta became a member of the Schengen area on 21 December 2007 and joined the Euro Area on 1, January 2008. Malta is a single-chamber parliamentary republic with a head of government - the Prime Minister - and a head of state - the President - whose role is largely ceremonial.[14]

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[13] https://europa.eu/european-union/about-eu/countries/member-countries/malta_en.
[14] https://europa.eu/european-union/about-eu/countries/member-countries/malta_en

The most important sectors of Malta's economy in 2016 were wholesale and retail trade, transport, accommodation and food services (20.9 %), public administration, defence, education, human health and social work activities (17.7 %) and professional, scientific and technical activities; administrative and support service activities (12.7 %).[15]

Malta is a net beneficiary of EU funds. In 2017 it contributed € 0.082 billion to the EU budget and benefitted from € 0.201 billion mostly in the form of fund programmes and projects including road building, research and environmental protection.[16]

In the past five decades a number of anthropological studied have been carried out in Malta. Most of them have tended to focus on religion and politics. These include works by Jerremy Boissevain (Boissevain, 1964; 1965; 1974 & 2006) as well as studies by Campbell (2008) and Mitchel (2002). Mark Anthony Falzon tackled bird hunting and conservation in Malta (Falzon, 2008 & 2020).

1.3 Technical entomology

Insects have been studied in Malta for at least 500 years. The studies do not take place in a vacuum but within and reflect contemporary society including the socio-political, economic, and cultural environment in which they take place. One of the key characteristics of technical entomology is the use of the scientific system and the Linnaean classification system.

[15] ibid
[16] ibid

In Malta, the scientific study of insects started relatively late when compared to other European countries. Initial observations of insects were made by foreigners who were either visiting the islands or who were living here for some time. In the 19th century a number of British writers were in Malta some of whom wrote about the insects that they observed usually in a casual way. In the second half of the century a small number of educated Maltese started to show an interest in insects and this led to a shift towards a more systematic approach towards the subject. Maltese entomology reflected the socio-political and cultural environment of the Maltese islands as well as beyond including the development of science in particular entomology which as from the early 19th century adopted scientific taxonomic methods. These developments changed the ways humans related with insects and their environment. The development of entomology in Malta followed developments in other parts of the world from where travellers and entomologists visiting Malta originated and with whom Maltese entomologists could communicate in either English or Italian.

The first persons to write about the insects of the Maltese islands were travellers and visitors some of whom lived here for some time as members of the Military Order of St John. One of the earliest to write about the insects of Malta was the French Knight Godehau du Reville who in 1750, in Paris, described a leaf-mining moth to which he did not give a name. This species was eventually described officially and named *Antispila rivillei*[17] by the English entomologist Henry Tibbats Stainton in 1855 (Sammut, 2000). In 1885 Ferdinando Sordelli wrote that in the second half of the 18th century all the vines in the Maltese islands were destroyed by this moth (Sordelli, 1885).

In 1813 the Maltese Islands became a British Crown Colony and several British military and non-military persons lived on the islands for varying periods of time although in the very first decades of the 19th century, British individuals and writers

[17] This species has been renamed *Holocacista rivillei*. It is believed to be extinct from the Maltese islands (Sammut, 2000).

did visit the Maltese islands, some as part of a tour around the Mediterranean or while touring British possession around the world. As a result of these visits several books and articles about the Maltese islands were published in Britain some of which included descriptions of nature including insects. Many of these publications were written specifically to highlight the richness of British possessions or as travel guides and were of a non-scientific nature. One such visitor, William Swainson (1789–1855) was a renowned naturalist and painter with a number of species named after him. Swainson had an interest in nature and as a young man fulfilled his urge to travel by enrolling in the Mediterranean army. He sailed to Malta from where he continued the journey to Sicily where he arrived in spring 1807. During his annual leave of duty he explored Sicily and travelled to Greece and once travelled to Malta His visit to Malta coincided with the appearance on the island of the plague and as a result he was confined for two months in a house in Valletta. During which time he finished his Sicilian and Greek sketches which he used in 1884 for his book that consisted of his diaries describing his travels in Sicily, Greece and Malta in which he noted that while in Malta he saw the painted lady (*Vanessa cardui*) (Sammut, 2000).

For some naturalist visiting Malta, insects were of secondary interest and were just mentioned as an addendum to their work about other aspects of natural history. One such naturalist was George Waring whose main interest was Maltese molluscs. Waring was in Malta from December 1833 to March 1834 spending much of his time searching for marine and terrestrial molluscs. He did collect some insects but his visit coincided with the colder months of the year when few insects could be found. He noted his observations in his book *Letters from Malta and Sicily Addressed to a Young Naturalist* (1843) which was written mainly for a young audience. When weather permitted, he visited bays and coves by boat. During one such trip he landed at Pwales Bay where he visited "a large thriving plantation of young mulberry-trees which had been planted for the purpose of feeding silkworms" (p. 135). This must have been the plantation at Għajn Tuffieħa on land which was leased by the Government to the British Colonial Silk Company in 1829 which was planting thousands of mulberry trees in various areas of the Maltese islands to have a supply of black mulberry leaves to feed silkworms which were being raised to produce silk (Portelli, 2011).

Waring collected some insects, mainly beetles of the genera Carabis, Circulio, and Scarabaeus. He also found several species of locusts, and a large brown mantis. The butterflies he saw were similar to those with which he was familiar in Britain including the clouded yellow (*Colias croceus*). During his stay in Malta he met Dr Elford Leach, a celebrated entomologist, who at the time was living in Pieta'. Leach was in Malta to collect insects and during their encounter he gave Waring information about insects that could be met with only in the warmer months. These included the swallowtail (*Papilio machaon*) and the death's head hawk moth (*Acherontia atropos*), both of which were described as common. Dr Leach never published any work on Maltese entomology as after his stay in Malta he went to Italy where he died of cholera (Harrison & Smith, 2008) although his work here was not entirely wasted as parts of his insect collection were studied by other entomologists including Küster (1849) who received two tenebrionid specimens collected by Leach via a Dr Sturm. These specimens belonged to a new species which he described and named *Opatrum melitense*. (Küster, 1849). This was probably the first publication to mention tenebrionid material collected from Malta. The type material however seems to be lost (Mifsud & Scupola, 1998) and this taxon has never been collected again from the Maltese archipelago (Lillig, Mifsud & Grimm, 2012). Other entomologists also had access to tenebrionids collected from Malta and deposited in various natural history museums in different European cities. These included Flaminio Baudi di Selve (1821 – 1901) an Italian entomologist who specialised in Coleoptera and Heteroptera who examined material deposited at the natural history museums of Genoa and Torino, Italy, from which he described two species and the French entomologist Ernest Allard (1820 - 1900) who described a new beetle from Maltese specimens deposited at the National Museum of Natural History in Paris (Mifsud & Scupola, 1998).

Insects were also mentioned by William Tallack (1831–1908), an Englishman known for his work as a prison reformer. Tallack was in Malta from the end of December to late spring of the following year. On his return to England he published *Malta under the Phoenicians, Knights and English* (1861) which included a description of the islands and some history. The book had a chapter on the natural history of the islands in which he gave a good description of its geology and wild plants while dedicating a only a small section to insects. In this section he mentioned a small number of butterflies namely the bath white (*Pontia daplicide*), which he described as abundantly common at Fort Manoel Island, the clouded yellow, the brown argus (*Aricia agestis*) and the meadow brown butterfly (*Maniola jurtina*). He also mentioned the hummingbird hawkmoth (*Macroglossum stellatarum*) and the silver Y (*Autographa gamma*). He then referred to the locusts and mantises and scorpions which he included with the list of reptiles.

Some years later, naturalist and painter George French Angas, travelled to the Mediterranean specifically to visit Malta and Sicily (Morgan, 1966). He arrived in Malta on 19th September 1841 having left England on 16th August. He left for Sicily from Valletta at the end of October of the same year. He spent most of his days in Malta visiting the countryside and noting the diversity of both terrestrial and marine fauna as well as the flora of the islands. He was particularly interested in insects and kept records of what he saw (Angas, 1842).

Some of his observations are of interest because of the change in status of some species such as the crimson speckled moth (*Utetheisa pulchella*) which at the time was so common that he described it as “the most numerous of Maltese Lepidoptera and in St Paul’s Bay and some other places they are in great abundance that one can hardly thread without raising a whole troop of them” (Angas, 1842 p. 32) which species is now considered as rare (Sammut, 2000). He also recorded the scarce swallowtail (*Iphiclides podalirius*) which is no longer present in the Maltese islands. This species is very common in southern Sicily and if his record was correct it has become extinct since Angas’s visit to Malta (Sammut, 2000). In total Angas mentioned five species of Lepidoptera, unidentified species of dragonflies which he found around fountains in private and public gardens, a cicada, flies and mosquitoes, beetles and at least two species of ‘locust’ with red or pale blue underwings which according to him the Maltese called ‘*farfetta*’[18] (Angas, 1842).

[18] *Farfetta* is derived from *farfet*t [butterfly]. I have never heard this word being used and it is not included in Aquilina (1987).

Andrew Leith Adams, army surgeon with the 22nd Regiment in Malta, a keen naturalist interested mainly in geology. He was more systematic in his approach to nature and as a result left his mark in various fields. He arrived in Malta on June 22nd 1860. He wrote about his researches on the natural history of the Maltese islands giving importance to the geology and palaeontology of the islands. In his book *Notes of a Naturalist in the Nile Valley and Malta* (1870) insects are included mostly as an addendum to the main subject which was the geology and palaeontology of the islands and his book is not usually referred to in entomological works. His most notable entry is the information about migrating locusts which he described as

> Enormous flights of locusts have passed over Malta at different times and although the insect is to be met with usually in gardens and villages in winter, I have noticed them more plentiful during some years than at others. During a south-west wind, on the 14th of March 1861, I observed an unusual flight of locusts on wing among the pomegranate groves in one district evidently migrating. (Adams, 1870 p. 94)

Species noted were "the *Locusta migratoria* as well as individuals of *Acridium peregrinum*[19] of North Africa which may have migrated, but no doubt solitary individuals of these and such like insects, are frequently conveyed on insects to distant lands" (Adams, 1870 p. 94).

Locust arrivals were also mentioned by the Reverend Henry Seddall, Chaplain of the Military Sanatorium at Malta, who included a section on the natural history of the Maltese islands as an appendix of his book *Malta: Past and Present* in which he dedicated less than a page to insects. The section consisted of a list of the major orders and a few lines on each. Under the entry Orthoptera he wrote

> The destructive migratory locust (*Aedipoda migratoria*)[20] occasionally visits these islands, and in numbers that give rise to just cause for fear that the crops would be devoured. In April 1864, if I mistake not, there was such a flight; but happily though they rested in considerable numbers on the

[19] Species could not be determined
[20] *Locusta migratoria*

> ground and on the trees, the main army of them passed on the westward, and occasioned no loss (Seddal, 1870 p. 345).

Migratory locusts were also mentioned in A Handbook or Guide for Strangers Visiting Malta by Thomas MacGill (1839) in which he wrote that many believe that the annual procession from Tarxien to Żejtun by all the Maltese clergy on the feast of Saint Gregory started as a vow for the liberation of Malta from a cloud of locusts.

The Reverend G. N. Godwin, Chaplain to the Forces, dedicated just seven pages of his 1880 book entitled *The Geology, Botany and Natural History of the Maltese Islands* to entomology. Godwin's book includes a chapter on insects which is based on Gulia's *Corso Elementare di Entomologia Maltese* which was summarised with the author's permission and thus added nothing to local entomology (Godwin, 1880).

An important development took place at the end of the 19th century when entomologist started to write about the insects of the Maltese islands. This marked a shift from the works of previous authors who wrote about nature in general and who gave only descriptions of what they observed to systematic writings based on scientific methods which were published in entomological journals. At this point one sees a methodological system of knowledge based on science and measurable data. The early entomologists included Gervase Frederick Mathew who in 1898 had *Notes on the Lepidoptera from the Mediterranean* published in *Entomologist*, Philip de la Garde who had *Mediterranean Lepidoptera* published in *The Mediterranean Naturalist* and Louis B. Prout who in 1903 had *On some Geometridae collected by paymaster-in-chief Gervase F. Mathew, R.N. on the Mediterranean published in the Entomologist* (Sammut, 2000). Another member of the British Armed Forces, Thomas Bainbrigge Fletcher (25 March 1878 – 30 April 1950), who started work as staff paymaster for the Royal Navy was a notable amateur lepidopterist who became an expert in microlepidoptera. His expertise was highly thought of, and this led the authorities to appoint him as the second Imperial Entomologist in India. In 1904-05 he published *A Preliminary list of the Lepidoptera of the Maltese Islands* in *The*

Entomologist. The paper was reproduced in *The Daily Malta Chronicle* in two sections.[21] Bainbrigge Fletcher's work dealt mainly with butterflies and was based on the little previous literature which was available at the time and some of his personal experiences while he was stationed in Malta. In this work he mentions the works of Philip De La Garde and Louis B. Prout and Mathew Gervase. The author noted that although thousands of British personnel had been stationed in the Maltese islands nearly none had been interested enough in the Lepidoptera to write down anything about the subject and he hoped that his work would partly fill this void. As with other works by previous naturalists, the author continuously compared the specimens found in the Maltese islands with specimens of the same species found in Britain and northern Europe.

Some visitors to Malta could not spend as much time visiting sites and countryside as much as they would have liked to because of other commitments but still managed to make interesting observations of the local insects. One such visitor, George Fraser, had a letter published in the magazine *Nature* (1889) in which he commented on Wallace's book *Darwinism*. In the short letter he wrote that he was so busy that he hardly had any time to go around the island but every morning he spent half an hour in the large gardens of the Imperial Hotel in Sliema observing nature. He saw several species of butterfly and hawkmoths in the hotel's garden and noticed that the butterflies found in Malta are "smaller than their English relatives and much less brilliant in colour" (Nature, January 2, 1890 p.199) adding that the larger hawkmoths are similar to those found in England. This was just an observation with no scientific value as it was not based on scientifically collected data but on personal observation which could have been biased and incorrect. He also noted that the butterfly collection of the University Museum had been devoured by mites.

[21] Bainbrigge Fletcher, T. A preliminary list of list of the Lepidoptera of the Maltese Islands. *The Daily Malta Chronicle* (11 & 14 March, 1905).

Other European entomologist included information about insects found in the Maltese islands in their publications without having visited the islands using either museums specimens or repeating (sometimes erroneously) information published by other authors such as W. F. Kirby who wrote the *Manual of European Butterflies* (1862). Kirby wrote that the clouded yellow (*Colias croceus*) and pale clouded yellow (*Colias hyale*) butterflies appear much earlier than they do on the European continent and in Britain although the latter species does not occur in the Maltese islands and according to Sammut (2000) this is a result of wrong identification, a mistake first made by Gulia in his *Corso Elementare di Entomologia Maltese* (1858) and which was repeated by Tallack (1861) and others.

The early visitors wrote about the colourful and charismatic insects especially butterflies and ignored less popular groups such as Diptera, Hemiptera and the Hymenoptera except perhaps for Rondani (1856 - 1880) whose eight-volume work, *Dipterologicae Italicae Prodromus*, included some flies that were found in the Maltese islands which was probably the earliest reference to Maltese Diptera (Schembri, S.P., Ebejer, & Schembri P. J., 1991).

There are few accounts on the Odonata of the Maltese Islands in past literature. Apart from some unidentified dragonflies mentioned by Angas in 1842, the earliest documented records are those of McLachlan in (1899), who listed *Ischnura genei*, *Crocothemis erythracea* and *Sympetrium striolatum* and described them as common species (Degabriele, 1992; Ebejer, Degabriele & Sciberras, 2008).

Adolf Andres's sojourn in Malta was of a different kind. Andres was a German prisoner of war who was held in Malta from June 1915 to February to 1916. He was incarcerated at Verdala barracks from where he recorded 55 species of Lepidoptera and even managed to breed some of them. He also collected several species of Coleoptera although, most entomologists tended to overlook this area of his work. When he left Malta he took the entomological material with him and used them as well as his notes to publish a paper based on his observations in Malta (Andres, 1916). In 1918 Hans Rebel described a new species of moth which he named *Sciopetris melitensis* from Andres's collection (Rebel, 1918).

A small number of Maltese men played an important role in early Maltese entomology. They wrote about their observations and discoveries and left invaluable information about the entomofauna of their time while laying the foundations for future studies. The first Maltese to write about nature wrote for the more educated Maltese and for foreign readers. None of the early writings were aimed for the general readership as was the case in Britain where one could find a good number of books with information about natural history including that of the Maltese Islands. This was probably because of the low rate of literacy in the Maltese islands. The first writings, which were either in Italian or English consisted mostly of lists of species and taxonomic descriptions. In some of these works there are references to collections made by a number of Maltese who never published any works on entomology and whose collections have been lost. These included the collections of Dr F. X. Schembri who was Rector of the University of Malta between 1854 and 1889 whose collection was mentioned by Caruana Gatto in 1891, as well as a Schembri and the Jesuit priest Fr Lebassi (Sammut, 2000). These collections are not considered as important and it is the work of a small number of local entomologists that are considered as milestones in early local entomological studies particularly Gavino and his son Giovanni Gulia, Count Alfredo Caruana Gatto and the brothers John and Paul Borg.

Gavino Gulia was born in Cospicua on June 8, 1835. He graduated as a medical doctor and in 1835 was appointed Professor of Botany, Hygiene, and Forensic Medicine at the Royal University of Valetta as well as the director of the Argotti Botanic Gardens in Floriana (Galea, 1987). His first major work was the *Repartorio Botanico Maltese* (1855) which updated previous works on Maltese botany. He was an active member of several international institutions including the Academia Gioenia di Scienze Naturali di Catania, the Horticultural Society of the Lower Rhine and the Botanical Society and the Society of Practical Medicine, both of Paris (Galea,1987). In entomological circles he is best known for a series of lectures to a class of gardeners which he delivered at the Palace of St Anthony under the auspices of Sir William Reid in 1857. The lectures were published in 1859 in book form entitled *Corso Elementare di Entomologia Maltese*. This work was the first ever that was dedicated solely to the insects of the Maltese Islands. Caruana Gatto (1894) described Gulia's lectures as "nothing but a series of lectures to a class of gardeners under the auspices of Governor Sir W. Reid at the Palace of St. Antonio" (p. 3) on the other hand he acknowledged that Gulia's work was "the first and only contribution to the study of our insects is very useful and it shows that in comparison with the present time much greater importance was attached to and more notice taken of Entomology as applied to Agriculture 40 years ago than is done at the present time" (p. 4).

Gulia was the founder director of *Il Barth*, a journal of medicine and natural history which was published between July 1871 and October 1877 (Galea, 1987). *Il Barth* was mainly a medical journal with several articles in every issue dedicated to the natural history of the Maltese islands. A regular feature was written by Gulia himself on the local flora, a subject about which all medical doctors used to get at least a basic knowledge as botany was included as a subject in the medical course at the University of Malta (Savona Ventura, 2005) and it was only natural that the editor included articles on the fauna such as the molluscs and fishes although no articles about insects were included.

Gavin's only son Giovanni, was born on 11 February 1864. He also studied medicine and like his father had a keen interest in natural history. In 1890 he followed in his father's footsteps and embarked on the publication of *Il Naturalista Maltese* which was meant to fill the void left by Il Barth which ceased to be published in 1877. The *Prontuario di Storia Naturale Maltese* (1889-1890) is considered as the major work on natural history by Giovanni Gulia. It consisted of a list of Maltese names of animals and plants and gives the equivalent scientific, Italian and English names. The entries for insects were copied word for word from his father's published lectures on insects delivered at San Antonio (Appendix II).

Count Alfredo Caruana Gatto was another important contributor to Maltese entomology and although Sammut (2000) described him as the father of Maltese entomology it would be more appropriate to describe him as a pillar of Maltese natural history as he also penned several seminal works on Maltese flora.

In 1891 he published *Prima contribuzione alla fauna lepidotterologica dell' isola di Malta*, a paper in Italian on the Lepidoptera of the Maltese islands in which he noted that no studies of Maltese Lepidoptera had been carried out before because only a small number of species were present and this group of insects was not considered as important fauna. He started to take note of the butterflies during his botanical excursions during which he started to collect specimens. For this study he visited the collections in the possession of R. Briffa and his uncle Michelangelo Caruana Gatto as well as that of Fr Labassi which was held at the University Museum in Valletta. He also reviewed the catalogue of the University Rector, Dr Schembri. In this work he listed 17 species including the brimstone (*Gonepteryx rhamni*) a species which was also listed by Gulia (1858), Bainbridge-Fletcher (1904-1905), and Borg (1932) but which according to Sammut (2000) was confused with the female of the Cleopatra (*Gonepteryx cleopatra*). Caruana Gatto blamed the lack of butterfly diversity on the lack of food plants although considering the plants present he believed that there should have been twice as many species present including the European peacock (*Aglais io*) the southern comma, (*Polygonia egea*), the green-veined white (*Pieris napi*), Southern festoon (*Zerynthia polyxena*) and the black-veined white (*Aporia crataegi*). After this he started collecting beetles and in 1894 Caruana Gatto published a paper, this time in English, *Common Beetles of the Maltese Islands*, which listed and described the common beetles of the Maltese islands. This publication was intended to be solely a springboard for further studies of Maltese Coleoptera. He complained that hardly anything had been written about Maltese beetles with no work or catalogue available and only a few species having been mentioned in entomological works such as Gulia's 1858 lectures on Maltese entomology. He believed that mounted beetles must have existed in the collections belonging to Mr Leach, Dejian, Mamo, Schembri, Prof. Gulia, Father Labassi, De La Garde, Walker and Pool. He complained that no record existed of these collections. In the note he referred only "to those species as are seen by everybody and which may be readily collected" (p. 5). He wrote that the main difficulty was that of identifying his specimens because of the lack of a local reference collection and in fact his specimens were identified by Mr Reitter of Paskau (Paskov, Moravia), an expert on the beetles of the Palearctic, to whom he sent specimens of every species collected. In this note the species were arranged according to the time of the year when they could be found. One hundred thirty-five species are listed in this work. He finished his work by appealing to others to continue with the study of beetles and not to stop before the research is completed as such a study would contribute to the knowledge of beetles in the Mediterranean region. He himself continued with his studies of the coleopteran fauna and in 1907 he co-authored and published *A List of the Coleoptera of the Maltese Islands* in the *Transactions of the Entomological Society of London* with the English entomologist Malcolm Cameron (1873 – 1954). This was a more comprehensive list of Maltese Coleoptera which Caruana Gatto believed included a good percentage of the Coleopteran species of the Maltese islands. It was the first and up to now the only published list of beetles of the Maltese Islands.

In 1925 Caruana Gatto updated his list of butterfly records which he published in the *Archivum Melitense*. This consisted of butterfly records that had not been included in his previous publications and included records of rare sightings (many considered as erroneous by Paul Sammut). Caruana Gatto postulated that many of these butterflies arrive here on windy days (Caruana Gatto, 1925a). In the same year he also published a paper in which he discussed a decrease and even disappearance of several insect species in bays at Marsa, Marsascala and San Giorgio in Birżebbuġa, localities he visited every year. At Marsa he blamed the change on the amount of water flowing down from higher lands through Wied il-Kbir and Wied is-Sewda which changed the vegetation with the result that insects disappeared. At other bays he blamed a tsunami which inundated the coast on the 28 December 1907 as a result of the great earthquake of Messina, when the sea moved out and when it came back it brought with it copious quantities of mud which covered everything and destroyed all insect life (Caruana Gatto, 1925b).

Another important figure in Maltese entomology, John Borg, was at his time the most renowned of Maltese botanists. He was superintendent of agriculture, professor of natural history at the University, and director of the Botanic Garden in Malta from which posts he retired in 1933. After his retirement he continued with his interest in natural history and agriculture up to his death on May 4th 1945 (Turril, 1945). John Borg was first and foremost a botanist and his entomological work was mostly related to insect pests particularly scale insects, a number of which had recently appeared in Malta and were becoming serious pests. Borg introduced a number of insect predators to control the introduced species such as the vedalia beetle (*Rodolia cardinalis*) which feeds on the cottony cushion scale (*Icerya purchasi*) (Borg, John, 1922a, 1932a, 1939).

John's brother Paul Borg was Malta's plant pathologist a post he occupied from 1920 to 1935. He followed his brother in many fields and like him wrote a book on the scale insects of the Maltese islands, a group of insects which he considered as important because of the harm they were causing to agricultural and ornamental plants (Borg, P., 1919). The book consisted of information about each species recorded in the Maltese Islands with information about their biology, the harm that they cause and ways of controlling or eliminating them, an aspect he dealt with in depth in the final two chapters, one about their natural enemies and the other about their control using direct treatment particularly by means of fumigation and spraying.

In 1932 Paul Borg published *The Lepidoptera of the Maltese Islands*. In its foreword he wrote about the arrival in the Maltese islands of new species of Lepidoptera which was inadvertently being imported with damaged foods and diseased fruits. Although most of these species failed to establish themselves, soon after arrival they multiplied in such profusion that they caused alarm even to the general public such as happened at the end of August 1919, when large numbers of moths used to be seen flying around lamp posts every evening both in the towns and in rural districts.

> So large was the number of these moths that by placing a large cardboard box under a gas lamp, on one occasion, no less than 660 moths were collected in two hours, the moths having partly burned their wings in the

> flame and fallen into the box. On examination these moths were found to be of five different species vis: farinalis, kuhniella, interpunctella, granella and ceradella.[22] The origin of these moths could easily be traced to imported cereals which were being disposed of during that month. (Borg, 1932 p. IV)

Borg's book on butterflies listed 28 butterflies and 158 moths. Paul Sammut believes that fourteen of the butterflies listed by Borg were mistakes as they do not occur in the Maltese islands and have not been found in any collection (Paul Sammut, personal communication, 1 May, 2018) which might be true for some species but not necessarily for all of them as insects can and do change their status.

At the end of the Second World War a new generation of Maltese naturalist started to become active. This was the result of better education and the more widespread use of the English language which made scientific writings in English more accessible and opened the possibility of correspondence with more foreign naturalists (Guido Lanfranco, personal communication, 23 November, 2013).

The foremost amongst these was Anthony Valletta. A teacher by profession and a keen lepidopterist, Valletta was very aware of the threats that insects were facing in Malta. Valletta shared his love for nature with the reading public and school children and left an indelible mark not only on many upcoming naturalists but on school children such as an elderly man whom I met in Gozo who remembered Valletta as a teacher who used to urge children to collect butterflies and preserve them between the pages of a book.

Anthony Valletta was born on 21st December 1908. He joined the Education Department as a teacher in which department he continued to work as school head

[22] *Pyralis farinalis*; *Ephestia kuehmiella*; *Plodia interpuntella*; *Nemopagon granella* & *Sitotroga cerealella*. All species are still present in the Maltese islands and all except the last are common or very common.

and eventually as an education inspector till he retired. Valletta was interested in butterflies and moths from a very young age and at six years of age he was already breeding silkworm caterpillars. As he grew older, he started to collect caterpillars from nature and embarked on a life-long quest for knowledge about the Maltese lepidopteran fauna. Gradually his interest in nature developed into love and a strong urge to share this love with others to try to make them love nature the way he did. Valletta was the first of a number of teacher/naturalists who use their skill and profession to create an awareness about nature. He wrote a large number of popular articles and for many years produced educational programmes on Rediffusion[23] about nature for school children. When he became headmaster at Ħal Luqa Primary School he proposed to the director of schools that children should be taught natural history so as to learn about nature and start to love it. He also suggested that the children should start growing plants in the school grounds. This proposal was agreed to, and a gardening expert who had just arrived from a course at Kew Gardens in the UK was loaned from the Department of Agriculture to the school to help with the project (Valletta, 1983). Valletta's first two articles were published in *Il-Bidwi* [The Farmer] and were written in simple Maltese as they were aimed at the farming community. He also sent letters for publication to the Times of Malta.[24]

In many aspects Valletta was well ahead of his time particularly in Malta where for many years he was the only Maltese person interested sufficiently in nature to write about it. Carmelo DeLucca (1916-1971) was another post WW2 amateur entomologist, although he was less known outside entomological circles than Valletta and who did not have the same impact on the Maltese public that Valletta had. DeLucca was a medical doctor who graduated in medicine in 1943. In July 1967 he was appointed Assistant Curator of the Natural History Section of the National Museum and on the death on the 3rd October 1970 of Professor H. Micallef who at the time of his death was curator of the section, De Lucca took over this role (Gauci,

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[23] A wired broadcasting sound transmission system that was found in most homes and in every classroom.

[24] Times of Malta) Butterfly find. (23 March 1948) &. Rare butterfly (1952 April 13).. The Sunday Times of Malta (13 April 1952).

1971). DeLucca carried out several studies on Maltese birds and published his results in several papers and books (Gauci, 1971).

In 1964 Malta became independent from Britain, a change that had a profound impact on the politico-socio environment as well as on the natural environment both of which had an impact on insects as the changes brought about a greater interest in technical entomology as well as increasing pressure on the countryside which resulted in a decrease in habitats, fauna and flora. These conditions provided the right conditions for the start of an environment movement. Two nature organisations were set up both of which were important for the creation of a greater awareness about nature and the need for its protection. The impetus for these changes was a higher level of education that started at the end of World War II and the resultant creation of a new middle class with more free time and disposable income. An important catalyst for these societies was the settling in Malta of a number of British expatriates who joined and supported them financially, by providing overseas contacts and by sharing their expertise in the running and management of such societies. Without their support, it would have been difficult for the two fledging societies to grow and become active in the way they did in such a short time (J Sultana, personal communication, 3 April 2011).

Guido Lanfranco was another teacher who spent a lifetime teaching and writing about various aspects of the natural environment including insects. Lanfranco's main contributions to insects and natural history in general was when he set up the Natural History Society of Malta as well as his large number of articles about nature which were published in several newspapers, magazines and journals. In the 1970s Lanfranco wrote several articles about various entomological topics in the Maltese Naturalist, of which he was the editor and later in the Central Mediterranean Naturalist which like the previous journal was published by the Natural History Society of Malta. An interesting article categorised the insects found in our homes on their value to humans. For Lanfranco these insects were friends, foes or neutral. While this is a typical anthropocentric view of nature that is mainstream in most societies, how insects are classified depends on both society and individuals and this changes over time and space as well as on the cultural values and environmental awareness.

Joe Cilia, one of the more active members of the NHSM, started writing about different groups of insects in 1972. His articles appeared regularly in *The Maltese Naturalist* which was published by the NHSM and eventually in another NHSM publication *Potamon*. Cilia studied mostly Coleoptera and his major work was the chapter on this group in *The Red Data Book for the Maltese Islands* (Cilia, 1989). Another entomologist, Paul Sammut specialised in Lepidoptera. In 1982 he published three articles in *Potamon* and in 1983 took a leap forward and sent a paper for publication in a foreign entomological journal. Since then he has continued writing regular papers in foreign journals. Together with Anthony Valletta he contributed the chapter on Lepidoptera in *The Red Data Book for the Maltese Islands* (Sammut & Valletta, 1989). In 2000 he authored *Il-Lepidoptera* which formed part of the encyclopaedic series on Maltese culture *Kullana Kulturali* which were published by PIN and is presently working on an updated checklist of Maltese Lepidoptera (Paul Sammut, personal communication, 26 June 2015). The publication of *Il-Lepidoptera* was an important milestone as the *Kullana Kulturali* series was part of cultural and linguistic revival and through it insects became part of the Maltese national heritage mostly because of the inclusion of butterflies and moths in this series, insects became part of Maltese culture and as a result the language of entomology made its way to the Maltese language.

In 1962 Guido Lanfranco was involved in the setting up of the Malta Ornithological Society (MOS), which has since changed its name to BirdLife Malta and the Natural History Society of Malta (NHSM) which is now known as Nature Trust (Malta). The two societies organised regular activities that brought together people who had an interest in nature but the biggest contribution of the two societies was the printing of a large number of publications for members and the public. Many members of the NHSM who were interested in entomology took up insect collecting as a hobby and eventually made important contributions to local entomology mainly by publishing papers and articles about new insect records, new species and observations about the behaviour of several species.

The members of the first Maltese societies such as the Malta Historical and Scientific Society which was set up in 1910, when the standard of living and the level of education of the Maltese were much lower than they are today belonged mainly to the professional class. Meetings and publications were either in Italian or English but not Maltese which excluding a large percentage of the Maltese population from participating in their activities. The primary objective of this society was to promote the study of history and archaeology of the Maltese islands and of other scientific subjects of local interest. The society issued a quarterly journal, *Archivum Melitense*, in which there was a record of the work of the society as well as papers or a summary of papers read before the society.[25] In all, five articles on insects were featured in the journal, two by John Borg and three by Caruana Gatto.

In 1962 two nature societies, The Malta Ornithological Society (MOS) and the Natural History Society of Malta (NHSM) were set up. The setting up of the two societies was possible as both the economy of the Maltese islands and the level of education of the Maltese were much higher than they were in the Pre-World War Two period. This resulted in more disposable income and more literacy both of which are necessary for the functioning of membership-based NGOs. The setting up of the societies was also possible by the presence in the Maltese islands of a number of English settlers who were mostly well-off and better educated who supported the new societies both financially as well as through their expertise in various areas including the running of NGOs and by providing contacts with foreign naturalists. Both societies published regular magazines and journals as well as newsletters which carried information both for technical and non-technical readers. They also cultivated an interest in various fields of natural history which resulted in a number of very keen naturalists with an interest in entomology.

[25] *Archivum Melitense* Vol 1 January 1910

The Natural History Society of Malta was active in the fields of research and conservation and was responsible for the publication of several nature magazines and journals. In 1998, the society joined forces with two young NGOs, Arbor and Verde, to form a single more effective association which was named Nature Trust (Malta). In June 2001, another organisation, the Marine Life Care Group also joined Nature Trust (Malta).[26] In 1998 The Entomological Society of Malta (ESM) was formed that focused solely on insects.[27]

The three main nature organisations produced publications which included various numbers of popular and scientific articles and papers related to the insect fauna of the Maltese islands. The Society for the Study and Conservation of Nature had a number of cyclostyled newsletters for members that contained mostly information about events and activities with little if any information about nature.

In 2002 BirdLife Malta together with Nature Trust (Malta) published the Wildlife of the Maltese Islands (Sultana & Falzon, 2002) which included a chapter on insects written by Stephen Schembri. In 2018 BirdLife published a book on the dragonflies of the Maltese Islands by Charles Gauci. This was the first entomological publication of BirdLife. When asked why BirdLife Malta decided to publish such a book Mark Sultana, the society’s Chief Executive Officer said that the society’s members wanted publications that did not deal solely with birds and when the opportunity came up they went ahead and published the book.

Nature lovers often strive to share their love for nature with others who do not have a similar interest in nature. Insect collectors show off their collections and share information by giving lectures, writing and illustrating articles, leaflets and books about nature. Nature photographers also share their passion for nature by exhibiting their pictures.

[26] Central Mediterranean Naturalist, 3, 3. 2001.
[27] Bulletin of the Entomological Society of Malta. Volume 1 (2008)

Gavino Gulia's lecture to a group of gardeners at San Anton Palace in 1857 was probably the first non-academic lecture on insects in the Maltese islands and the publication of the same lecture in the following year was also the first of its kind. The publication was in Italian but it is not known whether the lectures were delivered in Maltese or Italian as at the time it was unlikely that gardeners were fluent enough in Italian to be able to understand the lectures if they had been delivered in Italian. Similarly, the publication cannot be said to have been aimed at the general public as most Maltese at the time were illiterate and Italian was understood only by members of the professional class and the clergy. The same could be said about articles and pamphlets about insects of agricultural importance which although written in Maltese would not be read by the farmers themselves because of their level of education but which might have been read to them by a literate person such as a priest.

Society has changed considerably since the 1960s with new technologies which have continued to make enthomology more popular and accessible being developed. These include insect photography and the Internet have become important tools in entomological research as well as an aid with which to raise awareness about insects and conservation. In 1996 I started to write weekly articles on Maltese nature, which was illustrated by photographs in the Times of Malta which included regular articles about insects.[28] I eventually set up a blog in which I uploaded the articles and photographs.[29] Guido Bonnet also used nature photography to share his love for nature. He published a number of books on Maltese nature (Bonett, 2005a; 2005b; 2017). Albert Gatt Floridia started to photograph insects when he retired from work. He started posting pictures on several nature and photography websites.[30] As he was not an entomologist and could not identify insects, he started to post images on websites were experts in various fields assist nature lovers and photographers by identifying the species in the images (Albert Gatt Floridia personal communication, 5 May 2013).

[28] Articles appeared in the Times of Malta from June 1996 to November 2016.
[29] Blog Maltese nature (http://naturalmalta.blogspot.com/)
[30] http://www.pbase.com/agfloridia; https://www.flickr.com/people/albertgattfloridia/; http://www.maltawildplants.com/fauna.php

These exchanges and cooperations were possible because just as the setting up of nature societies brought together people interested in insects from around the Maltese islands, the development of the Internet is linking together people interested in nature from all around the world. This is providing new opportunities for the exchange of information, and is facilitating contact with persons from around the world who share the same interests as well as with specialists who help with identification of difficult species. The web is also giving the possibility to insect photographers to share their pictures with others. This has helped to increase the popularity of insect photography as can be seen by the increasing number of persons joining Facebook pages dedicated to insects and other specialised websites such as the Facebook page Maltese Entomology and Wildlife which in August 2018 had over 1900 members[31] as well as other pages and sites.[32] [33] [34]

Some entomologists are now using photography as a tool for insect identification and to keep records of their sightings. Charles Gauci (2018) had a book on Maltese Odonata published by BirdLife Malta. The book contains many pictures of various stages of all the dragonflies and damselfly of the Maltese Islands. Gauci relied completely on pictures for his records and admitted that he feels sorry when he sees others catching dragonflies to pin them there nowadays this is no longer necessary to study dragonflies (Charles Gauci personal communication, 9 September 2017).

An important development in insect taxonomy is the analyses of DNA which can result in accurate identification to population level. An exercise carried out on a small group of insects, the butterflies, has shown that a number of them had been misidentified and the list of Maltese butterflies has recently been revised. A DNA analysis of Maltese butterflies was carried out at the Institut de Biologia Evolutiva in Barcelona and the University of Malta. Some of the findings were published by Louis Cassar in a revision of the butterfly fauna of the Maltese Islands (2018). As a

[31] https://www.facebook.com/groups/432445020266183/
[32] https://www.facebook.com/groups/432445020266183/
[33] https://www.facebook.com/WildlifeThroughTheLens/
[34] https://www.facebook.com/groups/990846607667212/about/

result of this analysis a number of butterflies occurring in the Maltese Islands were found to have been wrongly identified (Cassar, 2018).

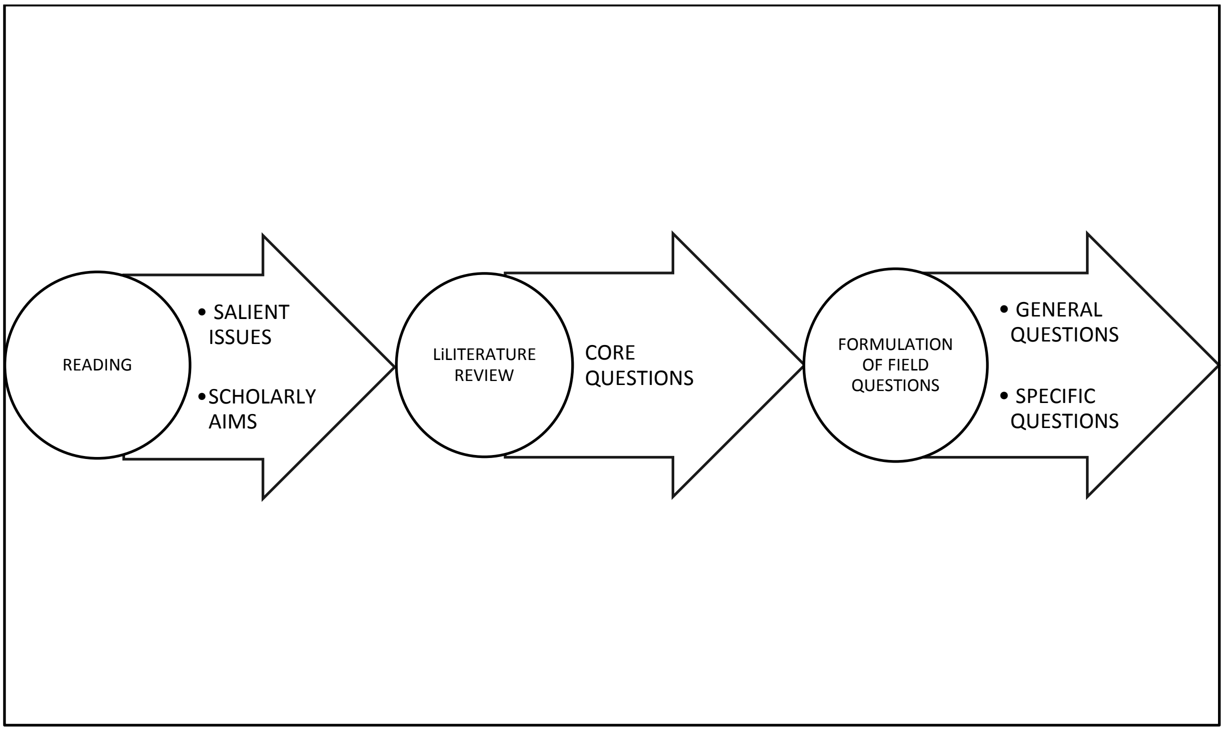
DNA analysis to resolve taxonomic problems in non-insect invertebrates is already taking place at the University of Malta. At least two theses were submitted in 2018 by university students this year (David Dandria, personal communication, 16 April 2018) and this technology is bound to be used more often in the near future to resolve taxonomic problems especially in coleopteran species where, because of the large number of species and the difficulty in separating species and subspecies (Mifsud and Scopoli, 1998)

Entomology is changing as scientific discoveries that have been taking place in the past twenty years regarding deoxyribonucleic acid (DNA) studies of museum insect specimens are changing the importance of DNA analysis in insect taxonomy (Mandrioli, 2008). DNA analysis overcomes the limitations inherent in morphology-based identification systems which are being exacerbated by decreasing numbers of taxonomists. The new methods include microgenomic identification systems, which permit identification by means of the analysis of a small segment of the genome by means of which sequences can be viewed as genetic ‘barcodes’ (Hebert, Cywinska, Ball, & deWaard, 2003).

2. Methodology

The methodology used for this thesis was the result of a process that started with an extensive reading on the role of insects and other animals in human societies. From these readings it was possible to identify the salient issues and the scholarly aims of this study. This was followed by the identification of core areas which led to the formulation of the core questions. These questions were used to formulate the field questions which were used to collect part of the data. Two sets of questions were formulated; general questions which were used to gather data from all interviewees, and specific questions which were formulated for specific interviewees who were chosen because they could provide information about particular topics (Figure 1).

Figure 1 Research design



2.1 Salient issues

The following are the salient issues that arose from an extensive reading in contemporary literature:

- Like other animals, insects are culturally embedded
- Insect types are culturally embedded in ways that involve emotionality, namely love, fear and disgust.
- Culturally insects are related to states of health and illness of the body
- Insects are culturally embedded because of their value as resources and as agricultural and domestic pests
- Insects are culturally embedded as they inspire artists and entertainers
- Insects are culturally embedded because the way we relate to them is located in social space and social time

These issues gave rise to the scholarly aims on which the thesis is based.

2.2 Core areas

A literature review made it possible for the following core areas to be identified:

- Awareness of insect biology (structure, life cycle)
- Knowledge about insect diversity
- Insects and language, beliefs and stories about insects
- Emotions elicited by insects (love, fear and disgust)
- Useful and harmful insects
- Disappearance of insects and appearance of new species

2.3 Core questions

The core areas were the basis for the following core research questions, that is, the questions that I set out to answer through this research:

1. In what ways are insects embedded in Maltese culture, tradition, and society?

Throughout this thesis I looked at the way insects are embedded in Maltese society and to what extend humans and insects are interconnected through emotions, beliefs and actions and whether these are of indigenous origin or the result of external influences.

2. Are these cultural embeddings characterised by transformations and are these transformations related to broader social transformations?

Through this question I investigate whether there has been a shift in values towards insects similar to that which took place in the latter half of the 20th century towards the environment.

3. Are these cultural embeddings charged with emotionality?

Here I investigate the main emotions elicited by insects and how these emotions determine if and how we relate with insects.

4. What are the broader bearings of these cultural embeddings to concepts of nature and the environment?

Through this question I investigate whether the way insects are culturally embedded reflect the way we relate to other forms of nature and the environment and whether insects provide a link with the natural environment.

5. Are attitudes towards insects socially patterned?

Does the way the people of Malta relate to insects differ according to gender, age, education and other criteria?

6. Are insects considered as resources?

Do people in Malta consider insects as resources particularly in agriculture, as food or to be used in medicine?

7. In what way, if at all, are insects aestheticized?

Through this question I want to determine whether the depiction of insects in arts, music and entertainment influences the way we think about them and vice versa? How?

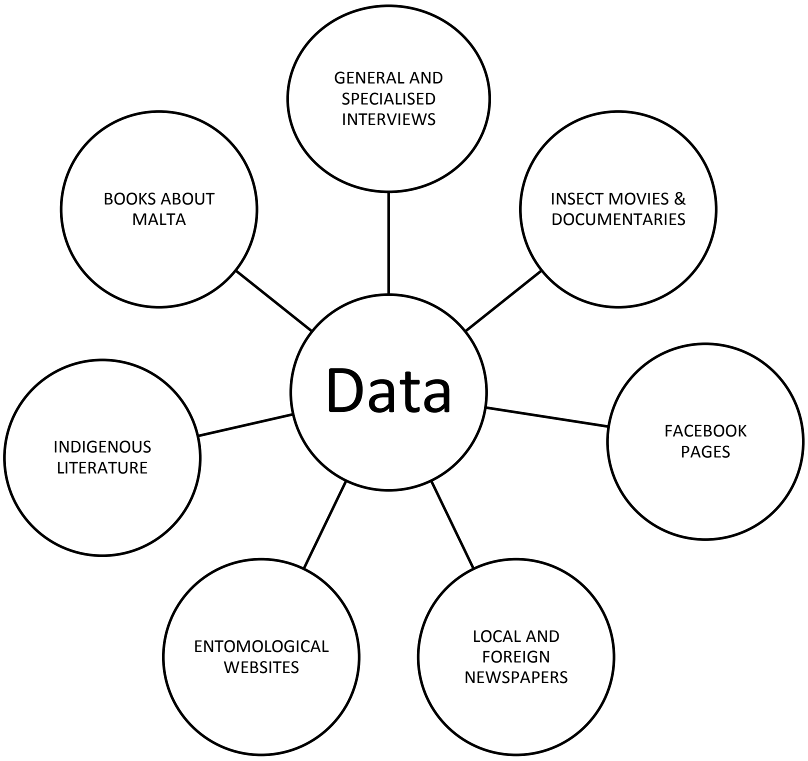
Operationalisation

These core questions were operationalised to formulate the general and specific questions used in the interviews (Appendix I).

Data sampling

Data was collected from various sources as in Figure 2.

Figure 2 Data sources



A total of 83 interviews were held. Interviewees consisted of two main groups; a core group which represented the general population and individuals who were chosen for their particular interests. The core group consisted of Maltese people of all ages, from different socio-economic backgrounds and living in the Maltese islands in both urban and rural areas and was chosen to represent the people of in contemporary Malta. This sample was chosen to provide data on knowledge, attitudes, feelings etc. towards insects. Non-random purposive sampling was used.

Figure 3 Interviewees by gender

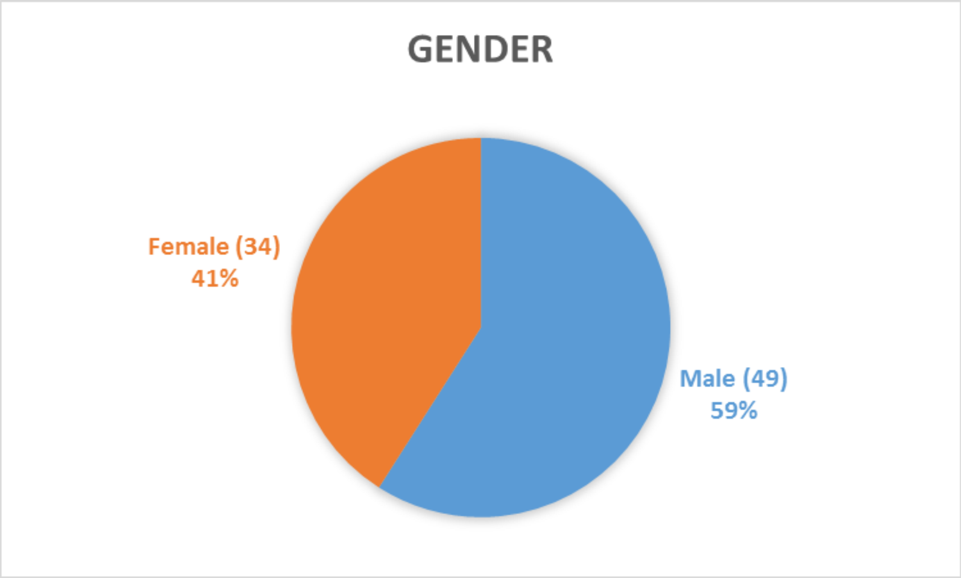


Figure 4 Interviewees by age

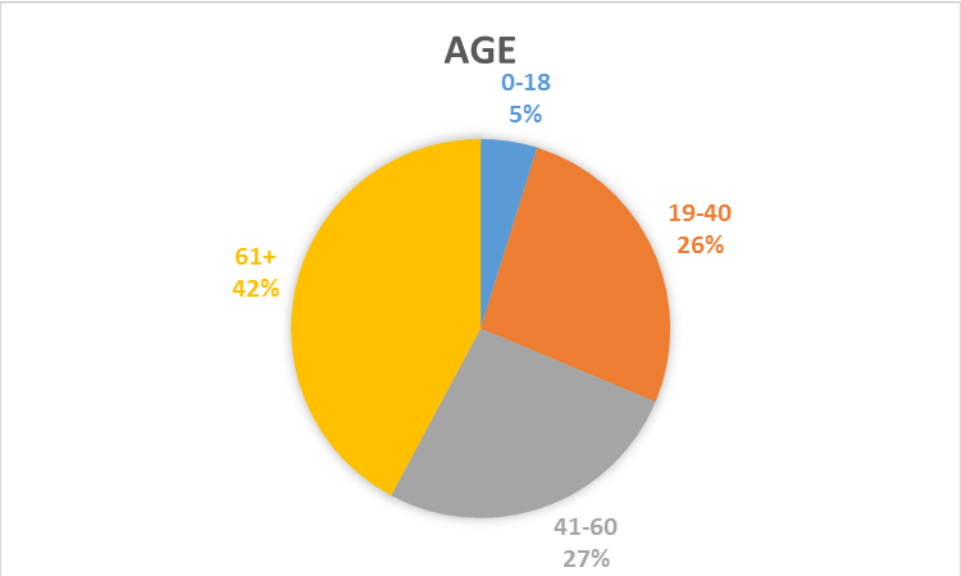
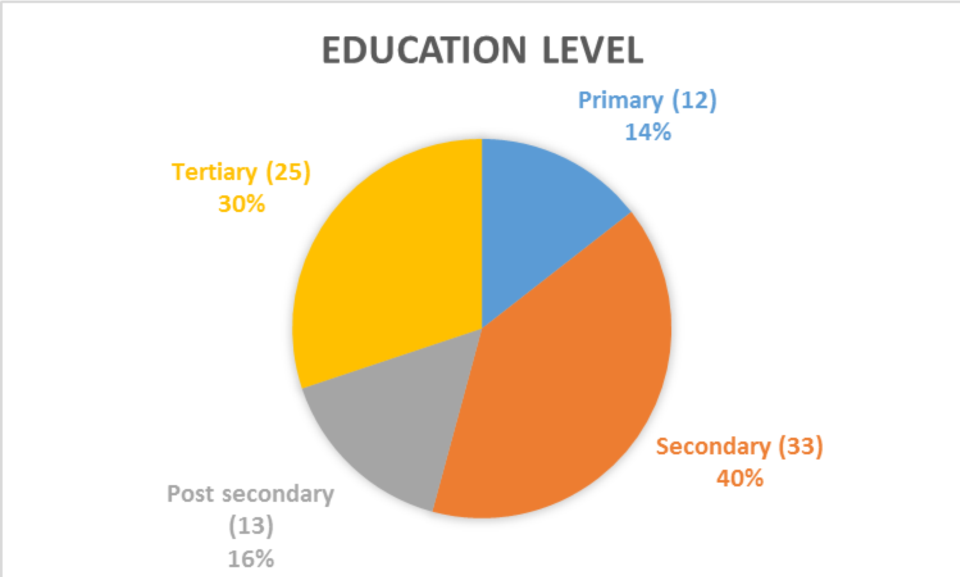


Figure 5 Interviewees by education level

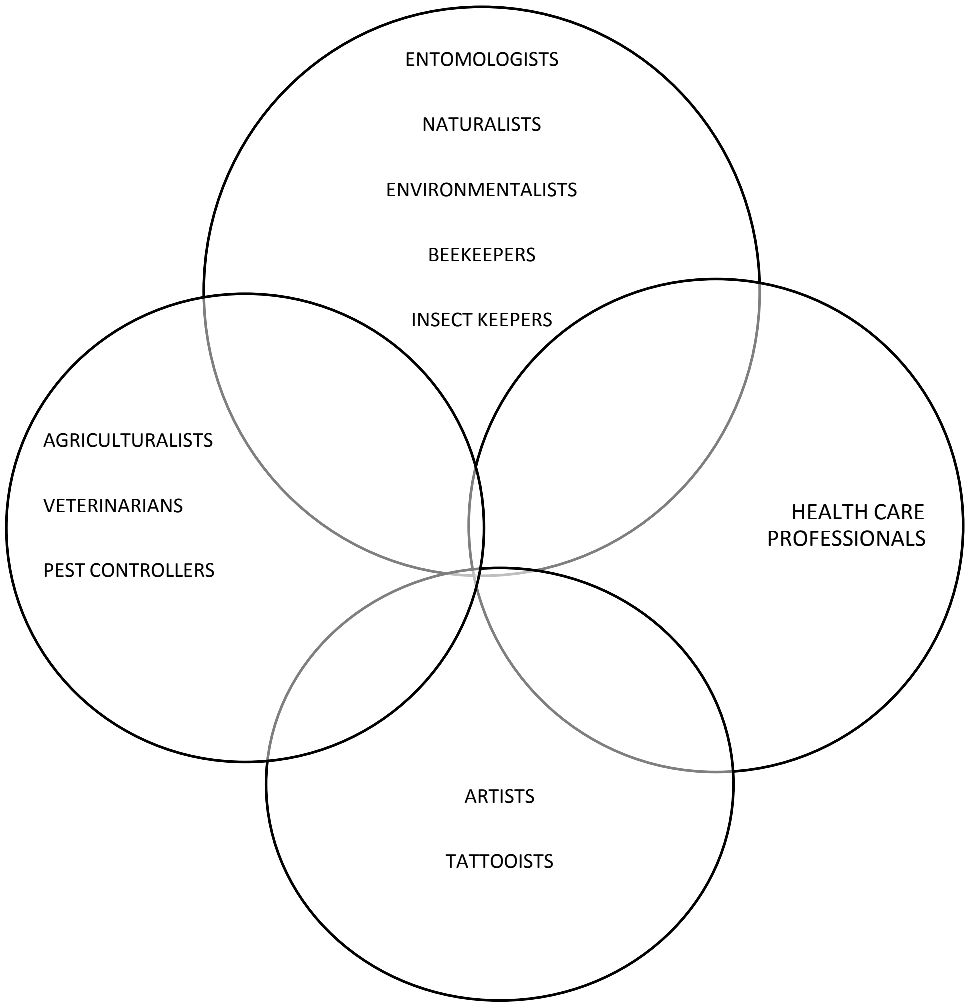


The interviewee demographics are not representative of the population of the Maltese islands. This is because the special interest interviewees do not represent the population.A case in point are nsturalists, beekeepers and farmers most of whom are men. A similar mismatch is noted in the level of education which is also caused by a number of professional persons including doctors, teachers, veterinarians and psychologists who were intervieweed because of their profession.

All interviewees were asked the same set of general questions. A second group of interviewees were hand-picked very carefully according to the research questions. They were chosen because of their special interest and were asked additional questions which were designed specifically to obtain data related to their interest as identified through the literature review.

The first group of persons with special interest consisted of persons who generally seek contact with insects. These include naturalists, environmentalists, entomologists, beekeepers and insect keepers. The second group was made up of persons who work in or close to agriculture while the third group consisted of medical practitioners including medical doctors, psychologists as well as a nurse and a podiatrist working in the Tissue Viability Unit at Mater Dei Hospital. The fourth group consisted of artists and tattooists who look at insects as design subjects. A number of interviewees especially teachers and environmentalists had more than one role (Figure 3).

Figure 6 Interviewees with specific interests



Each interview consisted of a list of core questions which were asked to every interviewee; for individuals with particular interests a second set of questions were prepared according to the interviewee’s interest. The core question section of the interviews was usually half an hour long. The second part usually lasted another half an hour but in some cases it was longer.

The internet was used to view local insect-related pages or pages used by Maltese entomologists, naturalists and nature photographers. Databases were used also to find Maltese publications and papers about insects while searches were made for 19th century British books about the Maltese islands that mentioned insects. On the other hand, indigenous literature was found at the National Library in Valletta and by using the database found in the Malta Public Libraries website and the Natural Heritage Library (Malta).[35]

I also immersed myself in the insect world. Since I was a teenager I had been an active member of the main nature societies and was also a founder member of the Entomological Society of Malta. I also joined the Malta Beekeepers Association and in 2019, I was elected a member of the society's executive council. As part of my research, I regularly carried out participant observation by accompanying beekeepers during visits to their apiaries and helped them with their work. I also joined and participated in several entomological and nature groups on Facebook and read Maltese and English language fiction books that involve insects.

[35] https://drive.google.com/drive/#folders/0BzKiit7NebRaaWYtSTd5Ry11b0k

3 Emotions of human/insect interactions

In this chapter I argue that the emotions elicited by insects underlie most human/insect relations. The basic emotions which range from love to fear determine how one feels about insects and other living and non-living components of the environment. Feelings such as disgust, annoyance, joy and serenity are usually complex reactions induced by emotions which influence behaviour and the way humans experience their surroundings as well as modify and manipulate their environment. The ways humans interpret their feelings and react to insects are influenced by culture which is in a state of flux and which varies between and within societies in time and space. There have been several attempts to try and explain what gives rise to these emotions but little about how these emotions affect human relations with insects and consequently with other non-human animals and how these emotional responses influence culture and society in Malta.

Human relations with insects are laden with different emotions and interviewees often spoke about emotions elicited by their encounters with insects. Some people especially naturalists, biologists, and beekeepers spoke about their love for insects and nature. Others spoke about the fear and/or disgust elicited by insects. Cho & Lee (2017) classified nature-related emotions into two primary groups namely affinity (biophilia) and aversion (biophobia). Emotions have been tackled by philosophers, sociologists and anthropologists from different schools. The constructionist approach assumes that all human beings are the product of their own social experiences. This has been extremely useful in helping anthropologists, but misses the important point that while the environment of most human beings may be predominantly social, human beings can pick up information not just from other human beings or in contexts of human creation but also from the non-human components of their environment as they continuously learn from the whole environment (including insects) not just from human things and their products (culture) (Milton, 2002). What one actually learns about the world depends on how humans, as individual organisms engage with it. In other words, it depends on their accumulated experiences, and because each individual’s combination of experiences is unique, so too is each individual's understanding of the world. This diversity of experiences means that some people think of nature, or parts of nature as composed of personal agents, while others see it as a complex of impersonal objects and mechanisms. It means that some people think of non-human animals as resources for human use, while others see them as non-human persons worthy of, moral concern, or respect, or punishment, it is diversity of experience that generates diversity in perception, knowledge and understanding (Milton, 2002). This includes the way fearful and loved insects, change the perception of ourselves, other species and the space in which these encounters take place, as will be discussed further in this chapter.

Human emotions and feeling have survival value as on one side, they protect individuals and societies from among other things, harmful and injurious insects and on the other hand create bonds with beneficial living things and their environment. Emotions elicited by insects should not be seen as the extreme ends of one continuum with love and fear being at opposite ends as the various emotions arising from contact with insects can be experienced in different intensities by an individual under different circumstances. While emotions can have a genetic basis, the way they are felt and expressed depends on the cultural contexts which vary over time and on a person's experiences and in turn determine an individual and society's behaviour and culture.

Emotions are important because they are the mechanism for attraction or repulsion between people and between people and nature as well as to pull down social structures and to challenge cultural traditions (Turner & Stets, 2005). In this chapter it will be shown that emotions provide the mechanism for the attraction and repulsion that are the basis of human/insect relations.

3.1 Entomophily

A lecturer in environmental science said that

> Not everybody loves to be in nature. Some do not feel the need as we do. For me there is a need. I grew up in the countryside and I find it very soothing and relaxing. I have never been far from the countryside even when abroad. If I have to go to big cities because of work even though there are parks, when I am there, I still try to find time to go to the countryside. And when I go for a holiday I do not go to a city. For me it is a psychological need. What worries me is that when I was a kid in our area you could still find the countryside close by, now you have to drive a distance to get to nature.

Interviewees who described themselves as nature lovers, including biologists, nature photographers, beekeepers, and naturalists, claimed to have loved nature from an early age and for most of them their earliest memories are related to nature although not necessarily insects. Love for nature was described as something internal which you are born with *tkun ġo fik, titwieled biha* [it is in you, you are born like that] and that people who are brought up in the countryside such as farmers do not necessarily like nature. Several remember spending time in the garden, playing in the fields or walking in nature looking at ants and other insects or collecting caterpillars to see them grow and metamorphose. One naturalist who became a professional pest-controller said that when he was a toddler, he was fascinated by cockroaches scuttling about in his grandmother's kitchen. Although love for nature is often already present in childhood, interest in insects can start when one is much older. Charles Gauci, a retired reserve warden, was a keen birdwatcher and ornithologist throughout most of his life. At the reserve he used to see many species of dragonfly but became interested in them only when he was about to retire. The interest started when he saw a new species of dragonfly. The sighting ignited an interest in Odonata and although he still likes birds, the study of dragonflies now takes precedence. Such a love for insects is generally restricted to people who have an overall love for nature although most of these consider insects to be part of nature not all of them are interested in insects because although love for nature is an emotion, the subject of one's love can be socially or culturally determined.

Love for nature is difficult to explain as nature means different things to different people. Most interviewees claimed to love nature; many of them do not love or care about insects except for useful or beautiful species such as bees, butterflies and ladybirds and do not consider other insects as being part of nature. Also, there is disagreement about its origin. Edward O. Wilson (1984) argued that humans possess an innate need to affiliate with other living things which he explained as an inbuilt human desire to relate to the natural environment, called biophilia which he described as a partial-genetic bias for the positive responses of humans to nature. While not claiming that there is a hereditary program hard-wired into human brains, he suggested that human responses and learned reactions to nature are biased in certain directions by humanity's hereditary history. Biophilia is used to explain the popularity of outdoor activities such as gardening, visiting zoos and the countryside and pet-keeping (Kellert & Wilson, 1993) but even if Wilson is right, biophilia varies widely from one person to another. At one end some individuals claim to love nature and cannot live without it while at the other extreme one finds individuals who are uncomfortable in nature and prefer to live without it. The rest of the population is found somewhere in between. For Wilson, biophilia is a characteristic which needs to be cultivated (Clowney, 2013).

Biophilia is a "good to believe in" theory for nature lovers and environmentalists as it allows them to believe that somehow everybody can love nature like they do and all they have to do is to expose the rest of the population to nature and give them information about the various species and their interactions to kindle a dormant interest. This research has shown that in Malta there are a small number of people who feel an extreme love for nature who seek to be in contact with it as often as possible. As a result, they either work in nature or take up past-times that bring them in contact with non-human living things. These include biologists, environmentalists, beekeepers, nature photographers etc. At the other extreme of the spectrum are individuals who hate insects and nature and would be quite happy if none existed. In between there is a wide spectrum of likes and dislikes most of whom appreciate useful or beautiful insects such as bees and butterflies but are afraid of or hate the rest and instinctively kill any insect that crosses their paths or invades their territory and no matter what information they get they would still kill them if and when they can. This antipathy towards insects does not necessarily spill over to other living things. Several have pets or love gardening.

A number of researchers suggest that if biophilia cannot be a descriptive theory of the human psyche it might be a prescriptive theory for which one should aim as there are valid reasons for it; a moral reason and because of the importance of nature for mental health (Lockwood, J., 2013). Lockwood coined the word entomopatheia for the bio-ambivalent. Individuals who cannot love insects should at least tolerate or ignore them. But as a conservationist he proposed a way of dealing with insects "that gives evolution its due while allowing culture its place in human psychology" (Lockwood, J., 2013 p. 172). He suggested that as insects have an important function in human ecology, we are predisposed to notice them and that culture determines our response to them. He thus proposed a three-step process to change the way we deal with insects. The first step is to pay attention to those insects which have an impact on our lives. Secondly those insects that are of no direct concern to us we generalise our initial attention into an aversion. Finally, he proposed entomopatheia, a mind-set that allows humans to live and let live and ignore insects which he believes is a workable solution that would bring about tolerance of insects (Lockwood, J.A., 2013).

As an alternative to Wilson's approach Nisbet, Zelenski, and Murphy (2009) proposed a new construct, nature relatedness, to describe individual levels of connectedness with nature that encompass one's appreciation for, and understanding of humans' interconnectedness with all living things on earth. It is an understanding of the importance of all aspects of nature even those that are not aesthetically appealing to humans such as most insects and spiders. For such connectedness to develop, one needs to have multisensory exposure to nature backed by the right information and experiences.

The word connectedness was first used by Schultz in 2002 in order to measure an individual's perception of inclusion with nature. He defined it as a personal cognition about the extent to which an individual is part of the natural environment. It refers to the association between an individual's self-schema and schema for nature. The closer these two schemes are the more connected one is with the natural environment (Schultz, 2002).

Many nature lovers insist that their love for nature did not arise because of the environment in which they grew up and although they did spend time in nature, it was a conscious decision to be close to nature, surrounded by vegetation or in the company of non-human animals. Most claim that their siblings, who were brought up in the same environment as them, do not share their passion for nature. A lepidopterist said that proof that his love for nature is something internal is the fact that when he got married and had children, he continued to spend a lot of time in nature even though he was very busy. Another said "I am linked with insects and I cannot live without them. If insects had to disappear, my life would finish". An older entomologist said that if for health reasons he would be unable to go anymore in the countryside he might as well die.

These positive feelings for insects and the rest of nature are the basis for human relations with the natural world and are an important aspect of many individuals' inborn affinity towards nature which Kellert (2012) said are inherent, part of our specie's evolutionary heritage and are associated with human competitive advantage and genetic fitness. He also said that these feelings are likely to increase the possibility for achieving individual meaning and personal fulfilment and form the self-interested basis for a human ethic of care and conservation of nature, most especially the diversity of life (Kellert, 2012). This is especially relevant for persons who are more biophilic and more connected to nature than others (Cho & Lee, 2018).

Such connectedness is found in beekeepers, a group of persons who build a special relationship with their bees. It is not the relationship one generally reserves for pets because unlike pets, bees do not need their owner but there is love, a love which they say is comparable to that of one human to another (Moore & Kosut, 2013). In their relationship and interaction with bees, Maltese beekeepers are not different from the New York beekeepers described by Moore and Kosut. They talk with passion about their bees and can become emotional especially when talking about their love for them. They express the love they feel very emphatically. One said "I love them, I love them, I love them", while another said that "Watching bees is like looking at your lover or at your baby". For them it is a mystery but they insist that it is something internal. One beekeeper asked "Why am I so obsessed? What do bees have to hook me so much? I am an addict, a slave to the bees". Some beekeepers believe that it is the pheromones released by the queen bee that has an effect on them and claim that the smell of the hive calms them and excites them at the same time. One beekeeper compared his love for bees to the love for a woman. He asked "Do you love her for her beauty, for money, for sex? You cannot say why you love her because if these disappear you would still love her". Beekeepers want to be with their bees as often as possible. One beekeeper even placed a hive on the roof of his office to be close to bees and often spends his lunch break looking at his bees flying in and out of the hive. An elderly beekeeper said that "My relation with bees is better than with my family. Bees need attention. When my kids were young my wife took care of them. I did not give enough attention to the family because of the bees". Another said that he loved his bees so much that he used to spend a lot of time with his bees that "my wife used to complain because I was always late for Sunday lunch".

Beekeepers are similar to other nature lovers in that they claim that they were born with a love for nature because before they started to keep bees, even as children, they liked to be in nature and to be surrounded by non-human animals. They also know that not everybody shares their enthusiasm. In most cases even their siblings did not share their passion for nature. One beekeeper said that when he was a child, he was the only one of eight siblings who took care of his father's chickens and rabbits. The love for bees does not come suddenly. It grows gradually over the years and increases as the number of hives increases. The love for bees makes a beekeeper work hard for his bees but when talking about love it is love for the bees that they talk about and not about beekeeping itself. Only a few individuals, usually ones with a large number of hives, say that they are not personally attached to their bees and although they like working with bees they do not use the word love.

When a beekeeper has to stop keeping bees, the love for bees does not end. While interviewing an elderly farmer who had bees for most of his life but had stopped a few years earlier, I was getting confused about whether he still had bees as although he had already told me that he had not had bees for seven years, he spoke excitedly about bees as if he was still a beekeeper. He said that he loved his bees and that while working in his fields he often looked at bees and stopped to wonder where they were collecting from and where they were going to and if he saw a swarm, he became very excited and phoned his son in law to come and collect it.

Many Maltese beekeepers started to keep bees by chance. In most cases it was not a family tradition and although they liked nature, they were not planning to start beekeeping until they met somebody they knew such as a neighbour, relative or friend who urged them to start keeping bees. Nobody forced or pushed them into beekeeping. Some described starting to keep bees like having an internal switch ready to be turned on and when the opportunity arose it was a natural thing for them to start keeping bees. Some even said that if it had not been beekeeping, they would have taken up another hobby that would involve contact with nature.

Although beekeepers love all their bees, they have a special love for the queen bee. The queen bees live long enough for the beekeeper to get to know them individually and some think of them as pets. A beekeeper said that he “cannot consider bees as pets but the queen, yes. She lives for five years and you get to know her and I know which is which. I take extra care with breeder queens”. One beekeeper said “If you have a good queen you love her more than others”. When beekeepers open a hive the first thing they do is to look for the queen and when they find her they show her off to any guests or visitors accompanying them, like parents proudly showing off their children. Despite their interest in individual queens Maltese beekeepers do not normally give them a name in the same way as they give names to pets but most of them give them a number which they use to be able to track them and record their progress. The queen is at her best for three or four years. When the queen bee becomes too old, most beekeepers said that they do not kill her because as they said “they do not have the guts” and many wait for her to die a natural death.

For some biophilic persons being with insects can be a source of pleasure. Most beekeepers said that they are very happy when they are with their bees and when they finish their work, they remain in a good mood for a long time afterwards. One entomologist said that working with insects, releases endorphins which keep him in a good mood for a long time afterwards. When they are not with their bees, they relive the moments that they spend with them by talking about them and by reading and watching videos and television programmes about bees.

Maltese beekeepers can be divided into hobbyists, part-timers and professionals but there is no typical beekeeper. All have different characters, attitudes towards bees and different ways of doing things. The pleasure a beekeeper feels increases with the number of hives but they say there is a limit to the number of hives beyond which beekeeping becomes stressful and no longer pleasurable. For many of the hobbyists twenty is the maximum number of hives that they can cope with.

None of the interviewed beekeepers said that they are afraid of insects and when stung by a bee they shrug it off as a minor inconvenience that is part and parcel of apiculture. Some beekeepers are even sorry for the bees which always die after stinging somebody. Beekeepers speak about their love for insects but say that they love bees most and that when they are working with them, they feel very happy. Happiness is a word that is understood by almost everybody but it can mean different things to different people and although emotions can be described through a shared language it is still difficult to understand exactly what is meant by such a term as “one cannot know what someone is feeling if one has not oneself experienced that emotion” (Goldie, 2002 p. 33). I understood this statement during an observation/participation session with a beekeeper whom I accompanied when he was asked to remove a large bees' nest from the space between the soffit and ceiling of a bathroom of a house in Mosta. The work consisted in cutting the combs from the ceiling and attaching them to frames which were then placed in a hive. The hive was then covered with a piece of cardboard which had a small slit cut into it through which the bees were gently made to enter into the hive by sweeping them gently with a piece of cardboard. This is a slow repetitive movement and after doing it for several minutes I started to experience a pleasant sensation that can be described as being happy but which is more a sense of being at one with the bees which I was saving similar to a meditative trance like the ones described by some beekeepers who sit in front of their hives to look at the bees flying in and out of the hives.

Beekeepers consider themselves lucky to have such a hobby. They know that they are different from people who do not share their love for bees and nature. Beekeeping is very satisfying and as one said he "does not need to find fulfilment and pleasure like others who try to fill their lives with alcohol, drugs or materialism but still do not manage to find happiness" Another beekeeper said that "When I am with the bees, I am unaware of the world". Beekeepers say that they get most of their pleasure by knowing that they are the bees' custodians. For them it is very rewarding to give something back to nature in return for what nature gives to humans.

Beekeepers get excited when they see the number of bees in their hives increasing and get pleasure from watching bees coming in and out of their hive. Watching bees is relaxing. Some describe it as a meditative experience. In winter, when the bees are not so active beekeepers get less pleasure from their bees. Some beekeepers feel very close to their bees and even get pleasure from the smell of bees. They tend to like other insects except for those which they consider as enemies or pests and none said that they suffer from insect phobias.

If the bees are sick or a hive is not doing well, beekeepers feel sad. It is much worse if something bad happens to the queen. An established queen might be killed accidentally but if a queen dies during her nuptial flight such as by being eaten by a bird it is not so bad, as they do not yet have an attachment with her and she can easily be replaced. The death of a hive affects even those beekeepers who say that they are not emotionally linked to their bees one of whom admitted that when this happens, he “feels sadness, grief and disappointment”. The worst thing that can happen to a beekeeper is, having to burn a hive with bees still alive inside because of disease.

Beekeepers also spoke about the humming sound made by bees which they said has an effect on them. It is a meditative sound that relaxes them and is a source of inner tranquillity. Moore and Kosut (2013) refer to it as “The Buzz”.

> It is an incidental sound made by the wings of the bee but for beekeepers it is the voice of the bees. Beekeepers can tell the mood of a hive from the buzz. Learning to interpret the buzz might take a long time but once learnt it becomes a language with which the bees communicate with the beekeeper. Beekeepers feel a buzz, a slight intoxication, enthusiasm, and exhilaration in the presence of these insects. This feeling is what we term the affective buzz, a transformation through bonding with bees. The affective buzz is a form of insect love, and also, similar to other types of love, it encompasses fear (Moore & Kosut, 2013 p. 87).

The hum can have an addictive hold on Maltese beekeepers. Most said that after finishing their tasks they sit next to their hives to extend the time spent in their company. Farmers who keep their hives close to their fields spend their lunch breaks listening to the hum and watching the bees fly past. They describe listening to and watching bees as a hypnotic experience that gives them moments of extreme joy and peacefulness. These moments, which beekeepers seek as often as possible clear their mind from the mental clutter that comes from the worries and stresses of everyday life. One beekeeper said that he visits his hives three times a week not because he has to, but to be close to them. Another beekeeper said that a Scottish beekeeper visits him every year in late autumn to listen to the hum of his bees because back home it is usually too cold and the bees are not so active and he also claims that the sound made by Maltese bees is different the sound he hears in Scotland.

Similar feelings were described by, a small number of persons who collect and sometimes breed invertebrates, especially arachnids and insects which they love and keep close to them. Three pet shop owners agreed that only a small number of customers buy such animals. These persons are mostly men in their thirties and forties and a small number of young women. These people like animals and love to be close to the animals they love. They take good care of them and are generally knowledgeable about them. Spiders and stick insects are the most popular invertebrates. Boys and young men prefer to keep tarantulas to show their lack of fear and to give an image of bravado and machismo. Women on the other hand are usually under twenty-five as most stop keeping insects when they reach that age.

None of the three interviewed pet shop owners consider insects as pets. They all said that pets are kept for company and pet owners interact with their pets. There is very little interaction with insects as handling tends to stress them, although other invertebrates such as spiders, allow for more interaction as they are sometimes allowed to move over the owners' arms and give the owners a pleasant sensation of touch which makes them more popular with insect keepers.

Eddy (2003) admits that there is no agreed upon definition of pets as there are no particular characteristics that make an animal a pet but proposes that they are "animals that are treated with unusual kindness or consideration" (p. 103) although generally, pets are animals that are kept for pleasure and are not used for work, they are not eaten, they live close to their owner and become part of the family (Wry, 2009). Bees fit perfectly well within this description but although humans and bees are often intimately related at an emotional level, this relationship is mostly one way as bees are self-sufficient and independent and do not need the beekeeper to survive (Moore & Kosut, 2013).

Likewise, beekeepers do not consider their bees as pets although one said that he looks at them every day as if he had a horse that he loves. The reasons they gave for not considering bees as pets were that you cannot pet bees, that they do not come to you when you call them, that they do not need you, and that you cannot take them inside your home. At the same time, for them a hive is like a single organism. It is long lived and from time to time it changes its character. The character of the hive depends on the worker bees which might either be docile or aggressive. This depends on the drones which mated with the queen bee during her nuptial flight. As the queen mates with several drones she carries within her the sperm of several drones. As the sperm from one drone finishes, the sperm of another drone starts to be used and as the genes of the new drone might have different characteristics the eggs laid by the queen might give rise to bees of a different temperament. Furthermore, the hive does not die with the queen, as when she dies or leaves the hive to found a new colony, the remaining bees produce a new queen just as they do when the queen dies. Thus, the hive can remain active for a very long time, changing queen and character with time.

One professional beekeeper compared his bees to employees whom he respects and treats well by providing them with accommodation and if necessary, feeds them. Another beekeeper stated that he is his bees' pet or slave. Another beekeeper said that "bees are not pets because we are not their masters and we do not control them. They are in control and we fear them because of their power over us". Beekeepers love their bees but it is love intertwined with fear which is different from the love for a companion animal. The fear rarely disappears completely but when it does, usually after decades working with bees, the relationship between the beekeeper and his bees changes completely. The beekeeper and the bees become one and the relationship becomes one of respect.

Entomologists also spoke about how happy they are when they are with their insects particularly while studying their subjects or even when they are just looking at their collections of mounted specimens or photographs and about the excitement they feel whenever they discover an insect which had not been recorded previously in Malta or which is new to science.

3.2 Fear and phobias and disgust

Many interviewees spoke about their fear of insects with some saying that they are afraid of some species while others are so terrifying that they cannot stand to be anywhere in their vicinity. Two insects, the cockroach and moths were often mentioned, but the fear provoked by the two insects is very different from each other. For many Maltese, the cockroach[1] is the most fear-provoking insect. Those in whom the cockroach elicited a negative emotion described their feelings in words that can be divided into three categories; fear *nibża minnha* [I am afraid of it], extreme fear *twerwirni* [it terrifies me], *ittini dehxa* [it makes me shudder], *iddarrasni* [it sets my teeth on edge] and disgust *tqażżiżżni* [it disgusts me]. While nobody claimed to like or love them, several individuals said that they were neutral in their regard.

Several interviewees said that their fear of the cockroach is of such intensity that when they see one, they hurriedly move away from it and take extreme measures to avoid it. An interviewee said that she seals all possible cracks to ensure that cockroaches do not enter her house and uses insecticides regularly to keep them away. In spite of all these precautions one day she saw a cockroach in the living room and she locked herself up in the bathroom, sealed the space between the floor and the door with towels and waited for her husband to return from work to check whether the cockroach was still in the house before she felt it safe enough to leave the bathroom. Another young lady said that "insects are so alien" and when describing cockroaches said "They are something that you cannot relate to. They do not have human features. They look so strange, the way they move I find it spooky. Its sudden movements and the way it moves its antennae I find this scary". Although cockroaches are silent creatures, cockroach related sounds can be disgusting. A

[1] Although there are several species of cockroach (Blattidae) in the Maltese islands the species in question is the American cockroach (*Periplaneta americana*) which in Maltese is called *wirdiena*. The Maltese use the word *kokroċ* for the brown-banded cockroach (*Supella longipalpa*). In this thesis unless otherwise stated the word cockroach refers to the American cockroach.

doctor blames her disgust of cockroaches because every time she sees one it reminds her of the sound it makes when it is squashed.

Some interviewees described cockroaches as anti-human insects. Several said that cockroaches cannot be destroyed and can even survive a nuclear holocaust, which would kill most living things including humans. Many fear that cockroaches are waiting for the day when they can take over the world. Cockroaches spend the day in troublingly ‘transitional’ or ‘liminal’ spaces such as the shadowy corners of a room or underneath cupboards, as well as in sewers, uninhabited buildings, cellars and other disused places waiting to come out at night. These insects inhabit the ‘oneiric’ spaces of day-dreams and nightmares. Indeed, it might be these characteristics and this ambiguous personality that make them so frightening; their inability to fit within the categories that constitute the dominant symbolic and social order. The appearance of these insects is intrinsically tied to the particular emotio-spatial challenges they pose for those they encounter. The worlds of the entomophobic individuals are defined and delimited by the insects they fear in ways which even they find difficult to describe (Smith, Davidson, & Henderson, 2012) as one interviewee said “cockroaches live in the same threatening and unknown places as the terrifying clown in Stephen King’s IT” and for many it is no surprise that evil aliens intent on destroying humanity to take over planet earth such as in the 1997 Barry Sonnenfeld film ‘Men in Black’ have an uncanny resemblance to cockroaches. For many, their fear of cockroaches has become a phobia an apparently unreasonable reaction that probably has survival value for mammals and perhaps other vertebrates by keeping them away from dangerous situations such as predators and/or their hiding places. This would explain the origin of phobias in humans and why these fears seem unreasonable and beyond cognitive control (Goodwin, 1983).

Phobias can be so powerful that they control a person’s life to the extent described by a convenience shop owner in Sliema who said that in summer one of his clients buys two cans of insecticide spray per day to ensure that no insect enters her home. Similarly, some individuals are so afraid of insects that even though they have mosquito netting in all their windows they still keep their windows closed to ensure that no insect finds its way in. So many people are afraid of insects that in Malta people accept fear of insects as a reasonable and understandable normal condition and none of those interviewed reported being stigmatised or laughed at because of their fear and they do not feel compelled to seek help. Many, including people who are not afraid of insects can recount stories about somebody who is afraid of them, such as a lady in her forties from Cospicua who described how an elderly neighbour was so terrified when a cockroach landed on her shoulder that she took off her top and ran through the street topless. The way the Maltese interpret the presence of insects in their lives and the way they feel about them has to be framed within a cultural context. A context that is the result of a collective memory created by the recounting of stories, superstition, nursery rhymes and tales (Smith, Davidson, & Henderson, 2012) such as the fear of geckos[2] which might appear as strange, as other lizards such as the Maltese wall lizard (*Podarcis filfolensis*) and the ocellated skink (*Chalcides ocellatus*) are not feared. What sets the geckoes apart from the other lizards is their habit of entering houses, their ability to walk on vertical walls and above all their warty skin which many associate with leprosy and other diseases – a fear which has come down several generations from a time when leprosy was a relatively common disease and has remained imprinted in Maltese psyche even though leprosy has become a very rare disease in the Maltese islands.[3]

Several interviewees who are afraid of cockroaches said that if there is a cockroach around they are always the first ones to notice it because entomophobics often have to know whether feared insects are sharing their space and continuously check their surroundings for feared insects. In the case of householders their cleaning routines constitute instrumental methods by means of which they attempt to control their surroundings so as to provide some sense of comfort and peace of mind. These routines often become increasingly complex, ritualised, and eventually time consuming, expensive and even dangerous (Smith, Davidson, & Henderson, 2012).

[2] Two species of geckoes are found in the Maltese islands, *Tarentola mauritanica* and *Hemidactylus turcicus* but few people can tell them apart.
[3] The Sunday Times of Malta 28, January 2018, Today is World Leprosy Day & The Sunday Times of Malta 4 February 2018, Leprosy in Malta.

Phobias are extremely common and are usually triggered by natural objects including predators, heights and wide-open spaces which were potentially deadly to hominoids including early humans (Öhman, 2008). They include fear of living things (biophobias) which could be both plant and animals although the most common are animal phobias such as entomophobia and arachnophobia. Animal phobias are usually restricted to one species or group of species. They are more common for creeping and crawling species such as worms, spiders, rats and mice (Marks, 1987). In Malta the most common phobias are elicited by cockroaches, rats, geckoes and snakes. Studies in other countries have shown that other animal phobias, such as bird phobias, do exist and these tend to be seen more in clinical situations, probably because victims of these unusual phobias seek help more often than those suffering from other phobias (Öhman, 1986). Biophobia is an aversion of nature which can trigger human-nature separation which can be the result of a negative perception of wilderness which like other negative emotions can be related to a fear of death (Cho & Lee, 2017).

While phobias could have survival value for animals, they often have a negative impact on human lives. Phobias are socially significant but their effects often lie hidden from public view as sufferers know that their phobias can lead to stigmatisation. It has been said that to avoid this, phobic persons often use tactics to pass as normal, although they sometimes do acknowledge their condition publicly (Davidson, 2005). It is possible for a phobic person to keep his or her phobias hidden from public view because when not faced with the feared object, the phobic person is completely normal and there is little to distinguish him or her from other persons (Smith & Davidson, 2006), although in Malta fear of cockroaches is so common that it is generally accepted as an inevitable aspect of life in Malta.

Fear of moths, on the other hand is not the same as the more common fear of cockroaches and much less intense. In fact, none of those interviewed said that they have a moth phobia (mottephobia). Interviewees who said that they are afraid of moths were all women most of them middle-aged. In all cases their fear is a result of the belief that moths are harbingers of bad luck and death. Most of the men interviewed said that they do not believe such things and described them as *ħmerjiet* [stupid things]. These fear-inducing beliefs are generally restricted to one species referred to as *il-baħrija sewda* [the black moth] although many do not know which species this is and are thus afraid of all moths. The moth that for centuries has been associated with death is the humming bird hawk moth (*Macroglossum stellatarum*), *ħabbara* [4] in Maltese (Gulia, 1858). Unlike most moths, the humming bird hawk moth is a day-flying moth that often enters houses. Other moths evoke the same fear as this species by association especially as these women either do not know the difference between the moth species or are not sure which species is the harbinger of death.

The fear provoked by moths is a fear of death uncontaminated by disgust with no phobic element. If a feared moth enters the house windows must be opened and the moth allowed to fly out. Some say a prayer to keep death or bad luck away. A 98-year-old man from Sannat, Gozo recounted how when he was young his mother placed a chair onto a table and then climbed on it to wave her skirt at a moth to make it fly out of the house. A moth must be made to leave the house. Killing it is a sure way of unleashing its power to bring bad luck and death.

A different but overlapping emotion was described by several interviewees who said that they are afraid or very afraid of cockroaches but went on to use the Maltese word *jaqq* which is an expression of disgust. Fear and disgust are two separate emotions but when elicited by insects there is considerable overlap and it can be difficult to tell them apart or to tell where one starts and the other finishes. While fear is a negative feeling brought about by a dangerous situation which requires one to fight or to get away from the danger, disgust is primarily an aesthetic emotion which has a social, cultural and linguistic origin (Miller, 1997). Fear is an emotional state brought about by a particular situation and is of limited duration. On the other hand, disgust comes from deep inside and links what one feels to the way one talks about the feeling (Miller, 1997). Both emotions are a product of natural selection and

[4] *Ħabbara* means predictor or harbinger although not necessarily of bad news.

have survival value (Öhman, 2008) and are crucial for animal evolution and serve a biologically useful function (Öhman, 1986). Fear protects animals from danger by inducing an aversive reaction that prepares an animal to run away or fight and without it a species could become extinct (Öhman & Mineka, 2001).

Fear of something harmful is a reasonable and natural reaction. Most people do not catch bees with their bare hands because their sting is unpleasantly painful but bees are still admired and appreciated and while those who were interviewed said that they are afraid of being stung and try to avoid bee stings, none of those interviewed said that he or she was terrified of bees. On the other hand, many said that they are terrified of cockroaches. In a large number of individuals, fear of cockroaches is of such intensity that it classifies as a phobia, which is persistent, extreme, and seemingly unreasonable fear which is triggered by particular objects or situations and which results in avoidance of real or potential danger (Goodwin, 1983).

Many interviewees who said that they were not afraid of cockroaches admitted that they did not want them in their vicinity. A well-known naturalist and conservationist said "I am not afraid of insects but I find cockroaches disgusting. Once I saw them walking on cadavers in a cemetery and this has affected me. Once you notice where they live you say this could have walked on something disgusting and is now touching me. Even flies bother me but I have not seen them on dead people and they do not disgust me". A female professional artist expressed similar feelings when she said

> I associate cockroaches with cemeteries. The implication is that the cockroaches are eating cadavers and that is disgusting, gross, and then they come close to you. But I think that deep down they remind you of death. I want to be cremated because I do not want to be eaten by cockroaches

and although these interviewees said that they associate cockroaches with cemeteries and cadavers none said that their disgust originates because of their fear of death.

Charles Darwin (1872) described disgust as a sensation that refers to something revolting, that is offensive to the taste and that is often accompanied by a frown and by gestures that recreate the movement of pushing something away or of guarding oneself from an offensive object. Since Darwin, there have been many descriptions and explanations of disgust including that by Angyal (1941) who described disgust as a reaction towards human and animal waste products which vary in intensity on the intimacy of the contact with the disgusting; the closer to the mouth the more disgusting it is. Other descriptions and explanations of disgust came from the philosophical, anthropological, humanities and psychological literature although these tend to be varied and inconsistent, which reflects the broad range of disgust phenomena and its universality. These included Aurel Kolnai who believed that disgust is a result of an excess of life, Sigmund Freud for whom disgust was a learned reaction that can be cultivated, Mary Douglas who argued that dirt and disgust are a product of culture and are the result of matter out of place which needs to be avoided and in psychology the main theory comes from the Rozin-Haidt school which sees disgust as originating in the rejection of spoiled foods, but also serving to cope with the existential terror of being an animal and hence mortal (Curtis, de Barra & Aunger, 2011).

Interviewees who said that they were afraid of cockroaches could not explain why they found cockroaches so frightening but a number of them said that more than fear it was repugnance that they felt as a result of disgust. What many describe as fear of cockroaches is usually a strong reaction of disgust. Fearful insects do not elicit such an intense reaction. A bee sting is very painful and can be fatal. Most people, with the exception of some beekeepers are afraid of being stung but I have not met anyone with an intense negative reaction to bees. Some Maltese are also afraid of large grasshoppers[5] because of the belief that it uses the serrations on its hind legs to defend itself and that if approached too closely the grasshopper would attack you with its so-called knives but again very few Maltese react strongly to these grasshoppers.

[5] A female Egyptian grasshopper (*Anacridium aegyptium*) can grow up to 70 mm long.

Many explanations have been given for disgust and its causes including fear of death and avoidance of disease and sources of infection. In 1998 Davey et al. proposed that disgust is a universal emotion which indicates that disgust is not a cultural but a biological phenomenon although this research has shown that what is considered disgusting is the result of culture and is learnt. Disgust is nearly always associated with food (Haidt, McCauley & Rozin, 1994) and is characterised by aversion brought about when someone is too close to an object which he or she does not want to touch or smell and which brings about thoughts about repugnance which cannot be rid of and may be accompanied by ideas of defilement which are normally associated with predictable cultural and social scenarios (Miller, 1997). This has been extrapolated to the possibility that fear of disgusting animals such as cockroaches and spiders might be fear of contact with a disgusting object as most people are not afraid of animals which are more disgusting than spiders, such as maggots, but with which there is no danger of unwanted physical contact (de Jong & Muris 2002). Furthermore, if a spider (or another disgusting insect) comes in contact with food the contact renders the food inedible (Mulkens, de Jong, & Merckelbach, 1996).

In spite of the feeling of disgust elicited by some insects when they come into contact with food, a surprising number of interviewed persons said that they would eat insects if given the option. These tended to be younger, better educated and more open-minded persons. Some of them have travelled to or lived in the Far East and actually ate insects while they were there and said that they found them tasty. Some compared eating insects to eating snails which are considered as a delicacy by many Maltese. A pensioner who spent a lot of time living and working abroad said “I have eaten insects at least twice, we eat snails so what’s the big deal?”. Three of those who were interviewed said that they would not eat insects because they are vegetarians and not because of disgust. A university lecturer who is also a beekeeper said that he has eaten caterpillars of the wax moth which is sometimes found living in beehives and described them as having a very good sweet taste and he did not feel disgusted at all. I also tasted these caterpillars during an observation session and even encouraged the two beekeepers who I was accompanying to try them as well. Both agreed that they had a good taste and that they were not disgusting at all.

On the other hand, others found the idea of eating insects disgusting and repulsive and that they would not consider eating an insect even if they were starving. Some of those who said that they would not eat an insect are aware that vegetables often contain insects which they unwittingly eat, but as long as they do not know about them, they can eat them without problems. It is only when they know specifically that there is an insect in their food that they feel disgusted. Most interviewees who said that they would eat insects said that they would also make use of a medicine made from insects as long as it is certified to be safe. A businessman who collects and mounts butterflies and moths said that he "would never eat insects. I find them disgusting because we are not used to them but in an emergency I think I would, on the other hand I would use an insect-based medicine". This is a reflection that insect eating reflects regional, historical and socio-cultural differences as while some people relish insects, others dislike them or find them disgusting. This disgust is purely cultural, resulting from perceived social norms which inhibits us from eating strange and possibly disgusting foods. These social norms can be overcome and even harnessed by marketers in order to surpass disgust of insects as a source of food (Jensen & Lieberoth, 2019). Although it is said that insect eating in westernised societies would be advantageous as in societies where insects are eaten, a link is created between them and the natural environment as they learn to recognise which insects are suitable for food as well as how, where and when to catch them (Nonaka, 2009). This would not be so in the western world as like many other foods insects would be commercially grown and heavily processed to such an extent that consumers would probably not see a direct link with the actual insects.

3.3 Theories of emotion

Many researchers proposed theories and models to explain emotions which could provide insight into the emotions of human/insect relations. Matchett and Davey (1991) proposed a Disease Avoidance Model to explain fear of non-dangerous animals. This model suggests that animal phobias are not mediated by fear of physical attack but by fear of disease and contamination. The Disease Avoidance

Model postulates that most feared animals elicit the food-rejection response of disgust (Davey et al., 1998). This model relies on disgust, which raised the question of how the relationship between disgust sensitivity and common animal fears are mediated (Davey, 1994b). Fear prepares the body for fight or flight while disgust appears to be a cultural acquisition which requires cleansing and purifying to bring relief. Fear decays rapidly while disgust lingers much longer. It is a learnt response to help people avoid being disgusted in the first place and thus marks the boundaries of culture and the self (Miller, W. J., 1997) a theory which is not necessarily correct as research for this study has shown that culture also has an important role in animal fears and disgust.

For McGinn (2011) disgust is caused by anything that reminds us of our mortality and the inevitable death and corruption of the body. It is elicited by rotting and decomposing animal flesh and by imperfections in our bodies, products and actions that confirm our animal nature. Insects that live or feed on these disgusting objects including faeces and cadavers are disgusting by association and by linking us to these objects against our will. When a cockroach is squashed the hard exoskeleton is broken exposing its soft smelly organs which remind us of rotting animal flesh. According to McGinn the awareness of death "is what produces the emotion of disgust. We avoid contact with the disgusting object because we want to avoid the reality of death" (p. 86). More recently Kasperbauer (2015) argued that animals elicit disgust in two ways. One is by triggering disease protection mechanisms and the other by eliciting what is called mortality salience or thoughts of death.

Others believe that disgust is what keeps humans away from potential sources of infection describing it as an inner voice which we cannot explain because it is the voice of our ancestors. A sensation of disgust or a similar sensation must be present in other animals. It is what keeps them from eating inedible objects such as faeces. It is still present in humans for a reason – and like fear it guides humans to behave in ways that are good for their genes (Curtis, 2011), which leads to the assertion that disgust and fear are closely related emotions and a change in one brings about a change in the other. Disgust-related information about an animal leads to greater fear and vice versa (Muris et al, 2009). This has led to the proposal that it is not the possibility of attack by a predatory animal that brings about fear but that the response is mediated by the food-rejection response of disgust (Davey, 1994b) although it could be that when stimuli normally associated with disgust become the focus of phobic anxiety, the disgust response may be amplified (Thorpe & Salkovskis, 1998).

It has been claimed that as with fears and phobias, disgust has exerted pressure that has led to the selection of a disgust/hygiene behaviour system in individuals that is universal but is adapted to the local environment. While what motivates hygiene behaviour, disgust sensitivity, is universal it varies between one individual and the other and between different societies. In all societies this behaviour is often motivated by the desire to avoid and remove things that are found to be disgusting. Only a small number of researchers offered explanations for the origins of hygiene behaviour or consider how it might be related to the emotion of disgust (Curtis & Biran, 2001). Amongst these are Curtis, de Barra & Aunger, (2011) for whom disgust, hygiene behaviour and culture are strongly intertwined to create a system that protects from disease. Disgust and disease avoidance behaviour are universal but disgust is plastic and can change to reflect changes within the body and in the social and biological environment. The way an individual reacts to an object or situation does not depend only on his or her behaviour but is led by others to take part in group hygiene behaviour which is a result of individuals using each other as models to be imitated (Curtis, de Barra & Aunger, 2011). This behaviour is imposed by means of rules, attitudes, and norms that become commonly accepted rules of appropriate behaviour. Deviations from these norms generally attract sanctions, such as shunning or fining although what is acceptable differs from one society to the other (Curtis, et al., 2011). Thus, if some people are happy to live in a house infested with cockroaches, they would probably experience pressure by family, friends and outsiders to clean up the house and if they do not, it is likely that they would be reported and the authorities would insist on the removal of the disgusting insects even though these might not be carrying any pathogens.

According to Davey (1994) although disgust probably originated to protect from sources of pathogenicity, there are a number of disgusting animals which are not carriers of disease. There are three ways in which certain animals could have acquired their disgust evoking status. Thus, animals such as rats, bats, mice, cockroaches and flies could be associated directly or indirectly with the spread of disease and infection. The second category consists of animals that possess features which resemble disgust-evoking stimuli such as mucus or faeces. This category includes mostly animals which are or are perceived to be slimy, such as snakes, lizards, slugs, snails, worms and frogs. The third category refers to animals that are or were historically associated with dirt, disease or contagion (Davey, 1994). For some animals, particularly spiders, this explanation is the most plausible as fear of spiders is mainly restricted to some Europeans and their descendant indicating that it is not universal and that it is transmitted from one generation to the next through culture, including story-telling, literature, visual arts and cinema, while some of those interviewed said that they do not find any animal disgusting which indicates that the way an individual perceives insects is a cultural phenomenon that is heavily influenced by modern science which has changed the way we view diseases and disgust. Contemporary ideas about defilement and dirt-avoidance have evolved under pressure from knowledge about the existence of pathogenic organisms and are nowadays based on notions of hygiene or aesthetics. Since the discovery of micro-organisms, it has become natural to associate dirt with pathogenicity. In spite of this, ideas about the need to avoid dirt in some societies existed well before the discovery of bacteria 150 years ago (Douglas, 2007).

Another explanation is based on the belief that both biophobias and disgust are increasing in some societies as a result of social alienation from nature as increasing numbers of people are living in sanitised environments with little or no contact with nature. Lack of direct contact with nature lowers the threshold level for insect-related fear and disgust which is especially seen in those with a strong desire for modern comforts (Bixler & Floyd, 1997) and attempting to be in complete control of the environment and to protect themselves from otherness which is nature itself. Any intrusion by unwanted nature into the protected spaces such as the home disturbs the well-ordered existence that is created in a totally artificial environment (Davidson &

Smith, 2003). This attitude towards nature came to the fore during this research where differences emerged between those who grew up exposed to nature and those who had little contact with nature. While the former were at ease in the presence of insects, the latter tended to find insects terrifying and disgusting. A typical example was that of a newly graduated female pharmacist from Sliema who said that she is afraid of all insects but she has now moved to Marsaxlokk to live in a house "surrounded by fields in an area that is full of insects". As a result of this exposure to insects she started getting used to them and lost some of her fear, enough to "get close enough to kill them" but this does not apply to the cockroach which is too scary. This case indicates that while fear of insects can be overcome as one becomes more familiar and used to them, repulsion by disgusting cockroaches and other insects is more difficult to get rid of.

The mechanisms of emotions were highlighted by a practising clinical psychologist who said that social referencing is the trigger for phobias and that animal fear is a learned behaviour, something that you learn at age 4 or 5 and is the result of a child seeing a significant adult showing fear of an animal as was described by a naturalist who brought up his son close to nature. The boy loved all creatures including species which many children and adults are afraid of such as snakes and all kinds of insects. When the boy was four years old, a cockroach entered the room where he was playing together with his older half-sister who had been brought up differently. The teenage girl who was afraid of cockroaches screamed in terror at the same instant that the boy saw the cockroach and in spite of the reassurances by his father, the boy immediately developed a fear of cockroaches. Likewise, a woman in her early thirties said that she was afraid of cockroaches because her mother and grandmother are both afraid of them.

Children search actively for emotional information from their caregiver and use this to appraise an uncertain situation. A mother's or siblings' fearful expression is enough to teach a child to fear a particular object. The more uncertain a child's situation is, the more it searches for emotional guidance and acts on it. Events at all ages can modify fear, but if they take place at certain sensitive phases, they have more permanent effects than at other times and may leave a long-term effect by increasing or decreasing fear. Sensitive phases tend to occur when the young are with their family as things learned at this time are hard to unlearn (Marks, 1987). Furthermore, children brought up in an anxious environment grow up more fearful (Muris, van Zwol, Huijding, & Mayer, 2010). Social referencing could explain why biophobias tend to run in families and why they are more common in some societies and absent in others and why different species are feared in different societies but does not explain all cases of fears and phobias.

In the case of the naturalist's son the impact of his father's imbuing a love for nature probably resulted in the son not becoming phobic and as he grew older his fear diminished to disgust of cockroaches as the effect of social referencing on biophobias can be eliminated or reduced by teaching parents or caregivers to give children more positive information about animals (Muris, van Zwol, Huijding, & Mayer, 2010). Even the type of information given to parents can make a difference to a child's fears and anxieties. Positive information leads to a decrease in fears and vice versa. Ambiguous information does not bring any changes (Muris, Mayer, Borth & Vos, 2013). Although this has been proven for larger animals it could be true also for small animals such as insects. This could be useful as by providing the right information one could slowly create a more positive attitude in children towards insects especially as most insects in the Maltese islands are not dangerous. Social referencing also influences hygiene behaviour by imitation. This is facilitated as both young and old are constantly seeking information about what is disgusting in the local environment so as to avoid risky behaviour. Such knowledge can then be passed on vertically from parent to child and can also spread horizontally within generations (Curtis, de Barra & Aunger, 2011).

The same psychologist said that from her experience with people who suffer from insect fears and phobias it can be said that most of these grew up with little contact with the natural environment. Fear of insects is not a matter of social status but depends on how much one is exposed to insects stating that

> If you are middle class and live opposite a field you are different from somebody of the same class who lives in a town and never sees insects. It's your exposure rather than class. Exposure is the learned behaviour, how your family deals with certain things when you are still young and how used you are to seeing insects and other creatures.

This reflects studies from which it has been concluded that phobias, which are nearly always caused by natural objects, are the result of the attempt of modern Western society to maintain a nature/culture dualism. Thus, phobic objects are considered as threatening not because they are dangerous, as hypothesised by evolutionary naturalism, nor because they are associated with the polluting effects of the body's waste products (psychoanalytic naturalism) but because nature is transgressing the symbolic order on which modern society and self-identity are founded (Smith & Davidson, 2006). Fear of animals reflects modern society's dominant cultural logic that tries to control the environment in which we live, work and entertain ourselves. Thus, if cockroaches did not regularly enter houses and disturb our sense of order and cleanliness, they would not be feared. Humans like and need nature but nowadays nature must be kept in a separate sphere and experienced on predetermined terms. In many urban societies the majority of the persons living there prefer to visit rather than dwell in nature preferring city parks, zoos and aquariums and for the more adventurous, eco-touristic destinations (which are still made up of controlled nature). Nature is allowed in homes under strictly controlled conditions and kept away from our cultured self. This makes phobias and fear of natural things a culturally-mediated phenomenon (Davidson & Smith, 2003). While there might be scepticism to the idea that western society has become alienated from nature, comparison with societies which live closer to nature tends to give credence to this idea. One such example is found in the matrilineal society of Malawi where cockroaches are not loathed or feared and are actually tolerated even though they are seen as harmful and often attempts are made to eradicate them from inside houses because it is believed that they damage food and bring disease (Morris, 2004).

An 1884 paper on emotion-specific autonomous nervous system (ANS) by William James tackled emotions from a physiological point of view and provided material for research that continues in the twenty-first century. James, contemporary with Carl Lange, proposed that emotional stimuli evoke psychological reactions, both visceral and somatic and it is the perception of these changes that evokes the feeling state of an emotion (The James-Lange Theory of Emotion) that is emotions were seen as functional processes that shared common physiological processes. In contrast, the common-sense view is that affective stimuli generate feelings, which in turn produce bodily changes. In 1929 Cannon and Bard presented a direct challenge to the James-Lange theory arguing that emotions have highly similar autonomic responses. The James-Lange Theory of Emotion was side-lined because of the increase in popularity of behaviourism which did not give any importance to subjective internal states. In the 1960s a new theory emerged in the cognitive zeitgeist that emphasized cognitive interpretation of external cues in determining external feelings. The main proponents of this way of thinking were Schachter and Singer who proposed that individuals rely on environmental cues to determine subjective emotional states. Thus, individuals experience physiological arousal that is labelled consistently with their cognitive circumstances, and that label determines the subjective emotional state. In the 1980s ANS came back to the forefront giving rise to the facial feedback hypothesis which proposed that feedback from facial muscles intensifies emotion (Friedman, 2010).

Phobias have been studied extensively by psychologists but research often lacks external validity as psychologists and other researchers attempting to find the origins and causes of biophobias work mostly in clinics and laboratories and their results often do not hold water when extrapolated to real-life situations. Psychologists have shown more interest in phobias than researchers from other fields, probably because of their frequent contact with phobic individuals. In most cases, explanations are based on the assumption that animal phobias are a precaution against life-threatening natural phenomena (Smith & Davidson, 2006). Many of the studies on animal phobias carried out by psychologists involve spiders and as a result, conclusions reached about animal phobias are often based on the reactions of arachnophobic and non-arachnophobic persons to spiders. As a result of this, investigators neglect other more common animal fears and phobias. In fact, arachnophobia is not as important as it is often made out to be. In the UK the five most commonly feared animals are snake, wasp, rat, cockroach and spider in that order while in Malta none of those interviewed for this research said that they are afraid of spiders while many said that they appreciate the presence of spiders in the home as they reduce the number of insects, especially mosquitoes. The difference in the number of persons reporting anxiety and dislike of the cockroach and the spider is significant showing that the spider is far less feared than other animals. This suggests that although the spider is often depicted as the most fearful animal in many parts of Europe and in the UK, the snake, wasp, rat and cockroach cause much higher levels of anxiety and are disliked much more than the spider (Davey, 1994b).

In 1960 Wolpe and Rachman discussed a learning theory interpretation of phobias, after rejecting Freud's psychoanalytic approach to phobias (Seligman, 2016). In response to Wolpe and Rachman's work, in 1971 Seligman proposed the "Preparedness Theory" according to which humans are highly prepared to learn behaviours that protect them from animals such as snakes (Seligman, 2016). In support of this theory, researchers particularly Öhman and his colleagues showed that evolutionary relevant cues (in the form of pictures of snakes and spiders) are slower to extinguish than non-evolutionary relevant cues (pictures of flowers and mushrooms) and that this satisfied the four criteria of prepared learning (Mallan, Lippt & Cochrane, 2013). The results of these experiments were eventually discarded as new data showed otherwise, leading to the conclusion that in non-clinical situations phobias persist because phobic persons do not expose themselves to potentially therapeutic stimuli. Secondly, most fears and phobias are not universal while many other species of animals, objects and situations, many of which are not and have never been dangerous, can trigger phobias (McNally, 1987). While the preparedness theory could explain fear of snakes and other dangerous animals, it does not explain the widespread fear of non-dangerous species such as the cockroach. Furthermore, the preparedness theory while giving importance to evolutionary factors ignores the importance of ontogenic or cultural factors and proposed that future research should consider "a dual-system theory of prepared fear learning whereby both genetic and cultural evolutionary processes may contribute" (Mallan Lippt & Cochrane, 2013 p. 1177).

Another explanation was put forward by Bennet-Levy and Marteau (1984) who argued that as in Britain feared animals are all small and harmless, the fears are triggered off by the animal's perceptual characteristics and although one knows that an animal is harmless, a phobic individual remains terrified by the sight, feel and thought of it. Like Seligman, the two researchers came to the conclusion that humans are prepared or wired to fear certain characteristics such as rapid or abrupt movement and stimuli which are discrepant from the human form. They concluded that certain fears of animals are 'innate to prepared' and that this accounts for the non-random distribution of animal phobias. According to them, the degree to which humans are prepared to approach or fear animals depends not only on its objective harmfulness, but also on the presence of fear-evoking perceptual properties, and its discrepancy from the human form (Bennet-Levy, & Marteau, 1984). This applies to such species as cockroaches which are commonly feared yet have never been a threat to humans while dogs which can be more dangerous are not generally feared (McNally, 1987).

For example, in the case of snakes it is their coiled body and not their colour that plays an important role in their rapid detection by both adults and five-year old children. Many snakes are not brightly coloured but all have an elongated, legless body shape that can coil (Lo Bue & De Loache, 2011; Vernon and Berenbaum, 2002). This was used to explain why snake fear is so widespread. It has been shown that snakes elicit fears and phobias in human adults, infants as young as 5 months old as well as in non-human primates. Human infants in fact do show a greater interest in snakes than in other animals (DeLoache & Lo Bue, 2009). Other experimenters showed that while spiders elicited more fear and disgust than other arthropods particularly bees, wasps, beetles and butterflies there is no general aversion against arthropods (Gerdes, Uhl, & Alpers, 2009).

Arguments have been made to account for spider fear by wrongly claiming that spiders have a special disgust-evoking status and that arachnophobic individuals are better characterised by their disgust (Vernon and Berenbaum, 2002). This argument is flawed as fear of spiders is not the result of preparedness or disgust specifically for spiders as it is not universal. While it is common in some Europeans and their descendants, it is absent in many other societies. Spider fear in parts of Europe could be the result of a cultural and historically close association between spiders and illnesses from the tenth century onwards. The association probably developed with the terror which swept throughout Europe as a result of a number of inexplicable epidemics from the Middle Ages onwards. The spider appears to have been a suitable target for the displaced anxieties of the time, as nobody knew then that it was the rat and its fleas and not spiders which were the real cause of the plague epidemics. The use of spiders in phobia research is thus flawed as since they are not universal, they cannot be of evolutionary origin (Davey, 1994a). Furthermore, only 0.1% of the 35,000 spider species are dangerous to humans reducing to a minimum the probability of encounters with dangerous spiders and thus further undermining the evolutionary explanation for spider phobia. Another argument against an evolutionary explanation of spider phobias is the fact that many phobic objects, such as moths, have never posed any real danger to humans and there are cultural associations that link them to fearfulness (Smith & Davidson, 2006). This research has shown that humans are biologically wired to fear objects that could be dangerous but the degree and object of fear vary from one person to another and to a large degree on culture. As a result of this feared objects are not necessarily dangerous and of insect is horror

One source of unexplained fear of insects is horror movies although hardly any of those interviewed for this thesis remembered ever watching insect horror movies and according to them their feelings about insects could not have been influenced by them, even though such insect movies have been popular for many decades. The only exceptions were a small number of nature lovers in their fifties who remembered being impressed by such movies particularly by the giant ants that featured in the 1957 movie ‘Them!’. This movie was mentioned by four persons, all of whom are active in nature conservation, who saw the film on Italian television during their childhood sometime in the 1960s. These movies make use of the harm-looming model which is based on a person perceiving a danger moving towards him or her. A similar situation was described by several interviewees who said that their fears were triggered on by a cockroach landing on their body, an action which they see as filled with intentionality as the words used to describe the incident as *tiġi fuqek* [it comes on you]. This gave them a fright compounded by the habit of cockroaches of running upwards giving the impression of moving towards the face. Furthermore, the legs have tiny spines with which the cockroach gets a grip on the vertical surface and the slight pricking of the skin by the six cockroach legs as it runs across the body adds to the shock and fear. The most notable of these incidents recounted by persons who went through such a trauma which took place while these young people were surrounded by taller adults packed closely together as is often the case during a procession or a band march which restricts the field of view of the young person and his or her ability to run away from the perceived danger. This situation has been described as a psychological reaction to some animals which is triggered by the anticipation that a danger is moving closer and accelerating or "looming" towards the victim. Individuals fear objects in direct proportion to the perceived forward motion and not just on the dangerousness of the feared object (Riskind & Maddux, 1993). According to this model, a person will perceive any movement except clearly receding movement as looming because he or she will try to refer it to the fear script and interpret it within that context (Riskind & Wahl, 1992).

3.4 Insect fears and society

A professional entomologist who spends most of his time lecturing about insects and peering at them through a microscope admitted that he is afraid of cockroaches but said that he does not want to do anything about it as it is a part of his character, while a lepidopterist who had a fear of beetles decided to pat a large beetle during a visit to French Guiana and convinced himself that if he could touch that beetle he could touch any beetle. These two contrasting experiences are not typical of the way most phobic persons deal with their insect phobias.

A counselling psychologist who works mostly with young people said that people do not go to her because of insect phobias but because of other anxieties and phobias but she helps them when the issue of insect phobias crops up. Most insect phobias in Malta are triggered by cockroaches because they are common insects that are found everywhere including inside houses. She continued that when clients have a phobia one teaches them how to handle the situation by using cognitive behaviour therapy and help them to reason it out. “I tell them that a cockroach is five centimetres, you are 170 cm and if you had to see a monster with that ratio who should be afraid of whom? I instruct them to say to themselves “I can deal with the situation. It is small; I am a thousand times larger than it. I can kill it and everything will be OK”.

Although individuals in different cultures have the same basic emotions there are cultural factors that influence the intensity and expression of these emotions. In one society the language of emotion might be richer than in another while differences might exist even within languages with members of different groups such as the underprivileged not being able to recognise or express their feelings as well as other speakers of the same language (Goodwin, 1983). This can result in some cultures being seen to be less or more afraid of insects than members of other cultures. Differences are partly the result of the extent to which an individual or a society see themselves as being part of nature which is the result of a process of differentiation which started during the European enlightenment. This period has been associated with the dualism of thought including a distinction between nature and culture. As a result people who see themselves as part of culture have started to disassociate themselves from nature and as a result have become alienated from nature (Davidson & Smith, 2003).

Love or fear of nature varies from one culture to another. In the United States only 16% of the population use natural areas for their recreation. Many avoid nature because of fear including fear of insects and spiders. Animal fears can be learned through direct experience, vicariously or through instruction. Although some individuals may develop fear of nature through direct experiences, such as by being stung by a swarm of bees it is those with the least direct experience of nature who are most afraid of it. This suggests that messages from parents, peers, various media such as horror movies and amusement park experiences may be responsible for the generation of many fearful perceptions (Bixler & Floyd, 1997). Copeland (2003) further states that children's prejudices against cockroaches are only one of many absorbed from their culture.

The media has also been responsible for increasing fear of the oriental hornet (*Vespa orientalis*), an indigenous species of wasp that used to be common in the Maltese countryside up to the 1950s after which it declined for unknown reasons until it became nearly extinct. Many men in their late sixties or older who spent their childhood in rural areas in the south of Malta said that when they were young, they used to catch the hornets and devised several ways to play with it. They all said that it had a painful sting but none of them said that boys were afraid of it. In 2010 The hornet started to be recorded in the Maltese islands with increasing frequency. Within a span of a few years it became very common especially in the densely populated inner harbour region from where it spread to other areas. In 2014, articles began to appear in newspapers and on social media describing it as a dangerous insect that needs to be destroyed.

An article in The Sunday Times of Malta written by a medical doctor and a pest controller specialising in insects advised readers to report nests in public places to local councils for pest control removal.[6] One month later the daily Maltese newspaper "L-Orizzont" had a front-page article boldly entitled "*Periklu minn 'Predatur' – Post iffrekwentat mit-tfal impestat b'żunżana li tista' toqtol*" [Danger from a 'Predator' – Place frequented by children plagued by a wasp that can kill].[7] The sensationalist article described the hornet as a very dangerous insect that has a very painful sting and that it would attack humans if they get too close to its nest. Newspaper articles about the oriental hornet as well as television news items continue to appear regularly in late summer, all of them warning readers to keep away from this insect and if stung to go to hospital as a sting could be fatal. These

[6] The Oriental Hornet, Sunday Times of Malta 24 August 2014.
[7] L-Orizzont 23 September 2014.

have created an atmosphere of fear surrounding the hornet. A school in Blata l-Bajda stopped children from playing in the school yard because of fear that hornets from a nest situated several hundred metres away from the school could attack the children.[8] While Lovin Malta, an online news portal, reported that "Hornet Sightings Around Malta Have Shot Up And Everyone's Freaking Out".[9]

During my research I met only one case of a person being stung by a hornet; a beekeeper who tried to destroy a hornet nest by hitting it with a stick. And although one is more likely to be stung by a bee than by a hornet, and despite the fact that a honey bee sting can be fatal for about 1% of the population, bees are not considered as dangerous and beekeepers are expressing concern that hornets are preying on their bees which is leading them to conclude that the hornets are depleting their hives.[10]

During research interviews it became apparent that there are differences between men and women in reported fear of insects as more women than men said that they are afraid of cockroaches and other insects, which agrees with Davey's (1994b) research. This was also confirmed by a clinical psychologist who said that this might be because men try to hide their fear of insects so as not to appear weak. It is always women who ask men to save them from a cockroach and although at face value it might seem that more women are afraid of cockroaches than men, this still has to be researched. According to pet shop owners there is also a gender difference in those who keep insects. About 80% of those who buy insects from pet shops are men. Women prefer to keep cats and dogs. This indicates that there is a gender difference in emotional responses to insects and that this is not solely due to cultural influences (Fredrikson, Annas, Fischer & Wik, 1996; Marks, 1987).

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[8] http://www.newsbook.com.mt/artikli/2014/10/7/residenti-beltin-inkwetati-minhabba-l-baghal-taz-zunzan.22962/

[9] https://lovinmalta.com/lifestyle/living-in-malta/hornet-sightings-around-malta-have-shot-up

[10] The Malta Independent Local 20.09.2017 Bee population increasingly threatened by growing number of alien Oriental Hornets

The reason for the difference between men and women in levels of animal fears is not entirely clear, although research carried out in the United States points at disgust-mediated animal phobias, as it has been found that fear ratings are significantly higher in women than in man for animals where fear is known to be disgust-mediated (Davey, 1994b) which would explain their higher prevalence of cockroach fear in Malta. Despite their predominance in women, phobias have not been given the same level of attention by feminists and social theorists as has been given to other issues such as anorexia and bulimia nervosa. This could be because fears have not been taken very seriously by the public and by the media even though, while not life-threatening, phobias are the cause of anxiety and suffering among phobic persons (Smith & Davidson, 2006).

Biological and cultural explanations have been given for gender differences in fear levels of animal fears and phobias. Differences might be due to the fact that women may be more vulnerable to animal and situational phobias as a result of different genetic and/or environmental transmission patterns (Fredrikson, Annas, Fischer & Wik, 1996). A second explanation could be that men might be less willing to report their fears especially where the fear is the result of harmless invertebrates (Davey, 1994b). On the other hand, since men show equal levels of blood-injection-injury phobias as women (Merckelbach, de Jong, Muris & van den Hout, 1996) it should be safe to say that men are equally likely to report a phobia as women, although it is possible that animal fears are the result of culture, with women being more socialized to be fearful than men (Cornelius & Averill, 1983).

Differences in fear ratings between men and women can also be seen in disgust sensitivity levels and in attitudes to disgust with women being more sensitive to all these emotions (Davey, 1994b). This indicates that gender differences are due to disgust and would explain why fear of some animals, particularly bees and wasps, is consistent across gender lines since this fear is not related to disgust sensitivity levels but with direct experience of a bee or a wasp sting (Davey, 1994b). Animal fears are also more intense in pre-school girls and girls of primary school age than in boys of the same ages (Prokop & Tunnicliffe, 2008). Even eleven-month-old girls learn to fear snakes and spiders more easily and faster than boys of the same age. Although this shows that young girls might be innately more subjective to animal fears it does not in any way negate the effect of society and culture on gender differences (Rakison, 2009). Similar differences can be seen in disgust sensitivity which could be because women need to be more sensitive to disgust than males as they need to be disgusted for two persons; themselves and their offspring (Curtis, de Barra & Aunger, 2011).

Fear and disgust come to the fore when staff at the Tissue Viability Unit at Mater Dei Hospital suggest to their patients that they should consider using maggot therapy to heal their wounds. Maggot therapy started being used in Malta about ten years ago. According to the unit's Tissue Viability Practice Nurse, it is used to remove non-healing skin and soft tissue wounds from patients referred to the unit, in most cases resulting from diabetes, bad circulation or pressure ulcers. Maggot therapy is possible because fly maggots, known as surgical maggots, feed on flesh which needs to be removed. The maggots are placed on wounds and ulcers infected with antibiotic-resistant bacteria such as methicillin-resistant *Staphylococcus aureus* (MRSA) to eat away dead flesh. Infection with antibiotic-resistant bacteria in recent years has become a serious problem especially in post-operative patients. Maggot therapy acts by debridement of the wound surface, disinfection and acceleration of wound healing. The advantage of using maggots is that while feeding they secrete compounds which suppress the growth of the MRSA as well as Gram-positive bacteria (Kruglikova & Chernysh, 2013). Many species of flies are involved in myiasis and several can be used in maggot therapy but the green bottle (*Lucilia sericata*) which is indigenous in the Maltese islands is considered as the most effective species under medical conditions (Wainwright, 1988; Wolff & Hansson, 2003). The maggots used in Malta are imported from the United States at a high cost especially as they have to be flown in, which puts a limit on the number of times the therapy can be used in Malta.

Figure 7 Maggots used for medical purposes (image from Wikipedia)

The attitude of Maltese patients and their families to the therapy varies but does not depend on age or level of education. Some accept it while others refuse to have maggots eating their flesh. The nurse in charge of the unit said that

> Sometimes we find resistance by patients who refuse maggot therapy. We inform the patients gradually. First, we tell them that it is a living thing (*dud*). We slowly build the information by telling them that it is a type of medication. We then explain that the maggots will be in a bag and that they cannot escape. They start to accept it slowly. Sometimes they know of somebody who did it and refuse it but sometimes the opposite happens.

The Unit's nurse said that from experience she can say that although the patients know that flies are carriers of germs, the reaction to maggot therapy is a mixture of fear and disgust. She said that it is predominantly fear which she described as a fear of having your flesh eaten by the same creatures that feed on dead animals “a reminder of human mortality that brings to the surface the conscious and unconscious fear of death”. Although when discussing this subject with persons who never had to face such a choice and who did not know of anybody who did, their reaction was of disgust with one person complaining that she lost her appetite just because I brought up the subject.

Fear and disgust elicited by some insects is so strong and pervasive that these insects, including cockroaches have come to represent that which is most unhuman in nature and when a person is seen to behave badly, he or she is said to be an animal. A person who is disgusting because of the way he or she eats is a pig. A person who behaves reprehensively is a cockroach and when Local Wardens were introduced in Malta in August 1996 they were seen as vile subhuman creatures and within a short time started to be referred to as *wirdien*, the Maltese word for cockroaches and a play on the word warden. The wardens became insects and an object that could morally be eliminated which in fact happened when a warden was killed in Gozo by two men as she was seen to issue too many traffic fines.[11] The association of the wardens with insects was so bad that to improve their image it was decided to replace their brown uniforms.[12] Similarly, to express disgust, Joe Grima, former Minister of Tourism, wrote on Facebook that the Muslim mayor of London was voted in by cockroaches. The comment was seen to be so insulting that it was condemned widely in the Maltese islands and led to the resignation of Grima from his role as Malta’s special envoy to the World Tourism Organisation.[13]

Dehumanisation of the enemy was widespread before and during World War II. Himmler described the elimination of Jews from Nazi occupied Europe as delousing

[11] Times of Malta 7/10/2008
[12] Press Release: Reference Number: PR214, Press Release Issue Date: Feb 20, 2004 downloaded from https://www.gov.mt/en/Government/Press%20Releases/Pages/2004/02/20/PR214.aspx on 22/04/2018.
[13] Times of Malta: Joe Grima resigns, admits language in 'cockroaches' comment may have been excessive, 10 May 2016.

and removing Jews was not a matter of ideology but of cleanliness (Raffles, 2010). Poles were seen in German eyes as an East European species of cockroach while eliminating undesirable people was based on standards of utility and by seeing these people as insects removed any issues of morality (Weinberg, 1995). More recently, in the years leading to the 1994 genocide against the Tutsis, the government of Rwanda used the term *inyenzi* [cockroach] when referring to the Tutsis until eventually the term became ingrained and accepted by the majority. This made it acceptable for the Hutus to kill Tutsis without compassion.[14]

Insectification is one of the results of the way emotions, particularly love, fear, phobias and disgust underlie most human/insect relations to such an extent that they often shape the perception of nature and the environment and human behaviour. The impact of these emotions can be seen in subsequent chapters in which I analysed these aspects of human/insect relations particularly the control, keeping and conservation of insects, their role on vernacular entomology, the way they change our perception of the environment and the sense of place.

[14] The New Times (13 March, 2014) downloaded on 8 April 2018 from http://www.newtimes.co.rw/section/read/73836

4 Keeping, controlling and conserving insects

In this chapter I discuss the keeping of insects both as a means of production as well by being part of the chain of production and as companion species. In all cases these insects provide a service either by producing goods such as hive products, silk or cochineal or by providing a service in the form of control agricultural pests, as plant pollinators or by giving pleasure when kept as companion species. I also discuss the control of harmful and noxious insects. This section is divided into three parts in which I discuss the control of insects that are known to carry pathogens such as flies and mosquitoes, agricultural pest control particularly the control of alien insects such as the red palm weevil and their impact on agriculture and other activities as well as the control of beehive pests and diseases. Also the argument is made that insect conservation, which is usually carried out by persons who love insects is often the result of a fear that some species could become rare of extinct which could have negative consequences on human life.

4.1 Insects as a means of production

In this section I discuss the role of a number of insects which are used or have been used as a means of production in Malta. They include the honey bee and bumble bees, silkworms and cochineal. These insects are managed and controlled so as to obtain maximum efficiency and hence higher production. Some such as sericulture and the cultivation of cochineal insect have not been successful even though time and effort was invested in these initiatives.

Several attempts have been made to introduce sericulture in the Maltese islands during the past 250 years but none of them proved profitable enough and all were abandoned after a short while (Portelli, 2011). An attempt was made in the early 19th century to introduce the cochineal insect (*Dactylopius coccus*) in Spain and other parts of the Mediterranean including Gibraltar and Malta with the intention of setting up a profitable dye industry in Europe.[1] Francis Edward Rawdon-Hastings, Governor of Malta between March 1824 and November 1826, encouraged the introduction and cultivation of the cochineal insect in the Maltese islands which led to an attempt to import the insects in January 1827. This attempt was not successful as the insects which were living on prickly pear plants growing in two pots addressed to the Marchioness of Hastings never arrived in Malta. In August of the same year a Dr Gorman, acting on behalf of the Government, brought to Malta three pots containing prickly pear plants with cochineal insects living on them.[2] Dr Gorman took care of them for three months during which time the insects bred successfully and produced several generations at Zejtun and in the gardens of St Anthony's Palace.[3] When Dr Gorman left Malta, it seems that nobody took over their care and nothing came out of this initiative (Skinner, 1828).

Loewe (1890) reports that an experiment in the cultivation of the cochineal insect was carried out in the estates of the British, Irish and Colonial Silk Company in Malta. Mr Montefiore, the owner of the company, saw the prickly pear trees that had been planted in preparation for the cultivation of cochineal insects when he visited Malta in 1827. It is probable that these prickly pears were being cultivated for the cochineal brought to Malta by Dr Gorman.

At the time there was a suggestion that the government should offer a premium for every pound of cochineal produced for the first two years. At the time the market value of cochineal was between 2.9 and 3 American dollars per pound (Skinner, 1828). Another attempt to cultivate cochineal was made during the government of Sir Frederick Cavendish Ponsonby who was governor from February 1827 to May 1835. This attempt also failed. In this case the Maltese climate was blamed as it was said to be unsuitable for the cultivation of cochineal (Badger, 1838) but it is more

[1] The Annual Register, or a view of the History, Politics and Literature of the Year 1828. London: Baldwin and Cradock; C. and J. Rivington.
[2] The Journal of Agriculture July 1849 – March 1851 New Series. Edinburgh: William Blackwood & Sons.
[3] Gazzetta Piemontese, No 51 (1828).

likely that they failed because successfully controlling insects requires dedication and expertise both of which were lacking in the two attempts to cultivate cochineal in the Maltese islands.

On the other hand, beekeeping in Malta started thousands of years ago and continued without major changes up to the 20th century when modern methods started to be introduced. It is not known when honey bees (*Apis mellifera*) first started to be kept in hives in the Maltese islands but beekeeping is deeply rooted in Maltese culture and tradition. Beekeeping is mentioned in several 15th century notarial documents which indicate that at the time it was practised at least on a small scale by several individuals (Portelli, 2011). Humans have been collecting honey for thousands of years but it was only in the early 20th century that the technology was developed to make the complete control of the reproduction cycle of the honey bee possible. Honey was at first collected solely from the nests of wild honey bees until eventually it was realised that by providing structures similar to wild nests it would be easier to control the bees and collect their honey. This gave rise to apiculture. (Free, 1982).

Apiculture remained mostly unchanged for many centuries. Major changes started to take place when movable frame hives were invented and more sophisticated management systems were developed. These changes gave rise to modern apiculture which introduced new technologies which made it possible for beekeepers to control bees and as a result produce more honey per hive. This led to profit-making and the commercialisation and the international production and sale of bee products including honey, royal jelly, packages (a box of worker bees used to set up a new colony), beeswax, propolis and others (Chauzat, Cauquil, Franco, Hendrikx, & Ribière-Chabert, 2013). Maltese beekeeping went through the same changes albeit more slowly and much later than in other European countries which led to the discovery in 1997 that the honey bees found in Malta belonged to an endemic race (*Apis mellifera ruttneri*). The discovery came after large numbers of Italian honey bee queens (*Apis mellifera ligustica*) were imported from New Zealand to supplant the local bee population which was decimated by disease and which was leading to fears of a total collapse of bee keeping in the Maltese islands. This gave local beekeepers an opportunity to compare the local honey bee with the imported domesticated bees which had been bred for particular characteristics. The Maltese honey bee had been isolated from other bees and probably remained largely unchanged for hundreds or thousands of years. Beekeepers did not interfere with it because the technology to control the queens' mating was not available in Malta. As a result, the bees kept by beekeepers were similar to the indigenous wild bees.

The imported queens started to mate with local bees resulting in hybrid honey bees being produced. This was leading to the dilution of the DNA of the local bees. This process continued for many years and beekeepers nowadays believe that no pure Maltese bees are left in Malta. Many beekeepers are concerned about the disappearance of the Maltese bees and a number of individuals are trying to keep solely Maltese bees but they were aware that on an individual basis this is impossible as they have no control on the mating of the queen bees and many felt that they cannot do anything to save the Maltese honey bee.

Most beekeepers nowadays agree that the domestic Italian honey bee is not as well adapted for the Maltese environment as the Maltese bee but most of them believe that after two or three generations of mixing with the Maltese bee, the hybrid produced is often better than either the Maltese or Italian bees.

While lauding the characteristics of the Maltese honey bee, many beekeepers believe that they should control its aggressiveness which many of them see as a problem. As one beekeeper from Mġarr said "The problem with the Maltese bee is that it is too aggressive because nobody worked on them to create a calmer bee which would be easier to work with and control" and although they are proud of this bee, they would like to have a bee that is easier to work with.

Maltese beekeepers until recently have been keeping wild bees but many of them are now willing to change them so that they become easier to use. Beekeepers who want a different version of the Maltese honey bee are unwittingly calling for its domestication. These are not concerned about its genetic purity and one beekeeper has actually compared the resulting bee with the Maltese population which is made up a mixture of people from several countries.

In 2017 the Malta Beekeepers Association launched a project together with Smartbees[4] to save the Maltese honey bee from extinction and at the same time to modify it in order to make it less aggressive and therefore easier to work with and to breed modifications that would make it better able to resist disease, particularly the varroa mite. While the Malta Beekeepers Association considers this as a conservation project to save the Maltese bee, the aim is also to change the Maltese bee by making it more docile. As the aggressiveness is one of the characteristics of the Maltese bee which helped it to survive in the Maltese environment changing this and other characteristics would lead to the loss of the Maltese bee.

There are two divergent opinions regarding the Maltese honey bee. Some beekeepers want to protect the Maltese honey bee ideally as it was before the importation of foreign bees, an impossible task since this bee does not exist anymore, while most would like to see it changed by selective breeding. Beekeepers who want to see the Maltese honey bee modified and improved believe that this would be better than the wild Maltese honey bee and would actually save it as otherwise beekeepers would import more foreign bees that are easier to work with. As one keen beekeeper said "If a breeding programme had to be made, we would improve the Maltese bee. To have a popular bee it must be able to compete with other bees. Doubtlessly it is the best adapted for the local climate and I am sure that it is the best to resist the varroa and live with it". On the other hand, some beekeepers are doing their best to keep the Maltese bee as it was or to bring back the characteristics it had before it started to mate with imported bees. To achieve this one beekeeper from Siġġiewi has devised a

[4] http://www.smartbees-fp7.eu/News/files/SMB-028.html

way to reduce the number of drones with non-Maltese characteristics thus increasing the probability of his queens mating with a drone with Maltese characteristics. The device consists of a trap for drones; drones which have the external characteristics of the Maltese bee are released while those which look like foreign bees are killed. He believes that this increases the probability of his queens mating with drones that have Maltese characteristics. Many beekeepers do not believe that such drastic action is necessary as according to them even when a new subspecies is introduced the resulting hybrid bees, within a few generations would revert back to the original form as nature would select those bees which are best suited for the Maltese environment.

The first step towards the domestication of the honey bee was taken in 1852 when Reverend L. L. Langstroth of Philadelphia patented a wooden hive which made modern beekeeping possible (Crane, 1984). One year later Langstroth made the first unsuccessful attempt to inseminate bees artificially but it was not until 1927 that an apparatus was developed by Watson, by means of which semen was successfully injected into the queens' reproductive tract. Since then the technique has been developed further and nowadays queen bees are routinely inseminated (Crane, 1999). Artificial insemination made it possible to fully control the bees' reproductive cycle and this made it possible to initiate the process for the domestication of the honey bee. It took several years for the results of the domestication of the honey bee to be seen. In 1908 Southgate Shaler wrote that the bee is "domiciled rather than domesticated" (p. 196). At the time, his statement was correct because the honey bee had not been changed enough to be called a domesticated insect. Artificial insemination is not yet practised in Malta as the required expertise is not available on the island and as a result, the Maltese honey bee has not yet been domesticated.

All honey bees can live independently of humans and act independently of their owner which is enough to categorise them as wild animals. On the other hand, humans now can control the bees' reproductive process and selectively breed particular characteristics and create new honey bee stock such as the Buckfast honey bee which was created by Brother Adams, a monk at Buckfast Abbey in Devon, England, in the 1920s (Wilson, B., 2004).

Other honey bee varieties have now been bred; a process that took place relatively recently because the queen bee's mating could not be controlled and in most cases was not even witnessed by the beekeeper. The queen mates with several drones in quick succession during its nuptial flight. The drones can come from up to sixteen kilometres away and the queen herself travels as far as five kilometres from the hive during this flight. As a result of this it is difficult to control which drones inseminate the queen unless the mating takes place where no other bees are present such as in desert oases or on small remote islands (Crane, 1984).

Honey bee domestication is the most recent step in a process of change that started thousands of years ago when humans provided bees with artificial cavities in which to build their nests. This brought a change in the relationship between humans and bees but for thousands of years the bees continued to live with minimum human intervention. In the past one hundred years or so the relationship has become much closer and intertwined but there is still no agreement on the status of bees in relation to humans as there is no consensus on what makes a domestic animal although all accept the fact that it is about the relationship between humans and target animals. Some writers (e.g. Free, 1982) refer to honey bees as domesticated insects. For Moore and Kosut (2013) bees are semi feral and semi domesticated but for many authors and beekeepers, honey bees are considered as wild creatures that can live without human intervention. Honey bee domestication is an ongoing process and it might never be completed for various reasons the main one being that the honey bee is spread throughout most of the world and would be difficult to replace all wild bees with domesticated forms. Secondly each honey bee race is adapted for its particular range and one would have to domesticate each race which would then have to be isolated from the wild forms. Except on small islands this is a nearly impossible task as bees need to roam over large areas.

Domesticated bumblebees (*Bombus terrestris*) are easier to keep and work with than honey bees. Several Maltese farmers regularly make use of these hymenopteran species to pollinate crops in greenhouses. Bumblebees started to be imported in its domesticated form by Martin Grima Ltd from the Netherlands in 1993 mainly to pollinate tomatoes and to a lesser extend aubergines and peppers in greenhouses. Initially farmers were using mechanical methods to pollinate their plants which included equipment to vibrate the plants while others were using a device known as the electric bee which pollinated one flower at a time. By 1993 most farmers were spraying the plants with a hormone that induced the plant to fruit even when it was not fertilised. This method was seen as being efficient and effective and in 1993 farmers were not willing to start using bumble bees. The situation changed in 2010 when the use of the hormone was banned in the European Union and farmers were forced to switch to bumble bees. Using bumble bees was found to be good value for money as before, growers had to spend about two days per week pollinating their tomatoes, also bumble bee-pollinated plants produced heavier and better quality tomatoes which fetched a higher price. The disadvantage of bumble bees is that whether you have a large or small greenhouse you still need a box of bumble bees making it less cost effective for those who have small greenhouses (Velthius, & van Doorn, 2006).

The bumble bee was domesticated in the 1970s. Soon afterwards, discussions started on the possibility of rearing it commercially. In 1987, after a decade of experimenting, commercial rearing started and by 1988 *Bombus terrestris* was being used in the Netherlands and Belgium to pollinate greenhouse tomatoes. The domestication of the bumble bee and its use in agriculture had both positive and negative environmental impacts. According to the two bumble bee importers, the use of bumble bees in greenhouses has catalysed the change from chemical to biological control of insect pests. As one of the importers said “You cannot apply insecticides in your greenhouse if you have bumble bees inside”. On the other hand, their use in areas where the species already occurs has raised fears of genetic pollution of the wild bumble bees by domestic bumble bees (Velthius, & van Doorn, 2006). The two importers maintained that the bumble bees do not fly out of greenhouses but since bumble bees started to be imported local naturalists have noticed an increase in bumble bees in the Maltese countryside but it is not known whether this is a natural increase or whether it is a result of domesticated bumble bees escaping from greenhouses as no studies of their DNA have been carried out (M. Balzan, personal communication, 24, January 2019).

Domestication is an interspecies relationship which has been defined as human control over another species but few consider the way domestic animals have changed human behaviour (Tsing, 2012). This would be seen if the Maltese honey bee which is very aggressive, would be bred to make it less aggressive as with less aggressive bees, beekeepers would be able to place their hives closer to other humans. This would reduce fear of bees among the general population and there would be fewer complaints, vandalism and legal actions against beekeepers. Domestication might also be of benefit to the bees as this would increase the amount of land available for bees. This would result in an increase in the honey bee population and honey production in the Maltese islands. On the other hand less aggressive bees could become unprepared to defend themselves against predators such as the oriental hornet which would induce the beekeepers to take measures to protect their bees from these predators.

Domestication is a functional relationship between humans and other animals. The relationship is one of control of one species of another and is one sided as it is humans that are in sole control of the relationship (O'Connor, 1997). A small number of insects have been domesticated to make them better suited for human needs, the first of which was the silkworm (*Bombyx mori*) which was domesticated by the Chinese 5,000 years ago. In the 19th century beekeepers started to change the honey bee (*Apis mellifera*) which led to the creation of domesticated bees and more recently the bumble bee (*Bombus terrestris*) which is used as a greenhouse crop pollinator (Zeder, 2012).

Whether an insect can be considered as domesticated depends on the definition of domestication adopted. Different definitions depend on the relative emphasis placed on either the human or animal side of domestication (Zeder, 2012). Often the definition is given from the perspective of the domesticator, which emphasises the role of humans in the domestication process (Zeder, 2015). Such definitions emphasise the intentionality of the domestication process and the dominant role of humans who with foresight intervened in the lifecycle of the animal by controlling the domesticate's movement, feeding, protection, distribution and breeding in order to satisfy particular human needs Zeder, 2012). This involves a change in the socio-economic organisation in which successive generations of domesticates become integrated in human society as objects of ownership (Zeder, 2006).

Others view the domestication process as a mutualistic, symbiotic relationship similar to that found in nature in which the relationship is beneficial to both sides or at least beneficial to one and neutral (or at least not strongly detrimental to the other). Biologists tend to look at domestication as beneficial for the domesticate as it results in a greatly improved reproductive fitness and expanded range (O'Connor, 1997). Domestication is different from nature because humans have the capacity to willingly change their behaviour to adapt themselves to new circumstances and to intentionally take the initiative to start the domestication process. This intentionality can accelerate the domestication process (Zeder, 2012). Commensalism and control of wild animals is not domestication while control of captive species can be considered as domestication depending on the degree of control of the reproductive process (Vigne, 2011).

In 2006 Zeder argued that domestication is not an equal process but one in which humans are in control of the domesticate. This term would make it easier to describe and define the domestication process as many definitions of domestication have failed because they relied solely on either a biological or cultural point of view. Such a one-sided view cannot work because domestication is a unique process which is the result of a conscious effort by humans, who throughout the process play a dominant role to consciously perpetuate it for their benefit but later she added that in some cases, domestication has been of greater benefit to the domesticates than to humans. In 2015 Zeder gave an overview of the various definitions of domestication.

One point of view looks at domestication in terms of the relationship between humans and target species viewing it at a mutualistic, symbiotic relationship that benefits both domesticator and domesticate although according to some, domestication is of greater benefit to the domesticates. Some researchers take a biological approach and look at domestication as a genetically driven change of the domesticate's phenotype. Some authors have broadened the definition to include other human-animal relations. One such definition proposes that domestication occurs when a species knows how to harvests another or when domestication is replaced with the term "cultural control". Zeder then proceeded to provide her own comprehensive definition as domestication being

> a sustained multigenerational, mutualistic relationship in which one organism assumes a significant degree of influence over the reproduction and care of another organism in order to secure a more predictable supply of a resource of interest, and through which the partner organism gains advantage over individuals that remain outside this relationship, thereby benefitting and often increasing the fitness of both the domesticator and the target domesticate (Zeder, 2015 p. 319).

Animal domestication started about 9,000 years ago with a small number of larger mammals that were living on the Eurasian continent. The process of domestication is on-going but for thousands of years few new species were domesticated. Only a small number of species have been domesticated because for domestication to take place animals must have particular characteristics such as the right social structure, sexual behaviour, and parent-young interactions. These characteristics are actually found in only a few species of animals of which only a handful are insects although over the past one hundred years, humans developed and utilised new sophisticated technology for breeding and rearing of animals in captivity which made it possible for more species to be domesticated (Zeder, 2012). The first insect to be domesticated was the silkworm (*Bombyx mori*), which was domesticated in China about 5,000 years ago and today bears little resemblance to its ancestral species and cannot survive in the wild. The domestication of the honey bee (*Apis mellifera*) did not start before the started in the 19th century because the mating of the queen bee could not be controlled by humans until the invention of the modern hive and artificial insemination of the queen honey bee (Zeuner, 1963), while that of the bumble bee (*Bombus terrestris*) started in the first decade of the 20th century (Velthuis, 2002).

4.2 Controlling insects

Pests are living organisms that compete with humans. They are plants or animals that are of detriment for human concerns, be it crops, livestock, health or living space. To minimise competition and nuisance humans have been using various methods to control pests especially insects and continuously study them to seek more efficient means to eliminate or control them.

Up to the end of World War II insects and other pests were controlled mostly by cultural methods (Russel, 2001). A seventy-four-year-old farmer from Siggiewi who continued with the family tradition of growing local cauliflower from seed said that “My father used to tell my mother and us children to go around the fields to search for caterpillars. We used to squash them between our fingers to kill them” although he admits that he is afraid of insecticides he uses them to control caterpillars and other insects. According to him nowadays there is pressure to produce more per unit area which he can do only by using pesticides and artificial fertilisers. He summed up the situation by stating that “The world has become too fast”. Another elderly interviewee described how his mother used to remove lice from his hair using a fine-toothed comb while another one said that when he was infested with fleas his mother covered him with a woollen blanket. The fleas moved to the blanket which she then hung in the sun to induce the fleas to move to the surface from where she squashed them with her finger nails.

The category pest is not a biological category. It can include both plants and animals from various orders with particular characteristics. Power (2007) defined pests as “a diverse group of organisms united by their perceived capacity to disrupt and disturb people and things of significance to them” (p. 215). The term ‘pest’ is a shifting identification which depends solely on the way an animal impacts on humans. For others "pest" is a contingent identification that reflects animal presence, activity, and the ways that animals impact on humans. This includes the purposive transformative and creative agency of nonhuman animals that shapes and motivates a range of human activities, including pest identification and elimination. Pest status depends also on the location of the human-animal encounter with pests viewed as organisms that disrupt or rupture human perceptions or experiences of particular places. Insects in the home or in a cultivated field are pests because their presence in such a place is undesired like dirt which has been defined as matter out of place. The affective status of a human/animal encounter also plays a role in the identification of a pest. Animals such as cockroaches, which generate feelings of fear and disgust in humans, and which are able to underpin the way people experience particular places, are more likely to be given pest status, a characteristic that is used by pest control professionals to sell their products and services (Power, 2007).

Pest controllers, farmers and the general public have an arsenal of chemical products to kill pests some of which can be bought from gardening shops and supermarkets. In Malta, research on insect pests is carried out mainly by the Department of Agriculture, the Department of Health and the University of Malta. Several scientific papers and reports have been published on insects in Malta that have a negative impact on humans many of which consist of records of indigenous and alien insect pests, predators and parasites (e.g. Gatt, Deeming & Schaffner, 2009; Gatt & Zammit, 2008; Mifsud & Dandria, 2002). Apart from being used to kill agricultural pests, insecticides are used in homes and by professional pest controllers to destroy insects in commercial and other establishments including shops, hotels, restaurants and houses.

Farmers are among the major users of insecticides and other chemicals to control insects. Many Maltese farmers believe that insects are enemies determined to make their life more difficult and that they must control or eliminate them to stop them from damaging their crops. An elderly farmer from Siggiewi reflected the typical attitude when he described an insect as "an object that destroys you. It works against you. You must use insecticides to protect yourself from it". Another said "I am against them" by which he meant that he was right in opposing them. Even farmers who respect living things feel that there is nothing wrong in killing insects, one said that "Insects are God's creatures but that does not mean that one has to allow them to live". A farmer from Fawwara said that "every living thing wants to live but this is not possible as insects have to be killed". Farmers who are also beekeepers tend to have a less hostile attitude towards insects but still believe that they must be destroyed. A farmer who is also a beekeeper said that "since insects were created by God then even bad ones must do something good" but since he was not aware what good they did he felt justified in killing the ones that damaged his crops. These farmers are more careful when applying insecticides and avoid spraying when the fruit trees are in flower so that bees are not killed when they visit the flowers. One farmer/beekeeper said that he buys more expensive insecticides because according to him these do less harm. The same farmer said that since he started keeping bees, he became more aware of the importance of insects and thinks that it would be good if more farmers kept bees as they would learn to appreciate insects more and they would be more careful when spraying their crops. Other countryside users particularly naturalists are aware of the impact of pesticides on Maltese fauna and blame them for a decrease in once common insects. Professor Louis F Cassar, who has worked on some species of crickets, summed it all up when he said that "Malta is the only Mediterranean island where you do not hear bush crickets and this is because of the overuse of pesticides".

Farmers are affected mostly by sap-feeding insects which can cause huge losses by depleting nutrients, transmitting viral diseases from one plant to another, injecting toxic saliva into the plant, and producing a sugary mildew which provides a substrate for sooty mould which blocks light and air from reaching the leaves. Most sap feeders are small insects and include true bugs, cicadas, whiteflies, jumping plant lice, scale insects, aphids and thrips. These pests can have a considerable impact on the agriculture of small islands which usually have a restricted variety of crops and their presence can leave an impact on the agricultural community in both economic and social terms such as when the export of Chrysanthemum flowers and cuttings from Malta was prohibited because of the accidental importation into Malta of the

American serpentine leafminer (*Liromyza trifolii*) which led to the collapse of the horticultural industry in Malta (Mifsud & Watson, 1999).

Farmers have probably been controlling insects since the beginning of agriculture. In the past, more than today, they used pest control methods that acted as built-in suppression mechanisms that reduced the number of insects mostly by cultural methods. These included crop rotation, tillage burning of stubble, careful placement of plants to avoid synchrony with pests, destruction of wild plants that harbour pests and/or cultivation of non-crop plants to conserve natural enemies as well as maintaining the genetic diversity of both crops and non-crops and matching soil varieties with crop varieties (Posey, 1986). These traditional methods often were effective enough to control insect pests by encouraging predators, parasites/parasitoids, pathogens and/or competitors which together with the interaction between the biotic and abiotic factors kept the insects and other potential pests in a state of equilibrium. These methods did not stop all pests and farmers accepted some losses as an inevitable fact (Gullan & Cranston, 2000). Pest control used systems of indirect control which as will be discussed later, changed to direct control immediately after the World War II.

Sometimes pest control fail and some insects become serious pests. When this happens competition for resources increases and this effects not only food production but also the welfare, aesthetics and profits. Such failure can take place when insects are accidentally or intentionally introduced in a new area where there are no natural enemies to control them. These introductions started to increase with faster and more extensive travel and the liberalisation of commerce which facilitated the importation of new plants and accompanying insects to new areas (Gullan & Cranston, 2000).

The means used to control of insects changed with time. From the mid-19th century quarantine and import restrictions were used as a first line of defence to stop the importation of alien insects and other plant diseases. These were in force for more than a hundred years but although effective they became more difficult to implement because of more liberal and wider commerce (Gullan & Cranston, 2000).

On 3 March 1876 an ordinance was published in the Government Gazette to prevent the introduction of agricultural diseases in the Maltese islands. The ordinance empowered the Head of the Government to prohibit the importation of any agricultural produce from any country if in that country the agriculture was affected by a particular disease. The first Government Notice to implement this legislation was published in 1880 to prohibit the importation of vine plants from countries where Phylloxera existed or was suspected to exist (Portelli, 2011). This legislation was so effective that while grape phylloxera was established in most countries between 1880 and 1890, it did not arrive in Malta and Gozo until 1919 (Borg, G., 1993). In 1965 it was felt that the 1876 Ordinance which was based on conditions prevalent at the time became inadequate and a new phytosanitary law was prepared and submitted for the necessary vetting together with the preparation of the relevant schedules.[5]

Sometimes these restrictions failed and insect established themselves in new territories, sometimes increasing rapidly because of lack of natural predators and become pests. Pests can sometimes be controlled by introducing their natural enemies from their country of origin (Sánchez, Grecho, & Cédola, 2004). In Malta biological pest control was successfully used for the first time to control the cottony scale insect (*Icerya purchasi*) which appeared in winter 1909 – 1910. The first sighting of this insect was at St George's and by the following winter nearly all gardens in St Julian's and Sliema were infected with this pest. In August 1911 a small colony of vedalia beetles (*Rodolia cardinalis*) was received from Professor Silvestri of the Royal School of Agriculture in Portici in Naples and on the 22nd of the same month the insect was distributed free of charge to all the owners of infested gardens. The introduction was a success and by the end of October the scale insect had practically disappeared. The vedalia beetle established itself in the Maltese

[5] Government Departmental Report 1965 (NAM GMR 2728)

islands and is still an important predator of the cottony scale insect. The Maltese authorities used similar strategies to control other alien species. The red scale *Chrysomphalus dictyospermi minor* was first detected in 1914 almost simultaneously at Attard, Sliema, and St Julians, from where it spread to many groves throughout the island. It became established throughout the Maltese islands and was destructive to citrus trees especially lemon trees and to ornamental plants chiefly roses. The pest is difficulty to control and trees die off after a mild infestation. It used to be controlled by being sprayed with a mixture of sulphur and lime until it was realised that it was being controlled by one or more parasites of other scale insects and that control by natural means was more effective than by artificial remedies.[6] The woolly apple aphid (*Eriosoma lanigerum*), which was infesting practically all the apple trees in Malta and Gozo, was controlled by *Aphelinus mali*, a very small wasp that lays its eggs directly in the aphid's body. In 1933 colonies of this wasp were imported from the Royal Phytopathological Observatories in Genoa, Verona and Turin and successfully introduced in Malta and Gozo (Portelli, 2011).

In natural biological control, when species increase their natural enemies also increase and prevent them from becoming serious pests. This was generally enough to control insects and prevented them from causing too many losses although sometimes as a result of unfavourable weather or an influx of migrant insects did increase in number and became pests with the result that there was a decrease in production and higher prices of particular agricultural products. When natural biological control failed to deal with a problem, farmers sometimes used non-persistent chemicals to control insects (Boussemart, Leleu, & Oja, 2011).

Biological pest control replicates natural processes that are often discovered when insect populations increase because of the disruption of the natural enemy population (Hoy, 2006). Natural biological control can be replicated by humans by introducing control agents to reduce the number of pests (Sánchez, Grecho, & Cédola, 2004). Biological control is host specific thus specifically targeting the pests but it does not

[6] Agricultural Report 1920 – 1921 (NAM – GMR 776).

eliminate all pests but reduces their number to a level acceptable to the farmers (Gullan & Cranston, 2000). Although biological pest control can go wrong such as when an introduced predator starts to feed on indigenous species, it has the advantage of being non-polluting, non-toxic, and self-perpetuating (Sullivan, 2006).

When biological pest control was introduced in Malta, the Director of Agriculture was following what was happening in the United States where in the late 19th century American authorities started to give more attention to agriculture with the aim of increasing production and as a reaction to the arrival in the United States of alien species of insects which were becoming pests of agricultural products. Between 1900 and 1920 experiments were carried out to control these pests by introducing their natural predators (Dunlap, 1980).

Biological pest control is nowadays rarely used in Malta even though most pests found in greenhouses can be controlled biologically. The main reason is that because of added expenses including freight and handling costs imported insects are more expensive to use than chemical control. Furthermore, while chemical pesticides give immediate results, biological systems that use predatory insects take longer to give results. A local importer of agricultural products used to import predatory insects including *Phytoseiulus persimilis* to control the red spider mite (*Tetranychus urticae*), *Encarsia formosa* and *Eretmocerus mundus* for whitefly control, Orius to control thrips, and *Amblyseius swirskii* to control thrips and aphids. In the 1990s Maltese farmers availed themselves of a system of subsidies of up to 50% of costs to use biological pest control. According to this importer the subsidies did encourage farmers to use such systems and when they were removed, interest in biological pest control disappeared because of the high costs involved. He believes that if subsidies were to be given again, farmers would go for biological pest control methods because they know that insect pests are becoming resistant to pesticides.

Sometimes extreme situations required extreme solutions such as when the Maltese islands were threatened by locust invasions that could have destroyed much of

Malta's agricultural produce for that season. John Borg (1939) wrote that the migrations of locusts from Africa to Sicily and southern Europe take place along a well-known route through Tunisia and by-pass Malta although small swarms sometimes reached the islands in early spring because of adverse weather hitting the main swarm. Borg witnessed five swarms crossing from the south-west to the north east at a height of about one hundred metres. One of the swarms consisted of thousands of individuals and made an unmistakable noise. Borg also wrote about a local belief that swarms of locusts once drowned in the sea at Saint Paul's Bay and that the Maltese ascribed their drowning to a divine intervention by Saint Paul. Borg postulated that it was possible that in the past locusts used to breed in the marshes of Burmarrad, Pwales and Ġnejna and from there the locusts spread to other parts of the Maltese islands. He also wrote that in the early 1930s there was a resurgence of locust swarms in Sicily and in other parts of southern Europe which could reach Malta and as a precaution the Department of Agriculture, of which he was the Director, bought several flamethrowers to destroy the swarms should they arrive in Malta. The locust swarms did not reach Malta and the flamethrowers were not required.

Immediately after the Second World War there was a shift from indirect to direct control of insects. Although farmers had been able to keep crop losses to acceptable limits, from the mid-1940s onwards they were told that it was possible to eradicate all pests by means of chemicals that had just been developed as part of the war effort that resulted in a stockpile of unused poisons. When these chemicals started to be used in the fields all forms of biological pest control started to fail and previously controlled insects started to become pests. Instead of serving as an eye-opener about one of the negative impacts of the new insecticides the failure of natural pest control and the explosion of pest populations triggered a race to find and use larger doses and stronger chemicals in a similar way to what was taking place in other countries which led to a roller-coaster effect from which farmers have not been able to leave (Russel, 2001).

During and immediately after World War II, as part of Malta's efforts to increase food production experiments were carried out by the Department of Agriculture to test the effectiveness of different concentrations of gammaxane[7] in controlling the Mediterranean fruit fly and sucking insects particularly aphids. The compound was found to be beneficial and it remained effective for a prolonged period and was commended for future use. Gammexane was also used against the caterpillars of the cabbage white which gave a 100% success rate. Gerald J. Peralta, Plant Pathologist, in his contribution to the Agricultural Report for 1938-1946 wrote "Control of these obnoxious pests is thus now possible and the time is not far when farmers will start resorting to these relatively new but most effective measures of control". In the same report the plant pathologist complained that

> the parasite *Apanteles glomeratus*[8] which normally manages to keep in check both *Pieris rapea* and *Pieris brassicae,* was unfortunately not present during the period under review in sufficient numbers to cope with the white cabbage butterflies infestations and extensive resort had to be made to artificial measures to deal with the emergency" He continued " Nor were the ladybirds, chief amongst which *Chilocorus bipustulatus, Coccinella 7-punctata* and *Coccinella 11-punctata*, normally constituting the most effective barrier against aphid infestation, present in their usual number with the result that during the current year aphids were conspicuous on most cultivated crops, fruit trees and ornamental shrubs. [9]

In 1955 the Department of Agriculture felt it necessary to intensify the campaign for combatting plant diseases and pests and to make bulk purchases of chemicals including gammexane and gammexane compounds and DDT and to invest in more effective spraying equipment.[10] In spite of these investments by 1959 from a net exporter of fruit, Malta started to import most of its citrus fruit, apples, pears, peaches and plums. "Fruit production has declined in the islands during recent years mainly as a result of overwhelming losses of trees and fruit through pests and diseases" with reference to peaches and pears the report stated that The decline has been mainly through premature death of trees attacked by wood boring insects".

[7] Benzene hexachloride
[8] Renamed *Cotesia glomerata*
[9] Agriculture Department Report 1938 – 1946 (NAM GMR 1501)
[10] Agriculture Department Report 1955 (NAM GMR 1855)

Departmental officials were optimistic that the page would be turned and that with the right investment sufficient production would be possible for export to start again without much difficulty. The Department managed to control the codling moth[11] and was looking forward to a seasonal glut of summer apples which was expected within a few years. The optimism was such that they recommended that "Investigations into the storage of fruit should be commenced to extend the marketing period and, if successful, may lead to increased plantings" (Agriculture Department Report 1959 p.26).

The same losses were reported for citrus trees

> Citrus production has dropped during recent years through 'die-back' of and loss of fruit through Mediterranean fruit fly. The latter shortens the ripening period causing seasonal glut. However it can now be successfully controlled and marketing can be extended throughout the winter using suitable varieties (Agriculture Department Report 1959 p.26).

With regards to its duties the Department of Agriculture said that it was its

> duty within the islands to help in raising the standard of health of trees, plants and crops. It is therefore essential to intensify the campaign to combat plant pests and diseases. The production of certain stone fruits such as peaches and plums will become economic when the problem of wood-boring insects is solved. At present this is the most severe limiting factor to tree survival (Agriculture Department Report 1959 p.26).[12]

Soon farmers also had to deal with new insects pests not mentioned in previous reports.[13] By 1962 efforts to control insect pests had to be widened and from an occasional insect infestation that was reported before 1945 it now included the Mediterranean fruit fly, wood boring insects such as *Cerambyx miles, Zeuzera pyrina* which started to be sprayed with a combination of Dieldrin and Chlordane. In spite of the increasing use of pesticides it was becoming impossible to control the pests. In 1962 the Director of Agriculture wrote that "a large number of apple and

[11] *Cydia pomonella*
[12] Agriculture Department Report 1959 (NAM GMR 2173)
[13] Agriculture Department Report 1962 (NAM GMR 2478)

pear trees has been uprooted and destroyed at Baħrija since 1961. As these were absolutely riddled with larval galleries, and no longer an economic proposition, their removal is opportune" (Agricultural Department Report 1959 p. 15).

To intensify the war against insects the Plant Protection Section, in 1963 reported that "Field and spraying equipment was increased, and the section now possesses practically the full range of equipment (except, of course, tractor driven models)" (Agriculture Department Report 1963 p. 34).[14] In the following year

> Investigations on '*Cerambyx dux* Fald', *Capnodis tenebrionis* L. and *Zuerzera pyrina* L. all serious pests of the apple and pear trees, were brought to a successful conclusion by confirmatory trials held during 1964. In addition, the complete life-history of the pest named has been studied and preliminary trials on its possible eradication have been initiated (Agriculture Department Report 1964 p. 32). [15]

In 1965

> Talks on Plant Protection were given to farmers in various villages in Malta and Gozo during Extension Service meetings. These were devoted principally to topics of a general nature. Talks were also given during the Sunday half-hour for farmers on the local Rediffusion service. All talks and broadcasts were delivered by the Department's plant pathologist and entomologist. Over 1,200 farmers and growers, including amateur gardeners and householders, were visited at their premises by members of the Section's staff, to give advice on pest control" (Agriculture Department Report 1965 p.49).[16]

Talks to farmers continued in 1966.[17] These actions continued in spite of the fact that the authorities in the United States and other parts of the world were already being warned by scientists and writers such as Rachel Carson (1962) that these chemicals were having a negative impact on agriculture, the economy, ecology and human

[14] Agriculture Department Report 1963 (NAM GMR2537)
[15] Agriculture Department Report 1964 (NAM GMR 2610)
[16] Agriculture Department Report 1965 (NAM GMR 2728)
[17] Agriculture Department Report 1966 (NAM GMR 2836)

health. In her book Carson highlighted information that was found in scientific reports that showed that insecticide use was having several undesirable effects including damage to agricultural land and surrounding natural areas, food and water contamination and chronic toxicity to humans and other animals (Boussemart, Leleu, & Oja, 2011). Within a short time chemical pest control started to become less effective as insecticide use resulted in the selection of insects to become genetically resistant to the chemicals. As a result of this, the chemicals become less effective and farmers had to rely on heavier doses of chemicals and repeated applications (Sullivan, 2006). Furthermore, use of these chemicals resulted in the destruction of non-target organisms, including pollinators, the natural enemies of the pests, and soil arthropods (Gullan & Cranston, 2000). In spite of Carson's warnings new chemical pesticides continued to replace traditional methods of pest control and their use continued to increase at a fast rate in the developed and developing world (Boussemart, Leleu, & Oja, 2011). In Malta the disadvantages of the use of persistent chemicals were brought to the attention of the Department of Agriculture which reported that

> The main item under consideration during the period under review was the effect of the new International restrictions on the use of chlorinated hydrocarbon insecticides as applied to local recommendations. Following a detailed study of the local uses of these insecticides, it was decided that the problem was a long-term one and that the best way out would be a gradual easing up of their use, coupled with the issue of alternative recommendations. (Agriculture Department Report 1967 p. 44)[18]

Since 1945 Maltese farmers have been bombarded with information about the positive effects of pesticides. Government officials promoted pesticides as the best solution to their problems and even referred to them as *mistura* [medicine] [19] which relegated insects to a disease. The message is continuing and although they are also being informed about the harmful effects of these chemicals, many of the older farmers are finding the warnings difficult to comprehend and accept. One elderly farmer is under the impression that when he sprays his orange trees with insecticides, white flies visiting the oranges find the oranges have a salty taste and leave them

[18] Agriculture Department Report 1967 (NAM GMR 2862)
[19] Many older farmers still use the word *mistura* when referring to pesticides.

alone. Another farmer said that before being allowed to use pesticides, farmers have to attend a course during which they are told about their harmful effects but some farmers do not believe that pesticides can do any harm and do not care how they use them.

Maltese farmers, like other farmers in Europe and America started using persistent pesticides when nobody was yet aware of the negative impacts of pesticides. At that time agricultural research was heavily biased in favour of the new chemical technology as it still is in some developing countries which are seen as a growing market by pesticide manufacturers. Many farmers, even in developed countries, are still unaware of the unsustainability of pesticide use. Pesticides have become an integral part of commercially grown crops which cannot be grown without the use of pesticides both because of production levels as well as because of consumer expected quality and appearance of the products. As a result of these forces, farmers become locked into ‘unsustainable’ agricultural systems (Wilson & Tisdell, 2001).

Younger farmers who are usually better educated than older ones, are more aware of the harm pesticides can have on all insects especially when they realise that non-target insects are suffering and that pesticides sometimes do not give the desired results. One such farmer from Siġġiewi who has invested heavily in fruit trees said that he has a couple of citrus trees growing in a field which he never sprays and they remain pest-free throughout the year while similar trees which are growing some distance away are sometimes full of insect pests even though he sprays them regularly. Another farmer who has realised the importance of insects in the balance of nature said that “God created insects to eat insects but we are destroying everything including beneficial insects”.

Individuals, companies and organisations which promote pesticide use as well as researchers affiliated to them such as Cooper and Dobson (2007) and Wood, Sebastien, & Scherr (2000), tend to minimise the negative aspects of pesticide use and maximise their benefits and argue that judicial use of pesticides reduces their disadvantages. They point out that pesticides, when used properly, result in more food production which brings about better nutrition and better health. They also claim that pesticides reduce drudgery thereby improving the quality of life of agricultural workers and allows better profits for farmers. Their arguments are based on the assumption that traditional agricultural systems had low productivity and that the use of chemical pesticides increases production thus justifying the use of expensive technology and chemical dependency (Posey, 1986).

Pesticide use in developed countries has increased drastically since the early 1950s. This is due to their cost effectiveness which has enabled farmers to implement new production technologies, enhance productivity, improve product quality, and reduced the use of more expensive inputs. These advantages come at a cost to the environment and the health of humans and other animals (Boussemart, Leleu, & Oja, 2011). Use of pesticides often results in the destruction of beneficial predators without which those pests against which the pesticide was intended as well as others increase to levels higher than those found before the use of pesticides especially if they are not used appropriately as they often are. The use of these chemicals to control pests creates a pesticide treadmill from which it is difficult or impossible to get off (Wilson & Tisdell, 2001).

The intensive use of organochlorine chemicals as pesticides started immediately after the end of the Second World War as chemicals that had been developed, produced and stockpiled to be used against human enemies were found to be effective also against insects. As the stockpiled chemicals needed to be disposed of, a commercial decision was taken to start marketing them for use against insect pests using military language such as ‘chemical warfare’ and describe their use as a war on enemies referring to insects as invaders and emphasised the need for them to be exterminated. This created not only physical and chemical barriers that kept insects out but mental divisions that classified insects as enemies which had to be eliminated at all cost. In the war against humans there are times when morality is taken in consideration but when the enemy is an insect such issues do not arise because in the western world the conquest of nature has long been regarded as a moral duty, although in times of war these values are often put aside and attitudes that are normally reserved towards insects are transferred to human enemies as can be seen with ideas of cleaning society from undesirable members and the use of the term "extermination" (Russel, 2001).

While some insects such as the locusts arrive in a new area by dispersion or migration, others do so through human intervention. The movement of food and other agricultural products facilitates the movement of insects some of which can become pests. Malta has been importing food products since antiquity. At first most of the imported food arrived from neighbouring Sicily but with better sea and air transport food started to be imported from further afield. The earliest alien pests such as the fruit flies were indigenous to the Mediterranean. As the movement of products around the world increased action had to be taken to keep invasive species such as the Colorado potato beetle (*Leptinotarsa decemlineata*) from Central America away, but as commerce started to become more liberalised, it became impossible to control the accidental importation of agricultural and apicultural pests. The number of new pests increased considerably after Malta's membership in the European Union which brought about the complete liberalisation of commerce with the European Union although it is possible to prevent the importation of some species such as the Colorado potato beetle, a destructive insect that lives on potato plants which has not been recorded in the Maltese islands. In 1877 it reached the United Kingdom and thence to France during and immediately after World War I. The Maltese authorities immediately prohibited the importation of potatoes from France to prevent the entry of the Coloradao potato beetle in the Maltese islands.[20] In 1923 the importation of plants, plant part, tomatoes and raw vegetables from European France, North America, Belgium and Luxemburg was prohibited [21] and from Northern Africa in 1924.[22] The action taken in Malta has been enough to keep this beetle away from the islands up to this day. As a result of this Malta is an EU Colorado Beetle Protected Zone. This is a status confirmed annually that certifies that a country or zone is free

[20] Government Notice of September 11, 1922
[21] Government Notice Number 175 of July 28, 1923 as amended by Number 272 of August 1 1932, p. 3
[22] Government Notice Number 236 of August 27, 1924

from a particular pest. Having such a status is advantageous as export of that product has a competitive advantage.[23]

The methods did not always work as in the case of the Mediterranean fruit flies. Two species of destructive fruit flies were reported present in the Maltese islands in 1932-1933. Both were alien species which arrived in Malta in the last quarter of the 19th century. In some years the Mediterranean fruit fly destroyed the small crop of summer fruits and sometimes also the citrus crop. The Department of Agriculture was finding it difficult to control these pests as the dry hot summers and the numerous varieties of fruits which matured one after the other during the year favoured their reproduction and because at the time there was no known remedy to control them.[24] Action was taken to control these two species such as by removing windfalls and other rotting fruits and destroying them with fire or by burying in quick lime, tilling the soil under the trees to expose the pupae to the action of the weather protecting delicate fruits such as pears with muslin bags, injecting carbon bisulphide to the soil and destroying the pupae during the season and spraying with soap washes 4% or water that has been used from washing clothes. Fly traps were not used as experiments carried out earlier with vinegar and with molasses and arsenicals had not given good results although other mixtures were being tried. None of the actions taken were being successful because of the large amounts of prickly pear fruits which were left uncollected and which were providing a vast breeding ground for these two species.[25] In 1933 the Superintendent of Agriculture wrote that unless some very effective direct treatment was found for this pest there was little chance that its numbers would ever be reduced during the summer months and suggested that special legislation should be enacted to place the planting and keeping of prickly pear plantations under the control of his department. [26] In 1934 it was reported that the fruit fly was responsible for a decrease of 40% in production of citrus and deciduous fruit. Furthermore, thousands of peach and nectarine trees were uprooted or regrafted to early varieties ripening before May before the fruit fly

[23] Il-Ħanfusa tal-Kolorado Dipartiment Għas-Saħħa tal-Pjanti MRRA (undated leaflet)
[24] Annual Departmental Reports 1931 – 1932 (NAM GMR1191)
[25] Annual Departmental Reports 1934 – 1935 (NAM GMR 1874)
[26] Annual Departmental Reports 1932 – 1933 (NAM GMR 1222)

makes its appearance in June. Farmers still did not bother to collect and remove rotting fruit and it was said that progress in this direction could only be achieved by legislation and compulsory action. An experiment was carried out at Buskett and San Anton where the trees were sprayed every 15 days with soft soap in water with very good results. [27] Today fruit flies are controlled by regular spraying with insecticides but farmers regularly have to find ways to control new insect pests such as whitefly, tomato leaf minor,[28] red spider mite, and several species of beetles such as the mulberry Castilloa borer. Many farmers believe that alien insects come to Malta hidden on foreign ships, in containers or with imported wood but they never mention Maltese ships or vessels or aeroplanes while a small number of farmers insist that some insect pests were imported on purpose by pest control agents to make more money by making farmers even more dependent on their products and services.

Some pests such as the red palm weevil (*Rhynchophorus ferrugineus*), can have a big impact on non-agricultural plants and trees. The red palm weevil is indigenous to southern Asia and Melanasia but has spread westwards into Africa and Europe. It was detected in Spain in 1994 and in Italy in 2004. Its range continued to expand and in 2007 it was recorded for the first time in Malta. In the Maltese Islands the red palm weevil damages one species of ornamental palm the Canary Island date palm (*Phoenix canariensis*). The only product obtained from it are the leaf fronds which are used by fishermen as sheltering floats for dolphin fish (*Coryphaena hippurus*) and in a religious celebrations to commemorate Palm Sunday (Mizzi, Dandria, Mifsud, & Longo, 2009). In 2009 it became compulsory to register any infected palm tree with the Plant Health Department and the owner of the tree or land on which a tree is growing is now obliged to treat and/or fell the infected tree or take any action deemed necessary on the plant.[29] In 2011 the government obliged itself to spray all palm trees falling within its responsibility with an appropriate insecticide against the red palm weevil and for Local Council to carry out mass pheromone trapping of the insect in infested areas within their locality. It also became obligatory

[27] Annual Departmental Reports 1933 – 1934 (NAM GMR 1244)
[28] Farmers refer to it by its scientific name - Tuta absoluta
[29] Plant Quarantine Act (Cap. 433) L.N. 42 of 2009 Control of the Red Palm Weevil Regulation, 2009.

for Plant Nurseries and Garden Centres to apply complete physical protection to prevent the introduction of the weevil within the area where palm trees are stored or cultivated and to treat them with the appropriate preventive insecticide.[30] In 2012 it became compulsory to obtain a written approval to prune the fronds of a palm tree and for the part of the tree from where the frond is cut to be treated with insecticide.[31] In August 2012 the Plant Health Directorate issued guidelines for dolphin fish fishermen who use palm tree frond as sheltering grounds in the traditional '*kannizzati*' fishing method.[32]

Another two coleopteran species, the Castilloa borer (*Phryneta leprosa*) and the citrus longhorned beetle (*Anoplophora chinensis*) had a devastating effect on fruit production. The Castilloa borer was probably introduced in the Maltese Islands with large tree logs imported from Cameroon and intended for use in the timber industry (Mifsud & Dandria, 2002). It is difficult to control by the use of pesticides because it spends most of its life at the end of a tunnel which the larva digs inside the branches of trees. The advice given by the Directorate of Plant Health is to insert a metal wire into the hole to destroy the larva inside but if the tree is infested heavily the only solution is to cut of the infested parts and to burn them.[33] Farmers complain that this beetle has destroyed a large percentage of mulberry and fig trees and as a result the production of black and white mulberry as well as figs has decreased substantially which has led to a sharp increase in the price of these once common summer fruits.

In 2008 the Plant Health Department issued an alert to warn the Maltese public to be on the lookout for the citrus longhorned beetle, a species which had not yet been found in Malta. The warning was issued so that action would be taken to eradicate it as soon as it was found so as to avoid it spreading and damaging trees particularly citrus trees on which it lives. This species is a native of China and Japan and other

[30] Government Notice No 1172 Ministry for Resources and Rural Affairs; Government Gazette 18,846 (23rd December 2011).
[31] Plant Health Directorate: Guidelines for palms to be used during Palm Sunday (Ħadd il-Palm) Press Release DOI PR 0666 (22nd March 2012).
[32] Press Release Regarding Palms to be used by Fishermen; Reference Number: PR 1782 (10.08.2012).
[33] Susa fuq Siġar tat-Tin u tat-Tut. Direttorat għas-Saħħa tal-Pjanti. MRRA.

countries in Southeast Asia but has spread to other parts of the world with exported trees.[34] A press release issued by the department to inform the public about this beetle had a number of readers' comments who were angry because they had to destroy expensive trees because of alien species and buy new ones from the same gardeners who imported the insect pests in the first place because of carelessness.[35] This insect like other alien pests is a potential threat to agricultural production as well as to part of the Maltese identity as citrus fruits particularly the Maltese orange are culturally important. This fruit has been and is still popular with Maltese consumers because of its particular sour taste and because it can be found in winter when there are few other local fruits available on the market.

The spread of pests had a big impact especially on beekeepers in most of the world including Malta, In the 1990s Maltese beekeepers started to face problems with non-indigenous pests and diseases that were decimating their hives and which were leading to the collapse of apiculture in the Maltese islands. The biggest threat came from the varroa mite which is considered a crucial factor in the decreasing numbers of beekeepers and honey bee colonies in Europe (Rosenkranz, Aumeier & Ziegelmann, 2010). The varroa mite is an external parasitic mite that feeds on the haemolymph of the bee larvae, pupae and adults. It was originally a parasite of the Asian honey bee (*Apis cerana*) which is indigenous to south-eastern Asia. It moved to the European honey bee when this was introduced in areas where the Asian honey bee is indigenous. The varroa mite has now spread throughout the world and it is now difficult to find a varroa-free hive except in Australia and small parts of south-eastern Asia where Asian honey bees are still used by beekeepers to produce honey. The impact on bee hives is a result of the fact that the European honey bee and the varroa mite, which until the honey bee was introduced in areas where it is not indigenous were geographically isolated, have not co-evolved for a long period and they do not have an adapted host-parasite relationship with the result that the varroa mite often kills its new host (Le Conte, Ellis & Ritter, 2010) and it has now become the most serious threat to apiculture globally (Kluser, Neumann, Chauzat, & Pettis, 2010).

[34] Il-Ħanfusa tal-Qrun Twil taċ-Ċitru (Citrus Longhorned Beetle; Dipartiment għas-Saħħa tal-Pjanti. MRRA

[35] Alert raised over harmful pest. Times of Malta (9.IX. 2009).

Furthermore, beekeepers have not had enough time to learn how to deal with this pest. Varroa mite infestation has resulted in an increase in cost to beekeepers and the contamination of honey and wax with residues of chemicals used in varroa control (Rosenkranz, Aumeier & Ziegelmann, 2010).

The varroa mite can spread viruses and bacteria and if left uncontrolled, a severe infestation can lead to the premature death of a colony within three years (Kluser, Neumann, Chauzat, & Pettis, 2010). The death of the colony is often the result of many inter-related factors affecting individual bees or the whole colony. The degree of harm is directly proportional to the intensity of infestation (Collison & Sheridan, 2011). No other p athogen has had a comparable impact on both beekeeping and honey bee research during the long history of apiculture.

In response to the spreading of the varroa mite to nearly every hive in the world, many chemical varroacides have been developed as well as alternative methods such as the use of organic acids and biotechnical and biological methods. When the varroa mite is detected in a country an attempt is typically made to control the spread of the mite. In spite of this, beekeepers suffer high bee mortality and colony losses especially because of lack of knowledge and experience of control methods. Many beekeepers stop practicing apiculture, those surviving being the ones who are able and willing to take up the challenges of varroa control. After a number of years, the beekeeping situation normally stabilizes although periodic high losses of 30% or more of the hived bee population, mostly during overwintering are still common (Rosenkranz, Aumeier & Ziegelmann, 2010).

Most varroacides are easy to apply, economically convenient, and do not require more than a cursory knowledge of the mites' biology. Their disadvantage is that they have to be used during a period when hives are broodless which in Malta does not exist. Another major disadvantage is that they are persistent and can accumulate after repeated treatments thus they may harm both the bees and consumers (Rosenkranz, Aumeier & Ziegelmann, 2010). Resistance to varroacides could be the cause of what since 2007, in the United States of America has been called Colony Collapse Disorder (Kluser, Neumann, Chauzat, & Pettis, 2010; Le Conte, Ellis & Ritter, 2010; Mahmood, Waghoure, ul Mahis, Raja, & Sarwar, 2012; vanEngelsdorp & Meixner, 2010). In response to this, research has been carried out to find means how to control the mite's number safely and with minimal side effects (Marinelli, ND). These include the use of substances with low environmental impact mainly organic acids such as oxalic and formic acids and components of essential oils such as thymol benzyl acetate and methyl salicylate (Mahmood, Waghoure, ul Mahis, Raja, & Sarwar, 2012). These compounds are widespread in nature and some of them also occur naturally in honey. No residue problems should arise when colonies are treated with organic acids. (Imdorf & Charrière, 2003).

Many Maltese beekeepers use thymol[36] to control varroa in their hives. Thymol users tend to be younger, better educated hobbyists who are ready to experiment and who practice more natural beekeeping. Commercial beekeepers tend not to take risks and use tested methods to control pests even if these are not the best for their bees and for the environment. Thymol is the preferred method of varroa control in warmer environments as it has been found to be more effective at higher temperatures (Marinelli, ND). It is a natural product that is the main constituent of several commercially available medicinal products and studies have shown that it can be effective at controlling mite infestations under certain conditions (Mahmood, Waghoure, ul Mahis, Raja, & Sarwar, 2012). Some beekeepers who between late spring and early summer move their beehives to areas rich in Mediterranean thyme (*Thymbra capitata*) to produce summer honey claim that at the end of the season their bees are free from varroa mites because their bees come into contact with thymol or a similar compound produced by the indigenous thyme plants.

Several Maltese beekeepers are taking a biotechnical approach such as the trapping comb method. The principle of this method is to encourage mites to lay their eggs in drone broods which are then removed without negative effects on the hive

[36] A chemical extracted from common thyme (*Thymus vulgaris*)

population. This method is more labour intensive as it involves finding and confining the queen to selected combs and then removing them to kill the mites usually by means of formic acid or heat. This method is used in areas that do not have a late honey flow and has a success rate between 50 and 70% (Rosenkranz, Aumeier & Ziegelmann, 2010). Maltese beekeepers use old queens for this method as these tend to lay more eggs that will become drones. In this way the queen bee is allowed to live and work even when she is past her peak egg-laying stage.

In some cases, controlling honey bee diseases requires extreme action such as in the case of the American foulbrood (AFB) that can only be controlled by burning the hive and all its content including the bees. AFB was detected in the Maltese islands in the 1990s at Mġiebaħ. The hives were burnt on the spot and the action was successful as the disease did not spread and it has not appeared again since then. None of the beekeepers interviewed ever had to burn any of their hives but they are aware that it would be a heart-breaking affair which none wanted to experience. When talking about the possibility of having to burn his hives a beekeeper from Birkirkara said "I do not feel comfortable doing these things. I feel sorry that after you have seen a hive developing you have to kill it".

American foulbrood (*Paenibacillus larvae*) is one of several diseases caused by microorganisms such as bacteria and viruses, protozoa and fungi. AFB is a notifiable disease in many countries including Malta where it is subject to strict regulations which are enforced by the veterinary authorities (vanEngelsdorp & Meixner, 2010). On 12th June, 2015 by means of *LEGAL NOTICE 192 of 2015* honey bees could be imported only from areas that were not subject to a prohibition order associated with the occurrence of AFB and in the case where the disease did occur it had to be officially absent for at least thirty days.

European foulbrood (EFB) has similar symptoms to AFB. It is caused by the bacterium *Melissococcus plutonius* and occasionally appears in Maltese hives. Like AFB it can be lethal for infected colonies. Both diseases are characterised by a bad smell emanating from brood cells, hence their name (Forsgren, 2010). EFB occurs in most areas where apiculture is practised effecting mainly stressed colonies such as those lacking food and water (Forsgren, 2010). In Malta EFB symptoms occur in areas with sporadic nectar flow and when nectar production is poor such as in hot years or when rainfall is poor.

Beekeepers also see the need to control insects threatening their bees. Many of the beekeepers whom I interviewed spoke about the oriental hornet (*Vespa orientalis*) which they said was destroying their bees. One of them invited me to his apiary to see the hornets attacking his bees. I accepted and spent at least two hours observing and photographing hornets attacking bees near or on the hives. As a result of my preliminary observations, I realised that strong healthy bees were able to fight back and /or escape from the hornets but the older bees were killed and carried away which led me to conclude that the number of bees taken by the hornets is not as big as the beekeeper imagined. In spite of my preliminary assessment, the beekeeper was not convinced and, in an attempt to protect his bees, he was killing the hornets by burning them with a flame lamp.

Figure 8 Beekeeper burning hornets to protect his bees

Maltese beekeepers perceive any predator that feeds on bees as a threat that has to be destroyed, without thinking whether it is actually having any negative impact on their bees and they would do anything not just to control but to get rid of these predators, particularly the oriental hornet. Since 2010 the hornet started to increase and in some areas, it has become very common and sometimes visits apiaries to hunt bees. Faced with this new predator beekeepers fear that this insect will deplete their bee population and want to see it destroyed as they do not realise that hornets predate mostly old bees whose wings have become frayed and are unable to fly properly or fight back and that healthy Maltese bees evolved to be able to defend themselves against it.

The negative valuation of the hornet is reinforced by television programmes and news reports about the Asian hornet (*Vespa velutina*), an invasive species which is now found in France, Spain and Portugal and which is receiving a lot of negative media coverage because of its aggressiveness. Many Maltese beekeepers are assuming that the indigenous oriental hornet is the Asian hornet which has not been recorded in Malta and this is leading to unnecessary fears. One beekeeper was so convinced that Asian hornets were attacking his bees that he brought me two specimens in a matchbox and I had to show him pictures of the two species to convince him that what he had killed were oriental hornets. The negative valuations and resulting control, like fear and other emotions, are socially and culturally produced.

Beekeepers also see the European bee-eater (*Merops apiaster*) as a threat. Bee-eaters feed on flying insects and for a few weeks during the spring and autumn migration they tend to gather around hives to feed on bees. This is a relatively new threat as up to about fifteen years ago these birds were scarce migrants but have now become very common. Bee-eaters are legally protected and it is illegal to destroy them but several beekeepers said that they would like bee-eaters to be controlled by adding these birds to the list of birds that can be hunted. Studies carried out in Egypt and Sardinia, where these birds breed, have shown that this species does not have any impact on the number of bees in a hive (Galeotti & Inglisa, 2001). There have also been complaints by some beekeepers that bee-eaters catch queens as they emerge to mate but according to other beekeepers their impact is practically nil because most queen bees emerge to mate in March and October when there are no migrating bee-eaters. Bee-eaters like other apicultural threats including the varroa mite and oriental hornet[37] came from other countries and they reinforce the idea that all threats to the bees come from outside Malta and that they disrupt an ideal way of life.

Presently the Permanent Crops Unit, within the Agriculture Directorate is responsible for preventing and controlling honey bee diseases. It does this by maintaining the Beekeepers Register for Malta and Gozo which includes details of the permanent apiary site of each beekeeper and the secondary sites of those beekeepers who practice seasonal movements, as well as the number of colonies and type of beehives utilised. Another important aspect of the Unit's work is to undertake research trials that explore new methods and techniques for rearing bees and monitoring as well as controlling disease. Most beekeepers are registered with this unit but some beekeepers have complained that there are some beekeepers who own just one or two hives who have not registered their hives. They feel that this is a threat to their bees as, if the bees in an unregistered hive become sick it would not be able to control the disease which would spread to other hives.

On the other hand a small number of insects can have a direct influence on human activities and the way humans relate to each other and to their surroundings because they carry and spread pathogens that cause potentially fatal diseases. The most dangerous of these insects are flies, mosquitoes and fleas.

A small number of Diptera are a threat to public health as they are carriers of disease organisms which cause poisoning and other enteric infections (Savona-Ventura, 2002). The main culprit is the house fly (*Musca domestica*), a ubiquitous insect that lives on all kinds of decomposing organic matter particularly animal dung and

[37] Although indigenous, the oriental hornet was nearly extinct before it started to increase again and it is widely believed that it arrived in Malta in a container.

household refuse. It can carry various diseases. Up to forty years ago houseflies were very common in livestock farms where the accumulation of animal manure provided an ideal breeding ground for these insects. As a result of the small size of the islands and the relative proximity of farms to urban areas, flies were also very common in and around houses and other places frequented by people (Harris, Grose, Saliba & Zammit Lucia, 1976).

The situation started to change in the decades after World War II when intensive spraying with persistent insecticides was used to control the number of flies in Maltese livestock farms (Harris, Grose, & Saliba, 1976). Changes in hygiene levels, relocation of most livestock farms to areas away from human habitations and the use of pest control methods has resulted in a decrease in fly populations in farms and a greater decrease in houses. The decrease has been a gradual process over a period of decades (M. Buttigieg, personal communication, 23 November 2017). Although most of those interviewed for this thesis mentioned flies when asked to give examples of insects, nobody included them as bothersome species or as species that are decreasing.

At the turn of the nineteenth century an attempt was made to control flies in American cities so as to eliminate disease. By that time medical entomology had established that flies carried germs and deposited them on food and that this was resulting in a high incidence of diseases such as typhoid, tuberculosis, polio and infantile diarrhoea. Before the launch of fly-control campaigns, the public was not averse to flies and was not bothered by their presence inside homes. Cities were full of flies mainly because humans lived close to the flies' breeding grounds which were mainly the thousands of tons of horse manure which was allowed to accumulate in stables, uncollected garbage and backyard privies. A two-pronged approach was taken to rid homes and cities from flies. Households were encouraged or obliged to seal their homes against insects by attaching insect screens on windows while on a city level, sewage services was extended to all parts of the city and action taken to ensure that horse manure was carted as quickly and as safely as possible out of the city (Biehler, 2010).

Another dipteran species, the anopheles mosquito (*Anopheles maculipennis*), is the vector of the parasite which is responsible for malaria. It used to be found in the Maltese islands and was collected from ditches at Salina and from Wied il-Qlejja (Chadwick Lakes) before 1945 but it has not been recorded since then and it is now considered as extinct in the Maltese islands (Gatt, 1996). Early writers such as Homer (c. 850 BC), Empedocles of Agrigentum (c. 550BC) and Hippocrates (c. 400BC) associated the disease with marshy areas. This gave rise to the belief that the disease was caused by miasmas rising from swamps, a belief that persisted until the late 19th century when it was discovered that a plasmodium and not miasmas was the cause of malaria and that female anopheles mosquitoes are its vectors (Cox, 2010).

Diseases referred to as fevers have been present in Malta for centuries indicating that malaria was probably indigenous in the Maltese islands. In 1530 a Grand Master's commission sent to Malta to compile a report before the Knights of St John established themselves on the islands referred to these fevers as "malaria" and attributed them to "bad air" emanating from water. As the presence of the disease can only be confirmed clinically it cannot be ascertained whether this was the same disease as modern-day malaria (Cassar, 1964).

As a result of the belief that miasmas were the source of the disease, laws were enacted to try to stop miasmas from polluting the air. Some were effective while others would not have made any difference. In 1525 a law was enacted that prohibited anyone from washing hemp in public fountains so as not to pollute the water. Legislation also included bans to reduce the amount of stagnant water in various localities. In 1648 it was made compulsory to close all wells and reservoirs in Qormi so as to stop the exit of disease-carrying vapours. In spite of these controls, regular waves of epidemics swept through the Maltese islands resulting in hundreds of victims especially in the areas of Rabat and Mdina. Other localities effected by the disease were Marsa and Qormi. In 1650 Grand Master Giovanni Paolo Lascaris proposed that the marshes at Marsa should be drained but the project was never implemented because of technical and financial difficulties (Cassar, 1964).

In 1705, Grand Master Ramon Perellos y Roccafol prohibited the cultivation of tobacco because it was believed that these plants had a bad influence on their surroundings. In spite of this and other bans, another epidemic of what was believed to be malaria broke out. Four hundred patients from the Rabat area were admitted to hospital and another six hundred died from the disease. It was believed that the disease originated near Mdina at Għeriexem, the site of a freshwater spring (Cassar, 1964).

Not everybody was convinced that malaria was present in the Maltese islands. In 1842 Dr John Davy, a doctor of the British Army expressed his doubts about its presence as he believed that the Maltese islands were too arid and lacked stagnant water and marshes (Davy, 1842). Davy was wrong about the lack of wetlands as several lakes and marshes existed as evidenced by several documents and place names. Wetlands existed at Għadira near Mellieħa Bay, St Paul's Bay, St George's Bay and Marsa. There also existed a large area of land behind Salina which is known as Burmarrad which means the sickly marshland. Smaller wetlands could be found at Pieta', San Ġiljan, Msida, Marsascala and Marsaxlokk (Blouet, 1964).

The presence of malaria in Malta was scientifically proven in 1904 by Dr G Caruana Scicluna and Dr Themistocles Zammit. At the time the disease was present at Qallilja which is close to Wied il-Qlejja (Chadwick Lakes) where the anopheles was present. During the British period, apart from cases involving the local populations several outbreaks appeared regularly involving British and Maltese troops who arrived in Malta from countries where malaria was present (Cassar, 1964).

In the 20th century locally contracted malaria appeared in 1904, 1919 and 1941 (Cassar, 1964). Although between 1990 and 1999 seventeen cases of malaria were recorded on immigrants (Savona-Ventura, 2002), the disease cannot establish itself in Malta as the anopheles mosquito is now extinct from the Maltese islands having been last recorded in 1945 (Gatt, 1996). In spite of the long history of the disease in the Maltese islands none of those interviewed mentioned malaria as an indigenous disease indicating that they are not aware that it used to be present and that it could appear again if the anopheles mosquito had to re-establish itself in the Maltese islands (Schaffner et al., 2010). The extinction of the anopheles mosquito had a welcomed impact on disease control which is probably the result of the over-use of freshwater in the Maltese islands and the drying up of former wetland areas that provided the breeding habitat for mosquitoes and other aquatic insects.

Another potential health threat, the Asian tiger mosquito (*Aedes albopictus*), although a recent addition to the Maltese islands is already well known in Malta. When asked to name an insect that is new to Malta many mentioned this species. It has become very common throughout the Maltese islands and is well known because of its aggressiveness and daytime biting habits as well as because its arrival in the Maltese islands was widely publicised in the media. This mosquito was first discovered in Malta in September 2009 at Mellieħa (Gatt, Williams, & Mifsud, 2009). Shortly afterwards, it was discovered in Marsascala (Buhagiar, 2009). Although colder temperatures reduce the adult activity of this mosquito, the winter temperatures in Malta are not cold enough to prevent larval development and the emergence of adult mosquitoes continues throughout the year and with the predicted rise in temperature it is feared that this species will continue to thrive while other potentially dangerous species could establish themselves in the Maltese islands (Gatt, Schaffner, & Cassar, 2010). As discussed further on, the Asian tiger mosquito has managed to establish itself well in the Maltese islands and as a result of this the Maltese had to change the way they relate with outdoor places.

Another dangerous insect, the Oriental rat flea (*Xenopsylla cheopis*) is the primary vector of *Yersina pestis* and is thus involved in the transmission of plague (Bitam, Dittmar, Parola, Whiting, & Raoult, 2010; Savona-Ventura, 2002), a zoonotic disease that affects mostly rodents but can also infect humans (Bitam et al., 2010). Plague has been responsible for countless deaths in Europe including Malta and for hundreds of years it spread terror throughout the Maltese islands until it was realised that the disease was spread by fleas. Cassar (1964) wrongly concluded that the plague had been visiting the Maltese islands since 1270 or earlier which was not possible as the disease arrived in Europe on board twelve Genoese traders in 1346 (Horrox, 1994). Just two years later, in 1348, a plague epidemic which became known as the Black Death arrived in the Maltese islands. Other epidemics reached the islands in 1427 – 28 and 1453. Several epidemics were recorded in the sixteenth centuries with the first one being recorded in 1501 followed by invasions in 1519, 1523, 1575 and 1592. In the 17th century plague epidemics broke out in Malta in 1623, 1655 and 1675 – 1676 (Cassar, 1964). The 1675 – 1676 epidemic was the most virulent in recorded history. Out of a population of sixty thousand, 8,569, that is, more than 14 % of the people living in Malta, succumbed to the disease (Micallef, 2015). The next big epidemic took place in the first decade of the nineteenth century soon after the arrival of the British in the Maltese islands when Malta was the main Mediterranean port of the British Navy. This epidemic killed 4,486 persons out of a population of just over 112,000 that is, about 4% of the people living on the island (Calvert, 1816). The next epidemic visited the Maltese islands in 1917 but as by then both the plague bacillus and its vector had been identified control was much easier than in previous epidemics and this time only four casualties were recorded. In 1936-1937 plague again visited Malta which resulted in twelve casualties but which also gave rise to the setting up of an efficient system of refuse collection from Maltese towns and villages and a systematic attempt to reduce the number of rats from Malta and Gozo. In 1945 and 1946 the heavy bombing created the perfect habitat for rats to live and this resulted in an increase in the population of the two species of rat in the Maltese islands and as it was not possible to stop the arrival of infected rats with service stores, cases of plague started to appear from the 18th of June onwards which resulted in 22 deaths (Cassar, 1964).

Fleas are small laterally flattened, wingless insects that have been implicated as vectors of a number of diseases and epidemics including plague and murine typhus. Disease transmission is by regurgitating blood meals and by faecal contamination. When a rat infected with the *Yersina pestis* bacterium is bitten by a flea, the bacterium is transferred to it and once infected it probably dies. When this happens, the fleas to which it was host leave to search for a new host. If the flea choses a human host and bites it, it transfers the bacterium to it which results in the bitten person becoming infected and possibly acquiring the disease. Not all rats are infected with the bacterium and therefore not all fleas living on rats are infected. Furthermore, all mammals can carry fleas which can also bite humans. Considering that during an epidemic such as that of 1675 – 1676 fourteen percent of the people living in Malta died of the disease and an unknown number of persons were infected but did not die and that not all fleas are infected, one can assume that being bitten by a flea was common and considered as normal. Nowadays, as a result of widespread use of insecticides to control fleas on pets and other domestic animals, a flea bite is an uncommon occurrence. Some of the older interviewees spoke about fleas but none of the younger ones did, indicating lack of familiarity with these insects in contemporary Malta. In the past, some wild plants such as the fleabane (*Chiliadenus bocconei*) and penny royal (*Mentha pulegium*) were used to repel fleas but nowadays many dog and cat owners use flea collars and sprays to keep fleas away from their pets. The attitude to fleas two hundred years ago could be similar to the present attitude to flies and mosquitoes which are considered as an inevitable nuisance. An eighty-year-old man from Baħrija said that fleas are dirty and described how when he was a young boy, he became infested with fleas so his mother covered him with a blanket made out of sheep's wool and the fleas moved onto the blanket. She then hung the blanket in the sun and killed the fleas by squashing them with her fingernails as they came out of the wool.

4.3 Insect conservation

While some insects are spreading and invading new areas, others are decreasing in range and numbers with some becoming globally or locally endangered or extinct. Naturalists and entomologists are very aware of the importance and value of insects in the natural environment and the need to conserve them. All of those interviewed said that they felt helpless and were saddened because they were powerless to stop the decline in biodiversity. Most of them believe that the main causes for the decline are the use of insecticides and other pesticides, the destruction of habitats, and climate change. Many mentioned the destruction of important sites and habitats because of the building of new houses, schools, petrol stations etc. in Outside

Development Zones (ODZs) and the widening and building of new roads. One lepidopterist said that a rare moth used to breed in one spot in Kalkara which has been destroyed by a large fountain which forms part of Smart City. This moth has not been recorded since the site was destroyed. Most mentioned the widespread use of insecticides and other pollutants. A lepidopterist who claims to have bred most of Malta's Lepidoptera insists that dust from construction and quarries is killing lepidopteran larvae. He said that nowadays he has to rinse food-plants before giving them to the larvae. Another lepidopterist blamed new insecticides including bacterial spores which farmers are nowadays using to control insect pests which are also killing non-pest species

At a global level, all insects are under threat from climate change, habitat loss, fragmentation and deterioration of habitat quality (Sumner, Law & Cini, 2018). Losses in insect diversity have been well documented as agricultural land, which supports far less biodiversity than natural land, has expanded primarily at the expense of forest area. Biodiversity is also diminished by agricultural intensification, which reduces the area allotted to hedgerows, copses, or wildlife corridors and displaces traditional varieties of seeds with modern high-yielding, but genetically uniform crops. Pollution, overexploitation, and competition from invasive species represent further threats to biodiversity (Wood, Sebastien, & Scherr, 2000). In the Maltese islands land is being used up mainly by the building industry and road building while agriculture is becoming more intensive. As a result of the ongoing threats to biodiversity including invertebrates, international conservation organisations are insisting that more importance should be given to the conservation of all invertebrates which are just as subject to extinction as the better known and more popular vertebrates (Wilson, 1987). Technology has expanded the ability of humans to alter the environment to such an extent that their activities are modifying the growth and vigour of plants, which in turn reduces the suitability of plant foliage as food for herbivorous insects. Insects consuming plants adversely affected by these pollutants grow slowly and produce fewer offspring than insects consuming healthy, robust plants (Berenbaum, 1995).

The successful conservation of insects requires the right public attitude which depends on the values one gives to insects. Several interviewees felt that useful insects such as the honey bee and the ladybird, beautiful insects such as butterflies, insects that provide us with moral stories such as the ant should be protected while insects that are ugly such as most beetles and cockroaches should be eliminated. The aesthetic value of insects varies widely from one person to another and often an insect is seen as ugly because it is valued negatively. Many farmers and gardeners are unaware that wasps are predatory insects and that help control insect pests. Farmers spoke about how they destroy any nest of the paper wasp they find on the walls of their fields by spraying it with insecticides, water or by burning it and were surprised when I informed them about the utilitarian value of wasps.

Research carried out for this thesis gave in many ways similar results to research carried out in the United States in the 1980s (Kellert, 1990). A large proportion of those interviewed expressed feelings of aversion, dislike or fear towards most invertebrates, particularly ants, bugs, beetles, ticks, and cockroaches; an aversion to insects in the home, a fear of stinging insects, spiders, and scorpions; a desire to eliminate mosquitoes, cockroaches, fleas, moths and spiders and a view of the cockroach as a highly unattractive insect. Farmers generally expressed views similar to those of the general public. In contrast biologists, naturalists and members of environmental NGOs in both studies indicated far greater appreciation of insects. A more positive view of invertebrates generally occurred when taxa possessed aesthetic value (such as butterflies), or practical value (such as bees) (Kellert, 1996). The research has shown that not all creatures viewed negatively in one society are viewed in the same way in other societies. These include spiders which in Malta are often mentioned as useful creatures. The differences in attitude to the various species between the two countries and between the various individuals within the two countries indicates that these attitudes are purely cultural and as with other areas of culture they can change over time.

Human attitudes and public support toward conservation have also been linked to the species itself, with species characteristics such as beauty, cuteness, body size, ecological importance and rarity being important factors (Summner, Law & Cini, 2018). Kellert (1997) listed nine basic values of nature which are rooted in human biology, but which are shaped by experience learning and culture. The identity and fulfilment of humans depends partly on the expression of these values which are utilitarian, naturalistic, ecologistic-scientific, aesthetic, symbolic, dominionistic, humanistic, moralistic and negativistic all of which can have an impact on the conservation status of an insect.

Utilitarian value reflects what humans derive from animals. In the case of insects, it is species such as bees which provide honey and other wax products as well as services such as pollination have a utilitarian value and are thus considered as priority species for conservation. This agrees with data as many interviewees expressed concern at the plight of the honey bee and spoke about the need for its protection even though in Malta it is not facing any threats. Naturalistic value is the satisfaction people get from the direct experiences derived from contact with nature such as the pleasure in taking pictures of insects, collecting or just observing insects. Ecologistic and scientific values are derived from the study and knowledge of insects which gives one the possibility of seeing and understanding insects which others without the right background cannot see. Aesthetic values are the result of beauty of living things on people. This characteristic arouses strong emotions in humans and evokes strong feelings of intense pleasure and awe. Symbolic values reflect a tendency in humans to use nature to express thoughts and feelings both verbally and visually. Dominionistic values are derived from the human urge to control their surroundings including insects, an attitude which challenges human capacities and ability to survive. The humanistic value results from humans' ability to express and develop emotional capacities to attach, bond and form intimate relations with animals including insects such as bees. Moralistic value is derived from the richness of the natural world which provides a source of kinship that bonds all life together and provides a source of spirituality that guides human conduct directing them to minimise harm to other creatures. Moralistic values are often associated with tribal people but can also be found in naturalists and environmentalists who view the world as a living and vital being worthy of a similar respect that is often reserved for other humans. Negativistic values are linked to sentiments of fear, hate and disgust that are associated with species such as the cockroach. Insects with a high negativistic value are not deemed worthy of protection and conservation and many people would be happy if they had to become extinct. These insects can provoke negative reactions that can lead to the destruction of the natural world such as through the use of insecticides (Kellert, 1997). These values can influence decisions on whether insects are to be conserved or destroyed. The value associated with insects can create a hierarchical value to insects with insects seen to have a positive value being placed higher in the hierarchical scale while those which are seen to have negative values being placed at the bottom of the scale. The value associated with each insect depends on the culture, and attitude of each person and is influence by experiences, education and knowledge and can thus change throughout life.

In the Maltese islands, notions of nature and environmental protection first appeared in the early 20th with calls for the protection of useful birds and thyme plants which are the source of nectar for thyme honey and which were being collected as fuel for bakeries (Portelli, 2011). In the 1950s there were appeals for the protection of butterflies but their take-up was generally slow. The lack of interest in conservation left nature lovers feeling powerless as land was started to be taken up for building or degraded by various human activities (G. Lanfranco, personal communication, 23rd April, 2014). The first persons to sound a warning about loss of insect diversity were Anthony Valletta a teacher and entomologist and Guido Lanfranco also a teacher. Valletta’s frequent visits to the countryside made him fully aware of the threats that were arising from the rapid building of factories, hotels, housing estates and roads that were resulting in a rapid loss of habitats in the Maltese islands. This awareness made him carry out studies in areas that were bound to disappear. He did this at a time when nature protection and conservation was still unheard of in Malta and as a result there was hardly anybody with whom he could discuss let alone collaborate on this issue. Being a lepidopterist, he naturally wrote about the plight of butterflies and the rapid loss of habitats which even in the 1950s was leading to a decrease of the local butterfly and moth populations.

Between November 1st, 1948 and October 31st, 1949, Valletta carried out a systematic study by trapping moths in fields at Mrieħel, a site which he chose "because it is considered one of the best for moths and as three large factories have already been built during the last three years it may be changed into an industrial area in the near future and consequently most of the species will disappear with the flora" (Valletta, 1950 p. 306). Valletta's fears were justified and Mrieħel is now one of Malta's major industrial areas and nothing of the countryside that Valletta described in the 1950s is left.

Valletta continued to include conservation issues in his scientific papers. In 1971 he published a paper consisting of a list of Hymenoptera of the Maltese Islands based on specimens that he collected over a period of 35 years. The aim of the paper was to publish a list so as to encourage others to add to it before it is too late as according to him

> With the growth of tourism, the islands are rapidly changing. Industrial and housing estates and large hotels and villas are springing up everywhere. New roads are being constructed and old ones widened and more quarries are being worked for building material. All these upheavals are making inroads into the fauna and flora. The countryside is diminishing and where once a profusion of coloured annuals and carpets of wild thyme covered large areas and attracted bees and other insects, there are now only blocks of concrete and plans exist for further buildings. Very soon in Malta the naturalist will have nowhere to wander and nothing to observe except human dwellings. (Valletta, 1971b p. 45)

In early June 1977 he went for a walk on the slopes of Wardija facing Xemxija and wrote an article about the plants and insects he saw there. He finished the article by wondering "If I retrace my steps in a few years' time will these slopes still teem with life or will the white glare of human habitation be my only welcome?" (Valletta, 1979c p. 2).

In 1980 Valletta sounded another alarm. In an article published in *Nota Lepidopterologica* the journal of the *Societas Europaea Lepidopterologica* entitled

"The butterflies of the Maltese Islands and their dwindling habitats" which was aimed mainly at foreign entomologists he wrote that the change of Malta from a fortress was leading to an expansion of the existing industries and to the creation of industrial estates to accommodate new ones. He lamented the loss of large areas of cultivated and uncultivated land which was being taken over for the construction of hotels, villas, blocks of flats, for the extension of the airport, the opening of new roads and the widening of old ones. He also mentioned the construction of the docks and the opening of new quarrying sites and the planting of ornamental trees along the sides of valleys all of which were taking their toll of unspoiled areas of countryside and reducing the habitat and food supply of many species of insect which was leading to an alarming decrease in the number of individuals of certain butterflies as complete colonies were disappearing from what became built up areas. Valletta ended his article by optimistically hoping that those who were in a position to do so would encourage the preservation of all the existing species by ensuring that the necessary food plants are not exterminated and in some cases deliberately propagated. He also suggested that butterflies should be bred in captivity and released in the wild when their populations become dangerously low (Valletta, 1980). The fact that Valletta wrote this article in a European journal and not in a local publication showed that he was already seeing the value of international and pan-European collaboration for more effective nature conservation. Such collaboration became more real when the leading nature-protection societies BirdLife Malta and Nature Trust Malta became partners with international organisations namely BirdLife International[38] and World Wide Fund for Nature respectively[39] and continued to gather moment with international bodies such as the United Nations, the Council of Europe and the European Union starting to tackle global issues such as biodiversity loss and climate change.

Guido Lanfranco was also concerned about the decrease in the faunal and floral diversity of the Maltese islands. He wrote several popular articles about insects and set up the Natural History Society of Malta. During a speech delivered to members

[38] http://www.birdlife.org/worldwide/partnership/birdlife-partners
[39] https://www.naturetrustmalta.org/who-we-are/partnerships/

of the society he raised his concern that some individuals were exporting mounted butterflies. In a report on the situation of the fauna of Malta (not including birds) which appeared in *The Maltese Naturalist*, in 1976 he wrote that

> Another enemy of the larger Lepidoptera both butterflies and moths, especially *P. machaon*, *G. cleoepatra*, *A. atropos*, *H. convolvuli*, *H. euphorbiae*, *C. elocata*, appear in the form of one or two collectors (with no sense of conservation for the local natural heritage, and no method of ensuring safety measures for the Lepidopteran fauna) who are known to have started to collect indiscriminately for exportation to dealers. These collectors are not engaged in scientific investigation, and should be considered a menace. (Lanfranco, 1976 p. 104)

Since Lanfranco's writing on the issue in 1976 some insect species, including the endemic *Papilio machaon melitensis* and the *Maniola jurtina hyperhispulla*, have become protected but in August 2018 pinned specimens of the two species of butterfly were available for sale from online insect sites.[40] [41] [42] [43]

Progress was initially slow but in 1989 an important milestone for insect conservation was laid by the Environment Division of the Ministry of Education which published *The Red Data Book of the Maltese Islands*. The book consists of a national list of threatened species of fauna and flora including insects. It is arranged on the same general lines as the red data books published by the International Union for the Conservation of Nature and Natural Resources (IUCN) and brought Malta closer to the reporting systems used by international organisations. The publication of the book was one of a series of steps that aligned nature conservation with international standards and prepared the ground for national legislation that complies with international conventions.

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[40] http://www.theinsectcollector.com/acatalog/bh_Papilionidae4.html downloaded on 02.08.18. https://www.ebay.co.uk/itm/Papilio-machaon-melitensis-female-form-rufopunctata-RARE-LAST-ONE-/302552368437 downloaded on 02.08.2018
[41] https://picclick.co.uk/Papilio-machaon-melitensis-female-302756748476.html
[42] https://www.ebay.ca/itm/392012132844?rmvSB=true
[43] https://www.ebay.ph/itm/MEADOW-BROWN-SSP-RARE-Maniola-jurtina-ssp-hyperhispulla-Malta-1989/382453706311

The red data entries for insects were divided into three chapters; Insects (excluding Coleoptera ad Lepidoptera) which was written by Stephen Schembri, Lepidoptera by Paul Sammut and Anthony Valletta and the Coleoptera which was compiled by Joseph L. Cilia. (Schembri & Sultana, 1989). The fact that three chapters were dedicated to insects and that each chapter was written by different specialists indicates that the idea of insect conservation was already being given importance in 1989 by the editors of the book even though at the time, insect conservation was still in its early stages and insects were not considered important or worthy of conservation by the public.

In the chapter Lepidoptera of *The Red Data Book* (1989) Paul Sammut and Anthony Valletta wrote that

> it was high time that a coordinated mapping programme be undertaken to accurately assess the status of Malta's resident Lepidoptera especially the endemic species and through this study one would be able to accurately identify which species are endangered and if necessary, carry out some breeding and release programmes, or the planting of particular food plants. This would improve or stabilise populations of species heading towards extinction. (Sammut & Valletta, 1989 p. 97)

In the book, 34 species (25 moths 9 butterflies) were listed as endangered. Repeating what Anthony Valletta had written earlier, the authors wrote that the main reason for the decline and disappearance of these species is that large areas of cultivated and uncultivated land were being taken over for the construction of hotels, villas, blocks of flats, for the extension of the airport and for new roads and widening of old ones. Furthermore, the construction of docks and the expansion of industrial estates as well as the opening of new quarrying sites to provide the necessary building material for these projects have all taken their toll of hitherto unspoiled areas of countryside. Moreover, with the improvement in the standard of living and the subsequent demand for more spacious accommodation, new residential areas have sprung up and housing estates now surround many of the old town and villages. His assessment was that "All this has considerably reduced the habitat and food supply of many of our resident species of Lepidoptera. Similarly, many of the occasional migratory species fail to establish themselves permanently for lack of suitable food-plants and adequate habitat." (Sammut & Valletta, 1989 p. 97).

All the butterfly species found in the Maltese islands (except for the two endemics) are also found in mainland Europe where most of them are very common and despite their inclusion in the Maltese Red Data Book, none of them are considered as target conservation species in Europe. The Maltese islands have the smallest number of butterfly species when compared to the other Mediterranean countries. This is not at all unexpected when considering the small size of the islands, the climatic conditions, the lack of variety in ecosystems and the fact that Maltese Lepidoptera has not been studied systematically for a long time. Nevertheless, the impoverished status of butterfly species on the Maltese islands is still questioned and debated especially when certain aspects are taken into consideration (Sammut, 2000). The fact that most of the butterflies found in the Maltese islands are found in other parts of Europe where they are not considered as target species, does not diminish the responsibility of the Maltese to conserve them because they are part of the natural heritage which is part of the culture of Maltese islands.

In the chapter on Coleoptera, Cilia (1989) wrote that up to the time of writing, most published works on local beetles were simply lists of scientific names with little or no information about distribution and biology. He continued that a considerable number of species had a restricted distribution as they are associated with habitat types that are rare in the Maltese islands such as saline marshlands, sand dunes, freshwater etc. Other species had not been reported for a long time; this may be partly due to their small size making them easily overlooked or because they had become very rare or extinct because of loss of habitat. He suggested that "habitats rather than species themselves be considered in conservation projects. Some of the larger and more conspicuous species are large enough to attract attention and are often indiscriminately killed out of a general fear of large insects" (Cilia, 1989 p. 105).

Lack of knowledge was also highlighted by Stephen Schembri who summarised the then available knowledge of the endangered and rare species and of the endemic insects excluding the Lepidoptera and Coleoptera. His assessment was that “The status of many species is still not adequately known and exclusion from this list does not necessarily mean that it is not threatened but may simply reflect our lack of knowledge.” (Schembri, S., 1989 p. 90).

Insect conservation in Malta would not have taken off were it not for the fact that in the early 1960s two nature societies were set up, one society, the Malta Ornithological Society initially focused solely on birds while the Natural History Society of Malta (NHSM) worked to create better awareness about other aspects of Maltese flora and fauna including insects. Over the years the two organisations nurtured an interest in nature protection in a number of individuals some of whom work both professionally and on a volunteer basis for nature and the environment or have become academics in areas related to biology or the environment.

As a result of pressure by these NGOs as well as legal obligations associated with Malta’s membership in the European Union, several areas in Malta and Gozo were given legal protection by means of Government Regulations through the Environment Protection Act. The areas include National Parks, Bird Sanctuaries, Nature Reserves, Protected Beaches, Tree Protection Areas, Special Protection Areas and Special Areas of Conservation (International and National Importance). One of these sites, Għar Dalam, was established because of the presence of the endemic Għar Dalam woodlouse (*Armadillidium ghardalamensis*) and is regulated by means of a Conservation Order to ensure its survival and possibly an increase in its range and number of this species as it is restricted to a part of a cave that is not accessible to the public and its presence does not add to the public experience and appreciation of Maltese invertebrates. Furthermore, no nature reserve has been established in the Maltese island specifically for insects although reserve managers at the Għadira and Simar nature reserves, both of which are managed by BirdLife Malta have created freshwater pools for dragonflies and other aquatic insects and bee hotels to provide shelter and nesting sites for hymenopteran species which reflects a growing interest in insects and their conservation among Maltese environmentalists including those whose main area of interest is not insects.

Several such reserves can be found in Europe and other parts of the world. In the UK, the charity Butterfly Conservation has 35 nature reserves for butterflies[44] while another charity A Rocha UK manages a nature reserve specifically for dragonflies.[45] In other reserves, managers often manage parts of the reserve to encourage insect diversity. The creation of such reserves is practical and relatively inexpensive and they can provide habitat for large breeding populations in areas that would be too small for vertebrates. (Wilson, 1987a).

A number of university students have carried out research to identify priority areas for butterflies and dragonflies. These included Audrey Anne Anastasi who argued that studies on individual butterflies should be mainly focused on the commonly-occurring resident species of the Maltese Islands as these are better indicators for species decline, affected by habitat degradation while prioritising vulnerable species within a butterfly conservation strategy. Her research led her to conclude that one of the best ways to preserve certain butterfly populations is through habitat restoration and to protect the remaining important butterflies (Anastasi, 2008). This was followed by a study carried out by Robert Caruana who identified an initial selection of potential Prime Butterfly Areas (PBAs) in Malta through a landscape approach (Caruana, 2013). The information is thus available and can be used to identify the best areas for the creation of nature reserves for butterflies and insects in the Maltese islands.

Legislation can also play a crucial role in the conservation of insects, provided that it is directed primarily towards the protection and proper management of important habitats and the control of trade in endangered species. The legal protection of

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[44] https://butterfly-conservation.org/our-work/reserves
[45] https://arocha.org.uk/meet-us-at-foxearth-meadows/

insects in the Maltese islands is presently being promulgated at various levels by means of international and European conventions, European Union directions and local legislation. Despite the importance of legislation, none of those interviewed mentioned legislation that protects insects either through direct protection of species or through the protection of habitats. This indicates a lack of familiarity and information about a powerful tool that can be used by Maltese citizens who feel powerless in the face of environmental degradation.

In April 1989, after years of pressure by Malta's main environmental NGOs, Malta signed the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), this was followed by the signing of the Bern Convention on the Conservation of European Wildlife and Natural Habitats, also known as the Bern Convention of the Council of Europe in November 1993. In 2004 Malta joined the European Union and as a result Maltese nature conservation assumed a multi-governance character with protection falling under international, European and local legislation a change, which was welcomed by many of the naturalists and environmentalists who were interviewed, although many expected Malta's membership to bring about better and faster results. One naturalist complained that as Malta's economy improves so does the pressure on the countryside.

The European Union signed the Bern Convention and in 1992 approved The Habitats Directive which brought EU legislation in line with the Convention with the aim of maintaining the biodiversity in member states.[46] This legislation protects over 1,000 animals and plant species and over 200 types of habitat. It also established the EU-wide Natura 2000 network of protected areas.[47]

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) ensures that no species of wild fauna, including insects, becomes or remains subject to unsustainable exploitation because of international trade (CITES,

[46] http://ec.europa.eu/environment/nature/legislation/enlargement/index_en.htm
[47] http://ec.europa.eu/environment/nature/index_en.htm

2008). CITES is implemented in the EU mainly through the Wildlife Trade Regulations, Council Regulations of Species (EC) No 338/97 on the Protection of Wild Fauna and Flora by regulating trade therein, and has been transposed into Maltese legislation by means of Legal Notice 236 of 2004. This convention controls the importation and trade in a small number of insect species none of which is indigenous to the Maltese Islands although it is of interest to insect collectors and keepers who are prohibited from importing any of the listed species.[48]

On the other hand, the aim of the Bern Convention is to conserve wild flora and fauna species within member states of the Council of Europe, in particular endangered and vulnerable species, including migratory species. The protected species and habitats listed in the Bern Convention were used to subsequently develop stronger legislation in many countries across Europe and also by the EU within the Habitat and Species Directive.[49]

The Bern Convention, of which Malta as a state and as a member of the European Union is a signatory, is legally binding by means of Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora known as the EU Habitats and Species Directive which is considered as one of the strongest pieces of wildlife legislation in Europe. It lists a wide range of priority species and habitats to be protected in all member states. The list includes many species that have since been confirmed as being highly threatened across Europe and have received much needed conservation action. In Malta this directive was transposed into Subsidiary Legislation 549.44 known as the Flora, Fauna and Natural Habitats Protection Regulations of the 7th December 2006 by means of Legal Notice 311 of 2006.[50] This legislation has become the main tool for the protection of insects. The aim of these regulations is to contribute towards ensuring biodiversity in EU member states and

[48] http://ec.europa.eu/environment/nature/legislation/enlargement/index_en.htm
[49] Downloaded from https://rm.coe.int/CoERMPublicCommonSearchServices/DisplayDCTMContent?documentId=0900001680078aff on 05.08.2018.
[50] http://justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=11550&l=1

the Maltese Islands through the conservation of natural habitats and of wild fauna and flora.

The regulations implement a number of European Directives and international conventions namely Council Directive 92/43/EEC of 21 May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora, Council Directive 79/409/EEC of 2 April 1979 on the Conservation of Wild Birds, the Convention on Biological Diversity, the Convention on the Conservation of European Wildlife and Natural Habitats, the Convention on the Conservation of Migratory Species of Wild Animals, and the Protocol for Specially Protected Areas and Biological Diversity in the Mediterranean of the Barcelona Convention.

The aim of the legislation is mainly to protect the large and popular animal species included insects listed in Schedules V and VI as well as all endemic species except those listed in Schedule X (Appendix III). The insects included in the list of protected species are mostly large colourful Lepidoptera and Odonata. Although the listed species are in need of protection, it is apparent that the main criteria for inclusion in the lists is their aesthetic value and popularity. Other much rarer and endangered species are not protected. Furthermore, the level of protection is limited to the pursue, taking or attempting to take, deliberately capture or kill or attempt to kill, deliberately destroy, keep, transport, by any method sell, buy, exchange, offer for sale or for exchange, import or export protected species. The law does not mention the killing, intended or accidental, of insects and other invertebrates, by means or insecticides or other chemicals used in agriculture or other industries.

Most naturalists, biologists and beekeepers mentioned climate change as a threat to insect diversity. Other interviewees were also aware that climate change is resulting in higher temperatures and that rain is falling over a shorter period with the consequence of longer periods of drought between one rainy season and another. As a result of this, the vegetation is going through profound changes. Many mentioned the fact that even mature indigenous trees such as the Aleppo pine (*Pinus halepensis*) in some years start to die during the summer months. A biologist working for Ambjent Malta said that soon we will need to think about introducing new trees and other vegetation from North Africa as these would be better suited for a more arid environment. This shift in vegetation would reflect changes that are taking place in the entomofauna of the Maltese islands as while some indigenous species have decreased or disappeared completely, several insects of North African origin are being recorded more regularly in the Maltese islands. These include butterflies such as the bright babul blue (*Azanus ubaldus*) a butterfly of African and Asian origin which was found to have established itself in Malta in 2016 (Catania & Seguna, 2017), dragonflies such as the violet dropwing (*Trithemis annulata*) (Gauci, C., 2014) and several species of moths such as *Lithostege fissurata* a North African species which was first recorded in Malta in 2004 (Hausman & Seguna, 2005) amongst others.

People who work close to nature and who depend on the vagaries of the weather, including farmers and beekeepers are very aware of the changes in climate that are taking place and are worried also about its consequences. Some of the interviewees spoke about their fear of dangerous alien insects that could transmit diseases such as the Asian tiger mosquito and agricultural pests, which would be able to establish themselves in the Maltese islands because of higher temperatures. These insects are becoming pests or vectors of diseases for both humans and animals as many species are undergoing changes in geographical ranges, community dynamics, abundances and phenologies (Walther, 2010). The atmosphere in the future is predicted to have increased concentrations of carbon dioxide which together with the predicted higher temperatures will have an unknown effect on the diversity and abundance of household, medical and agricultural pests (Cannon, 1998).

Those who complained about changes in climate felt powerless and unable to deal with the issue and although they know that the change could be halted if not reversed, they believe that nothing can be done at an individual level as it is up to the leaders of other countries and international bodies who have the power to implement the necessary changes but who are not doing so because of various commercial interests. A typical response when discussing the issue was *X'tagħmel*? [What can you do?] which was accompanied by the typical raising of the hands with palms facing upward and a facial expression denoting helplessness.

The impact of climate change on insect diversity is not just a local issue. The effects occur at different organizational levels, that is, from individual plants and animals, to populations and communities through ecosystems (Guo, & Kang, 2011). Effects include changes in geographical ranges, community dynamics, abundances and phenologies (Walther, 2010). Climate change can also affect insect migration and dispersal with the result that new disease-vectors and pest species can appear in areas where they had not been recorded before and although adult insects are not strong fliers, many can be passively dispersed by the wind, possibly up to a hundred kilometres in a single night especially over the sea (Nicoletti, Murugan & Serrone, 2014). Higher temperatures can promote growth and can result in more generations per unit time (Altermatt, 2010). Species are not evolving in response to climate change and as a result, scientists are observing a disproportionate number of population extinctions along the southern edges in response to climate warming resulting in contractions of species' ranges at these boundaries as well as the local and global extinction of many species (Parmesan, 2006).

Maltese environmental NGOs are starting to give more importance to insect conservation. In 2018 Friends of the Earth (Malta) launched a campaign to promote the conservation of bees but in view of the general antipathy towards insects, for campaigns to be successful and give positive results, it would be beneficial if popular and loved species such as the large and colourful swallowtail and the emperor dragonfly, are chosen to represent other less popular, feared or hated insects.

A successful insect conservation campaign must tackle the perception that insects are pests or harmful as this makes it difficult for conservationists to sell the idea that insects need protection and that the authorities need to give them importance by allocating resources for their conservation. One of the best ways to achieve this is through the promotion of flagship species. These are popular charismatic species that can serve as rallying points and symbols for insect conservation similar to vertebrates that have a similar function (Gurney, & Oberhauser, 2008). Campaigns using flagship species can be used to raise money and build public awareness about insect diversity, their value and the need to protect them and their habitats. Butterflies are often chosen as flagships as they are amongst the few species that can foster public sympathy which can be raised in classrooms, through the media, museum displays and butterfly houses.

A flagship species does not necessarily have an important ecological role like umbrella, indicator or keystone species do, but they perform a strategic socio-economic role that supports wider conservation priorities on a number of levels (Walpole & Leaser-Williams, 2002). Insects chosen to be flagship species must be chosen with care and should fit within a number of criteria. These include their conservation status; threatened insects are more likely to generate interest by both professional entomologists and the general public. They should also belong to a group that is easily identified such as butterflies and dragonflies. They should have physical attributes that make them aesthetically appealing such as a large size and bright colours. Another important characteristic is having an attractive common name (Barrua, Gurdak, Akhtar, & Tamuly, 2012). The success or otherwise of an insect conservation campaign involving flagship species has been found to depend among other things, on the general awareness of the public about insects and nature in general. It also depends on the level of education of the target audience, gender and prior knowledge about the species concerned (Schlegel & Rupf, 2010).

Another hindrance to insect conservation is the belief expressed by a number of interviewees that it would not be a problem at all if insects such as flies, cockroaches and mosquitoes had to become extinct. Another issue stems from the fact that many farmers do their utmost not only to control but also to destroy all insects which they deem as harmful even if in the process they destroy useful or neutral insects. One farmer summed it up by saying that “I know that ladybirds are good insects as they eat aphids, but when spraying my crops, you should not expect me to go around it to keep it alive". Many of these interviewees said that they support animal conservation which for them are charismatic species such as birds, whales and other mammals.

Keeping, controlling and conserving insects are emotionally laden activities which often involve direct human/insect contact and or interaction. In many cases the interaction is based on scientific studies and technical entomology. This is especially important in apiculture and the use of insect species that requires a good technical knowledge of the life cycles and behaviour of hymenopteran and other species, control which is based on a good understanding of dangerous and pest species and in the keeping and collecting of insects and other invertebrates which requires an appreciation of the biological needs of the species involved. On the other hand vernacular entomology which is also emotionally laden, does not usually involve direct contact with insects but the non-contact interaction with insects through among other things language, beliefs and symbolism.

5 Vernacular entomology

Little has been written specifically about the role of animals in Maltese society and even less about that of insects. Falzon (2008), Fenech (1997) and Veríssimo and Campbell (2015) studied the socio-economic, cultural, political, demographic and environmental aspects of bird shooting and trapping in the Maltese islands while Portelli (2011) carried out research on insects of commercial value focusing on insects used in biological pest control, apiculture, and sericulture. Some works on Maltese folklore, proverbs, superstitions, beliefs and folk-medicine also include information about insects and other small animals.

Cassar-Pullicino (1967) compiled a list of special terminology and animal folklore including animal tales and legends, proverbs, songs, nursery rhymes, superstitions, beliefs, folk-medicine etc. His work includes information about both domestic and wild (mostly terrestrial) animals. An analysis of the animals mentioned in the paper gives a clear indication of the kinds of animals that the Maltese interacted with. Most were farm animals such as pigs and cows. Several insects and small animals are included in the study most of which are still seen as harmful or annoying. Species mentioned include ants, wasps, flies, fleas, lice and ticks. Bees are the only insects mentioned in good light. Cassar-Pullicino's paper is a compendium of what he termed as 'folk' traditions and beliefs, and customs that provide an insight into how the Maltese viewed the natural world in the past which can be compared with present-day views of non-human animals.

Another interesting list of animals which can provide useful information about insects in Malta is found in document MS 1187 at the National Library of Malta which was transcribed and published by Reginald Vella Tomlin (1960). The anonymous document with the title *Erbario Italiano, Maltese, e Latino con l'Aggiunta delle denominazioni di frutti di mare, pesce, e volatile, che si prendano nel territorio, e mare di Malta, e Gozo (1786)* [Herbarium in Italian Maltese, and Latin with the addition of the names of seafood, fish, and poultry, which are taken in the territory, and sea of Malta, and Gozo (1786)] consists mainly of lists of wild and cultivated plants, fish and other marine species as well as birds that were found in the Maltese islands. These writings give an indication of which insects played a role in the life of the people of the Maltese islands and the way they classified and categorised.

On the other hand many interviewees did not differentiate between members of the class Insecta and other arthropods, and referred to all these animals as *dud* (singular *dudu*/*a*). The current Maltese word for insect is '*insett*' (pl. *insetti*) but this has not always been so. Gavin Gulia in *Corso Elementare di Entomologia Maltese* (1858) which is the text of a series of lectures he delivered at the San Anton Palace, used the word *dud* when referring to insects. At the end of the publication he included a list of entomological terms which consisted of the Maltese, English, Italian and scientific names of several insects and other non-insect arthropods such as millipedes (Class Diplopoda), centipedes (Class Chilopoda) or scorpions, ticks and mites (Class Arachnida) all of which were included under the term *dud*, a word which is still in use in Malta for insects and other arthropods together with the word insect which is also used for non-insect invertebrates.

The use of the word *dud* for a large diversity of species is a reflection of the folk classification of smaller animals which is different from that followed by scientists, in particular by taxonomists, who use phylogenetic history as the basis of animal classification. According to Dupré (1999) folk classification should be treated on a par with scientific classification, although, in actual fact the scientific classification is accepted even by non-scientists as having a different prestige value from folk classification each of which is rooted in its particular history although many interviewees, especially those with a non-scientific background were not even aware of the existence of a scientific form of classification, thinking that their classification is the only form possible, an attitude shared with many biologists who have no interest in non-scientific classification of plants and animals. These conflicting attitudes point to a friction between global science and local knowledge which often share a lot of characteristics between them.

Knowledge about insects is an important indicator of the role of insects in a society. When asked to give some examples of insects, many interviewees showed that they have a restricted repertoire of insect names. The most commonly mentioned insects were ants and mosquitoes closely followed by bees, flies and butterflies. Beetles, cockroaches, grasshoppers and earwigs were mentioned only by a small number of interviewees. There were also many who included non-insect arthropods such as spiders, scorpions and woodlice while a small number included vertebrates such as skink, lizard and mouse. An elderly man from Luqa said that he had never thought of the butterfly as an insect because as far as he knew all insects are harmful and the butterfly gives you pleasure (*jagħtik pjaċir*).

The knowledge of my interviewees about insects varies widely and often depends on such factors as age, level of education and sources from which information is obtained. It also reflects knowledge about other forms of nature and the environment. As a rule, persons who have an interest in entomology or those who studied some biology are knowledgeable about insect biology and insect classification. On the other hand, those whose biological knowledge is limited or non-existent learnt about insects from other persons including parents, friends and relatives and in some cases from television. Young people tend to get their information about insects from the internet, school, and books. The knowledge of my interviewees about insects was mostly restricted to genera level such that those who mention butterflies often were not able to tell you the name of different species of butterflies. Younger interviewees knew more about insects found in other countries than they did about local species which indicates that they get most of their information from non-Maltese sources.

Most of those interviewed were familiar with the ‘white butterflies’ and several of them especially farmers are aware that their caterpillars feed on plants of the cabbage family and often damage crops. Many are also aware of other butterflies but few can give them a name. Very often butterflies are referred to either by the generic term *farfett* (butterfly) or by their colour e.g. *farfett abjad* [white butterfly], *farfett isfar* [yellow butterfly], *farfett oranġjo* [orange butterfly] or habits such as *farfett ta' bi nhar* [day-flying butterfly] or *farfett ta' billejl* [night-flying butterfly] (which is sometimes used for moths). While many other insects are known as *dud* which has very negative connotations, the butterfly is a *farfett* and in spite of the damage of some of them to crops they are not abhorred like other insects because of their beauty.

Most persons can classify only a small number of insects which are usually those with which they come into direct contact on a regular basis. In urban areas these are usually flies, mosquitoes and cockroaches and sometimes butterflies and moths. People who visit or live in rural areas are familiar with a different set of insects while farmers are also very aware of agricultural pests with which they come into regular contact such as aphids, scale insects and some species of flies and ignore those species which do not damage their crops even though some such as grasshoppers can be very common in the countryside where they spend most of their time. Similarly, urban dwellers tend to be familiar with insects found in urban environments such as the housefly and cockroaches while they are unaware of the existence of those species with which they do not come in contact with.

5.1 Ethno-biological and folk classification

In biology, a species is a group of interbreeding natural populations that is isolated reproductively from other organisms. The scientific naming of insect species is similar to that of all other plants and animals. A scientific name is in the form of a Latin binomial created by Carl Linnaeus, who in 1735 proposed a system of globally unique names for each species that ever existed. A name consists of a generic and specific component with each named species having a unique binomial name that has been published formally. The system is still in use although species are being constantly re-evaluated as a result of DNA analysis (Brock, 2002).

Humans cope with the diversity of animal species by grouping and separating them according to differences and similarities. This process of categorisation is a cultural process that is influenced by and influences culture (cognitive categories) and can be specific to each society (Posey, 1986). Classification is so ubiquitous that we take it for granted but it is an important tool for the acquisition, efficient organisation and processing of information as well as in the communication of knowledge. Classification also helps in the creation of categories and the prediction and generalising about nature. Scientific systems of categorisation are based on the same principles but they are usually richer and more elaborate than folk biological classification systems (Ghiselin, 2005).

Berlin, Breedlove, and Raven (1973) together with Atran (1993) argued that for humans, classifying is a natural process and that this tendency gave rise to the traditional systems of classification. The universal or intellectualist tradition argued that humans recognise information chunks shaped by nature and that classification is independent of practical value. As a result of this folk categorisation in different cultures follows similar patterns and that in most cases folk genera are similar to scientific biological classification (Lampman, 2010). Other researchers such as Hunn (1982) believed in a utilitarian system based on the premise that the human mind constructs reality thereby imposing an arbitrary system on the natural world developed on a unique history and culturally defined beliefs, behaviours and preferences of a particular cultural group. As a result of this, folk categories are in a state of flux and vary with gender, age, and social context. Support for the utilitarian approach comes from studies which show the variability of folk categories that deviate from the idealised intellectualist model (Lampman, 2010).

Folk classification does not follow a globally accepted system. To understand how European peasants and herders classified insects one must assume that they did not differ much from similar societies in other parts of the world with regard to their ecological knowledge but there is hardly any information regarding past and present European folk knowledge of wild invertebrate fauna especially focusing on their use in nutrition and healing and what is known, has been compiled mainly by folklorists and linguists very often without contextual analysis. In pre-modern and pre-industrial European societies such knowledge was essential for the survival of communities and was passed down from one generation to another. The only European invertebrates with significant ethno-biological literature are snails, leeches, slugs, ladybirds, crustaceans, oil beetles and head lice (Ulicsni, Svanberg, and Molnár, 2016).

Classification relies on the creation of concepts and categories that facilitate how an individual interprets his or her environment. Categorisation is believed to be a basic human quality by means of which people interpret reality. It is derived from experience with the world and allows for the structured order within which people can describe and interpret reality (Lampman, 2010). Categorisation is important because humans have a tendency to characterise information, that is, to perceive the world not as it is but according to existing concepts and categorisations. Characterisation is thus how an individual or group of individuals deal with information and how this is categorised. This leads to a concept which is a mental idea or notion. A category on the other hand is a set of entities grouped together thus the concept ‘insect’ could be made up of a set of qualities that a creature possesses that give rise to the thought of an insect (Goldstone, Kersten, and Carvalho, 2003).

Concepts are equivalent classes, thus, once objects fall within the same class they come to be treated as belonging to the same class. Thus, if the concept of insect is that of a dirty creature then all insects are considered as dirty unless they are divided into different categories such as good and bad insects. In this case if no category exists outside these two categories an insect is considered as either good or bad without the possibility of it being considered as neither good nor bad (Goldstone, Kersten, and Carvalho, 2003). Furthermore, the way people perceive, categorise, and classify the natural world determines how they think, act and feel about insects and other species of fauna and flora. Thus, in many societies, since the category ‘insect’ is often perceived as bad, other small creatures that are considered as bad such as rats, geckoes, earthworms, scorpions spiders, millipedes and woodlice are also classified as insects. Insects are identified not just on morphological and biological characteristics (cognitive dimension) but also on psycho-emotional criteria (affective dimension), beliefs (ideological dimension), and behaviours (ethological dimension).

These perceptions give rise to feelings of disdain, fear and aversion and often lead to the killing and destruction of these 'insects' (Costa-Neto, 2000).

Categorisation is essential as with the right information and concepts, categorisation makes it possible to make connections between things that have different forms. For persons with poor knowledge about insects, caterpillars, maggots, butterflies, beetles, and flies which have different shapes and forms are not necessarily related, but to somebody with an adequate knowledge of insect life-cycles and structure, they are all insects. Concepts also act as filters that determine how we organise and interpret the external world. A concept can combine with other concepts to build an infinite variety of thoughts and allows us to generalise our experiences. Generalisations help us to link objects and thoughts together. Thus, any insect that has the same colour pattern as a wasp is assumed to sting like a wasp.[1] While such generalisations can lead to stereotypes, they help us to protect ourselves and to survive in both familiar and unfamiliar surroundings (Goldstone, Kersten, and Carvalho, 2003). Stereotyping leads to the projection of feelings of harmfulness, danger, irritability, repugnance, and disdain toward non-insect animals including people by associating them with the culturally defined category 'insect' (Costa-Neto, 2000).

Concepts make it possible to remember and recall information quickly and efficiently. Thus, by having a concept for insect we know that a creature is an insect when we meet one and we do not need to remember the shape and biological features of every insect. This reduces the need for learning. Shared concepts facilitate communication. Research has been carried out to determine the relationship between language and concepts. It is believed that one's accumulated concepts may influence the types of word meanings that one learns. On the other hand, some have proposed that it is the language that determines the concepts that are formed (Goldstone, Kersten, and Carvalho, 2003).

[1] Such assumptions can be wrong as for example some flies mimic wasps but do not sting.

Concepts of nature can depend on culture. In Westernised societies nature is seen as being a counterpart of human culture and independent of human influence. This contrasts with some non-western cultures such as those influenced by Shintoism in which a unitary concept of nature and culture exists which lacks a hierarchical or other qualitative difference between the two (Prominski, 2014). Concepts of nature and hence nature related vocabulary changes with urbanisation (Brock, 2002). As people urbanise they tend to lose contact with nature and as a result folk biological taxonomies start to decay from bottom up creating taxonomies that have less specific classes and more general terms indicating a lesser need for specific identification and knowledge (Brown, 1979). This was noted among the interviewees as those living in urban areas had less direct knowledge of insects than those living in rural areas.

Classifying insects is a difficult task even for entomological taxonomists, because of the large number of species to be classified. It is often easier to give names to large animals and vascular plants which can be useful, harmful, or impossible to ignore and therefore are given a name. However, in folk classification insects are often lumped together with thousands of species included in a single category (Bentley & Rodríguez, 2001). Thus, all mosquitoes are lumped in one group as *nemus* although nowadays many Maltese are very aware of the recently arrived Asian tiger mosquito and refer to it as the *L-Asian tiger*.[2] This differentiation from other insect species is partly the result of information about it in the media as well as because of its notable aggressiveness, its habit of flying during the day and the human body's reaction to its bite especially when it first arrived in the Maltese islands.

If people discover the categories of nature, then folk taxonomy of living things should have formal similarities cross-culturally because of the biological integrity of our planet. If people create the categories of nature, each culture should order living things uniquely (Berlin, 1992). The universalist or intellectualist school claims that some living things are so perceptually salient, so biologically real, that they are crying to be named (Berlin, 1992), an approach that does not necessarily hold water

[2] The Asian Tiger

especially if there are cross-cultural currents, for example, or a system of global science.

Universality does not imply that everything everywhere is the same. Rather it means that the effects of global encounters and influences are persistently unpredictable even within the same society. They are constantly being shaped and reshaped in response to both internal and external pressures that result in friction between the old and the new, the past and present as well as the global and local. The changes and resulting friction are unpredictable and any research into their effects is not a prediction of future trends. Friction often results in heterogeneous and unequal encounters which bring about new arrangements and alignments of culture and power. It is a result of changes that were believed to take place freely such as the free flow of goods, ideas, money and people and the lack of restraint would bring about friction-free changes in the economy, science and society. Friction should not be seen as a brake on forward movement but as a requirement for global power to be kept in motion. It empowers global connections and shows that global power does not operate smoothly as is claimed (Lowenhaupt Tsing, 2005).

Folk knowledge of nature varies from one society to another because the cultural importance (utility) of the domain varies with its ease of observation (conspicuousness, perceptual salience). A species is easy to observe if it is large, social, colourful, abundant, noisy or diurnal. Many species go unobserved because they are small, solitary, cryptic, rare, silent or nocturnal. Hunn (1982) emphasizes perceptual salience: the more distinctive a species is, the more likely it is to be named, the boundaries of biological categories are formed along the lines of discontinuities in nature an idea which Bentley and Rodríguez (2001) do not accept completely as according to them perceptual salience is less relevant than ease of observation. Thus according to them species that look very much alike are actually given different names if there is a cultural reason to do so.

In this argument, culturally important species are those that are perceived to be important within a specific culture. While culturally important species can be useful or harmful, the utilitarian school has emphasised economic use. The Universalist school has countered that animals are named that are not strictly useful. Defining "culturally important" to include harmful species and not just useful ones gives the utilitarian argument a wider range (Bentley & Rodríguez, 2001).

Both the intellectualist (universalist) and utilitarian hypothesis have been used to explain folk classification. The intellectualist approached led by Berlin (1992) and Atran (1993), is based on the argument that natural continuities and discontinuities arising from patterns of evolutionary divergence are an integral part of human thought. On the other hand, the intellectualist approach as proposed by Hunn (1982) imposes an arbitrarily defined order on the natural world. Folk classification viewed through the utilitarian system are said to develop from the unique history and culturally defined beliefs, behaviours and preferences of a particular group. Folk categories are thereby viewed as shifting, and subject to idiosyncratic variation; and patterned according to variables such as gender or social context (Lampman, 2010).

Attempts have been made to reject both approaches. To reject the universalist hypothesis, one must seek folk taxonomies ordered along the lines of the utility of organisms. In such a classification names for taxa would be based on cultural criteria (e.g. use or harm), and folk knowledge would be deeper for the culturally important creatures than for the perceptually salient ones. In contrast to reject the utilitarian hypothesis, one would need to find folk taxonomies ordered along the lines of creatures' morphology and animals would be named for their physical characteristics, while folk knowledge would be deeper for easy to observe than for the culturally important. According to the utilitarian school, folk taxonomies should be based on taxa that the people in a specific culture use. Supporters of the universalist hypothesis argue all languages have words for the major morphotypes of insects and have other similarities. Bentley & Rodríguez (2001) demonstrated that the two perspectives are complimentary since some folk categories are named for their roles in local culture while others for their biological properties while folk knowledge is deepest for creatures that are both culturally important and easily observed.

Which classification is used for a group of creatures and at a particular time depends on how the world is perceived in a particular culture (of which there could be many in one society) and often determined by its wants, needs and goals. While some authors (e.g. Berlin, Breedlove and Raven, 1973) argue for an intellectual basis of folk biological classification, others believe that folk classification is similar to that of scientists and natural historians who classify species because they are interested in understanding organic diversity on its own and who classify animals primarily as a means of satisfying a human need (Boster & Johnson, 1989).

Studies carried out among the Campusinos of Honduras show that people pay more attention to natural attributes but also name a substantial minority of creatures for their roles in human culture indicating that people both discover and create their world. They name nature's major morphotypes, the biologists' orders and families such as ants and butterflies which are insects that Berlin (1973) said are "crying out for names". This supports the universalist argument although the Campusinos, like other societies, discriminate finer categories according to local cultural priorities such as avoiding pain and managing pests which supports the cultural relativistic argument (utilitarian) through which culture is seen to deal with creatures as much for their nuisance value as for their utility (Bentley & Rodríguez, 2001).

5.2 Insects in myths, legends and beliefs

Insects are the subject of myths and legends in which very often they are believed to be endowed with special powers. In this mythological world these insects have supernatural characteristics which they use to help or hinder humans but always their powers make them fearful creatures which are difficult to control and which must be destroyed, appeased or kept at arm's length. Some species, such as locusts can at different times be friends or foes. Others, like moths can be just messengers or evil creatures that inflict death. Many of those who spoke about these insects believe in these powers or else know of others who do.

An old shepherd from Mellieħa recounted a story, which he fully believed to be true, of a farmer and his wife who had some fields at L-Aħrax, an area close to Mellieħa. This couple had a very lazy son who did not want to work in the fields. One day the young man went to Tunisia where he met somebody who sold him three crickets in a matchbox. These crickets were actually *xjaten* [devils] whom he could command to do anything he wanted them to. When he came back to Malta, he took the crickets with him to the field and in the evening, he released them from the box and ordered them to work the fields which they did during the night. In the morning he went back and ordered the cricket/devils to jump back into the box. This used to be repeated every evening and every morning. While this was going on the people of Mellieħa used to see strange movements and hear strange noises coming from the direction of L-Aħrax so they informed the village's Parish Priest (Fr Magri)[3] who was a very wise man. The parish priest went to speak to the young man who admitted that he had three devils and showed him the three crickets in the box. As soon as he saw them the priest quickly cut off their heads and killed them as they were evil and had to be rid of. The old shepherd had heard this story from his father and was convinced of its veracity especially as the Parish Priest in the story actually existed and crickets were often kept as pets.

Several species of insects are said to be bad omens such as the widespread belief that if a "black moth" [baħrija sewda] enters the house one should not kill it but try to make it leave and if it does not leave one should pick it up or catch it and release it outside to avoid its negative influence. An elderly man said that some moths have the power of witchcraft [seħer]. A retired police sergeant said that he is afraid of black moths because when one appears, bad news is on the way. He justified his fear because once when on the roof of his house he saw a black moth and a short while

[3] On the 5th September 1883, the Parish Priest, Rev Francis Maria Magri blessed the first stone of the new church. (http://thechurchinmalta.org/en/posts/621/mellieha).

later the father of his son’s wife died. He continued that since these claims were so widespread, they must be true otherwise people would not continue to believe them.

Many believe that the hummingbird hawk-moth (*Macroglossum stellatarum*) is a harbinger of death in the household if it enters a house. The moth is known in Maltese as *ħabbara* (Sammut, 2000) which means the one that announces or foretells although there is a lot of confusion about its name as Aquilina (1987) gives its name as *baħrija sewda* [black moth] and adds *baħrija bajda riżq tajjeb*; *baħrija sewda risq ħażin* [white moth good luck; black moth bad luck]. Since viewing the 1991 horror thriller ‘Silence of the Lambs’, many Maltese are claiming that the death’s head hawk-moth is the culprit but it is unlikely that it ever was the moth which was said to bring bad luck because it was never as common as the humming bird hawk-moth, is not diurnal, and does not enter houses.

A security officer from Cospicua confirmed that it is mostly women who believe in the power of moths to be the portents of death and claimed that in his hometown most women and some of the men believe this. They open the window so that the moth flies out of the house and cross themselves or say a small prayer to ward of the moth’s bad influence. He added “nowadays they do not want even small moths in the house – they are afraid of them. He insisted that this belief has increased and if you try to convince them that these things are not true, they do not believe you”.

A teacher, who is also a keen naturalist, confirmed that nowadays, because of lack of knowledge about nature, superstitious women do not distinguish between different species of moth and are afraid of any moth that enters the house while a medical doctor from Rabat said that it has become taboo to kill moths. A woman from Fgura said that the dark moth brings bad luck because it is ugly while the yellow moth is beautiful and brings good luck and wealth [risq u barka]. This is a reflection of the aesthetic value of insects. Beautiful things must be good, hence colourful insects such as ladybirds, butterflies and dragonflies must also be good. In reverse ‘nasty’ or ‘noxious’ insects, especially cockroaches and most beetles, are seen to be ugly with dull colours particularly brown and black.

For farmers ants are a nuisance because they are competitors that must be supressed, but in the past, they were sometimes seen as allies who came to the aid of the Maltese in times of trouble. According to one legend, in Malta there are several ant colonies each of which is ruled by a queen ant, however a king ant rules over all the colonies and all ants obey him blindly. When the Maltese rose against the French occupiers in 1798, the king ant ordered his subjects to help the Maltese patriots by biting the French soldiers and so they would not be able to aim their guns properly. It was also claimed that if the French had to invade Malta again, the ants would once more come to the rescue of the Maltese (Mifsud, S. D., 2014). The ants are a microcosmic representation of the Maltese nation determined to protect their land from their enemy. The ants are small but they are still able to overcome the much larger and more powerful invaders who were trying to take away that which belonged to Malta at a time when the idea of nation and nationalism was beginning to take root. In an earlier legend from an earlier period the Maltese relied on divine intervention to save them from the enemy as migrating locusts are said to have helped ward off a raid by pirates. The story goes that the inhabitants of Mellieħa once sighted a Turkish fleet heading towards the Maltese coast. Terrorised by what would happen to them if the Turks landed, they prayed for heavenly intervention. Their prayers were answered as just before the pirates made land a massive swarm of locusts surrounded the fleet making it impossible for the sailors to see where they were going and to avoid running aground the fleet had to turn back (Mifsud, S. D., 2014). Another story involving spiders and divine intervention took place at Wied Speranza [Valley of Hope]. A young girl was tending her family’s sheep and when she saw Turkish pirates walking in her direction she ran to hide in a cave. Terrorised she prayed to Our Lady and a spider built a web across the cave’s entrance. As a result the Turks did not look for her in the cave.[4]

[4] https://www.guidememalta.com/en/stranger-things-7-maltese-places-with-famous-legends

Some beliefs do not imply any intentionality but a natural consequence of interacting with insects based on mistaken interpretation of observations such as the belief is that if you touch your face after handling a white butterfly you get dandruff or ringworm. According to Guido Lanfranco this belief came about because when you touch the wings of a butterfly some of its scales (which look like dandruff) fall off and get stuck to your hand (personal communication, 23rd April, 2014). A number of interviewees said that bedbugs, mosquitoes and fleas attack people with "sweet blood" [demm ħelu].

Many insect beliefs are of a negative nature and involve a negative intention on the part of the insect. In most of the actions described, the insects either show intentionality or are an accessory to intention thereby being either a direct threat or merely a vehicle of evil. Their actions are not casual and give the impression of pre-determined action with some insects having special powers and evil intentions. These included dragonflies, grasshoppers and moths. A middle-aged person from Cospicua is convinced that the dragonfly buzzes around you with the intention of stabbing you in the eye with a knife while many others believe that the hind legs of a grasshopper are knives that are used to attack you for no particular reason. An elderly lady from Mqabba said that grasshoppers fly at your face. The belief that dragonflies stab you is not restricted to Malta. In North America it is considered to be a myth of recent origin that has given rise to several vernacular names for dragonflies such as "sewing-needle', darning-needle", and horse-sting' (Klausnitizer, 1987).

Another belief heard from various sources is that grasshoppers do not fly; they only jump while a beekeeper said that when grasshoppers are migrating, they use one wing to fly and the other as a rudder. According to him, this method of flying is also used by migrating quails (*Coturnix coturnix*). A farmer from Baħrija said that in a dry year if a grazing sheep smells an oil beetle[5] (*Meloe tuccius*) which lives in vegetation, it becomes inflated and soon after it dies. These and similar beliefs used

[5] *Dliela*

to exist in other parts of Europe and might still exist in some areas although in her 1954 book "Insect Fact and Folklore" Lucy W. Clausen describes several folk beliefs related to insects from all round the world but when referring to beliefs in Western Europe including the belief that the death's head hawk moth is a harbinger of bad tidings she was already writing about these beliefs in the past tense.

5.3 Insect symbolism

Many species of insect have symbolic value which often reflect emotions that they elicit. Several interviewees described ants and bees as very busy hard-working insects that should be emulated. A farmer at Baħrija said that when he was a child whenever he saw ants carrying food to their nest his father used to say "*Fis-sajf aħdem u rsisti biex fix-xitwa jkollok lira*" [In summer work hard so that in winter you will be able to save a lira[6]]. Another two farmers recounted Aesop's fable about the cricket which spent all summer singing and in winter died of hunger while the ants which worked hard throughout the summer collecting and storing food were able to survive the winter. Both said that they had known these stories since childhood and that these stories had be recounted by a parent to teach them how important it is to work hard. For these persons, bees and ants are symbols of hard work and industriousness. When referring to bees some interviewees said that these insects stand for the value of cooperation and community an elderly farmer from Mġarr said that a bee dies after stinging to save its hive just like Jesus Christ who died to save all Christians.

None of the interviewees used the word symbol when discussing these insects but it was clear that the behaviour of these species had several direct and indirect meanings and messages which can be deciphered and understood. The foremost of these is hard work and industriousness.

[6] The Maltese Lira was the currency before Malta adopted the Euro.

In many cultures ants still symbolise industry, thrift, providence, and forethought. In the Old Testament ants symbolised wisdom (Cooper, as cited in Kirsty and Cherry, 2000). The community of ants in their anthill can be considered both a microcosm of humanity and their world and a lesson in the power of communal cooperation (Leach, as cited in Kritsky and Cherry, 2000). Another social insect, the honey bee, is probably the most universally symbolic of insects. Bees are admired, venerated and feared and at the same time they are the subject of cults, rituals, and beliefs in births, death, and the soul (Cooper as cited in Kritsky and Cherry, 2000). The bee is considered to be a rich symbol of ethical virtues, diligence, organisation and technical skills, sociability, purity, chastity, cleanliness, spirituality, wisdom, courage, abstinence, sobriety, creativity etc. (Tressider, as cited in Kritsky and Cherry, 2000).

Symbolism is often encountered in art and other visual representations as well as in literary and linguistic contexts. (Hogue as cited in Kirsty & Cherry, 2000). The use of animal symbols dates back to ancient times when people ascribed spiritual powers to various creatures and used them as the subject of folk tales, rituals and symbolism to interpret both the real and imaginary world (Kritsky & Cherry, 2000). During interviews artists, designers and tattooists, described insects such as butterflies and dragonflies as symbols of beauty, gentleness, femininity etc. This agrees with Gagliardi (as cited in Kritsky and Cherry, 2000) who wrote that in many cultures the butterfly is a symbol of the beauty of nature besides being used as a symbol of femininity, freedom, creativity, and foolishness.

Myths can help one to understand how societies think about their environment, how they embed people in time, space and a symbolic universe as they are often used to explain some feature of life including the origin, morphology, and behaviour of different insects and other forms of life and the world in which people live. Another function of myths is to provide a basis for social cohesion as, through sharing mythology a strong social tie is formed (Cavendish as cited in Cherry, 2002). Myths may also provide social cohesion by justifying a social structure (Jay as cited in Cherry, 2002) and by being the basis of governments and national identity (Bierlen as cited in Cherry, 2002). A third function of myths is to provide moral order (Campbell 1968; Bierlen as cited in Cherry, 2002). In addition, many animals including insects frequently occur in myths that show how one should lead a moral life, or to show the consequences of not doing so by showing the outcome of inappropriate behaviour. In the Bible, of the 10 plagues that were sent by God to Pharaoh's Egypt at the instigation of Moses and Aron, three were insect plagues, namely lice, flies and locusts (Smith, Mittler & Smith as cited in Cherry, 2002).

Insects used as symbols by interviewees were all perceived to be hard working and therefore to be emulated. The persons who spoke about the symbolic value of insects were farmers. These have been familiar with these insects since childhood and the stories had been told to them by an older relative to teach them about the value of hard work.

Another role allocated to insects is that of weather forecasters. A number of insects are said to be able to forecast the weather mainly as a result of their appearance at particular times of the year. An old farmer who lived all his life in Baħrija said that if one sees lines of ants (*nemmilijja*) carrying material to their nests or even more, when one sees winged ants, rain is on the way (jimmarka x-xita). A farmer from Żejtun believes that flies can predict bad weather three days ahead. "When flies start pestering you inside your house it is a sure sign that bad weather is round the corner". Another farmer said

> They are afraid of bad weather and go inside. I do not know how they do it but they must have something better than humans. They must have a membrane (*rita*) in their brain that can predict the weather. Even birds have it.

A similar belief was described by the 17th century German priest who wrote that "Flies and fleas bring tidings of rain when they sting and bite both man and beast more frequently and more severely than usual" (Klausnitzer, 1987 p. 228).

Another farmer from Żebbuġ said that you can also tell that bad weather is on the way when you see the tiger moth (*Cymbalophora pudica*) which actually always appears in September and October irrespective of the weather. A retired policeman living in Kirkop went even further. He called this moth *farfett tax-xita* [rain butterfly]. According to him its appearance was a sign that it was going to rain because it attracts the rain (*tiġbed ix-xita)* "When you see it you can tell it is going to rain. When I see it on the wall, I say to myself it is going to rain because it attracts rain"

The perception of the environment or the way the environment is experienced is a result of social experiences. Clayton and Opotow (2003) proposed an integrative construct of environmental identity that encompasses multiple meanings which give identity of individuals a dynamic nature that depends on the way one defines the natural environment. In this case the definition depends on the degree of similarity that is perceived between oneself and the other components of the natural world and whether one considers nature and the non-human natural entities to be valued components of one's social and moral community (Clayton & Opotow, 2003).

Experience of the environment sometimes leads to misinterpretation of facts and thus to false beliefs such as the belief of many Maltese in the spontaneous generation of insects and other invertebrates. Several interviewees, including young well-educated persons, still believe that some insects are generated from non-living organic or inorganic matter. They insisted that some insects are created out of inert matter if the conditions are right. They based their beliefs on information that came down through generations and confirmed through personal experiences. When challenged about their belief in spontaneous generation all argued that insects appeared in places out of nowhere. An elderly lady from Kirkop said that if you keep paper or hardboard in warm places it forms cockroaches. Another interviewee said that you do not need any material for cockroaches to form as warmth is enough. Another said that cockroaches come out of the bodies of dead animals while a man from Dingli said that when a dog or a human is alive it does not have *dud* [bugs] living in it but as soon as it dies *dud* start to form inside its body. He also said that fleas form *mix-xejn* [out of nothing]. A couple of farmers said that if you place heaps of rabbit manure in a field to dry, after one week it warms up and starts producing fleas. A farmer in Birżebbuġa who keeps sheep and goats to make Maltese *ġbejniet* [small cheese] said that *dud* [maggots] form spontaneously because if you place *ġbejniet* in a jar and seal them, after some time they produce maggots while a man in his thirties who was listening to this conversation corroborated this theory by saying that if you are far out at sea and keep a freshly caught fish in the open air it starts forming maggots even if there are no flies around. Insects that are said to generate spontaneously are culturally important but difficult to observe and explanations for their appearance seemingly out of nowhere while not scientific make sense for those making these observations because without the use of microscopes and conceptual tools such as germ theory and metamorphosis the only explanation is that the organisms generate spontaneously (Bentley & Rodríguez, 2001).

Belief in spontaneous generation is not of Maltese origin. It was first mentioned by Aristotle who wrote that “the flea is generated out of the slightest amount of putrefying matter; for wherever there is any dry excrement, a flea is sure to be found” (Klausnitzer, 1987 p. 226). It was repeated by others including Thomas of Cantimpré who wrote in the 13th century that the flea comes into being of warmed dust and decaying damp matter (Klausnitzer, 1987). Another 13th century author also quoted by Klausnitzer wrote that

> The moth is a clothes worm that comes into being from the decomposition of clothing if it is left for too long in a close atmosphere without being exposed to the wind, or folded up in the fresh air. It is a sensitive creature and hides within the clothes, so that it is rarely seen. Bay leaves, the needles of cedars and cypresses and the like, laid among the clothes, protect them as they also protect books from damage by moths (p.175).

Humans have always been intrigued by their origin and by the question of the origin of life itself. The belief in spontaneous generation of life provided the answer to this question for thousands of years (Brack, 1998). Aristotle’s belief continued throughout the Middle Ages and beyond until it was scientifically discredited completely first by Redi in 1668 then by Louis Pasteur in 1862 who carried out a series of experiments to show that microscopic life forms do not spontaneously generate in vessels of sterilised liquid (Parke, 2014). A literature search on this topic in English and Italian did not yield any references regarding current beliefs in spontaneous generation which would indicate that people no longer believe in spontaneous generation although it is possible that researchers assume that such a belief does not exist anymore and thus do not carry out any research to determine whether it actually still exists. The existence of non-scientific beliefs indicates a dual system of thought in which beliefs from different lineages exist not only in a society but also in an individual such as a farmer who is aware that animals reproduce sexually but at the same time believes that others reproduce by spontaneous generation or the primary school teacher in her late twenties who was terrified of a humming bird hawkmoth which entered a museum during a school visit because it brings bad luck. In these and similar cases the information arrives to the individual via different sources; the formal sources including books and school lessons and from informal sources such as family members and others who impart information that has come down the line for many generations.

Awareness and knowledge of insects was summarised by Bentley and Rodríguez, (2001) who concluded that

> for insects that are culturally important and easily observed, folk knowledge is deep: local people often know more about them than scientists do...... For insects that are not culturally important but are easily observed, folk knowledge is thin: local people know them in a way that scientists can understand, although local knowledge may be less complete than that of specialized natural scientists. Local knowledge of the culturally important but difficult to observe is gritty: local people may have beliefs and perceptions which are at odds with scientific notions and cannot always be tested with the scientific method. About insects that are difficult to observe and of no cultural importance, local people know very little (p.288).

5.4 Insects as inspiration

Insects have inspired humans in many areas including in language and in creative arts. Some insects have become part of the Maltese language particularly as some are used in order to describe particular characteristics. Others are used in similes and metaphors both to describe positive and negative situations as well as insults. A well-educated man from Luqa gave several examples of insects used as insults – to a slow-moving person one says *iċċaqqlaq qiesek nemla* [move on you are like an ant], *mur inħasel għandek riħa ta' ħanfus fuqek* [go and wash yourself, you smell like a dung beetle], *fitt daqs dubbiena* [as annoying as a fly], *perikoluż daqs żunżana* [as dangerous as a wasp]. Similarly, the very negative perception of lice (*qamel* in Maltese) is reflected in various words and sayings. The Maltese word, *qamel*, can also mean something that is dirty, as can be seen from variations of the word as well as sayings such as *għad iġorru l-qamel* [he is so lazy that he doesn't take the trouble to keep himself clean]. Q*amel* also associates dirt with stinginess with the saying *dak mqammel, ma jikolx sa ma jixba* [he is a lousy fellow who doesn't even eat enough]. *qammiel* [a person infested with lice] is commonly used in everyday language for a stingy person as in *qammiel li qatt ma jinħasel* [a lousy man who never washes himself] (Aquilina, J., 1990).

Similarly, plague epidemics had such an impact on Maltese society that several centuries on, their mark can still be felt on Maltese language. A number of expressions referring to the plague are still in use today even though some users might not be aware of the origins and significance of these expressions. The most commonly used expression is *maħmuġ seba pesti* [he is as dirty as seven plagues], or *jinten seba pesti* [he stinks like seven plagues], *impestat* [he is sick with plague] is usually used when referring to a dirty person or to a place full of pests such as cockroaches (Aquilina, J., 1990). The plague caused fear and terror and people were told not to frequent crowded places including churches (Cassar, 1964). The fear kept people also from interacting with each other and this gave rise to the expression

Mela qed taħseb li għandi l-pesta [you are keeping away from me as though I have the plague] (Aquilina, J., 1990).

The horsefly (*xidja*) bites horses and other animals including humans. Its bite is very painful and this fly is used to denote a very irritating person. A man from Cospicua said that the expression *kemm int/ hu xidja* [you are such a horsefly] is used to describe an obnoxious child. Another man said that the expression *qisek xidja f'sorm patri* [you are like a horse fly in a priest's bottom] had a similar use. The name *xidja* is shared with a demon which is also called *pest*, which pesters and bothers people to make them angry. It can possess children to turn them to veritable pests just to annoy their parents and in the past took the form of a shadow that spread diseases such as plague and cholera (Mifsud, S. D., 2014).

From use in language it is a small step to be used in prose, poetry and song. A search in the Malta Public Library internet portal[7] carried out on the 29th of October 2018 for insect-related words was used to give an indication of books with insects in their titles. Searches were carried out using both English and Maltese words. The words searched were *bergħud*, *briegħed*, *debba, dubbien*, *dubbiena*, *dud*, *duda*, *dudu*, *farfett*, *friefet*, *grillu*, *ġurat*, *ġurati*, *kokroċ*, *musbieħ*, *naħal*, *naħla*, *nannakola*, *nemel*, *nemla*, *nemus*, *nemusa*, werżieq, *wrieżaq*, *wirdien*, *wirdien*, *żunżan* and *żunżana*. The English words searched for were ant, ants, bug, butterfly, butterflies, caterpillar, caterpillars, cricket, crickets, dragonfly, dragonflies, grasshopper, grasshoppers, hornet, hornets, insect, insects, ladybird, ladybirds, mosquito, mosquitoes, mantis, mantises, wasp and wasps.

The first thing that comes out from this search is that most Maltese-language books with insect-related words in their titles are aimed at children. The only exceptions were two horror books with the word *wirdien*[8] and "Id-debba tax-xitan" [The praying mantis] a romance/horror by Natasha Turner in which a jilted wife dreamt that she

[7] https://www.maltalibraries.gov.mt/iguana/www.main.cls?surl=MaltaLibraries
[8] Wirdien (1976) by Anton Grasso and Wied Wirdien (2008) by Simonne Vella and Loranne Falzon

was a praying mantis that eats its partner during copulation. Children books featured ‘cute’ insects namely *farfett*, *nannakola*, and *dudu* with one book about Aesop’s fable “The cricket and the ant”.

The search using English language words gave basically similar results except that there was a greater variety of books for adults of which only one was a horror and interestingly this was written by a Maltese author and the title used the word cockroach.[9] The most commonly used words in children’s books are bugs, butterflies and ants while for adults they were butterflies and dragonflies.

The search for Maltese books probably brought up all Maltese books written with such titles in the past twenty or thirty years but the English language books reflect personal choices of those responsible for the purchasing of books which should reflect the reading preferences of the users of Malta’s public libraries. The books available are also a reflection of the general attitude of library users (many of whom are Maltese) towards insects, that colourful and harmless insects are for children while fearful and disgusting insects such as cockroaches and praying mantises are suitable only for adults.

A search in a page listing the most popular Maltese poems by author carried out on 13th of November 2018 was used to determine which insects were mentioned in Maltese poetry.[10] The search yielded two poems namely “Dudu tal-ħarir” [Silkworm] by Mary Meilak and “Lill-musbieħ il-lejl” [To the glow worm] by Matthew Sultana as well as several poems by Anton Buttigieg. In these poems, Buttigieg puts into words his feelings and attitude to insects as well as those of Maltese society. He wrote about insects that he liked particularly butterflies, the firefly, ants, the ladybird and cricket in beautiful language while a small number of works were inspired by insects that provoke, fear, disgust and annoyance such as mosquitoes. The poet’s choice of insects reflects the general feeling. Insects that are

[9] Evil of the King Cockroach. (1960) by Francis Ebejer
[10] https://mt.wikipedia.org/wiki/Lista_tal-poeti_tal-ilsien_Malti

loved are described in glowing terms while mosquitoes and their kin are described in negative terms or used in poetry that uses negative or ugly words or phrases.

Personal observations of the names of shops, houses and apartments indicated a pattern of insect names that are used for such purposes. To get more data an internet search carried out on the 27th of October 2018 using insect names and insect-related words and the word Malta to find which of these words are used in Malta in naming companies, businesses, shops, houses, apartments, streets etc. (Appendix IV). This search indicated that although there are many insects to choose from only a relatively small number of insects are used in such names probably because only they are considered as appropriate. The most common insect related words are butterfly, ladybird, bee and bee-related words such as honey and hive. Catering establishments tend to prefer bees and bee products as well as butterflies. Insects used are always familiar and loved species that are usually useful or aesthetically pleasing.

Figure 9 Newspaper advert for BeeSmart child care centre

Very few artists in Malta have included insects in their works. Lisa Falzon who left Malta more than a decade ago sometimes includes insects particularly butterflies, dragonflies and ladybirds in her work. Insects are occasionally depicted in body art. According to two tattoo artists about 5% of their clients chose an insect design for a tattoo. The favourite are aesthetically appealing insects such as ladybirds, butterflies and dragonflies. The artists said that they are not aware of any particular symbolism involved in the choice of insect although it is possible that the chosen insects mean something to the client but they usually do not discuss this with the tattooist. According to one of the two tattooists in many cases the insect chosen for a tattoo often reflects the character of the clients. Most women go for beautiful images that project their femininity while men go for creatures that project toughness, a gendering of insects that is also seen in the choice of arthropod pets. Clients do not usually ask for a particular species of butterfly but request the colours they would like to be used. Very often butterflies are not tattooed on their own but form part of a design that includes flowers. None of the tattoo artists interviewed had ever had a request to ink in 'nasty' insects such as cockroaches. Once a client asked specifically for a tattoo of the moth (death's head hawkmoth) that he had seen in the movie 'Silence of the Lambs'. Non-insect arthropods are sometimes chosen and, in many cases, these do symbolise something such as the black widow which projects power and gives a message that the person carrying the spider should not be messed with. Insect designs could also serve as group identification.

Contemporary westerners have a variety of reasons for selecting permanent personal adornments. Up to a few decades ago tattooing was a matter of personal choice only. There were no cultural imperatives or aesthetic demands for it (Pearson, 1996) although in recent years, as tattoos started to become more mainstream young people felt compelled to ink themselves in order to conform to their peers. Pearson (1996) claimed that motivations for getting a tattoo are divided into five categories: As a symbol of an interpersonal relationship; participation in a group; self-identity/magical/protective significance; as a decorative/aesthetic statement; and a representation of key interests or activities. When insects were used as symbols of interpersonal relationships, they were always negative e.g. a black widow with the face of a former girlfriend the death's head hawkmoth also symbolises a failed relationship.

The death's head hawkmoth was sometimes mentioned by interviewees when asked whether they recalled insects in movies having been seen in the 1981 movies Silence of the lambs. Insects are often used in movies originally as objects of horror but increasingly as creatures to be valued, protected and conserved either because of their beauty or because of their ecological importance but in spite of the large number of movies in which insects and other invertebrates took centre role, most of those interviewed for this thesis did not remember ever watching a movie featuring insects. The only exceptions were persons who loved nature, a few of whom even remembered movies which they saw during their childhood these included Them!, the 1954 giant ant movie which was screened on Italian television in the late sixties, [11] and '*Ape Maia*' (Maya the Bee), the cartoon series which was first shown on Italian television in 1980.

Figure 10 Them! 1954 horror movie

[11] Up to the 1990s, when cable television was introduced many Maltese regularly watched Italian television.

Nature lovers said that they had not been negatively influenced by insect horror movies but they enjoy watching pro-nature movies or movies with a pro-environment theme. On the other hand, several of those who did not recall watching insect movies or television programmes mentioned the killer or 'African' bees believing that they are very dangerous killer bees from Africa that are killing all kinds of animals including humans in the United States, a belief that has obviously been formed through watching horror movies and sensational pseudo-documentaries about Africanised bees in the southern states of America.

Horror movies started to become popular in the 1940s and from the very beginning bugs became a regular subject as they built on public fears of insects. In many of these movies, insects became a public enemy intent on destroying civilisation and all that humanity had built. Often the insects were of gigantic proportions and were the result of either science gone wrong, the creation of an evil scientist or invaders from outer space. In the second half of the twentieth century, bad bee movies started to be produced. These movies built on a bee created by the Brazilian geneticist Warwick Kerr who attempted to improve honey production in South America by cross-breeding his bees with the more aggressive African subspecies of the honey bee (A. *mellifera scutellata*) in the hope that the offspring would be as productive as the bees in South Africa. One day a caretaker removed the entrance guard and some queen bees escaped and established new colonies outside the hive. The hybrid bees started to colonise areas further north and being more aggressive. There were a number of reports of cases where they attacked humans and domesticated animals leading to them acquire the reputation of "killer bees" which became a good movie subject. The creation of 'monster bee' in movies continued with the epidemic fear of a communist attack on American values of liberty and conscience with the bees becoming a model of socialist society in which the individual is subdued to the will of the state resulting in the 1960s coalescing of the mob killer and communist swarm in horror movies (Preston, 2006).

The cartoon series Ape Maia (Bee Movie) which was popular in Malta was one of the first productions that showed honey bees in a positive light and opened the way for movies which did not depict bees as dangerous insects but made them the subject of good human-insect relations which reflects growing environmental awareness and the realisation that bees and other insects are of benefit to humans and at risk of disappearing (von Schlemmer, 2009) and just as horror movies consciously or subconsciously reflected and reinforced negative attitudes towards insects pro-environment cartoons, documentaries and movies could help to create a more positive attitude towards the natural environment including insects.

Figure 11 L'Ape Maia (Maya the bee)

The change in attitude towards insects and the natural environment, seen in movies and TV programmes that started in the 1980s and 1990s is also reflected in Maltese stamp and coin designs. The first Maltese stamps showing nature were issued in 1971. This was a set of four stamps showing the Maltese rock centaury (*Centaurea spathulata*)[12] and the blue rock thrush (*Monticola solitarius*) which paved the way for these two species to become popularly known as Malta's national plant and bird respectively.

[12] This species is currently known as *Cheirolophus crassifolius*

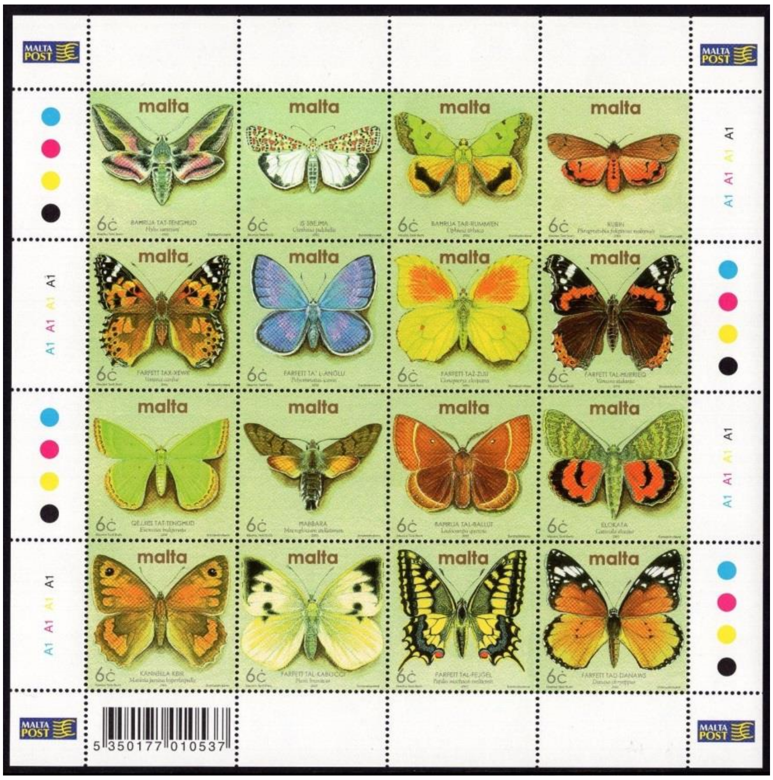
In 1972 Malta stopped using British currency and introduced a Maltese decimal currency. All the coins depicted images related to Maltese identity such as the Maltese Cross, the George Cross and the Great Siege Monument. The three-mill coin had an image of a honey bee on a comb. This shows that bees and honey production were being seen as components of Maltese identity at par with more tangible components of the Maltese cultural repertoire.

Figure 12 Three mill coin (1972)

In 1986 images of insects were used for the first time on a Maltese stamp. This was a stamp forming part of the Europa issue with the subject of Nature Conservation which showed three butterflies, the painted lady, the red admiral and a blue resting on or flying around a green sphere. In 1993 a set of two stamps showing the swallowtail and the red admiral were issued on the occasion of the European Year of the Elderly. This was followed in 2001 by a set of two stamps issued on the Europa theme 'Water Treasure'. The two stamps showed cartoon drawings of a painted frog and another of the red veined darter (*Sympetrum fonscolombii*).

In 2002 an important shift took place with the production of a sixteen-stamp set dedicated to Maltese butterflies and moths.

Figure 13 Butterflies and moths stamp set (2002)



The species chosen were all colourful and attractive species even if not all were well-known by the Maltese public. Three years later another set depicting sixteen insects was issued by Maltapost.

Figure 14 Insects stamp set (2005)

5.5 Playing with insects

In the past, more than today children played with insects. Several men but no women described how they used to play with insects when they were young. The only woman who mentioned playing with insects was describing how, when she was young and living in Qrendi her brothers used hornets to power a home-made miniature mill. Playing with hornets (*Vespa orientalis*) was restricted mainly to the south of Malta and parts of Gozo probably because this species was not found throughout the Maltese islands. In these areas, boys used to catch a hornet, pass a needle through its eyes and stick the needle to the side of a wine bottle cork. It then tried to fly away but instead of flying forward it would fly around the cork to which it was attached. Some even said that they placed a wick or a cigarette behind the hornet to make it fly faster. The name of this game was *il-bagħal tas-sienja* [the mill's mule]. The hornet in Maltese is called a *bagħal taż- żunżan*. The description of this game was recounted only by men who were children in the mid-1950s as by the mid-fifties the hornet started to decrease and within a short time it became extinct or very rare in the Maltese islands. This species has now reappeared in the Maltese islands and has established itself in some areas but children are not playing with it mainly because of the intense fear of hornets generated by the media and also because children spend most of their time indoors and do not play with insects.

Other interviewees described how they used to catch a hornet or a carpenter bee (*Xylocopa violacea*) and insert an oat flower into their posterior part and set them free. The carpenter bee or hornet would fly up but the added weight of the oat would pull it down and as it ascended again it would fly in a wave-like flight pattern which the boys found very amusing. Other boys used to tie a long thread about a metre long to a hornet or a carpenter bee. They then dipped the thread in ink and released the insect somewhere with people in the vicinity hoping that it would hit them and leave an ink mark on their body or on their clothes. Angas wrote that he saw boys tying threads to butterflies and follow them as they flew from one flower to another and when ready from their playing gently removing the threads from the butterflies (Angas, 1842).

Children used to hunt butterflies by hitting them with a piece of wood or cardboard and collecting the dead or injured butterflies in a tin can. In several parts of Malta boys used to set up butterfly trapping sites similar to those used to trap birds. The site consisted of two handkerchiefs placed on flat ground with two small sticks on the sides to hold them taut. A number of butterflies were tied to a stone. These would flutter up and down near the net and attract other butterflies. If one landed in the space between the handkerchiefs the boy pulled a string which made the handkerchiefs flip onto the butterfly trapping it underneath. When trapping insects the boys were copying adults who would be trapping birds on a full-scale bird trapping site. At the end of the day the boys would count the number of butterflies to see who caught the largest number. By the end of the day most butterflies would be dead and they would be thrown away.

An elderly lawyer who as a child lived in an old house with a basement described how he and his siblings used to put a small lighted wick on the back of a large beetle or an Egyptian cockroach to see it moving about in the dark. Many boys used to pull off fly wings to see them running about, some used to kill them by using a magnifying glass to burn them alive. Other boys just caught the insects and kept them in jars or match boxes. Insects mentioned were ladybirds, glow worms, cicadas and most commonly crickets which were caught in large numbers and kept at home because of their singing.

Cricket-keeping has been practised in the Maltese islands for a very long time. In 1842 Angas included a description of this custom noting that the "Maltese seem greatly attached to these insects; they capture them as we would a bird, and hang them up in little wicker cages, full of leaves, outside their windows" (p. 19). In the 1850s the two spotted field cricket was very common (Gulia, 1858). Many described how children, mostly but not only, boys, used to catch crickets and kept them in a tin can at home so as to be able to hear their singing at close quarters. It was possible to buy a small cage which was made of a wooden base and pieces of wire tied together but probably most children did not have enough money to buy the cage. In Luqa some people used to keep several trapped crickets around the roof of their house. These crickets acted like a burglar alarm as they would stop singing when approached. This past-time of keeping crickets has now disappeared mainly because of the disappearance of this insect and the alienation of children from nature. In 1950s the custom of keeping of crickets was already dying out (Valletta, 1954).

Figure 15 Cricket cage (courtesy of Guido Lanfranco)

Most of the games that were described by these persons today would be considered as cruel. When asked whether they think that their relationship with insects involved cruelty all those who spoke about the subject said that it did but added that at the time things were different and that they did not think about the cruelty. One of the interviewees said that this is not surprising as a lot of things that today are seen as cruel at the time were considered as normal adding “We were cruel even to people”. Animals, including insects, were incorporated into the world of sentient beings and the way they are treated reflects the conventions of society at a particular time. Insects do not live in a separate world and what has changed is the way we relate with both humans and insects.

Children do not play much with insects nowadays. This is a result of the greater urbanisation which makes it difficult for children to visit the countryside unless on a visit organised by their parents or an educational institution. Children spend most of their times indoors watching or playing with electronic gadgets without much contact with nature. They are also being taught not to destroy or interfere with nature. Victor Falzon, a teacher and environmental educator, said that the fact that children have stopped playing with insects is good but on the other hand insects have become strangers and this could have a negative impact on these children’s relations with insects, nature and the environment.

Unlike Maltese boys, Japanese boys still catch and play with insects. Insects and implements to catch and breed them can be bought from department stores and from post offices, and in rural areas children are encouraged by schools to prepare collections of live insects during the summer holidays. Different species of insects are associated with different seasons of the year and with particular times of the day and this helps children to become aware of the changing seasons and the biological diversity and to conserve nature as keeping insects requires personal observations, reflection and even experimentation (Laurent, 2001, Takada, 2012).

Kawahara and Pyle (2013) argue that all kids are born entomologists and it takes the right environment for this innate love to be cultivated into a lifelong passion. Most adults with an interest in insects know the beginning of their interest in their childhood. Most played with living things during their childhood and this fostered a life-long interest in insects with several becoming either naturalists or professional biologists. This point of view might not reflect reality as it might be that not all children are born with an innate love for nature and while these children become so passionate about nature that nature becomes a lifelong hobby or profession, other children need to be brought into contact with nature and to be taught about it to care and feel responsible for its protection and conservation (Samways, 2013).

5.6 Cultural keystone insects

Sometimes an insect becomes so deeply embedded in a society that it acquires a keystone status within it. When these species are removed the whole of society changes as happened in Safi, a small agricultural village in the south of Malta, where up to fifty years ago nearly all households, had at least one hive. The hives were kept either in their fields or their garden. The families harvested the honey which they kept for themselves and sold or bartered the excess. For these families the bees played an important role in their life as they depended on them for honey and other products. The bees were part of the village’s culture and way of life. When the bees died because of disease many characteristics of the village disappeared or had to change (J. Spiteri, personal communication, 28, December 2016).

This happened because a number of species of plants and animals including insects such as the honey bee play an important role in the way some people live which is reflected in diet, medicine and language which is the basis of a culture's narration. Such species are looked at more positively and have been called Cultural Keystone Species. The concept of cultural keystone species was derived from ecological keystone species which was coined by Robert Paine in 1966 after he observed that when he removed a species of starfish from a particular area along the coast the number of species of marine fauna and flora started to decrease resulting with only one mollusc and one alga remaining in the area. He realised that some species are ecological keystones as they

> play an important role in species conservation and ecological restoration. These are also the species for which a people will have developed the most detailed names and associated vocabulary, and the ones on which they focus in their immediate activities and conversations (Garibaldi & Turner, 2004 p.1).

Cristancho and Vining (2004) developed the concept further and proposed the term Culturally Defined Keystone Species so as to involve the members of the society for whom a species is considered as culturally important. The term was originally used for species in human/non-human relations in pre-industrial cultures but the authors suggest that studies should be carried out to determine whether the concept could be applied to cultures within industrialised countries. They believe that cultures living in areas dramatically changed by humans including urban areas could still have culturally defined keystone species. Platten and Turner (2009) continued to expand on the concept, proposing that a cultural keystone is not a biological species, but a complex that also includes numerous other system elements, both material and non-material defining cultural keystones as "system elements with crucial non-redundant functions in maintaining any particular level of structural complexity" (p. 493).

The changes in beekeeping which took place in Safi and other localities in Malta introduced scientific concepts and methods that changed beekeeping into modern apiculture based on technical entomological methods.

Entomology, whether technical or vernacular takes place in and reflects a culture which changes in both place and time while at the same time the presence or absence of insects or particular species of insects brings about changes in their location. The impact of insects on location, most of which is the result of the emotions elicited by insect, will be discussed in the following chapter in which particular emphasis will be placed on the role of the honey bee in the creation of a sense of place and of feared insects which change the sense of place in the location of an encounter between fearful humans and feared insects.

6. Locating insects

Insects are a way by means of which people in contemporary Malta create and experience place. The place in question is always under construction as a sense of place is never accomplished. Humans are constantly producing and reproducing place. This is because the environment, like nature is a created place with multiple meanings. It is the product of what Massey (2005) calls a “multiplicity of contemporaneous plurality, as the sphere in which distinct trajectories coexist” (p.9).

The environment is a social place that can and often is produced via insects. Insects are also a way in which we locate ourselves in a social place, that is, place as experienced culturally using a number of ingredients such as language, smell and touch. Furthermore nature and insects themselves are spatialized. Production of place can be both formal and informal. Informal through the personal experiences of nature, and formal through legislation including that which is required because of membership in the European Union; a supra national organisation that continues to recognise regions and locality.

This chapter is divided in three parts. In part one I discuss the spatializing of the environment, the places of childhood and memories, the formation of an ethnic space and the honey bee and the Maltese environment. In part two I discuss the creation of a sense of place of the Maltese landscape through insects by looking at hives and apiaries and how these form part of a Mediterranean space, the seasonality of landscapes via honey bees and thyme honey production as well as the production and consumption of Maltese honey and the production of a Maltese environment which has found its place within the European Union. In part three, I discuss changing concept of places through the presence in Malta of alien insects as well as changes in individual spaces as a result of insect phobias.

6.1 Changing the sense of place

In the past fifty years the Maltese landscape has gone through several drastic changes which have resulted in loved places disappearing and others being created as well as in changes in the number and variety of insects within these places. Many older people are saddened by these spatial changes and talk about the insects which are no longer present.

Many interviewees especially those over fifty spoke about the disappearance of insects once considered common. They blamed the disappearance on the use of insecticides and the destruction of the 'environment', a word which like place and space, has multiple meanings. For most people the destruction of the environment is the replacement of natural areas by man-made structures particularly buildings and roads. For others it is clean and well-kept public areas in towns and villages. An elderly man from Siġġiewi vented his anger when he said "They are destroying everything. Soon nothing will be left". Those close to nature, including nature lovers, biologists, ecologists and many environmentalists go further as they see the environment not just as a place which provides habitat for plants and animals but look at the various abiotic and biotic components in a particular area and their interaction. For them, insects are a component of the environment and not something that just lives in the environment. A lepidopterist whose main interest is breeding moths expressed the feelings of many when he said "When one of these places disappears, I feel sad. Although development is important, it should not be at all cost. The disappearance is not only due to habitat destruction but also to pollution especially dust on the food plants of butterflies and moths".

For most people nature and the natural environment are the non-human element of the environment although no such places exist in Malta where humans have been changing every part of the land for the past 7,000 years. To a different extent this is true for all parts of the world as nowadays even what many refer to as untouched remote areas are being influenced by human-induced factors such as pollution and climate change (Clayton & Opotow, 2003).

On the other hand, while farmers and most of the public see insecticides as a poison that is killing off insects, others with an interest in nature and the environment such as naturalists, beekeepers, ecologists and most environmentalists see insecticides as a cause of environmental degradation and destruction. A beekeeper from Safi said "Animals have become rare because a lot of things have changed. We are using a lot of pesticides and many fields have been replaced by roads and buildings". A family doctor from Rabat, like other interviewees older than fifty, lamented the loss of butterflies and said that

> Butterflies have decreased a lot. I am not so well informed about other insects. When we were young, we used to see more butterflies than we do now. I think that this reflects that the environment is not as good as it used to be. For me it is a bad sign.

The decrease in the number of butterflies and other insects is indicative of the changes that took place in the last fifty years in Malta because insects are part of the process by which a sense of place is produced.

A biologist lamented that a place with no living things in it is no longer an environment. The environment to which naturalists and other persons who frequent the countryside allude to exists only as long as both plants and animals are present. For a biologist, space with no living things in it is no longer an environment. Thus, for those who know an area rich in butterflies and other insects that has been denuded of its insect life, perhaps because of insecticide use, the environment no longer exists. For these people the insects have become a biological indicator with their absence being a warning of the negative effect of human activities on the natural environment.

When speaking of insects that have disappeared interviewees were also talking about the places where the insects used to be found and which no longer exist. The biggest lament was the edges of villages, most of which up to fifty years ago were still surrounded by fields. As children, these people used these places as their playgrounds in which they got direct contact with nature. Today most of these places have been built up. Towns and villages have expanded to such an extent that most localities are surrounded by other towns and villages. Hardly any open spaces are left between them and children today have no place where to play freely in nature. A teacher involved in environmental education said that “For most children in Malta knowledge about nature comes mostly through the Internet”.

Older interviewees spoke mainly about crickets, glow-worms and ladybirds all of which are species that were common in the border habitat between built up areas and fields. Most of those interviewed spoke with sadness about the loss of insects and the countryside and none spoke in positive terms about the changes. A sixty-year-old man from Birżebbuġa said “My grandchildren will never experience the same things that we did. You can show them a picture of something and they will not believe you when you tell them these insects once lived here” while a powerful statement was made by Guido Lanfranco who said

> It saddens me when plants that I have known for many years and which I consider as my friends are bulldozed away. I miss the butterflies most because apart from being beautiful their presence or absence reflects the conditions prevailing in a locality.

Persons who spoke about the decrease in butterflies and other insects were using them as a means by which they created a narrative of environmental transformation thereby creating a sense of place via insects. The changes took place over a relatively short period of time and the response was not just nostalgia for a lost way of life but anger arising from helplessness and their inability to stop the change. It was nothing like the nostalgia for something that did not exist which was described by Massey (2014) as a “looking backward to a past that never was” (p. 65) but the creation of another sense of place through the spatialization of memory.

The insects concerned were found in a public place that has changed but which for them no longer exists. This was a place that could be shared between insects and humans from which the insects with which they shared their lives and other forms of nature have now been excluded. Those who were interviewed spoke about the insects that have disappeared mentioned only insects that they liked and none mentioned any harmful or noxious insects. If any of these had disappeared they had forgotten about them. They were not mourning just the loss of the insects which they loved and missed but also the places where the insects lived and which they represent. In other words, the place had changed, a process that had always been going on and the insects that disappeared accentuated the change process. A change that involves not just the place but the contents as while some insect species have disappeared others have arrived in their stead which have created a new sense of place.

The response of older people to being questioned about insects was very different from that of younger people who had never had an opportunity to experience an insect-rich countryside. Older people spoke about how they used to play with insects, how they drank a sweet liquid stored in the nest of a solitary bee. They described the different level of pain when stung by a wasp, bee or hornet or the pleasure of knocking down butterflies with a piece of wood. Theirs were complex feelings derived from experiences accumulated since childhood, built from a range of sensations including the direct and passive senses of smell, taste and touch as well as the visual and auditory senses, all of which are full of symbolisms that those who did not share these experiences do not understand and do not miss. These experiences become part of the cultural experiences but are tinted by emotions and feelings that go beyond the basic sensations of heat, cold, pain and pleasure. The insects that these people are talking about are held in awe although they might not mean anything to others who come from a different culture such as those who were brought up and lived in an urban environment. These places gave them a sense of self and identity and when they saw them being destroyed, they felt unable to control their destiny which is now bringing a nostalgia for an idyllic past (Tuan, 1997).

Insects and nature are used to give a place a value and to construct places of childhood. Many of the interviewees who complained that when they were young they used to see more insects might have been basing their statements on an opinion which is the result of changes in point of view as a person's age makes a difference to the way one perceives place. Scale, distance and angle of view make a difference to one's perception of nature and the environment. For a child walking in the countryside, insects are much closer than to an adult whose point of view is at least one metre further away from the ground and vegetation. Insects seen from close seem larger, more impressive and more exciting. Such a recalibration in insect dimensions has been used effectively in arthropod horror films in which insects, spiders and other innocuous creatures acquire gigantic proportions and become a threat to humanity. A number of naturalists in their fifties interviewed were impressed by the 1954 classic horror film 'Them!' which was shown on Italian television in the late sixties. In this movie ants mutated into gigantic creatures as a result of exposure to radiation from nuclear tests in the New Mexico desert and went to live in the storm sewers of Los Angeles where they terrorised the inhabitants and the film viewers although this did not stop the naturalists who saw this film in their childhood from loving insects.

Adults often do not notice the small creatures on the vegetation, on the ground or underneath stones because they do not look for them as many children do. A middle-aged security officer from Cospicua summed it all up when he said

> I enjoy seeing nature but not as before. In the past I used to go into more detail. Today I just walk by. Before I was curious to know how many insects I could find and how many butterflies I would catch. We used to have fun catching them.

Similarly, Vince Attard, the CEO of Nature Trust Malta said

> When I was young the insect variety was enormous. There were more fields and the impact of pesticides was much less than today, so one grew up in that type of environment. Today one has to fight for the environment and perhaps that is why there are people of our age fighting for the environment because they remember times when the state of the

> environment was much better. Nowadays you do not find any insects in the countryside.

For a person like Vince Attard who remained close to nature throughout his life it is possible to compare insect numbers and diversity which existed when he was young with the present day. Sense of place in and from childhood is another of the constructed spaces of nature. Like other places, nature has changed and the insects are symbolic of this change. To those who were interviewed the insects that have disappeared stand for the natural environment which has changed or disappeared even though the two might not be necessarily linked together.

6.2 Beekeeping and the formation of an ethnic sense of place

Honey bees have been part of the production of the place of nationality and more recently the place of locality. Honey bees and their products give a sense of place that differentiates the local from the global bringing about a revaluation of locality.

Honey bees and honey had a role in the formation of Maltese identity and in the localisation of the Maltese and the Maltese islands in a more globalised world. Beekeeping as it is practised today is very different from the way it was practised fifty years ago but it is still seen as a continuation of a tradition that has been part of Maltese culture since antiquity and is partly a basis for Maltese identity. It is widely believed that the name Malta is derived from the Greek μέλι, (*meli*) which means honey. In 1647, Abela quoted Jean Quintin's *Insulae Melitae Descriptio*, which was published in 1536, to show that Malta had been famous for its honey since early times. He also quoted from the speech by the first century lawyer Marcus Tullius Cicero in which he accused Caius Verres of smuggling several things out of Syracuse Harbour including a large amount of honey (Abela, 1647). In his speech Cicero did not say that the honey came from Malta and Abela's interpretation of the speech is wrong as Cicero asked Verres where he got the 400 amphorae of honey without specifying their origin. Quintin's and Abela's writing could have given rise to the belief which is still alive today that Malta has been famous for its honey since antiquity (Bonanno, 2005). Abela's writing, as with other early writers about Maltese history could have been an interpretation of history to make it fit with preconceived ideas and myths. Such interpretations can result in the invention of traditions similar to the narratives related to matters of the Maltese's Christian faith where his aim was to interpret the past to suit a contemporary need by promulgating a belief in the continuation of the faith since the arrival in Malta of St Paul. Abela's writing could also indicate that beekeeping was also practised by the land-owning or upper classes as for Abela the Maltese were only the élite and not the common folk whom he refers to as "gente idiota" (Cassar, 2000). The belief in the importance of Maltese honey continued to be promoted in several mid-19th century writings when many articles were written praising the quality of Maltese honey and other bee products, beekeeping in ancient Malta and the need to revive the beekeeping industry and formed part of the making of an ethnic and at a later stage a national space and identity (Portelli, 2011).

The endemic Maltese honey bee, which is part of Maltese nature, has become indigenised as its endemism ties it directly to the Maltese islands. Its existence and presence in Malta made an ethicised place and it became itself ethicised in the process. This became possible because the Maltese honey bee is one of several subspecies of the western honey bee (*Apis mellifera*) which is divided into many subspecies twelve of which are indigenous to Europe. This subspecies has characteristics similar to those of the Sicilian bee (*Apis mellifera sicula*) and the North African bee (*Apis mellifera intermissa*) (Sheppard, Arias, Grech, & Meixner, 1998). The Maltese honey bee is well adapted to survive in the local environment and climate which is characterised by mild wet winters and hot dry summers. During the summer months, when most vegetation dries up, the Maltese bee is still able to bring in food and rear brood. Like the Sicilian and North African counterpart, it produces large numbers of queen cells prior to swarming and is able to defend itself against local predators including predacious wasps and some moths. Since they became aware of the existence of an endemic race, Maltese beekeepers no longer refer to all bees as *naħal* but refer to the local bee as *in-naħla Maltija* (the Maltese bee) or *in-naħla s-sewda* (the black bee) thus distinguishing it from other bees.

When this happened, the honey bee changed its status from being a “bee” to become “the Maltese honey bee” and since the change took place the local bee has become synonymous with being Maltese. The change in status started in the 1970s when local honey bees started to become sick and die. By the 1990s the local stock of bees had decreased so much that it was feared that beekeeping was about to disappear from the Maltese islands. To save apiculture the Maltese Government imported domesticated Italian bees (*Apis mellifera ligustica*) from New Zealand and sold them to established beekeepers at subsidised rates but not before many beekeepers who had lost all their bees had given up beekeeping forever (Portelli, 2011).

Up to the time when honey bees started to be imported most Maltese beekeepers had been familiar only with the indigenous Maltese bee without being aware of its uniqueness and the existence of other races of honey bee. The realisation came about when they noticed that the imported bees were different from theirs. The new bees were gentler, larger and of greater size and easier to work with. Research on the existence of a local subspecies was instigated by veteran beekeeper Arnold Grech who, following the importation of the Italian honey bee, realised that the local bee was better adapted for the Maltese environment than the imported bees. Grech contacted researchers in the United States who sent a team of entomologists to Malta to study the local bee population. In 1997 the researchers discovered that the bees found in the Maltese islands were of an indigenous race which was given the scientific name *Apis mellifera ruttneri*. (Sheppard, Arias, Grech, & Meixner, 1997). The Maltese honey bee is not the only endemic insect in the Maltese islands but it is the most important because it is the one that has ethnicised nature and which has produced a Maltese ethnic place.

The existence of a Maltese honey bee took time to be fully accepted officially as an entomologist working for the Department of Agriculture initially scorned the idea of a Maltese bee and saying that even if it ever existed, he doubted whether pure strain Maltese bees still existed. As a result, now that beekeepers have become aware of its existence the Maltese honey bee has become part of their vernacular. They have a deep fondness for the Maltese bee and they are aware that it needs to be protected, but although they claim that they prefer this bee to any other bee they are not completely happy with it mainly because of its aggressiveness. They would like the local bee to be selectively bred to become calmer and easier to work with but selective breeding would create a new bee which would be different from the original Maltese bee.

Those who want to protect and conserve the Maltese honey bee are not doing this solely for practical reasons. Although domesticated bees are easier to work with and are more productive, many beekeepers feel that the Maltese bee is a link with the past which they believe was better than today. It symbolises what is Maltese and the countryside that is being rapidly lost. It gives them a sense of nostalgia and identity. When they meet foreign beekeepers either on a casual personal basis or during international meetings and conferences, they speak highly of the Maltese bee. One former official of the apiculture section said that when he used to attend international meeting on apiculture, he “always waved the flag for the Maltese bee”. With his statement this former official succinctly stated that the Maltese honey bee has spatialized memory, nostalgia, nationhood and tradition.

Honey bees play a role in a sense of place even within the Maltese islands. In present day Europe beekeeping varies from country to country and from region to region as a result of historical traditions and climatic conditions. There are differences in the number of beekeepers, density of honey bee colonies, size of the apiaries and honey production. The Mediterranean climate is much more suitable for beekeeping than northern latitudes and in fact 47% of the colonies of the European Union are found in southern Europe particularly in France, Greece, Italy and Spain (Chauzat, Cauquil, Franco, Hendrikx, & Ribière-Chabert, 2013).

According to a former President of the Malta Beekeepers Association, about 70% of Maltese beekeepers have links with agriculture even if they are not farmers themselves. In most cases either themselves or members of their family are either a full-time or part-time farmer or own a piece of agricultural land which they work in their spare time. Those whose family does not own any agricultural land often rent or buy a piece of land or else reach an agreement with a farmer to place their hives on his land.

Traditional Maltese beekeeping has several similarities to beekeeping in other parts of the Mediterranean especially in North Africa and the Middle East. As in these areas, bees in Malta were kept in a tubular baked clay structure known in Maltese as *qolla* (plural *qolol*). A *qolla* is about half a metre long. At one end it narrows leaving a small aperture which is blocked by a circular perforated stone through which bees can enter and leave. The *qolla* is placed horizontally on a shelf in an apiary or on the ground in a shady place such as underneath a prickly pear or a carob tree. The wide end of the *qolla* was blocked with a piece of wood or stone. When the number of bees increased the beekeeper could add one or more extensions to the *qolla*. The extension is known in Maltese as a *żieda* [addition]. A *qolla* with one or more additions is known as a *kanun* [cannon]. Nobody knows when the *qolla* started to be used in the Maltese islands. The fact that similar hives and extension rings used to be found in Ancient Greece, Morocco and on sloping cylindrical hives in Crete and closely resemble hives painted on Rechmire's tomb in Ancient Egypt in 1450 BC (Crane, 1983) and the oldest beehives which were dated as being from the 9th or 10th BCE that were found in Tel Rahov in Israel (Mazar & Panitz-Cohen, 2007), indicates that the design was imported from other Mediterranean cultures. This placed Maltese honey bees and beekeeping within a Mediterranean context adding another layer of space via insects.

Figure 16 ***Qolol***

All *qolol* had a similar shape but differed in their quality and finish. Older ones were handmade and look cruder than more recently-made ones which were made on a potter's wheel. All *qolol* have a set of markings which were made close to the top or bottom part. These markers were made by the manufacturers each of whom had his own unique design. Beekeepers admire the beauty of these hives and many beekeepers have at least one of them. More than aesthetics, they see the *qolol* as a link with a lost era when bees did not become sick and beekeeping was much simpler than it is today. A small number of beekeepers keep some of their bees in *qolol* to maintain traditional beekeeping. Beekeepers who get an opportunity to buy a *qolla* do so and the older ones proudly say that they are keeping them for their children.

The change from the *qolla* to modern hives started in the 1930s (Zammit, 1935). The adoption of modern hives brought about a revolution in beekeeping which modernised beekeeping and increased the potential yield factor by 10 or 20 times per hive and by a factor of several hundred times per beekeeper. The modern hive also made possible the manipulation of the bee colony so that the number of bees in the colony can now reach a population of 50,000 or more bees which has resulted in an increase in the production of excess honey which can be harvested. When the number of bees in the hive increases the beekeeper adds chambers (supers) so that the colony does not become overcrowded and the bees do not have to swarm. The queen extruder allows the worker bees to pass into the super while preventing the larger queen from passing through, thus the cells in the super do not have brood in them and they are used only for stored honey (Crane, 1984).

When modern hives were first introduced in Malta most beekeepers resisted the change even though a subsidy was being given for every modern hive that was being used (Portelli, 2011). Nowadays beekeepers prefer the modern hives and know about their advantages, including the fact that they can be opened and checked anytime and because they can accommodate a much larger number of bees. In a good year a beekeeper can harvest up to twenty-five kilograms of honey from a modern hive as opposed to two kilograms from a *qolla*. Modern hives are said to be much better at maintaining a steady internal temperature and are kept in full sun throughout the year while the *qolol* had to be placed in the shade so as to prevent overheating. A local beekeeper who keeps a small number of *qolol* places them in large metal tanks with the space between the hive and the tank filled with straw to insulate them as according to him this was a common practice in the past comparing this to the thick walls in old Maltese houses.

The earliest beehives were inspired by the natural cavities in which wild bees live. They were made from local materials and varied from region to region according to local climate and available materials (Uysal & Arat, 2012). Local climate determined both the shape and configuration of traditional hives. In a hot or warm climate, a hive was usually placed horizontally, and the honey combs were harvested from one end. In cooler climates the hives were placed vertically as this conserved heat generated by the bees and honey combs were harvested from either the top or bottom (Crane and Walker, 2000). As a result of this the most widespread type of traditional hive outside northern and Western Europe, where temperatures are higher, is the horizontal cylindrical hive which can be made of wood, bark or other plant materials or, in dry areas like Mediterranean lands and the Near East they are made of unbaked dried mud or baked clay (Crane, 1983).

Before modern hives started to be used the *qolol* were often placed in a structure known as a *miġbaħ* (pl. *mġiebaħ*). The *mġiebaħ* were built to protect the bees from animals and thieves and to protect them from the rays of the sun. The existence of several of these apiaries in the Maltese countryside was often considered as proof of the importance of beekeeping in the Maltese islands (Camilleri, C., 1849). Maltese apiaries were of three basic types, modified caves, rock hewn or stone huts (Camilleri, A., 2003). The old apiaries are found mostly in the north and west of Malta including at Baħrija, Mtaħleb, Ħad-Dingli, Girgenti and Buskett (Borg, J., 1995). In Wied Dalam (Birżebbuġa) a World War II pillbox was used for a long time as an apiary. The apiaries in the northern and western parts of Malta were used only during the months when the Mediterranean thyme was in flower. The landscape in these parts of Malta can be divided into two according to season with the most important for beekeepers being the thyme season when the area is good for honey production. Thyme honey was traditionally collected on the 26th of July, the feast of St Ann. After this date the apiaries were emptied and the *qolol* were taken to other areas. These apiaries belonged to people residing at Mellieħa although some belonged to beekeepers from other parts of the Maltese islands especially from Rabat and Birkirkara. Until the introduction of motor vehicles most beekeepers used to carry the *qolol* on the back of a mule a journey that took several hours each way. The arduous journey was considered as worth the effort as the thyme honey which can be produced only in these areas is considered as the best-tasting of all Maltese honey (A. Grech, personal communication, 9 February 2016).

Most Maltese beekeepers are men who live in the central and northern parts of Malta as well as in Gozo. The provenance of the beekeepers and the fact that most hives are found in the central and northern parts of Malta nowadays has no practical reason as the hive density in the south is low and can be increased. Many beekeepers believe that this is purely cultural although it is probable that in the past this part of

Malta was less suitable for beekeeping and although the planting of exotic trees and plants has made it possible for bees to find nectar in the summer, persons living in the south of Malta have not taken up beekeeping. This could be because beekeepers usually start beekeeping by learning from a friend or relative and these are usually tied to a particular area leading to more beekeepers being found in areas where beekeeping is already present. This leads to particular places being more closely tied to honey production and associated feelings of pride.

Maltese beekeepers and consumers are proud of Maltese honey especially as through their work they made honey Maltese. Arnold Grech proudly said that Malta was known for its honey because of the presence of thyme which makes good honey. A veterinary officer who is responsible for apiculture in Malta said that the Maltese buy Maltese honey even though it is twice as expensive as imported honey because they believe that Maltese honey is the best, while a retired accountant who has been keeping honey bees for the past twenty years said that all local honey has a good taste and is consistent. Beekeepers claim that their honey is the best in the world and give examples of honey from other countries which they themselves bought or which they got from friends which is not as good as theirs. A beekeeper from Siġġiewi said "A friend once got me honey from Thailand. There was no comparison. Ours is much better". A beekeeper from Għargħur said that "Honey is the only Maltese food product of which the Maltese are actually proud".

Many Maltese beekeepers believe that honey is so precious that many of them advise their clients not to warm the honey too much as this would destroy it while some even claim that they do not sell their honey to those who they know will use it for cooking and tell them that for cooking instead of Maltese honey they should buy cheaper commercial honey from supermarkets.

For the Maltese beekeeper producing genuine honey is a source of pride that is part of a whole process which starts with the acquisition of the hive and swarm, seeing the swarm grow and producing excess honey which is harvested and consumed.

Hobbyists and part-timers sell their honey directly to individual clients as an artisanal product steeped in a sense of local community. For them selling honey is like giving their clients a product that was lovingly produced specifically for them. It is not about making money but sharing their love for bees and nature with their clients and by doing so help their clients to come closer to nature and become part of it and part of the land where it was made even though nature means different things to different people.

This is also true for insects, as nature and the environment mean different things to different people. A cabbage white is a beautiful butterfly in the eye of a nature lover but a serious pest for a farmer. Likewise, the West Indian Lantana *(Lantana camara*) in a garden is a desirable source of nectar for butterflies and bees and at the same time the same species is a potentially invasive alien if it is growing in nature even if this is just a few metres away because the valuation of nature depends on the place in which it is located.

In 2004, when Malta joined the European Union it had to adopt Council Directive 2001/110/EC as national legislation. This legislation contributed to the changing of honey to a national product.   More changes were implemented in 2015 when the Honey Regulations were amended by the Honey (Amendment) Regulations of 2015.[1] These regulations implemented the provisions of Directive 2014/63/EU of the European Parliament and of the Council which amended Council Directive 2001/110/EC. These regulations made it compulsory for the country or countries where the honey is harvested to be indicated on the label. If the honey originates in more than one country, the label must have one of the following as appropriate "blend of EU honeys", "blend of non-EU Honeys" or "blend of EU and non-EU-honeys. These regulations link honey with its place of origin and create a strong attachment of the beekeepers with the apiary and the area from where the bees collect nectar and pollen. This was possible because regionality is one of the spatialities that is constitutive of, and constituted by the EU.

[1] L.N. 242 of 2015

Changes to the honey legislation changed the way Maltese honey is labelled and hence perceived by both the beekeepers and the consumers but this was not enough to bring about scientific studies of its microscopic and chemical composition even though European legislation on the production and marketing of honey stipulates standards to which all honey produced in the European Union must conform to, if it is to be placed in the local or foreign market (Gambin, Lanfranco, & Mifsud, 2013). Determining the chemical and microscopic contents of local honey is important for a more targeted marketing as this makes it possible to promote the honey either as coming from a particular source or locality, as it is known that even a small place such as Gozo can produce different honeys depending on their place of origin (Attard & Mizzi, 2013). Because of the lack of such studies most Maltese beekeepers have to label their honey according to the season during which it is harvested: spring, summer and autumn honey. Spring honey is known to be polyfloral while summer honey used to be called wild thyme honey especially if it originates in areas rich in thyme although this has now changed because determining the floral origin of honey requires a qualitative analysis of the pollen types found in honey samples. This type of analysis makes it possible to identify the types of honey that are produced locally adding value to the honey. It also makes it possible to identify honey that has been blended with imported honey (Gambin, Lanfranco, & Mifsud, 2013).

Local food products, including honey, are not necessarily produced solely from Maltese narrowly defined local sources to be Maltese. Autumn honey is considered by beekeepers to be mainly produced from nectar collected from carob trees and eucalyptus trees. Eucalyptus trees are alien trees imported from Australia which started to be planted in Malta in large numbers in the 1970s. They flower in late summer before the carob trees start flowering and provide bees with nectar at a time when few if any other sources of nectar are available. In spite of the recent introduction of these alien trees in the Maltese islands, honey containing nectar and pollen from Eucalyptus flowers is still considered to be genuinely Maltese. Similarly the other honeys often contain nectar and pollen from a large variety of alien, naturalised and cultivated plants. In this way Maltese honey is similar to Maltese food which according to Billiard (2010) "does not lie in the local origin of its ingredients but in their local combination of such ingredients and the way they are consumed" (p. 51).

The botanical source of honey is an important factor in honey labelling. The European Honey Directive[2] states that the botanical source of a honey may be reported on the label only if the honey has originated from that source and if it possesses the physical, chemical, and microscopic characteristics that are typical of honey produced from that source. Thus, beekeepers must be careful when stating the botanical source of their honey, as incorrect labelling may lead to the withdrawal of their honey from the market. The botanical source may only be determined by microscopic analysis of the honey together with sensory and physiochemical analysis. Honey labelled as of a particular botanic origin must be tested to prove its content and thus its botanic origin before it can be labelled as coming from a particular source of flower (Gambin, Lanfranco, & Mifsud, 2013). Maltese beekeepers are not willing to go through the process of analysing their honey because the testing is expensive and not cost-effective when considering the relatively small amount of honey they produce. When selling honey, the beekeepers often explain the origin and properties of different types of honey and consumers willingly buy the honey with the new labelling as long as they trust to beekeeper who produced it. Thus two contemporaneous spaces are produced one formally through EU regulations and legislation and informally by the beekeepers by means of conversations with their customers.

To counteract the lack of studies on the composition of Maltese honey, a research project was carried out between the Division of Rural Science and Food Systems of the Institute of Earth Systems of the University of Malta and Golden Islands Ltd with funds granted by the Malta Council of Science and Technology (MCST) through the National Research and Innovation Programme. The research project analysed in detail the physiochemical characteristics following international

[2] Council Directive 2001/110/EC of 20 December 2001 relating to honey

recognised standard techniques of honey of different floral origin from different parts of the Maltese islands. This project was the first in-depth study of the local honey and formed the basis to authenticate it. The study gave a clear picture not only of the floral origin but also of the percentage of the different flora found in different samples of Maltese honey. This study made it possible to map out the islands' best foraging areas which should be protected to safeguard honey production. According to Adrian Bugeja Douglas who carried out this research at the University of Malta, "This study has also produced a Maltese Honey Standard that will make it easier to identify imported counterfeit products" thus aiding the localising of Maltese honey within the Maltese environment.

The European Union regulations did not bring about only a change in labels but the creation of a new product with a unique identity. When buying honey from local beekeepers, consumers ask specifically for "għasel ta' Malta" [honey from Malta] and not *għasel Malti* [Maltese honey] which associates the honey with a place more than with a process. Similarly none of the beekeepers stated it directly but during our conversations it became obvious that they prefer to sell their honey to Maltese customers. They feel that Maltese honey is for the Maltese as for them consuming Maltese honey is part of being Maltese, an act best described by the popular saying "You are what you eat" or as Billiard (2010) described it "You are what you wish to eat" (p. 47) as a result of which eating honey becomes a social act. It is a process of identification that "implies a consumption of self-defining symbols that are not self-produced but obtained in the market place" (Friedman, 1995 p. 314). A sense of place is also created when beekeepers are invited to participate in public events and local festivals organised by local councils and other organisations for both locals and tourist, some of whom travel to different countries to taste authentic local products. During these events the beekeepers are encouraged to display information about honey bees and honey and to sell their honey and other hive products as their presence adds status and credibility to such events. Very often the beekeepers invited to participate in such events are from the same locality as the events and this continues to highlight the link between the honey and the land. Beekeepers participating in such events are very keen to share their knowledge about bees with the public while giving the public an opportunity to buy honey directly from them.

Such public events especially those promoting local crafts and foods provide opportunities for beekeepers to promote and sell their honey as an artisanal product of the locality which creates a sense of place and counter the globalisation of food production that has generally led to a decreasing knowledge about its origins and while in a supermarket you expect to find the same brand of honey you find in supermarkets in other parts of Europe, in local fairs, consumers know that they will find only local honey produced with love and care by local people. Such participation helps to raise awareness about food production and an interest in local food and its origins (Brščič, Poljuha, & Šiklić, 2013). At these events visitors meet other Maltese people and with them recreate their collective history (Billiard, 2010). There is also an opportunity for honey producers to gain price premiums by marketing their honey as a more artisanal product and seeking ways of differentiating the product and developing niche markets, such as has been done with other agricultural commodities like cheese and olive oil (Wu, Fooks, Messer, & Delaney, 2015). By selling directly to their customers and by giving them information about their work with the bees, Maltese beekeepers are changing honey into an artisanal product tied to a locality and as a result of this they are able to sell it for twice the price of honey sold in supermarkets because they are not just selling honey but offering consumers of their honey a taste of the environment where their honey was produced thus satisfy a basic need for awareness about foods' origins.

There is also a trend for organisations and institutions such as Heritage Malta, Nature Trust and the convent of Discalced Carmelites which forms part of St Theresa Sanctuary in Birkirkara to sell honey as a product of a particular site. The friars label their honey as "Għasel mill-Kunvent*"* [Honey from the Convent] mainly because as the friar who cares for the bees said "people tend to trust a religious institution more than just any beekeeper". Heritage Malta, the national agency for museums, conservation practice and cultural heritage, sells honey made in hives placed at three heritage sites namely Għar Dalam in Birżebbuġa, San Pawl Milqi at Burmarrad and Tas-Silġ temples near Marsaxlokk. The environmental NGO Nature Trust sells honey produced at the Wied Għollieqa Nature Reserve at Kappara. This honey is marketed as being from these sites and when buying honey visitors are taking a part of the nature of these sites with them adding a local dimension to a national product.

Honeys tied to a locality are a response to the availability of a large variety of honeys from various parts to the world in Maltese supermarkets. It is a revaluation of local honey in response to the globalisation of honey.

Beekeepers have a choice of marketing strategies and messages. They can market honey as being beneficial to consumers or as a purchase that could be of benefit for nature and the environment (Wu, Fooks, Messer, & Delaney, 2015). In Malta as in the rest of Europe there is no central marketing or uniform pricing mechanism. Thus, many beekeepers, especially hobbyists and part-time producers do not know how to price or label correctly in a manner that enhances their economic viability. At present most Maltese part-time or hobbyist beekeepers do not market their honey as a product of a particular area as since their production is not enough to satisfy demand and as they feel obliged to sell honey to their regular customers, they do not feel the need to sell their honey at a higher price and do not realise that improved honey marketing leads to a stronger honey industry. Producers who carefully select packaging for their honey products and the information they provide on labels and in advertising could obtain price premiums and generate greater profits at relatively low cost (European Commission, 2013) as consumers are willing to pay premiums for honey based on private attributes such as provenance and floral sources (Wu, Fooks, Messer, & Delaney, 2015).

The European Union regulations which link honey with floral sources do nothing to promote the concept of honey coming from a particular area which can lead to the development of a terroir of honey. Although the concept of terroir originated in France it has now started to encompass other products such as cheese in the United States (Paxon, 2010) and coastal food products in western Denmark (Gyimóthy, 2017). The word terroir, which knows its origins in the French word for soil '*terre*' refers to the particular tastes, scents and flavours of a food product which are specific to a particular place thus giving a taste of place. It thus imbues a product with the characters of the cultural traditions and landscape ecology of its origin. When referring to cheeses Paxson (2010) writes "Terroir is also being translated to suggest that the gustatory values that make artisan cheeses taste good to consumers are rooted in moral values that make the cheeses ethically good for producers to make" (p. 445) a concept that is equally valid to locally produced honey.

6.3 Changing places

Places are not static and change in many ways in response to changes in the socio political, economic and natural environment. These include the places created by honey bees and other insects. In the 1980s Maltese apiculturists became aware of major honey bee diseases and the possibility of the end of beekeeping in the Maltese islands. American Foul Brood (AFB) appeared in Malta in the 1980s and the varroa mite appeared in 1992.[3] Their arrival brought about major changes which resulted in the end of the *qolla* and what is now viewed as traditional apiculture. The diseases forced the beekeepers to adopt new methods that brought about major changes in Maltese apiculture. New legislation was introduced and the older generation of beekeepers were forced to change their methods to be able to continue keeping bees while a number of young persons who had never practiced beekeeping before took up beekeeping and were willing to learn and use modern methods.

The changes took place very quickly because the Maltese honey bee like other honey bees, had not evolved to deal with new pests and diseases which were being caused by bacterial, fungal, viral and microspordial parasites as well as by predators and pests and when these appeared, they were not able to deal with them (vanEngelsdorp & Meixner, 2010). Some of the diseases are caused by viruses that are now found in most of Europe include the Kashmir bee virus (KBV), acute bee paralysis virus, (ABPV), sacbrood virus (SBV), deformed wing virus (DWV), and Israeli acute paralysis virus (IAPV). DWV is presently the most common bee virus in Europe (Collison & Sheridan, 2011).

[3] Biedja u Sajd Issue 30, December 1992.

Before the varroa mite (*Varroa destructor*) appeared in Maltese hives the apiculture section of the Department of Agriculture was already aware of the imminent arrival of this parasite in the Maltese islands as by then it was found in all surrounding countries and officials from the department asked all beekeepers to be on the lookout for this parasite and to inform the department should it appear in any of their hives (Grech, 1992). The varroa mite was responsible for the death of more than 85% of local hives and resulted in a sharp decrease in honey production. Many beekeepers gave up beekeeping while those who continued had to learn new ways of keeping bees, not an easy task especially for the elderly and those who were not highly educated. Before varroa, many beekeepers were still keeping their bees in the *qolla*. These hives were not inspected and were opened only when it was time to collect the honey but the presence of the varroa mite and other diseases made it necessary for the beekeeper to inspect all the hives regularly and those beekeepers who at the time were still keeping bees in a *qolla* had to change to modern hives. The forced change to modern hives resulted in an increase in honey production as modern hives have a larger volume and can accommodate more bees and a larger amount of honey. The regular inspections which are now required, also changed the relationship between the beekeeper and his bees. The relationship became more intimate as the beekeepers got to know their bees better, including the character of each and every hive. On the other hand, for part-timers and professionals the bees changed from being just insects producing honey, to employees, colleagues and sometimes pets but none of these new relationships improved the status of the bees within the human-animal relationship.

Another alien insect, the Asian tiger mosquito, was first recorded in Malta in 2008 and soon became established in the Maltese islands (Gatt, Williams & Mifsud, 2009). Its presence brought about changes in the way of life of the Maltese particularly in the way the ‘outside’ is no longer viewed as a desirable area in which to spend time. The Infectious Disease Prevention and Control Unit at the Department of Health Promotion and Disease Prevention recommended that people should minimise the time spent outdoors between dawn and dusk, when the mosquito is most active, and to install tight fitting screens on doors and windows. She also suggested that where possible one should wear socks, shoes, long trousers and long-sleeved shirts when outdoors for long periods of time and that clothing should be made of tightly woven materials to keep the mosquitoes away from the skin. The Department suggested that water in which the mosquito can breed is removed. Although in Malta the Asian tiger mosquito is not of medical importance as neither the CHIKV nor the DENV viruses are currently present it has an annoyance value because in most people the bites provoke a reaction in the skin which in most cases disappears after one or two days (Melillo, 2013). When the Asian tiger mosquito first appeared in Malta, doctors were seeing many patients with symptoms of allergic reactions to mosquito bites but things have changed as according to a Maltese family doctor most Maltese have now become desensitised to it and its bite is no longer causing the same reaction as it did a few years ago. This mosquito is difficult to eradicate and has become part of Maltese life and has brought changes to the Maltese lifestyle in particular it has changed the space outside the house into an unsafe and uncomfortable place and has created a new space filled with anxiety.

The location of a human-insect encounter determines the categorisation of an insect as a friend or foe. A home is considered as an autonomous private and secure space and organisms that invade this space automatically become pests as they challenge the sense of security one feels inside the home. This was exploited by advertisers for insecticides who created border narratives to sell these products (Power, 2007).

Before the discovery that specific germs caused diseases and that insects helped to spread the germs, people saw nothing wrong with the presence of flies in the home (Biehler, 2010). This attitude started to change when it was realised that flies were carriers of germs and spread diseases. The authorities came to the conclusion that flies created networks that connected disease and healthy places. In the first two decades of the twentieth century in the USA, health officials launched fly-control campaigns to keep flies out of the domestic space. Housewives were informed about germs and told to install window screens that kept flies out of the house and gave sanitary integrity. They also helped to change the status of the home into a private realm. As a result, urban insects started to be seen as a threat that required the use of pest-control tools to control and eradicate them. Modern society is still at war with insects and as a result is suffering from excess fears and phobias, poisoning from the use of insecticides and nature deficit disorders which many claim are the result of lack of contact with nature (Biehler, 2010).

Such changes can be the result of the presence of a feared insects within viewing distance of a phobic person creates a high level of dissonance within the phobic person which results in a change in the perception of space a phobic sees the feared insect much closer than it actually is and the shared space deceptively smaller.

A female interviewee said that once she was nearly run over by a car as she ran blindly away from a cockroach that was walking on the pavement on her side of the road. She was so terrorised that she did not think about what she was doing and although the cockroach was more than a couple of metres away, she thought that it was about to jump on her. The presence of a frightening insect alters the geography of the encounter as there is a perceptual reduction in distance between them. The space which was formerly open to all becomes filled with fear which can trigger the loss of an individual's self-control even though he or she is aware of his or her irrational response (Smith, Davidson, & Henderson, 2012). Space and distance shrink. They shrink to such an extent that for a phobic person, a cockroach on a wall several metres away, is believed to be close enough to touch him or her.

Cultural differences also account for the way we view our personal space. For some, a sense of invasion can start from bare skin to any space within the field of vision. The closer an object comes to one's self, and encroaches on personal space, the more severe and less tolerable is the sense of violation (Davidson, 2000b). For many cultures, the skin is viewed as the outer boundary of the self. Touching the skin, especially if without being invited, such as when a cockroach lands on somebody is often viewed as an intrusion of personal space (Davidson, 2000a). Smith and Davidson (2006) further argue that "the emotional experiences of disgust and fear within modern societies are closely tied to the maintenance (and also breakdown) of boundaries between those elements categorized as 'natural' and 'cultural'; it is inextricably linked with both flows and barriers between the stuff of each" (p. 48). Persons who have weakened their self-protective boundaries are more susceptible than others to phobic reactions although the life events that bring about this susceptibility might have nothing to do with the phobic object, but most likely this insecurity finds expression in objects that are perceived to pose a threat to the cultural order in which a person's self-identity is grounded (Smith & Davidson, 2006).

There is nothing more telling of this than the way many people scrupulously clean their homes and ensure that no unwanted objects (including insects and other small animals such as flies, cockroaches and spiders) are kept away lest they pollute their space. The cleaning is not just to avoid disease but a ritual that sets boundaries and makes a statement. It has become a ritual that is justified as a fear of disease but is nothing but an excuse based on the science of pathogenicity (Douglas, 2007).

7 Conclusions

In this thesis I investigated human/insect relations in Malta, an area of research that has been completely ignored until now. Insects make up the vast majority of animal life on earth and as expected, humans come in direct and indirect contact with them and interact regularly with such ubiquitous organisms. To investigate these relations I looked at the ways insects are embedded in Maltese culture, tradition and society and at the extent humans and insects are interconnected through emotions, beliefs and actions and whether these interactions are of indigenous or foreign origins. I also investigated whether these cultural embeddings are characterised by transformations and whether these transformations are related to broader social transformations. I investiated the cultural embeddings related to concepts of nature and the environment and how people in Malta relate to other forms of nature and whether insects provide a link with the rest of the natural environment. I also looked at whether the way the people of Malta relate to insects depends on gender, age and level of education.

I also looked at which insects are considered as resources and whether there are hindrances to such a consideration. I finally looked at the way insects are culturally appropriated and the way insects are part of the spatialization process and how this process in turn spatialized insects.

The research showed that emotions underlie most human/insect relations in Malta. Emotions range from love to fear and they determine how we feel about insects and consequently about other living organisms and the environment. Feelings such as disgust, annoyance, joy and serenity are usually complex reactions induced by insects and they influence the way we experience our surroundings. The interpretation of emotions and feelings and our reaction to insects is influenced by culture which is in a state of constant transformation.

The people of Malta relate to insects in various ways that reflect widely different interests, and several uniquely individual views of nature and the environment. In many cases insects are seen as alien species that have no place in the vicinity of humans because they are feared, hated and should thus be eradicated.

The research showed that all this is because emotions underlie most human-insect relations. Emotions determine how we think about insects and how we behave in their presence as well as how we relate to other living organisms and with the natural and man-made environments. The emotions, mainly love fear and disgust give rise to give rise to feelings particularly annoyance, joy and serenity which influence the way we experience insects as well as other invertebrate and vertebrate species and the environment. The interpretation of emotions and feelings and our reaction to insects is influenced by culture which is in a state of constant transformation. There are a multitude of cultures in Malta and relations with insects differ within different cultures, within individuals as well as according to age, gender and level of education. The ubiquitousness of insects and reactions to their presence or absence influence thought processes, the Maltese language as well as literary, artistic and musical works.

The most culturally influential insect, the bee, has for many years been playing an important role in the formation and strengthening of a Maltese identity. Many people in Malta believe that Maltese honey is the best honey in the world while as a result of the discovery that the local honey bee is an endemic race that should be conserved has given further impetus to this notion of ethnicity.

Thus insects are a means by which people in Malta produce and experience a sense of place. These are multifaceted places that are constantly being produced and reproduced. What is called the environment is a social space which can and often is produced and interpreted via insects. Insects are used to create a narrative of environmental transformation and are mediators of various places. These include places of childhood, regionality, nationality, and locality while the honey bee has spatialized memory, nostalgia, nationhood, and tradition. Maltese honey bees and their products are giving a sense of place to the Maltese environment that differentiates the local from the global which is resulting in a revaluation of locality. The existence of the Maltese honey bee in Malta created an ethnicised place and in the process became itself ethnicised.

The values of insects are of importance when attempting to protect or conserve them. One is unlikely to contribute towards the protection of feared and despised insects although from a scientific and ecological point of view these are as important as any other insect. As one is more likely to protect a loved and appreciated species conservation efforts should be aimed and these species and their habitats which indirectly will be of benefit to other less loved species.

Naturalists and other strongly biophilic persons, especially those with a special interest in entomology are often at the forefront for the conservation of insects but their work would benefit from greater participation of less biophilic citizen scientists. Insect conservation requires baseline taxonomic information and survey data, ongoing monitoring, and enhanced knowledge of insect life-histories which can be met by professional entomologists and amateur naturalists with the support of persons not involved in the study and conservation of insects but who can underpin advocacy and influence policy making (Cheesman & Key, 2007). The need for public support is important because invertebrate conservation is hard to justify when many people see each insect as a potential pest or threat. With few exceptions, the public is not aware of invertebrate roles in ecosystems and the conservation threats many species are facing. Without such information people tend to disregard invertebrates as important for ecosystem functioning or as in need of protection (Cardoso, Erwin, Borges, & New, 2011) and would not change their ways to ensure their survival (Berenbaum, 1995) especially as in many societies, humans have an ambivalent relationship with nature which oscillates between romantic devotion to the natural world to an obsession to conquer and tame it. The relationship is both emotional and rational and goes from exploitation, domination to preservation. Through all this emerged the concept of nature as an object of scientific enquiry and as a resource for economic progress that is, conservation of a resource solely for the benefits that humans can benefit from them. This attitude is based on the Judeo-Christian ethic in which the material world is God’s gift to humanity which came with the condition that humans master and improve upon it while being given stewardship and responsibility for it. Humans, according to this tradition are both conquerors and keepers of nature (Uggla, 2010).

The change in attitude in Europe started during the enlightenment when wilderness started to be transformed to nature. This ushered in the scientific and industrial revolutions by means of which nature became a resource and a means to an end (Uggla, 2010). This ideology is still predominant and has become embedded in deep layers of consciousness, not only in Europe where it originated, but also in almost every culture. It lies at the centre of any attempt to transform the world into a more liveable, friendlier, lighter and safer place and has led to what is being labelled as the era of the “Anthropocene”. Many believe that this global state of affairs is neither morally nor practically sustainable (Pattberg, 2007). The realisation that the interrelationships between society and nature, and the importance of environmental health to human health, have recently become widely acknowledged, and these have drawn attention to the fact that biodiversity loss can have both direct and indirect effects on human well-being. This state of affairs has brought about a reaction (Alves & Rosa, 2007) that is giving rise to arguments that are based on the aesthetic value of nature and the belief in the self-fulfilment through a personal relationship with wild pristine nature. More recently streams such as biocentrism and ecocentrism have emerged, that question human supremacy over nature and the notion of nature as being “other” to human society and culture. Discourse of sustainable development goes counter to such arguments as it promotes more of the modern nature-culture divide that has been determining the relationship between humans and the environment (Uggla, 2010).

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Appendix I - Field questions

Core questions

i. Do you know what an insect is?

ii. Can you mention some insects?

iii. Can you tell me something about them?

iv. Can you tell me anything about the biology (way of life) of insects?

v. Do you know when and where you can find insects?

vi. Do you know of any particular beliefs, stories or sayings about insects?

vii. Do you know any useful insects? What do you think about them?

viii. Do you know of any harmful insects? What do you think about them?

ix. Are you afraid of any insects?

x. Do you know of any insects which have become rare or that have disappeared? How do you feel about this?

xi. Do you know of any insects that have appeared in Malta and that were not found here before? How do you feel about this?

xii. Have you ever seen any films or TV programmes about insects? Did you like them?

xiii. Would you eat insects or use them as medicine?

xiv. Do you eat honey?

xv. What kind of honey?

Entomologist

I. Which group of insects do you study?

II. Why insects? What are your feelings towards the insects you study and towards other species?

III. How do you study them?

IV. When did your interest start?

V. Did somebody inspire or encourage you?

VI. What do friends/colleagues/family think of your interest in insects?

VII. Do you think that more people should be interested in entomology? Why?

VIII. Have you noted new species or species that have disappeared?

IX. What do you think brought about these changes?

Farmer

i. Do you think that insects are important for agriculture? How?

ii. Are there more insect pests today than in the past/ Why?

iii. Which insects are your biggest enemy?

iv. How do you deal with them?

v. Do you think that you will ever get rid of them?

vi. Do you know how they used to control insects in the past?

vii. Would you use such systems yourself? Why?

viii. Have you ever used other insects to control your insects?

ix. Would you use such systems? Why?

x. Do you like or hate insects?

Medical doctor

i. What disease/problems are caused by insects?
ii. Are there persons who are more likely to become sick because of insects? Why?
iii. Are there places/localities where one is more likely to get these problems?
iv. Can anything be done about these problems?
v. Has the incidence of these diseased increased or decreased? How and why?
vi. Do you think that the incidence of these diseases will increase or decrease?
vii. What is the attitude of the public to these insects and diseases?
viii. Is there public awareness about the role of insects and the spread of disease?
ix. Do you encounter problems caused by fears and phobias?
x. Are insects used in medicine?

Pet shop owner

i. Do you import any insect or other arthropod pets?
ii. What species?
iii. Do insects make good pets?
iv. Are they popular?
v. Which are the most popular species?
vi. Why do people keep insects?
vii. Who buys insects?
viii. Do insect-keepers know what they want when they come here?
ix. Do they know how to care for them?
x. Do you give them advice on what and how to keep insects?
xi. Do you sell dangerous species?

Tattooist

i. Do the Maltese choose insects or other small animals as subjects for tattoos?

ii. Why do they choose an insect?

iii. Which insects do they prefer?

iv. Why do they choose these particular insects?

v. Is there any meaning or symbolism in insect tattoos?

vi. Do insect tattoos represent?

vii. Who chooses insects? Why?

viii. Is there a difference between males and females?

Tissue Viability Unit staff

i. When and why do you use maggot therapy

ii. How often is maggot therapy?

iii. Which species do use for maggot therapy?

iv. Where do you get the maggots from?

v. Who needs this therapy?

vi. How do you explain what the therapy is to them?

vii. What is the reaction of patients and their relatives when they are told that you are going to tell them about the therapy?

viii. Is there a change in attitude after the start and finish of the therapy?

ix. Do the patients see the maggots?

x. Do they associate them with flies?

xi. Do you use other insects or insect products? Honey?

Veterinarian

i. What disease/problems are caused by insects?

ii. Which animals which are more likely to become sick because of insects? Why?

iii. Are there places/localities where one is more likely to get these problems?

iv. Can anything be done about these problems?

v. How are these insects being controlled?

vi. Has the incidence of these diseased increased or decreased? How and why?

vii. Do you think that the incidence of these diseases will increase or decrease?

viii. What is the attitude of the public/farmers to these insects and diseases?

ix. Is the public aware about the role of insects and spread of disease?

x. Do you ever get insect pets at the clinic? What kind of people keep such pets?

xi. Does the keeping of insect pets make a difference to the way these people look at other insects?

Bumble bee importers

i. Which species do you import?
ii. When did you start importing them?
iii. Where are they imported from?
iv. Has the country of origin changed?
v. How did farmers pollinate their crops before?
vi. What was the reaction of the farmers to them?
vii. Has their attitude changed?
viii. Has the used of insects made a difference to production and to costs?
ix. Has it made a difference to pest control methods?
x. Did the importation of bumble bees make a difference to the population of wild bumble bees in Malta?
xi. How are bumble bees used?
xii. How long do they remain alive?
xiii. How much do they cost?

Psychologist

I. What is the extent of insect fear in the Maltese islands?

II. Which species are feared most?

III. Are there differences in fear related to social status?

IV. Are there differences related to gender?

V. What is the effect of fear of insects on individuals?

VI. Do people normally seek help because of their fears?

VII. Is nature or nurture the cause of these fears?

VIII. Does nature have a positive influence on a person's well-being?

IX. Are there any issues which are specific to Malta?

Appendix II Annotated Checklist of the Common Insects and other Invertebrates of Malta

The insects mentioned in the thesis are only a very small fraction of the insects that have been recorded in the Maltese islands. At a global level about 80% of all described faunal species are invertebrates with coleopteran species alone comprising at least 10 times the number of species of all vertebrates together and over 25% of all described species. Recent estimates have put the number of invertebrates on earth as high as 30 million. Preserving the diversity of invertebrates as of all other organisms, has been described as a true "life insurance for humankind" (Cardoso, Erwin, Borges, & New, 2011 p. 2647). More than 4,200 insect species have been recorded from the Maltese islands although it is likely that about 5,000 species actually exist, which means that several hundred still have to be discovered (Mifsud, D. 2000).

In this thesis, for names of insects in Maltese and English I followed the nomenclature used in Sultana and Falzon (2002) while for Lepidoptera and Odonata I followed Sammut (2000) and Gauci (2018) respectively.

Invertebrate species mentioned in text

English name/s	**Maltese name/s**	**Scientific name**	**Species listed in Prontuario di Storia Naturale Maltese**
Dictyoptera			
American cockroach	Wirdiena ħamra	*Periplaneta americana*	Uirdiena hamra
Brown-banded cockroach	*Kokroċċ isfar*	*Supella longipalpa*	
Egyptian cockroach	Wirdiena sewda	*Polyphaga aegyptiaca*	Uirdiena sewda
Praying mantis	Debba tax-xitan kbira	*Mantis religiosa*	Debba ta l' infern/tax-xitan

ORTHOPTERA			
Migratory Locust		*Aedipoda migratoria* = *Locusta migratoria*	
		Acridium peregrinum	
Two-spotted field cricket	Grillu	*Gryllus bimaculatus*	
Egyptian grass hopper		*Anacridium aegyptium*	
Mole cricket	Buħarrat	*Gryllotalpa quindecim*	
Hemiptera			
Bed bug	Baqqa	*Cimex* sp.	Bakka
Phthiraptera			
Head louse	Qamla	*Pediculus humanus capitis*	Kamla
Body louse		*Pediculus humanis corporis*	Kamla
Pubic louse		*Phthirus pubis*	Furrax
Homoptera			
Cicada	Werżieq ta' bi nhar; żarżur, zarzur	*Cicada orni*	Uuirziek/grillo

Hymenoptera			
Wallace's giant bee		*Megachile pluto*	
European honey bee	Naħla	*Apis mellifera*	Nahal tal ghasel
Maltese honey bee	Naħla maltija	*Apis mellifera ruttneri*	
Italian honey bee	Naħla taljana	*Apis mellifera ligustica*	
Sicilian honey bee		*Apis mellifera sicula*	
North African honey bee		*Apis mellifera intermissa*	
African honey bee		*Apis mellifera scutellata*	
Asian honey bee		*Apis cerana*	
Oriental hornet	Żunżan bagħal	*Vespa orientalis*	Baghal
Asian hornet		*Vespa velutina*	
Bumblebee		*Bombus terrestris*	
Carpenter bee	Bomblu iswed	*Xylocopa violacea*	Nahal baghli
		Aphelinus mali	
		Encarsia formosa	
		Eretmocerus mundus	
White butterfly parasite		*Apantales glomeratus* (*Cotesia glomerata*)	
Hemiptera			
Cottony cushion scale		*Icerya purchasi*	
Cochineal insect		*Dactylopius coccus*	*Cocciniglia*
Red scale		*Chrysomphalus dictyospermi*	
Woolly apple aphid		*Eriosoma lanigerum*	

Diptera			
House fly	Dubbiena tad-djar	Musca domestica	Dubbiena
Green bottle	Dehbija tal-ħmieġ	*Lucilla sericata*	
Yellow horsefly	Xidja; Dubbiena taz-żwiemel	Atylotus sp	Xidia
Asian tiger mosquito	Asian tiger	*Aedes albopictus*	
Anapholes mosquito	Nemusa	*Anapholes maculipennis*	
Sandfly		*Phlebotomus perniciosus*	
American serpentine leafminer		Liromyza trifolii	
Siphonaptera			
Human flea	Bergħud	*Pulex irritans*	Berghud
Cat flea	Bergħud	*Ctenocephalides felix felix*	
Dog flea	Bergħud	*Ctenaphalides canis*	
Oriental rat flea	Bergħud	*Xenopsylla cheopis*	
Lepidoptera			
		Antispila rivillei = Holocacista rivillei	
Meal moth	Piralis tat-tqieq	*Pyralis farinalis*	Berbis/Farfett tat- tkik
Mediterranean flour moth	Efestja tat-tqieq	*Ephestia kuehmiella*	
Indian-meal moth	Plodja	*Plodia interpuntella*	

European grain moth	Farfett tal-qamħ	*Nemopagon granella*	
Angoumois grain moth	Farfett tas-sbula	*Sitotroga cerealella*	
Leopard moth		*Zeuzera pyrina*	
Tomato leafminer	Susa tat-tadam	*Tuta absoluta*	
		Antispila rivillei (=*Holocacista rivillei*)	
		Lithostege fissurata	
Silkworm	Dudu tal-ħarir	*Bombyx mori*	Dud tal harir tac-ceus(l)i
Crimson speckled moth	Is-sbejħa	*Utetheisa pulchella*	
Scarce swallowtail		*Iphiclides podalirius*	
Tiger moth	Żarżur	*Cymbalophora pudica*	
Cleopatra	Farfett taż-żiju	*Gonepteryx cleopatra*	
Brimstone		*Gonepteryx rhamni*	Farfett taz ziu
Bath white	Farfett tal-ġarġir	*Pontia daplicide*	
Silver Y	Plusja	*Autographa gamma*	
Barbary spurge hawkmoth	Baħrija tat-tengħud	*Hyles sammuti* = *Hyles tithymali*	
Spurge hawkmoth		*Hyles euphorbiae*	
Convolvulus hawkmoth	Baħrija tal-leblieb	*Hyles convolvuli*	
	Qejjies tat-tengħud	*Eucrostes indigenata*	
Humingbird hawk moth	Ħabbara	*Macroglossum stellatarum*	Bahria seuda
Red underwing	Elokata	*Catocala elocata*	
Large cabbage white	Farfett tal-kaboċċi	*Pieris brassicae*	Farfett tal cromb

Small cabbage white	Farfett tal-kromb	*Pieris rapea*	
Painted lady	Farfett tax-xewk	*Vanessa cardui*	
Red admiral	Farfett tal-ħurrieq	*Vanessa atalanta*	
Clouded yellow	Farfett tas-silla	*Colias croceus*	
Pale clouded yellow		*Colias hyale*	
Brown argus	Kannelli ta' l-anġlu	*Aricia agestis*	
Meadow brown	Kannella kbir	*Maniola jurtina hyperhispulla*	
Swallow-tailed butterfly	Farfett tar-reġina	*Papilio machaon melitensis*	
Death's head hawk moth	Baħrija ta' ras il-mewt	*Acherontia atropos*	
		Sciopetris melitensis	
		Hipparchia blachieri	
Bright babul blue		*Azanus ubaldus*	
European peacock	Il-pagun	*Aglais io*	
Southern comma	Il-virgola	*Polygonia egea*	
Green-veined white		*Pieris napi*	
Southern festoon		*Zerynthia polyxena*	
Black-veined white		*Aporia crataegi*	
Coleoptera			
Oil beetle		*Meloe tuccicus*	
Red palm weevil	Bumunqar Aħmar tal-Palm	*Rhynchophorus ferrugineus*	
		Opatrum melitense	
Vedalia beetle	Nannakola tas-salib	*Rodolia cardinalis*	

Colorado potato beetle		*Leptinotarsa decemlineata*	
Seven-spot ladybird	Nannakpola tas-seba' tikki	*Coccinella 7-punctata* (*Coccinella septempunctata*)	Cola
Eleven-spot ladybird		*Coccinella 11-punctata* (*Coccinella undecimpunctata*)	Cola
Gourd ladybird	Nannakola tal-faqqus il-ħmir	*Henosepilachna elaterii,*	
Citrus long-horned beetle		*Anoplophora chinensis*	
Glow worm	Musbieħ il-lejl	*Lampyris pallida*	*Musbieh il leil*
Mulberry long-horned beetle	Susa tat-tut	*Phryneta leprosa*	
Heather ladybird		*Chilocorus bipustulatus*	
		Cerambyx miles	
		Cerambyx dux	
Flatheaded wood borer		*Capnodis tenebrionis*	
Odonata			
Island bluetail	Damiġella	*Ischnura genei*	
Broad scarlet	Skarlat	*Crocothemis erythraea*	Mazzarell[1]
Common darter	Ħamran mitfi	*Sympetrum striolatum*	
Red-veined darter	Ħamrani	*Sympetrum fonscolombii*	
Emperor dragonfly	Sultan	*Anax imperator*	
Lesser Emperor	Sultan sewdieni	*Anax parthenope*	

[1] All dragonflies (Neuropteri) are Mazzarell

Violet dropwing	Vjolett	Trithemis annullata	
Arachnida			
Acari			
Varroa mite	Varroa	*Varroa destructor*	
		Phytoseiulus persimilis	
Red spider mite		*Tetranychus urticae*	
Swirski mite		*Amblyseius swirskii*	
Scorpion			
Ghar Dalam woodlouse	Ħanżir l-art ta' Għar Dalam	*Armadillidium ghardalamensis*	

Order **Odonat**a Dragonflies and Damselflies

The number of dragonflies recorded in the Maltese islands has increased during the past two decades due to new species colonising the Maltese islands probably as a result of climate change and an increase in man-made aquatic habitats. Dragonflies are strong fliers and notable migrants, characteristics that facilitate the colonisation of new areas especially in response to environmental changes (Degabriele, 2013).

Family: Aeshnidae

Common Name/s: Blue Emperor (Emperor Dragonfly)

Maltese Name: *Sultan*

Scientific Name: *Anax imperator*

The blue emperor is a common colourful dragonfly that is regularly seen away from water. It is recorded from January to October (Gauci, C., 2018)

Family: Libellulidae

Common name/s: Broad scarlet

Maltese name: *Skarlat*

Scientific name: *Crocothemis erythraea*

Probably the most common dragonfly in the Maltese Islands and the one most likely to be seen. The brightly coloured males are very conspicuous as they prefer shallow stagnant water particularly reservoirs and fountains in both rural and urban areas (Gauci, C., 2018).

Order **Orthoptera** Grasshoppers and crickets

The Orthoptera is a large group of insects in which we find the grasshoppers and crickets. Orthopterans have well-developed hind legs which are used for jumping and two pairs of legs which are utilised mostly for clinging. They feed on vegetation and can become pests of agricultural produce. There are also predators, scavengers and omnivores. The males of many species attract females by making a chirping or squeaking noise which is produced by rubbing two body parts against each other (Schembri, S., 2002).

Family: Gryllidae

Common name: Two-spotted field cricket

Maltese name: *Grillu*

Scientific name: *Gryllus bimaculatus*

Male two-spotted field crickets produce several distinctive chirps, though each sound is made by rubbing the two outer wings together. Loud and steady chirps made throughout the night are to attract females and to warn off other males. These crickets hide under logs, in grasses, and in crevices. They also dig holes in the ground to create homes, or live in holes created by other animals. Males are territorial and will fight off other males, but allow any number of females to coexist in the same shelter.[2]

Family: Gryllidae

Common name: Mole cricket

Maltese name: *Buħarrat*

Scientific name: *Gryllotalpa quindecim*

The mole cricket lives underground in humid areas and irrigated fields especially at Burmarrad, Pwales, Għajn Tuffieħa, Ġnejna and Mtaħleb. It used to be very common and caused a lot of damages as it feeds on vegetable roots and potatoes and was a

[2] https://en.wikipedia.org/wiki/Gryllus_bimaculatus

veritable agricultural pest (Gulia, 1858) but is now effectively controlled by means of insecticides and does not cause significant damage.

Order **Dictyoptera (**Mantids and cockroaches)

The order Dictyoptera consists of two families the Mantidae and the Blattidae. The Mantidae is represented by three mantis species while about 7 species of Blattidae have been recorded (Schembri, S., 2002). A number of species of cockroach are well adapted to live in houses and other buildings because these offer a warm habitat similar to the tropical environment which is favoured by many of these species. (Savona-Ventura, 2002). Three species, *Blatta orientalis*, *Periplantea americana* and *Supella longipalpa*, which are considered of medical significance have been recorded from the Maltese islands (Schembri, S., 2002).

Family: Mantidae

Common name: Praying mantis

Maltese name: *Debba tax-xitan kbira*

Scientific name: *Mantis religiosa*

The praying mantis is well camouflaged and rarely seen by the public. Gulia (1858) gives two Maltese names for this species, *debba tal-infern* and *debba tax-xitan* meaning the mare from hell and the devil's mare respectively. The latter name is the one currently in use. Valletta (1954) wrote that it is very common and found in various localities but it is difficult to see because it is well camouflaged.

Family: Blattidae

Common name: American cockroach

Maltese name: *Wirdiena ħamra*

Scientific name: *Periplaneta americana*

This is the largest cockroach recorded in the Maltese islands. It lives in dark, dank places such as sewers and comes out at night when it often enters houses. In some places particularly in the harbour area it is very common (Schembri, S., 2002).

Family: Blattidae

Common name: Brown-banded cockroach

Maltese name: *Kokroċċ isfar*

Scientific name: *Supella longipalpa*

This is a very common insect which is sometimes found in large numbers in kitchens. Valletta (1954) noted that

> It is said that this cockroach was introduced into the island during the first Great War. I quite remember its first appearance in my grandmother's house when my uncle returned home after serving in the merchant navy during that war. It naturally was carried in his luggage. Nowadays it is very common indeed and widely distributed. Its favourite haunts are the kitchens (p. 12).

Cockroaches are less likely to be found in kitchens than they did in the 1950s because of aggressive pest control.

Order **Heteroptera** True bugs

This is a large order consisting mainly of terrestrial species but with some aquatic species. The majority feed by sucking plant fluids by means of a sharp tubular proboscis which they insert in the stems or leaves. Some are predators while others suck human blood and can carry diseases (Schembri, S., 2002).

Family: Pentatomidae

Common name: Striped shield bug

Maltese name: *Spallut irrigat*

Scientific name: *Graphosoma lineatum* ssp. *italicum*

This is a common and easily noticeable insect because of its conspicuous red and black striped body and its habit of staying on top of giant fennel (*Ferula communis*) and fennel (*Foeniculum vulgare*) flowers.

Order **Homoptera** Cicadas; aphids; scale insects

The Homoptera has not been studied properly in the Maltese islands. Homopterans (except for the cicada) are small insects that feed on plant material and can be injurious to cultivated plants. Their mouths are adapted to pierce and suck fluids although a few species do not have a mouth and hence do not feed in the adult stage (Schembri, S., 2002).

Family: Cicadidae

Common name: Cicada

Maltese name: *Werżieq ta' bi nhar*

Scientific name: *Cicada orni*

The cicada looks like a large fly. It appears in mid-summer and is noticed by its loud shrilling song which can be heard wherever there are large trees. Despite this, many of those who were interviewed were not aware of its existence and failed to recognise it when shown a picture of it.

Family: Coccoidea

Common name: Scale insects

Although scale insects are economically important because of their impact on agriculture and horticulture, few people have studied them in Malta. Many species are important pests of fruit, nut, forest and ornamental trees as well as several agricultural crops. Losses due to plant death and increased production costs are estimated to exceed five billion dollars annually worldwide. Several species such as the cochineal have been beneficial to various cultures for a very long time (Mifsud, & Porcelli, 2011).

Family: Margarodidae

Common name: Cottony cushion scale insect

Maltese name: *Miskta bajda*

Scientific name: *Icerya purchasi*

The cottony cushion scale is indigenous to Australia. It arrived in the United States in the 1880s where it became a serious threat to the Californian citrus industry. It was controlled by the Vedalia beetle (*Rodolia cardinalis*) which is a predator in its native habitat (Portelli, 2011).

Family: Aphididae

Common name; Black Bean Aphid

Maltese name: *Bergħud tal-ful*

Scientific name: *Aphis fabae*

The black bean aphid is a 2mm insect that lives on herbaceous plants especially beans and peas. They tend to be present in very large numbers and can reduce crop yields. Up to the mid-20th century Maltese farmers often relied on the presence of the seven-spot ladybird which in most years arrived in large numbers from Sicily to control these aphids.[3]

[3] Agriculture Department Report 1938 – 1946 (NAM GMR 1501)

Order **Coleoptera** Beetles

The Coleoptera is the largest insect order. Members of the order vary widely in size. They follow the same body structure of a typical insect. The forewings (elytra) are hard and/or thick and cover the hind-wings which are thin and delicate and kept folded underneath the elytra when not being used for flight Some species do not have wings (Gullan, & Cranston, 2000). It is estimated that between 1,200 and 2,000 species occur in the Maltese islands. (Schembri, S., 2002)

Family: Staphylinidae

Common name: Devil's coach-horse

Maltese name: Katarina-għolli-denbek

Scientific name: *Staphylinus olens*

This species is active mostly at night. It spends the day hidden underneath stones and if it is uncovered it raises its abdomen and opens its mouth in a threatening position. The Maltese name which means Catherine put up you tail, refers to this behaviour. Some people also refer to it as *kappillan* (Maltese word for parish priest because of its long black body which reminds one of a priest's cassock). This name is also used for another species of the same family, the rove beetle (*Creophilus maxillosus*) (Schembri, S., 2002).

Family: Lampyridae

Common name: Glow worm

Maltese name: *Musbieħ il-lejl*

Scientific name *Lampyris pallida*

The glow worm is an unusual endemic beetle in that while the adult male looks like a typical beetle, the female looks like a larva whose tail glows in the dark. The light emitted by the female attracts males (Schembri, S., 2002).

Family: Coccinellidae

Common name: Seven-spot ladybird

Maltese name: Nannakola tas-seba’ tikek

Scientific name: *Coccinella septempunctata*

The seven-spot ladybird used to be common all year round and in some years in spring its numbers used to be augmented by the arrival of migrants. John Borg (1939) wrote that his brother Paul had observed the irregular migrations of vast numbers of this ladybird. He assumed that the swarms came from Sicily. He also noted that in years when they came it was during the months of March and April.

Family: Coccinellidae

Common name: Gourd ladybird

Maltese name: *Nannakola tal-faqqus il-ħmir*

Scientific name: *Henosepilachna elaterii*

This is a common ladybird and is well known to children and adults who frequent the countryside. Adults and larvae live and feed on the leaves and flowers of the squirting cucumber (*Ecballium elaterium*). Their colour makes them very conspicuous and they do not bother to hide themselves (Schembri, S., 2002).

Order **Diptera** Flies

The order Diptera is one of the largest insect orders with several members adapted to live close to humans. The order includes a number of locally occurring families of medical importance (Gatt, 1996; Gatt, Williams & Mifsud, 2009; Schembri, S., 1995).

Family: Tabanidae

Common name: Yellow horsefly

Maltese names: *Xidja; Dubbiena taż-żwiemel*

Scientific name: *Atylotus loewianus*

Horseflies are medium to large flies. Several species occur and all are common especially in coastal areas. *Tabanus autumnalis* and *Tabanus regularis* were recorded as common by Ebejer (1995). The females suck blood by piercing the skin of both humans and livestock. A biting fly is persistent and the bite is very painful. The males are innocuous and live on flowers, feeding on pollen and nectar. Horseflies are generally found in the vicinity of fresh water. The yellow horse fly is usually found in coastal areas especially in sandy bays (Schembri, S., 2002). Older interviewees said that horseflies are not as common as they were in the past probably because of the decrease in the number of livestock animals on which the females feed. These people described how the horsefly was so persistent in its attempt to drink blood that it used to drive equines and bovines 'crazy'.

Family: Culicidae

Common name: Asian tiger mosquito

Maltese name: Asian tiger[4]

Scientific name: *Aedes albopictus*

The Asian tiger mosquito is native to Southeast Asia where it originally laid eggs in water collected in coconut shells and bamboo stumps but has adapted itself to breed in man-made objects such as water barrels and car tires which can hold small amounts of water (Becker, 2008). Since 1979 it has undergone a tremendous expansion in its range and it can now be found in tropical and sub-tropical regions and occasionally in regions with moderate climate. Its expansion in range has been

[4] The Department of Health used the English name for this species (https://deputyprimeminister.gov.mt/en/health-promotion/idpcu/Documents/aedes_full_mt.pdf)

supported by greater human mobility and international trade especially in used tires (Nicoletti, Murugan, & Serrone, 2014).

Orders **Siphonaptera** and **Acari** Fleas, mites and ticks

Family: Cimicidae

Common name: Bedbug

Bed bugs are members of the order Hemiptera that have become specialised to feed on vertebrate blood (Boase, 2001) and have been associated with humans for thousands of years (Seidel & Reinhardt, 2013). Bedbugs spend the day hiding in mattresses, bed frames, headboards, wall skirting and behind pictures and come out at night to feed on exposed human skin to which they are attracted by warmth and carbon dioxide (Levy Bencheton, Berenger, Del Giudice, Delaunay, & Morand, 2011). Although bedbugs can be common in the Maltese islands and important because they are part of a narrative of past hardship and poverty, they have not yet been studied by Maltese entomologists and little is known about their biology. Entomologists do not yet know which species is or are found in the Maltese islands.

Order **Phthiraptera** Lice

Lice are blood-sucking wingless insects that live on other animals. Two species live on humans; the head louse (*Pediculus humanus capitis*), and body louse (*Pediculus humanus corporis*) and the pubic louse (*Phthirus pubis*) (Raoult & Roux, 1999).

Family: Pediculidae

Common name: Head louse

Maltese name: *Qamla*

Scientific name: *Pediculus humanus capitis*

The head louse spends its entire life on the human scalp where it feeds on blood. It is contagious and is easily transferred from one head to the other by contact especially when children are playing close to each other (Savona-Ventura, 2002).

The pubic louse, on the other hand, is restricted to pubic hair. A doctor said that "pubic lice are common. Many do not realise what they have but present themselves with itching. Infestation is not brought about by lack of cleanliness but by promiscuity". She also said that "changing fashions can have an impact on the population of certain insects as in certain parts of the world pubic lice have become rare mainly because it has recently become fashionable to remove all pubic hair".

Order **Siphonaptera**. Fleas

About eleven species of flea have been recorded in the Maltese islands. Their presence has been monitored because of their association with the transmission of plague and murine typhus (Savona-Ventura, 2002).

Family: Pulicidae

Common name: Oriental rat flea

Maltese name: *Bergħud*

Scientific name: *Xenopsylla cheopis*

Fleas are known to be responsible for the spread of plague epidemics. The rat flea is also a vector of murine typhus. Other fleas have been recorded in the Maltese islands including *Pulex iritans, Ctenocephalides felis* and *Ctenocephalides canis*. The last two being present on cats and dogs respectively (Savona-Ventura, 2002).

Order **Lepidoptera** Butterflies and moths

The wings of Lepidoptera are covered in small overlapping scales that provide these insects with patterns and colours that are used for camouflage and to identify and attract a mate. The scales often fall off when a butterfly or moth is picked up. In 2000, five hundred and ninety-nine species had been recorded (Sammut, 2000). Several more species have been added to the list since then (example Catania, 2010; Catania & Seguna, 2017; Sammut, 2003a; 2003b; 2007).

Family: Sphingidae

Common name: Hummingbird hawk moth

Maltese name: *Ħabbara*

Scientific name: *Macroglossum stellatarum*

This is one of the few day-flying moths of the Maltese islands. It is common and sometimes enters houses. Gulia (1858) refers to this species as *baħrija*. This moth is nowadays known as *ħabbara* while the word *baħrija* is used to refer to most other moths.

Family: Sphingidae

Common name: Death's head hawk moth

Maltese name: *Baħrija ta' ras il-mewt*

Scientific name: *Acherontia atropos*

This is the largest moth. It sometimes visits beehives to drink honey but is often attacked and killed by the bees. It is not common but being a migratory species, the local population is sometimes augmented by visitors. Gulia (1858) refers to it '*farfett el meut*' or '*ras el-meut*'

Family: Gelechiidae

Common name: Tomato leaf miner

Maltese name: *Susa tat-tadam*

Scientific name: *Tuta absoluta*

The tomato leaf miner is a South American species of moth. In 2006 it appeared in Spain and in the following year it appeared in several other European countries. In April 2009 it was found in a greenhouse in Dingli and by the time a survey was carried out it had spread to most tomato-growing regions in Malta and Gozo. Its presence in Malta was resulting in severe damage to open and greenhouse tomato crops which was resulting in losses to tomato growers especially to growers of the summer tomato crop which is the raw material for the tomato-processing industry (Dandria & Catania, 2009).

Family: Pieridae

Common names: Large cabbage white, Large white

Maltese name: *Farfett tal-kaboċċi*

Scientific name: *Pieris brassicae*

The large cabbage white is a very common butterfly that is considered a pest because the caterpillar feeds on plants of the cabbage family. Its numbers have decreased probably because of chemical control. According to John Borg (1939), his brother Paul observed large numbers of cabbage whites migrating from the Libyan coast to Malta at irregular intervals between February and April and in October and November. The butterflies fly in groups of 50 to 100 a few feet above the surface of the sea or just skimming the waves.

Family: Pieridae

Common name: Small white

Common name: *Farfett tal-kromb*

Scientific name: Pieris rapae

This is also a very common butterfly. It is very similar to the large white but smaller and has similar habits. Many Maltese do not know that there are two similar species of white butterfly and refer to both of them as *farfett abjad* (white butterfly) or *tal-kaboċċi* (cabbage butterfly).

Family: Papilionidae

Common name: Swallowtail

Maltese names: *Farfett tal-fejġel; Farfett tal-bużbież*

Scientific name: *Papilio machaon melitensis*

This butterfly is widespread but not common and numbers can vary from one year to another. It is very eye-catching and well known. The race found in the Maltese islands is endemic. The caterpillar feeds on fennel (*Foeniculum vulgare*) and rue (*Ruta chalepensis*) hence two of its Maltese names (Sammut, 2000).

Family: Satyrinae

Common name: Meadow brown

Maltese name: Kannella kbir

Scientific name: *Maniola jurtina*

The meadow brown butterfly was one of the commonest butterflies in the Maltese islands but in the past thirty years has decreased and has become very rare and in danger of becoming locally extinct.

Order **Hymenoptera** Bees, ants and wasps etc.

This is an important order not only because some species are essential pollinators and predators or parasites of harmful insects but also because some species produce honey and other hive products that are harvested for human use.

Family: Apidae

Common name: Maltese honey bee

Maltese names: *Naħla sewda*; *Naħla Maltija*

Scientific name: *Apis mellifera ruttneri*

The honey bee is a well-known insect because of its importance as a producer of hive products and as a pollinator. A subspecies endemic to the Maltese islands was described in 1997(Sheppard, Arias, Grech & Meixner, 1997). This subspecies is in danger of extinction because of interbreeding with imported non-indigenous races of honey bee.

Family: Apidae

Common name; Bumble bee

Maltee name: *Bomblu*

Scientific name: *Bombus terrestris*

The bumble bee is indigenous to Malta and is known as '*bomblu*'. Large numbers of domesticated or semi-domesticated bumble bees of this species are imported to be used as pollinators of greenhouse crops especially tomatoes and aubergines. Farmers refer to it as '*naħla tad-dakra*' (pollinating bee). This is an example of a species which had its name changed because as a result of domestication.

Family: Vespidae

Common name: Oriental hornet

Maltese name: *Bagħal taż-żunżan*

Scientific name: *Vespa orientalis*

The oriental hornet is an indigenous species that was common up to about sixty years ago but suddenly started to decrease until it nearly disappeared. In recent years it established itself again in the Maltese islands possibly as a result of the arrival of a colony with imported merchandise.

Family: Vespidae

Common name: Paper wasp

Maltese name: *Żunżan tax-xehda*

Scientific name: *Polistes omissus*

Paper wasps are very common in the Maltese islands. Two species occur *Polistes omissus* and *Polistes gallicus* (*Żunżan tax-xehda kbira*). Most people are not aware that two species are found in the Maltese islands and refer to both species as *żunżan*

Appendix III – Protected insect species

SCHEDULE V

INSECTS OF COMMUNITY INTEREST IN NEED OF STRICT PROTECTION

ANNEX II, IV & V SPECIES WHICH OCCUR IN MALTA

Brachytrupes megacephalus		Giant cricket
Myrmecophilus baronii		Baroni's Ant-cricket
Cerambyx cerdo		Great capricorn beetle

SCHEDULE VI

INSECTS OF NATIONAL INTEREST IN NEED OF STRICT PROTECTION

Eurynebria complanata		
Scarites buparius		
Ptosima flavoguttata		
Oryctes nasicornis	Buqarn il-Kbir	Large Rhinocerous Beetle
Gastropacha quercifolia	Werqa Niexfa	Lappet Moth
Lasiocampa quercus	Baħrija tal-Ballut	Oak Eggar
Lasiommata megera	Kannella tax-Xemx	Wall Brown
Pararge aegeria	Kannella tad-Dell	Speckled Wood
Catocala conjuncta	Katokala Rari, Baħrija tal-Luq	Red Underwing
Catocala elocata	Elokata	Red Underwing
Catocala nymphaea	Katokala Safra Kbira, Baħrija tal-Luq	Oak Yellow Underwing
Catocala nymphagoga	Katokala Safra Żgħira, Baħrija tal-Luq	Oak Yellow Underwing
Sphingidae (All species)		
Gegenes pumilio	Il-baħri	Pygmy skipper
Aricia agestis	Kannelli tal-Anġlu	Brown Argus
Celastrina argiolus	Ikħal Fiddieni	Holly Blue

Lampides boeticus	Ikħal tad-Denb Twil	Long-tailed Blue
Lycaena phlaeas	Farfett tas-Selq	Small Copper
Polyommatus icarus	Farfett tal-Anġlu	Common Blue
Syntarucus pirithous	Ikħal tad-Denb Qasir	
Zizeeria knysna	Ikħal ta' l-Afrika	African Grass Blue
Coenonympha pamphilus	Kannella Żgħir	Small Heath
Maniola jurtina hyperhispulla	Kannella Kbir	Meadow Brown
Gonepteryx cleopatra	Farfett taż-Żiju	Cleopatra
Morophaga choragella		
Anax parthenope		Parthenope's Dragonfly
Orthetrum trinacria		
Orthetrum brunneum		
Acanthaclisis baetica		
Italochrysa italica		

SCHEDULE X

ENDEMIC SPECIES NOT COVERED BY REGULATION 26

Acinopus ambiguous (Dejean)	Busewdien tax-Xatt	Shore Ground Beetle
Aleurolobus teucrii Mifsud & Palmeri		
Allophylax picipes melitensis (Baudi)		
Alphasida grossa melitana Reitter	Ħanfusa tal-Fekruna	Tortoise Darkling Beetle
Attalus melitensis Peyron		
Danacea (Allodanacaea) thymi Liberti & Schembri		
Dasytidius melitensis (Bourgeois)	Dasitidu ta' Malta	
Laemostenus (Sphodroides) Picicornis melitensis (Fairmaire)		
Mniotype deluccai (Berio)	Melvizza ta' Delucca; Melvizza ta' Valletta	Valletta's Brocade

Appendix IV – Insects as inspiration

Papillon	Papillon Caterers (Hamrun)
	Papillon Services Ltd (Valletta)
	Papillon Unisex Hairstylist (Victoria, Gozo)
	Papillon Cafe (Balzan)
Bee	Busybee Cafe (Msida)
	Bee Insurance Management (Floriana)
	Bee Hive Confectionary (Zebbug)
Hive	The Hive ICO (Paola)
	The Hive Web Design (Attard)
	The Hive Childcare Centre (Tarxien)
	The Hive Food Store (San Giljan)
	Hive Leisure Ltd (St Paul's Bay)
	The Hive Ltd (Gzira)
	Happy Hive Cafe (Marsascala)
Naħal	Triq in-naħal (Mellieha, Mosta & Naxxar)
Naħla	Triq in-naħla (Żabbar)

Xehda	Triq ix-xehda (Marsascala, Naxxar,)
Mġiebaħ	Mġiebaħ Bay
Farfett	Il-Farfett Florist (Zabbar)
	Partit tal-Farfett (Political Party)
	Triq il-Farfett (Marsa)
	Trejqet il-Farfett tal-Korpus (Ghasri)
	Triq il-Farfett tal-fejgel (Zabbar)
Butterfly	Butterfly Diner (Birkirkara)
	Butterfly Car Rentals (Santa Venera)
	Butterfly Therapies (Sliema)
	Butterfly Investments Ltd (San Gwann)
Dragonfly	Nil
Mazzarell	Nil
Fly	Nil
Dudu	Nil

Cricket	Nil
Grasshopper	The Grassy Hopper (Gzira)
	Grasshopper Bar (Lija)
Ġurat	Nil
Grillu	Nil
Dubbiena	Nil
Fosdqa	Nil
Ladybird	The Ladybird Stree Cafe (Gzira)
	The Ladybird Gourmet Store (Valletta)
	Ladybird Cafe Gourmet (Msida)
	The Ladybird Foundation (NGO)
	Ladybird Books
Nannakola	Nannakola Childcare Centre (Għargħur)