Alexandria University
Faculty of Agric. (Saba-Bacha)

STUDIES ON INSECT AND ANIMAL PESTS ATTACKING LAWNS IN ALEXANDRIA

A Thesis

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of

MASTER IN AGRICULTURAL SCIENCES

In

ECONOMIC ENTOMOLOGY

By

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أستاذ الحشرات الإقتصاديه الغير متفرغ

كلية الزراعة – سابا باشا جامعة الإسكندرية

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دراسات على الآفات الحشرية والحيوانية التي تصيب المسطحات الخضراء في الإسكندرية

مقدمة من

أحمد طه عبد المعطى جاد الله

للحصول على درجة

الماجستير في العلوم الزراعية

تخصص حشرات إقتصاديه

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In partial fulfillment of the requirements for the degree of

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By

AHMED TAHA GADALLEH

A thesis submitted in partial fulfillment of the requirements governing

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ECONOMIC INSECTS

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رساله علميه

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استيفاء للدراسات المقررة للحصول على درجه

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تخصص الحشرات الاقتصاديه

مقدمه من

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CONTENTS

CHAPTER 1

INTRODUCTION

There is no doubt that lawns are the most important item in the components of private and public gardens. The lawns are the role of the design and the direction of the depending on it when constructing a garden also, it is considered as a garden ground. With the lawns the designer starts distributing and planning the areas inside the garden; and with it the designer finishes his work in the garden. The cost of lawns is about half of the total cost of garden. The lawns have a beauty value not less than it's technical value. The lawns and it's spread are as a measure of environmental progress of the nation we have to mention that, for rich country 70-100 m^2 per person mild country 25-70 m^2 per person and poor country less than 25 m^2 per person. Egypt and Middle East are poor country in this era according to the last 5^{th} report of the United Nations. Lawns are important for some sports such as football, cricket, golf and hokey.

Because of this reasons, the European and American peoples give a care to the science concerning the lawns and carried out many researches in caring, creating and studying of pests and pest control, but the major step was done when the USA organized the world cup at 1994 when producing Passpilum grass, which was considered a big progress in both type and production methods (rolls method). It was a creative method which was for 1^{st} time in covering play grounds in world cup which affected on the performed of the players. This world cup was the best till now and in other direction Japan produced a moving machines and inserted the transverse machine for the 1^{st} time in 1996 and produced big tractor to be used in fast mowing that made a big success in word cup 2002.

The starting point in the success way is to prepare specialists and efficient persons to take care of our gardens or stadiums, specially if we know that in Egypt 14 stadiums supervised by 9 foreign companies because of rarity of the Egyptian trained and efficient persons in this sector. In this concern, there are also rare trials in studying the pests of lawns. Therefore, this research was carried out for surveying and determining the common prevailing insect and animal pests on two important types of lawns in Egypt, the Passpilum which a common type and permoda which is spreading in our gardens. The choise of this subject is also coincided with the recent going on the world development in the science concerning lawns, to be the 1^{st} step in a long way.

CHAPTER 2

REVIEW OF LETERATURE

2.1. The abundant injurious insect and/or animal-species of lawns.

In Egypt, Hammad (1968) studied the gasson worm *Pachyzancla licarsicalis* and described the life cycle and morphology.

In Florida, Perry (1974) examined the situation with regard to nematodic pests in turf grasses used in lawns and golf courses. Bermuda Zoysia and centipede grasses are identified as the most susceptible, whereas bahai grasses as the least. St. Augustine grasses suffered from a specific nematode, *Heterodera leucilyma*. He declared and discussed the parasitic nematodes and the most serious identified species as *Belonolaimus longicaudatus* and *Hoploaimas galeatus*. The use of chemical nematicides was suggested as the best option for control, and DBCP was proved as the most effective one. A few granular nematicides were also suggested.

Goodyer (1983) provided notes on the recognition, biology, injuriousness and control of *Mythimna convecta, M. loreyimima, M. separata, Persectania ewingii, Spodoptera mauritia, S. exempta* and *S. exigua* (noctuids that attack a variety of crops) in New South Wales. Besides Current recommendations for the control of noctuids (with chlorpyrifos or trichlorfon) on cereals, pastures, maize, lawns and turf. Various natural enemies of noctuid larvae are discussed, including parasites, insect viruses, predacious birds and predacious bugs, especially the pentatomids *Cermatulus nasalis* and *Oechalia schellembergii*.

Monkman and Dow (1983) gave notes on the morphology, life history, economic importance, detection and control of the chinch bug (*Blissus sp*.) which attacks some cereal crops and grasses and is a particular pest of lawns of permoda crabgrass [*Stenotaphrum secundatum*] in permoda. Nymphs and adults feed together in concentrated patches preferring hot, dry and sunlit places causing yellowing or browning of the grass in localized areas, and then migrate outwards. Infested lawns should be mown, watered thoroughly and allowed to dry before application of diazinon, chlorpyrifos, carbaryl or the special chinck bug killer Aspon [thiodiphosphoric acid ([(HO) 2P(S)] 2O) tetrapropyl ester]. So as to wet the base of the leaves and runners; a second application of the first 3 compounds 7-10 days later is advisable; and a third may be required for severe infestations, since eggs are not killed by these insecticides. Aspon requires a follow-up application 8 weeks after the first.

Nath (1983) surveyed the coleoptrous species pertaining to Scarabaeidae in the Varanasi and Mirzapur districts of Uttar Pradesh, India, in 1978-80, nineteenth phytophagous *melolonthines, rutelines* and *dynastines*, and 16 scavenging coprines, aphodiines, geotrupines, hybosorines and orphiines were recorded. Besides, many endemic pockets of pests of sugarcane, groundnut and ornamental lawns were identified.

Castner (1984) explained that gryllotalpids especially *Scapteriscus* spp., are severe pests of crops, pastures, turf, lawns and gardens in the southeastern USA and in Puerto Rico. In conducted studies in Florida, *Larra bicolor* F. successfully parasitized *S. abbreviatus* Scud., *S. didactylus* (Latr.) , *S. imitatus* Nickle & Castner, *S. vicinus* Scud. and *S. acletus* Rehn & Hebard, but the percentages of parasites completing their development varied widely, averaging 90, 18, 87, 51 and 79 days, respectively. The difference was statistically significant in the case of *S. didactylus* L. *bicolor* failed to parasitize 90% of the examples of *Neocurtilla hexadactyla* (Perty) offered as hosts on account of the sticky fluid excreted by this mole cricket when attacked.

In the United Kingdom ,French (1984) mentioned that the leatherjackets (*tipulid* larvae) are important soil pests, troublesome to both the farmer and the gardener. They are usually most numerous after prolonged damp weather in late summer and early autumn. The largest populations occur in grassland, particularly leys, lawns and golf courses. Variable crops following infested grassland may suffer serious injury from such pests. Cereals, root crops, vegetables such as brassicas and courgettes, and many herbaceous garden plants are frequently damaged. The worst attacks usually occur in spring, young plants suffering the most. Closely sown crops are sometimes infested with many leatherjackets without showing serious loss, but, when crops are thinned, the remaining plants may be damaged severely. Similarly, thinly-sown or transplanted crops may suffer severely. Some stubbles, particularly in western areas, can become very grassy in the early autumn, especially during a wet period; leatherjacket trouble often follows such conditions. In gardens, even a few leatherjackets can cause serious losses, especially to seedlings. In this revised leaflet, the author gave also information on the injuriousness, morphology, life history, natural enemies and control (on field crops, garden crops, and lawns and golf courses) of leatherjackets.

In Canada, Kelleher (1984) reviewed the insect and other invertebrate pests which included sections on pests of cereals, lawns, forage grasses, oil plants (including rape) tobacco, greenhouses, vegetables, pome fruits, stone fruits, small fruits, stored products, miscellaneous field crops, ornamental plants, man, domestic animals and households. Also section on beneficial insects was devoted to arthropods for the biological control of pests and weeds.

Kelsheimer (1984) studied diseases and pests of lawns and their control in Florida (U.S.A).

Spackman (1984) designed a manual to aid Wyoming pesticides users in the identification of common insect pests and selection of appropriate treatments for tree, shrub and lawn pests. Sucking insects, chewing insects, gall producers, borers and lawn pests were illustrated and described. Recommended control treatments for each pest were given. Also the suggested formulations for insecticides were supplied.

Robert *et al*. (1986) reviewed Records since 1920 of *Melolontha melolontha*, which used to be an important agricultural pest in France until 1950, attacking forest trees, pastures, hedges, fodder crops, cereals and vegetables. In the last gradation period in 1967-79, the scarabaeid caused economic damage only in extensive permanent grasslands in Auvergne, Franche-Comte and Lorraine. The decline or disappearance of populations in

areas of intensive crop production is attributed to the removal of many hedgerows and copses, reduced cultivation of fodder crops and the mechanization of tillage, which destroys larvae in the soil. Surveys of cockchafer populations *M. melolontha* in 1980-85 in various regions (especially north-eastern France) revealed the existence of small localized foci of infestation on apple trees in Aquitaine, on grassland in Limousine and on lawns and garden vegetables in Lorraine.

Laurence (1987) described the damage caused by pests of lawn and improved pastures in Trinidad and Tobago including the mole crickets *(Scapteriscus vicinus*) chinch bugs (*Blissus insularis*) frog hoppers or spittle bugs (*Aeneolamia varia saccharina*) leaf hoppers (*Pagaronia mollicelle, Hortensia similis* and *Kolla bifider*) aphids (*Sipha flava*) armyworms (*Spodoptera frugiperda*, *Mocis punctularis*) cutworms (*Spodoptera* spp.) grass worms (*Herpetogramma phaeopteralis*) ants (*Acromyrmex octospinosus*, *Trachymyrmex urichi* and *Solenopsis germinata*) and slugs. Recommendations were also made for the control of these pests. It was also shown that the mole cricket is the most important pest of improved pastures and lawns and for its control the chlorinated hydrocarbons were applied as sprays in lawn for an extended period, beside poison baits consisting of the insecticide-carbaryl and rice bran, wheat bran or corn meal (in the proportion of 1 part of insecticide to 20 parts of bait),which controlied the insects in the improved pastures.

Sitchikhina (1987) gave details of the development and suitability on lawns of nine new *Festuca rubra* varieties. which showed potential for producing high quality lawns, resistance to unfavourable climatic conditions, diseases and pests?.

Smart (1987) carried out laboratory and field experiments to test the potential of the nematode *Neoaplectana carpocapsae* for the control of the gryllotalpid *Scapteriscus acletus* and *S. vicinus*, which attack turf and pasture in Florida. It was concluded that populations of *S. acletus* and *S. vicinus* could be reduced by releasing *N. carpocapsae*.

The profusely illustrated book of Tashiro (1987) is the only comprehensive English-language text reference on pests of lawns and turf grasses in the USA (including Hawaii) and Canada. It contains substantial technical material for the professional entomologist, as well as information for turfgrass managers with limited or no entomological training. A special feature is the use of colour photographs to assist in recognizing pests (including adults and immature stages) and the damage they cause, and of text illustrations of diagnostic features, seasonal biology and distribution. It also provides a review of turf grasses and their structure and climatic adaptations (including drought dormancy and its relationship to insect damage). Besids a review of insects and other arthropods., including mites, gryllotalpids, Hemiptera, three families of Lepidoptera, three families of Coleoptera (including five subfamilies) Diptera, Hymenoptera and secondary insect and mite pests (about 20 species and other taxa). For each of about 30 important pests or groups of pests, information is provided on their taxonomy, importance, history, distribution, food-plants, damage, recognition, seasonal history, habits and other features such as mortality factors, laboratory rearing, control, sampling techniques and natural enemies. The secondary pests are dealt with similarly but in less detail and included on other invertebrates, and vertebrates, their detection, diagnosis, population survey techniques and control measures (including plant resistance, natural enemies, cultural practices, insecticidal control and insecticide resistance). Although intended for use in

North America and Hawaii, this text could be of value in other countries and areas, especially as many of the pests dealt with have been imported from elsewhere or are widely distributed.

Ali (1989) described the most common arthropod, gastropod, fungal disease, nematode, weed and vertebrate pests of turf grass with notes on their biology, detection, damage and control. He gave photographs, in colour, to aid identification. He provided considerable information on the best selection of pesticides and emphasis was placed on the safe and effective use of pesticide chemicals. Specific chemical recommendations were not given.

In Arkansas, Boyd (1989a) studied the effect of mowing, fertilizers, irrigation and weed control on *Cynodon dactylon* lawns and turf and their side effect on insect-pests.

Also the same author (1989b&c) stated the factor of the festuca and/or zoysia for studying the effects of each of lawns and turf mowing, irrigation, weed control, fertilizers, plant disease, control insect- pests and sawing on both turf types.

Goss *et al.* (1989) authorized a book on home lawns in Washington State, USA, included sections on starting a new lawn, lawn maintenance, disease control, weed control and insect control.

Kiss (1989) classified the pests of lawns and improved pastures in Trinidad and Tobago. Major pest species included: the gryllotalpid -*Scapteriscus vicinus*, the lygaeid- *Blissus insularis*, the cercopid- *Aeneolamia varia saccharina*, the aphid- *Sipha flava*, the noctuid -*Spodoptera frugiperda*, the pyralid -*Herpetogramma phaeopteralis* and the formicids- *Acromyrmex octospinosus*, *Trachymyrmex urichi* and *Solenopsis geminata*. He also stated that Slugs damage grasses. Various insecticides are recommended for the control of *Scapteriscus vicinus, H. phaeopteralis* and *B. insularis*.

Mohanasundaram and Parameswaran (1989) studied the mite fauna associated with grasshoppers [Orthoptera], in dry and wetland ecosystems, in cotton and sugarcane fields and in lawns in Tamil Nadu, India. The mite associated with 13 species of Orthoptera were listed. All the mites found were parasitic.

Forschler and Gardner (1990) indicated that at least 91 species of the genus *Phyllophasa southectera* USA occur in the region. Adults reportedly defoliate host plants including pines [Pinus], pecans, other broadleaves and various row crops. The immatures reside in the soil, feeding within the root zone and inflicting damage to pasture and turf grasses, new plantings of trees and row crops. Economic thresholds do not exist for most crops attacked. Cultural and insecticidal measures were generally recommended for control, but often were not economical or effective. Alternate management strategies (i.e., natural enemies, host plant resistance) have not been extensively investigated. In addition, surveys of occurrences and distributions are incomplete, out-of-date or non-existent for many of the southeastern states. Distribution maps and adult flight period data for selected species were compiled from available survey information.

Koizumi (1990) mentioned that the adults of the turf grass pest, white grubs (larvae

of beetles of the family Scarabaeidae) are important insect pests, not only in nurseries growing hinoki cypress (*Chamaecyparis obtusa*) and Japanese cedar (*Cryptomeria japonica*) but also in fields of sweet potatoes, peanuts, tea plantations, lawns etc. In experiments in 1985-87 in Ibaraki prefecture, Honshu, 2-yr-old *C. obtusa* seedlings planted in March 1985 were treated with *Steinernema suspensions* with 5000, 10 000, 100 000, 500 000 or 1 000 000 juveniles/m2. Tree roots were slightly damaged on all plots. More than 100 000 juveniles/m2 were required to produce 100% beetle larval mortality.

McCarty *et al*. (1990) incorporated an information and Pest Scouting (TIPS) program modified from traditional Integrated Pest Management (IPM) strategies, into a pilot project specifically designed for turf managers. Objectives of the TIPS program were (i) identifying and incorporating scouting techniques to indicate pest presence and pressure; (ii) maximizing plant health through proper maintenance while promoting prescriptive pesticide usage to maintain acceptable appearance; and (iii) applying computer technology and remote sensing techniques for stress identification and plant problem analysis on golf course turf. Background information was compiled on maintenance practices such as mowing, fertilizing, watering and applying pesticides. Scouting was performed on a 10-day cycle and involved inspecting for pest problems and improper agronomic practices. Management practices were reviewed and recommendations suggested to each manager. Results included (i) educating turf managers on recognizing important pests and determining when sufficient pest levels were present to apply pesticides rather than treating on a calendar basis as previously performed; (ii) transferring computer technology to aid in record keeping and mapping of pest or problem areas; (iii) providing aerial photographs to pinpoint controversial course design or corrections that were necessary; (iv) improving communication channels between county agents, university specialists, and turf managers; and (v) identifying research and extension needs, as well as providing on-site research and demonstration areas.

Quisenberry (1990) reviewed researches in the southeastern USA related to the evaluation of forage and turf grass germplasm for resistance to insect and mite pests is presented. Resistance to insect and mite pests has been found in genotypes of Barmuda grass (*Cynodon spp.*) centipede grass (*Eremochloa ophiuroides*) St. Augustine grass (*Stenotaphrum secundatum*) and zoysia grass (*Zoysia* spp.). Also Factors (i.e., fertilization, cultural condition, insect strain, dietary conditioning, assay methods) that influence the screening of germplasm for resistance to insects were discussed.

In Japan, Sato *et al.* (1990) studied the pertaining to the Insect-pests families of Noctuidae; Lepidoptera- attacking Grasses. And described their life cycles in the lawns-and-turf grasses.

Evans (1991) conducted a book of 10 chapters including all aspects of the construction and maintenance of modern cricket grounds, set in historical context by a survey of the development of the ground sman's art since the 18th century. The chapters dealt with the history of ground smashup and with the increasing role played by agronomists and other scientists in the study of cricket surfaces; the assessment of existing cricket tables; pitch preparation; mechanized maintenance operations; fertilizers and top dressing; weed, moss, worm and pest control; renovation and repair; care of the outfield; and the planning and construction of new grounds. In addition, seven significant scientific

papers were reprinted as appendices together with extracts from the rules currently governing cricket, which deal with the design, maintenance and management of the playing surface.

Potter and Braman (1991) studied the ecology and management of arthropod pests of turfgrass in North America. They reviewed in details the arthropod pests of turfgrass; and current status of their integrated pest management, which included discussions on insecticides, sampling, monitoring and risk assessment, biological control, cultural control, host plant resistance and prospects for integrated pest management.

Randell (1991) tabulated the recommended insecticides, their dosage and application suggestions for controlling home, yard and garden pests including pests of food, fabrics, structures, humans and animals, lawns, shrubs, trees, flowers and vegetables. It explained integrated pest management (IPM) and insecticide classifications. A small quantities conversion table, sources of insect information and a list of safety precautions were provided.

Villani and Nyrop (1991) studied the movement patterns of larvae of *Popillia japonica* and *Amphimallon majalis* the common insect pests of soil-turf grass, as influenced by gravity, host plant position and external disturbances in laboratory. It was shown that from 2nd- to 3rd -instar larvae just before pupation were monitored using radiographic techniques. Neonate larvae were monitored using destructive sampling. The results demonstrated significantly different movement patterns between species and among age groups. The development stage of the larva had a large effect on behaviour of *P. japonica* and a measurable, but lesser effect, on that of *A. majalis*. All larval stages of *A. majalis* and all larval stages of *P. japonica*, except neonates and post over wintering 3rd-instar larvae, displayed a downward movement in response to disturbance. Neonate larvae of *P. japonica* showed little movement while post over wintering. *P. japonica* moved upward when disturbed. Larvae of *A. majalis* of all age classes displayed random vertical movement with some arrestment in or near sod. Preoverwintering and post over wintering 3rd-instar larvae of *A. majalis* showed less dramatic arrestment behaviour than other instars tested. Second-instar larvae of *P. japonica* behaved similarly to those of *A. majalis*; however, 3rd-instar larvae behaved very differently. All 3rd-instar larvae except those tested in late winter and early spring showed some innate downward movement in the soil microcosms. *P. japonica* tested in late winter displayed random movement with some arrestment in sod, whereas those tested in early spring exhibited upward movement and arrestment in sod.

Myburgh (1992) illustrated the principles of preliminary identification of pest problems by plant type roses, carnations, bulbs, protea, aloe, shrubs and trees, and lawns and sports fields and specific descriptions of pests and damage by pest type flower- and leaf-eating beetles and lepidopterous larvae, leaf miners, bud and bulb flies, galls, stem and seed borers, aphids, whiteflies, thrips, soft scales, mealybugs, armoured scales, mites, and ground-level and underground pests.

Sarazin (1992) mentioned that the compilation of contributions from research stations in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia (Canada). Information for 1991 on the most notable insect