

Field Agrarian Survey for Tomato Leaf Miner Insect *Tuta absoluta* in Nineveh Governorate / Iraq

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Abstract

The tomato leaf miner (Meyrick) (*Tuta absoluta*) destroyed Tomato plants in the Northern, Middle and southern region of Iraq, it found in southern and Middle in 2008 before the northern of Iraq in 2010. Assesses the study the incident of the tomato leaf miner attack by using a survey of questionnaire in the affected Rabia region which consider agricultural area for Tomato located in the Northern part of Iraq by meeting 50 farmers to know the conditions of their spread, reproduction method, life cycle, size damage and control method. a case study of the insect nature were appears the pest attacks tomato leaves, stems, flowers, and fruits. The life cycle development stages of the insect under 15°C It takes 89 day and under 30°C takes 29 day, their spread was rapidly in the case of host presence and fit climate, It also attacks potato, eggplant and bean crops. Most feeding damage is done to the leaves and stems of tomatoes creating blotch leaf mines that are visible on both sides of the leaf. There can be several mines on a single leaf mines have dark frass, where assessed the size of damage in some farms for Tomato 100%. The biological review of *T. absoluta* was also conduct were found their activity is concentrated in the early morning and dusk; during the rest of the day they remain hidden among the leaves. The female lays the eggs mainly on the leaves, although they can also be found on stems and petals. Eggs are laid isolated, thus facilitating their distribution on the crop. The number of eggs per female is usually between 40 and 50 and may reach 260, for the insect four stages (egg, larvae, pupa and adult). It became clear that the harmful phase was larva stage. Responses to questionnaires were presented. It appeared that knowledge of farmers on pests and management procedures was few. The results showed that farmers were not properly oriented on pest reporting, and many farmers were unaware of the existence of programs pest support. Pest monitoring programs and post attack response systems were found inadequate. Many farmers perceived that the pest was new while some respondents reported that similar attacks occurred on farms in the previous year in southern and Middle of Iraq. We found a lacuna in the control program that could be exploited by *T. absoluta* pest to repeated attack on

crops by the reason of their acquired immunity against insecticides in Rabia agrarian region for Tomato . That clear the insect owns ability to damage all Tomato fields in rapid form by their fast reproduction and presence of host .Through the survey of farms clear applying control program was used by follows several means, such as the pheromone trapping for males, which showed its superiority in reducing the incidence 40-50%, the pesticides which used were Biolitrol benzoate , Abamectin and Alto extra reduced the incidence 75- 80% , by using above pesticides alternately each 10 days.
Key words: Tomato, *Tuta absoluta*, survey, Nineveh, Iraq.

Introduction

Tomatoes are one of the most important crops in Iraq their cultivation in large areas, are grown in various parts of Iraq particularly in the areas of Rabia, Beiji, Samarra and southern Iraq in Zubair , Safwan region, which estimated the area planted with tomatoes more than 6000 hectares[1]. The tomato crop was attacked in its growing areas by several insect pests and diseases pests, such as tomato leaf miner (Meyrick) which appeared in the summer of 2010 epidemiologically in many tomato cultivation areas of Nineveh governorate like Rabia .The original habitat of this insect was south America in particular Argentina [2]. The insect is rapidly spreaded along in the northern and southern of Mediterranean sea from which the insect entered Spain France, Malta and then the Maghreb countries (Morocco, Algeria and Tunisia) finally arrived in Lebanon , Jordan and from there moved to Syria, then stabilized in Iraq through March 2010. This rapid spread of the insect is a sign of high bio-potential for this insect, which enables it to continue and spread and losses In large form tomato farms which that are considers the main host of this insect, also attacks many plants of *Solanaceae* family such as eggplant , tobacco and potato in addition to many herbs[3]. The insect larvae attacks the leaves, stems ,fruits, and petal of flowers causes fast dehydration for leaves this leads to rot and deform of fruits also transfer the infection to other tomato fields[4]. due to the seriousness of this effect on tomato yield in rate (80-100%) the researchers used the Integrated Control Program to control this insect by using chemical pesticides such as Chlorfenapyr and Abamectin, Triflumuron with the use of Microbial pesticides like *Bacillus thuringiensis* in addition to use of pheromone traps[5,6]. the Tota insect

has been spreading in many South American countries for over a year 1970. *Global spread* this moth was first known as a tomato pest in many South American countries. In 2006 it was identified in *Spain*. The following year it was detected in *France, Italy, Greece, Malta, Morocco, Algeria and Libya*. In 2009 it was first reported from *Turkey* and the Syrian border. The advance of *T. absoluta* continued to the east to reach Syria, Lebanon, Jordan, Iraq and Iran. Further advances southward reached Saudi Arabia, Yemen, Oman and the rest of the *Arabian Gulf* states. In Africa, *T. absoluta* moved from Egypt to reach Sudan, South Sudan and Ethiopia from the east and to reach the Senegal from the west. It was reported in *Nigeria and Zambia*. [7,8]. In 2010/2011, appeared as a new pest that affecting both greenhouse and open field of tomato crops in Iraqi cities such as Basrah, Muthanna, Dhi Qar and Nineveh. By June the Iraqi Ministry of Agriculture confirmed that it had reached north of Iraq in Sulaymaniyah G. has rapidly spread across the Mediterranean region and has now reached South East Iraq. Crop damage from this pest can reach 100%. It feeds on many cultivars and weeds, which belong to the families of Solanaceae and Fabaceae. So far, 26 different plant species have been specified as host plants. It feeds mainly on tomatoes (*Lycopersicon esculentum* Mill.), potatoes (*Solanum tuberosum* L.), aubergines (*Solanum melongena* L.), peppers (*Capsicum annum* L.), some weeds (*Datura stramonium* L., *Lycium chilense* Coralillo, *Solanum nigrum* L., and *Nicotiana glauca* Graham) (Solanaceae) and beans (*Phaseolus vulgaris* L.) (Fabaceae) [9]. Besides their hosts in leaves, it also attacks the stem, fruit, and even flowers, and by this way it can cause damage of approximately 100 % of farms [10]. *T. absoluta* is considered a typical invasive species because of its capacity to develop very quickly on tomato farms and to spread rapidly in new areas causing economically relevant damage, Since the time of its initial detection, the pest has caused serious damages to tomato in invaded areas [11,12,13], It is currently considered a key agricultural threat to European, Middle East, North African Tomato production and part of Asia. Biologically the *Tuta absoluta* has a high reproductive potential and a life cycle that can take 24 - 76 days in some regions, depending on the environmental conditions. The harmful stage was adult; silvery gray with black spots on the forewings and a wingspan reaching 10mm, their activity is concentrated in the early morning and dusk; during the rest of the day it remain hidden among the leaves. Adult life span ranges between 10 and 15 days for females and 6–7 days for males. The female lays the eggs mainly on the leaves, although they can also be found on stems and petals. Eggs are laid isolated, thus facilitating their distribution

on the crop, the number of eggs per female is usually between 40 and 50 and may reach 260, Eggs are small 0.35mm long, cylindrical and creamy white to yellow, egg hatching takes 4-6 days. Young larvae are cream in color with a dark head, as they develop, the larvae become greener and slightly pink in the last, pupa may take place in the soil, on the leaves and other parts of the plant. The pupa is cylindrical and greenish when recently formed, later turning brown. It may be protected by a silky white cocoon[14]. Due to the recent entry of this insect to Iraq and its seriousness in the fields of tomatoes in the area of Rabia, so the present study aims at conducting a field survey for all the characteristics of the insect *Tuta absoluta* is a kind of moth belongs to family *Gelechiidae* known by the common names tomato leaf miner. the main host of insect was Tomato plant as well as attacking potatoes, eggplants, peppers and herbs from the same family The larva feeds on vegetative parts of plant with doing tunnels and pathways in the leaves, the insect can reduce 80-100% of the yield,

Materials and methods

This research was performed in the Nineveh governorate of Iraq in Department of Plant Production / Technical Institute / Mosul in the agricultural areas by Conducting field survey questionnaire for agricultural Rabia fields .The aim of study ; diagnosis of (Meyrick) (*Tuta absoluta*) insect, knowledge of the morphological and biological nature of the insect , their effect on Tomato plant , its spread and methods of control . The study assessed the incident of the tomato leaf miner by using a questionnaire survey in the affected region of Rabia agricultural area for Tomato in the Northern part of Iraq by meeting 50 farmers, appeared through study it was a new pest spread by epidemiologically form in summer 2010 by where that arrived the country from neighboring countries, conducted by support of agricultural companies in Nineveh governorate and relying on the publications on pesticides and contact with companies producing pesticides. The control program was identified and the nature of its spread in the agricultural season 2010 and the control program was applied on several methods: pheromone traps and chemical control using a pesticides such as of Biolitrol

benzoate 250 g / 400 liters of water , Abamectin100g /100 liters of water and Alto xtra 250 ml / 400 liters of water.

Discussion and Results

Nineveh province, located in the north western part of Iraq in the semi-arid region between the longitudes (41°-25) (44° -25) and latitudes (34° -55) (37° - 03) which occupy an area of 7323 km² affected by climate of the Mediterranean Sea. Was dominated by cold weather in winter and low temperature below freezing in the most days with snowfall in most areas and survival for a long period[15]. Rabia area characterized is agrarian region for their soil fertility , supply of irrigation water and suitable climate in especially which was planted by Tomato crop in chief form in summer season , where supply 80% from Iraqi of Tomato demands. Recently observed of degraded the production of Tomato by the reason of agricultural pests in special form by insects such as Meyreck Leaf minor where was a big problem in the region. so required a numerous attention for study this pest by all faces. Conducted this research we found ; identified the insect for the first time in the region of Rabia by date in summer 2010. *Tuta absoluta* has a high reproductive potential and a life cycle that can take from 24 to 76 days, depending on the environmental conditions. Adults are silvery gray with black spots on the forewings and a wingspan reaching 10mm. Their activity is concentrated in the early morning and dusk; during the rest of the day they remain hidden among the leaves. Adult lifespan ranges between 10 and 15 days for females and 6–7 days for males. The female lays the eggs mainly on the leaves, although they can also be found on stems and sepals. Eggs are laid isolated, thus facilitating their distribution on the crop. The number of eggs per female is usually between 40 and 50 and may reach 260. Eggs are small, 0.35mm long, cylindrical and creamy white to yellow. Egg hatching takes 4-6 days. Young larvae are cream in color with a dark head. As they develop, the larvae become greener and slightly pink in the last stage. Larval development goes through four stages and pupation may take place in the soil, on the leaves and even within the galleries or other parts of the plant. The pupa is cylindrical and greenish when recently formed, later turning brown. It may be protected by a silky white cocoon. The figure (1) explain the life cycle of the insect , its flight was in night will be hidden in day . The risk and damage of insects in the larvae stage on tomato leaves in greenhouses and open crops where the larvae feed on them and occur tunnels between the two surfaces of the leaf ,this insect develops on all parts of the plant above the soil

surface. The larvae feed on the leaves by digging tunnels and irregular passages between both surface of leaf. The surface of the leaf and later turn into dry spots as well as attack by secondary infects such as virus, bacteria and fungi. The Figure (2,3) *T. absoluta* caused 50-60% and 100% crop losses in tomato open fields in Rabia region. The study assesses the incident of the tomato leaf miner attack using a questionnaire survey in the affected regions which were Rabia agricultural area in the Northern part of Iraq by meeting 50 farmers, responses to questionnaires were presented, it appeared that knowledge of farmers on pests and management procedures was weak. The results showed that farmers were not properly oriented on pest reporting, and many farmers were unaware of the existence of programs pest support. Pest monitoring programs and post attack response systems were found inadequate. Many farmers perceived that the pest was new while some respondents reported that similar attacks occurred on their farms in the previous year by several insects. We found a lacuna in the control program which could be potentially exploited by agro-pests to inflict attack on crops in a new dimension, but there is no evidence of agro-pest in relation to attack on tomato by *T. absoluta* in Iraq in previous away. The results can be useful in developing the pest mitigation strategies in Iraq. This is clear where the insect has the ability to destroy all tomato fields in rapid form through its rapid reproduction and presence of host. Clear the application of the control program using several means, this requires the use of integrated control program of different types of pesticides to ensure the insect does not develop and prevent immunity against pesticides. The study concluded that repeated spraying every 10 days by several pesticides in the agricultural season gave positive results in reducing insect spread and development. It noted the weakness of activity of the insect in the hot and cold climates and was increased during the moderate climate. Table (1) shows the days number of completion the insect life cycle between the temperature 15-30°C. the control program was applied on several methods: pheromone traps and chemical control using a pesticides such as of Biolitrol benzoate 250 g / 400 liters of water, Abamectin 100g / 100 liters of water and Alto xtra 250 ml / 400 liters of water, the spraying was carried out in the larvae stage, which is the harmful phase of the insect. The activity of the insect was at night in dark period and the peak activity of insect was during September and October to suit the moderate climate for its activity, as it entered

the stagnation(dormancy) stage in high and cold temperatures. ,where the proportion of eradication reached to insects 75-80% in the last spray as in table(2) .

Temperature	Development stages of the insect in days					Life cycle
	Egg stages	Larva	Development / day		Adult	
15°c	10	36	Pupa	20	23	89
30°c	4	22		5	9	29

Table (2) Effect of alternately repeated spraying in eradication the the insect %

spraying Number	Eradication of insect%
First(A)	1-10%
Second (B)	20-30%
Third (C)	30-40%
Fourth(A)	40-60%
Fifth (B)	60-75%
Sixth(C)	75-80%

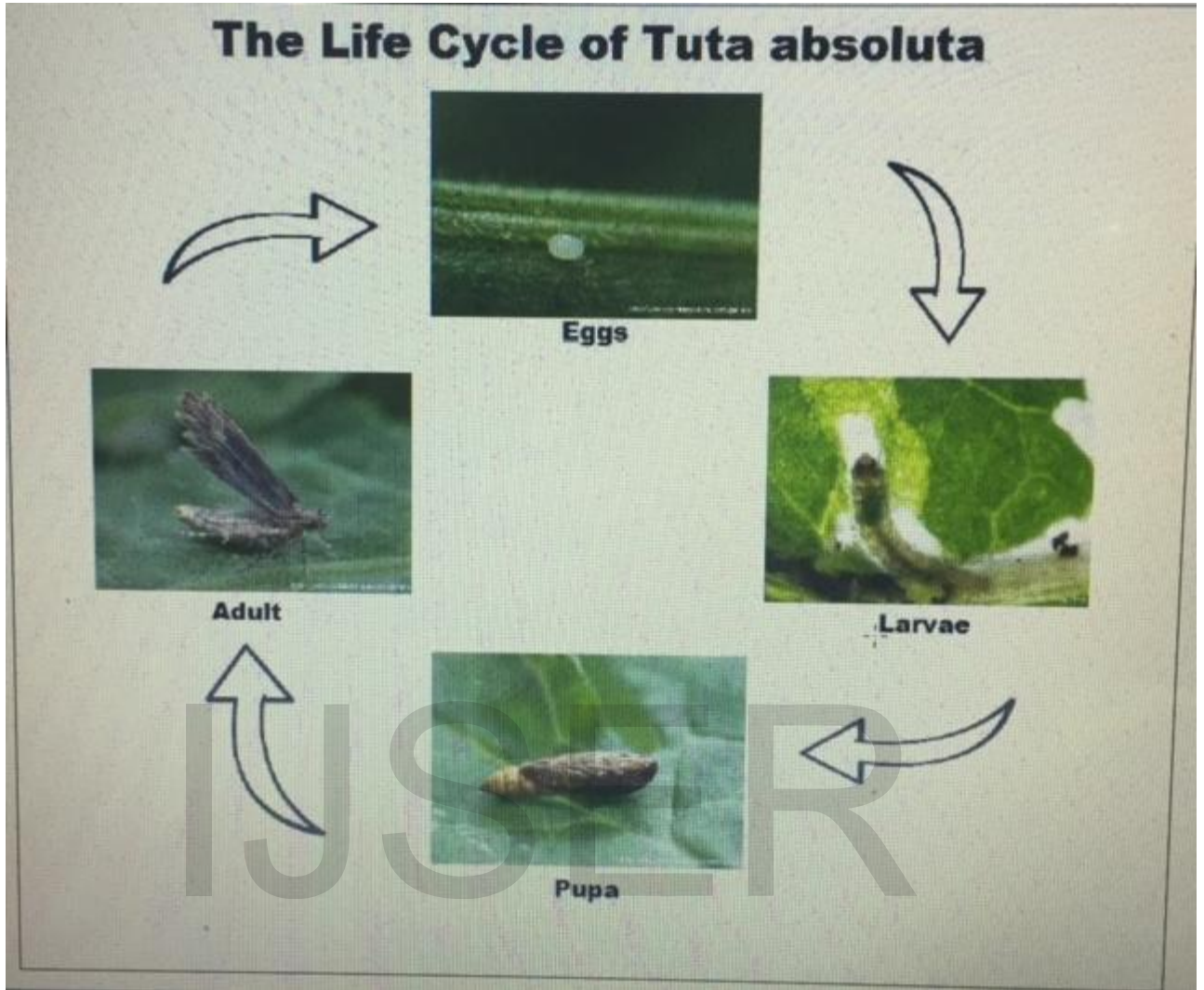


Figure (1) Life cycle of *Tuta absoluta* insect



Figure (2) *T. absoluta* caused 50-60% crop losses in tomato open fields in Rabia region



Figure3) *T. absoluta* caused 100% crop losses in tomato open fields in Rabia region

Tuta absoluta is a very challenging pest to control. Effectiveness of chemical control is limited due to the insect's nature of internal plant feeding as well as its rapid capability to develop insecticide resistant strains. The use of **biological controls** are still largely under development and not yet ready to combat this pest in a cost effective way. Pheromone traps can be used as an early detection tool. Mass trapping and lure and kill application of pheromone has been found to be effective to control *Tuta absoluta* somewhat but not complete control so require follows the precautionary approach .

Recommendations

There are a number of cultural control measures that aid the eradication of this pest. Crop rotation, crop residue removal and the selective removal and destruction of infested plant material are important practices that help eradicate this pest in greenhouses. Wild host plants in infested areas should be removed and destroyed, to prevent the buildup of a potential population reservoir. All infested plant material should be removed and disposed of in a phytosanitary secure manner. Farmers are currently advised to adopt the antivirus ventilation screens to screen or cover all other entry points into

greenhouses and to control the insects with pheromone traps. Treatment of the soil before planting the crop. Swelling the soil to get rid of the leaves of the infected leaves, get rid of the fruits and plants infected. Continuous monitoring of the field. The use of healthy seedlings, continuous control of weeds, closing of plastic houses with the use of nets on the doors.

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