STUDIES ON CERTAIN INSECTS PESTS INFESTING SOME GRAMINACEOUS FIELD CROPS

BY

AML ZAKARIA NOUR EL- DIEN Al-HABASHY

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AML ZAKARIA NOUR EL- DIEN Al-Habashy

B. Sc. Agric, (Economic Entomology) Fac. Of Agric., Zagazig Univ., 1992
M. Sc. Agric, (Economic Entomology) Fac. Of Agric., Zagazig Univ., 2001

Under the Supervision of:

Assistant Prof. Dr. METWALLY MOSTAFA HATTAB

....

Prof of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Moshtohor Banha University.

Assistant Prof. Dr. REDA EL-SAED MOHAMED OMAR

....

Prof. of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Moshtohor Banha University.

Prof. Dr. ALY MOURSY SOLIMAN HEGAB

....

Prof. of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Zagazig University.

Prof. Dr. ALY MAHMOD SOLIMAN

....

Prof. of Economic Entomology, Plant Protection Research Institute, Dokki, Giza.

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APPROVAL SHEET

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AML ZAKARIA NOUR EL- DIEN Al-Habashy

B. Sc. Agric (Economic Entomology) Fac. Of Agric. Zagazig Univ.,1992
M. Sc. Agric, (Economic Entomology) Fac. Of Agric., Zagazig Univ., 2001

This thesis for Ph D. degree has been Approved by:

Prof. Dr. IBRAHIM I. MESBAH I. Mesbah ....

Prof. of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Tanta University.

Prof. Dr. FARIS AMIN MOHAMED El-LAQUAH

Faris El-Laquah ....

Prof of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Moshtohor Banha

Prof. Dr. ALY MOURSY SOLIMAN HEGAB

Aly M. Hegab ....

Emeritus Prof. of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Zagazig University.

Assistant Prof. Dr. METWALLY MOSTAFA HATTAB

M. Khattab ....

Ass. Prof of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Moshtohor Banha University.

Assistant Prof. Dr. REDA EL-SAED MOHAMED OMAR

R. El-Sayed ....

Ass. Prof. of Economic Entomology, Department of Plant Protection, Faculty of Agriculture, Moshtohor Banha University.

Date of examination: 28 / 7 /2008

Abstract

The present work was conducted to survey some homopterous insects (aphids, leafhoppers, and planthoppers) infesting certain graminaceous field crops (maize and wheat) also the seasonal abundance of the aforementioned dominant species, the ability of *Rhopalosiphum maidis* to transmit Barley yellow dwarf virus, effects of some agricultural practices(sowing dates ,varieties and fertilization levels) and relationship between host plant, chemical contents and the infestation with certain homopterous insects influenced by the epidermal plant cell thickness and its effect on insect infestation was also considered .

1-Survey Studies could be summarized as followes:

a)Aphids

The following aphid species were collected from maize and wheat *Rhopalosiphum maidis* , *Rhopalosiphum padi, Schisaphis graminum, Sitobion avena* and *Aphis gossypii.*

b)Leafhoppers and planthoppers

The following leafhoppers and planthoppers species were collected from maize fields *Empoasca decipiens, E decedens*, *Cicadulina chinai*, *Balclutha hortensis* , *C bipunctella zeae, Sogatella furcifera and S vibix*

2-Seasonal abundance of dominant homoptrous insect species infesting maize and plants.

The obtained results were summarized as follows: Aphids (*R maidis, R padi* and *S. graminum*) showed one peak on maize and wheat but *A. gossypii* recorded only one peak on maize. Whereas leafhoppers and planthoppers; *E decipiens* recorded two peaks on maize while it showed one peak on wheat.; *E decedens* recorded two peak on maize and one peak on wheat ;*C chinai* has one peak on maize; *B. hortensis* recorded one peak on maize; *S furcifera* recorded one peak on maize ; *S vibix* recorded one peak on maize.

3:Effect of certain climatic factors

The effects of Maximum temperature and minimum temperature on the population density of dominant homopterous insects infesting some cereal field crops were higher than that of relative humidity

4-Effect of certain agricultural practices on population density of certain insects (Aphids, Leafhoppers and planthoppers)

The second sowing date (end of May) and (Mid of November)in case of maize and wheat respectively with Singie cross 18 maize variety, and sakha 61 wheat variety showed lowest mean number of insects per sample

5-Effect of chemical contents of maize and wheat plants

Positive correlation was found between total protein % ,carbohydrate % and insect populations while there was a negative correlation between pH values and insect populations.

6-Effect of potassium fertilization on leaf epidermal cell thickness

The thickness of leaf cell measurements revealed that increasing the amount of potassium resulted in considerable increase in the thickness of epidermal plant cell and pronounced reduction in the population density of aphids, leafhoppers and planthoppers .

7-Transmission of Barley Yellow Dwarf Virus by Aphids

R maidis has ability to transmit the virus to maize plants. The acquisition threshold feeding periods ranged between 1 hrs 2 days; Incubation period in insects ranged between 48-96 hrs while it was 18 - 25 days in celery; Inculcation threshold feeding period ranged between 48 - 96 hrs.

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CONTENTS

LIST OF TABLE

LIST OF FIGURES

1-INTRODUCTION

Graminaceous (maize and wheat plants) are considered the most important crops which use as human food in Egypt and abroad because of its value for structure of human body and provision with vitamins and mineral salts. During the recent years, the cultivated area of these two crops have noticeably increased in an a attempt to cover the needs of local consumption.

As a result of the expansion of cultivated graminaceous plants the problems of insect pests have been increased. In the last years graminaceous plants were subjected to attack by a large number of insect pests throughout the growing seasons. **Hegab *et al.*,(1987-1988) Hegab-Ola(1997-2001)**. Among these pests, certain homopterous insects such as aphids, leafhoppers and planthoppers are of great economic importance which causes serious damage either directly by sucking plant juice or indirectly as vectors of virus diseases **Hegab-Ola(1997-2001)**. Therefore, the scope of the present study was contributed towards more knowledge on the following points: -

1- Survey and seasonal abundance of certain homopterous insects (aphids, leafhoppers and planthoppers) infesting some graminaceous crops (maize and wheat plants).

2-Effect of certain climatic factors (temperature and relative humidity) on the population density of the dominate homopterous insects infesting the two graminaceous crops.

3-Effect of certain agricultural practices (Sowing date, Varieties and Fertilization) on the population density of the aforementioned insects.

4- Relationship between certain chemical contents of certain graminaceous plant varieties and aphids, leafhoppers and planthoppers infestation.

5- Effect of fertilization on the thickness of plant epidermal cells and its relation with the population density of homopterous insects.

6-The role of aphid *Rhopalosiphum maidis* Koch as vector insect of barley yellow dwarf virus from infected maize plants (BYDV).

2. REVIEW OF LITERATURE

2.1. Ecological Studies

2.1.1. Survey and population abundance of some homopterous insects (aphids, leafhoppers and planthoppers) on certain graminaceous field crops

2.1.1.1. Aphids.

2.1.1.1.1. Survey and seasonal abundance of some aphids infestation on certain graminaceous field crops

Hassan (1957) recorded the corn leaf aphids Aphis maidis (Fitch) on maize , wheat and barley plants. **Wheatly (1961)** in Kenya reported that Aphis maidis (F.) infested maize plants. **Tawfik et al.(1974)** revealed that *R. maidis* occurred from the beginning of August till mid of October.

Suss (1978) found that the commonest insect pests on wheat were the aphids *Sitobion avenae* (F.), *Rhopalosiphum padi* (L.) and *Metopolophium dirhodum* (Wlk.) and the chrysomelid beetle Oulema melanopus (L.) (Lema melanopus), and those on maize were the noctuids *Agrotis ipsilon* (Hfn.) and *Rhyacia sp.*, the *pyralid Ostrinia* nubilalis (Hb.), and elaterid beetles of the genus Agriotes.

El– Hariry (1979) found that the planting during the period from March 15th to May 15th seemed to be free from aphid infestation until harvesting .He also noticed that the highest infestation occurred when the plants were 69 to 79 days old grown on early July. He found a correlation between length of infestation period with aphids and date of planting.

Suss and Colombo (1982) in Italy mentioned that spring cereals, such as barley, immediately on sprouting became infested by aphids that had multiplied on maize. In the autumn, aphids (especially *Sitobion avenae* (F.) and *Rhopalosiphum padi* (L.)) infested the basal leaf-sheaths of maize, from which they migrated to the tender shoots of well-fertilized wheat and barley when the maize plants dried up. Barley, oats and wheat were especially subject to aphid attack in April-May after mild weather in February and March, but damage did not become apparent until flowering or, more usually, until the heading stage.

Groot *et al.*, (1984) mentioned that the peak of population of *R. padi* L. *Metopolophium dirhodum* Walk, and *Macrosiphum (Sitobion) avenae* (F.) occurred during late July and early of August on maize plants.

Abd–Alla (1985) mentioned that the maize, barley, wheat was hosts for *R. maidis*. The aphids were found on the tassels and tender rolled leaves, after that they transferred to the upper leaf sheaths, among hunks of ears and existed in very low numbers on the lower surface of some leaves. In the heavy infested plants, the aphids were found on all parts. Barley plants were infested by *R. maidis* (Fitch) from 25th November to 25th April. The maximum mean numbers (72.4 aphids / tiller) was recorded in 10th March, while the plants leaves, its sheaths and spikes were infested. Within, the growing seasons of wheat plants from 10th December to 25th April, the infestations appeared at 25th January and increased in numbers to a maximum (17.5 aphid / tiller)at 10th March and it decreased again to (4.7 aphid / tiller) at 10th April . The aphids occurred in hearts leaf sheaths and spikes of the plants.

Kuroli and Nemeth (1987) monitored aphids on five crops in western Hungary in 1986. Numbers of aphids on the plants increased in the 1st half of the breeding season, and the numbers per a plant averaged 13.72 on winter wheat, 58.92 on maize, 28.40 on broad bean (Vicia faba). In the 2nd half of the growing season numbers declined, and drought conditions in May – October no swarming aphids could be gathered. The dominant species on wheat and maize was *R. padi*.

Coderre and Tourneur (1988) investigated the abundance of the aphids *R. maidis*, *R. padi* and *Sitobion avenae* on maize, in southern Quebec in 1978- 1982. The two species of Rhopalosiphum were the dominant aphids, and emigration bimodal seasonal distribution, with a decrease in abundance at the end of July. Climatic factors and emigration could not explain this decrease, and it was suggested that it was related to diminished plant nutritional quality and an increase in predation.

Hegab *et al.*, (1988) mentioned that abundance and flight activity of certain aphids infesting maize plants growing in newly reclaimed sandy areas at Salhia district, Egypt were studied during 1986 and 1987 seasons by using pan yellow traps, sticky board traps and plant sampling techniques. They pointed out that the dominant aphid species infesting maize plants were: *R. maidis* (Fitch) *R. padi* (Linne). Few numbers of *Macrosiphum avenae* (Fabri) and *Schizaphis graminumi* (Rond) were collected by yellow pan traps and sticky board traps. The flight activity of the dominant aphid species showed that *R. padi* had one peak in October.

Popov *et al.*, (1988) indicated that during surveys of aphid pests of wheat and barley throughout Romania in 1980-85, 14 species were recorded, the most important of which were *Rhopalosiphum maidis, R. padi, Metopolophium dirhodum and Sitobion avenae.*

Henry and Dedryver (1989) mentioned that in western France in 1985- 87 *M. avenae* was presented in maize field from early June, members were maximal in late July, and the aphids disappeared in August. Number of *R. padi* fluctuated differently each year: in 1985 and 1986 they were very low in early July, increased appreciably by the end of August, and in 1985 reached very high levels in September. In 1987 *R. padi* colonized the field from July, reached a maximum in August, but was no longer abundant in September – October. For all aphid species, there was a good correlation between weekly counts on maize and corresponding suction trapping of alates.

Kurppa (1989) reported that a widespread questionnaire survey during an outbreak of the cereal aphid *Rhopalosiphum padi* in Finland in 1988 showed that peak numbers varied between 20 and 60 aphids per plant.

Pons *et al.*, (1989) mentioned that the population density of aphids remained low in July and August; numbers were again high in September. *R. padi* being the most common species.

Youssef (1990) found that *R. maidis* infestation in maize fields occurred as early June and July. The mean numbers of *R. maidis* increased gradually from early August to the 3rd week of September. The level of infestation began to decrease gradually as from about the end of September.

Abd El – Rahim *et al*, (1991) reported that maize plants were not attacked by *R. maidis* when it was planted during the period extending from mid – April until mid – May. The first signs of aphid infestation were recorded on the maize plants during plantation of the first June.

Ali *et al.,* (1991) monitored in Egypt the seasonal abundance of *S. graminum* and *R. padi* on wheat during 1988-1990. The numbers of aphids per a tiller averaged 46 – 165 in 1988, 98 – 422 in 1989 and 15 – 277 in 1990. The number of both species reached its peak in late of February in 1988 and in the first half of March in 1989 and 1990. Aphids of both species were most abundant on the 2nd and 3rd leaves whereas the oldest leaves were colonized by fewer aphids. Stem (leaf sheaths) and ears were the least colonized parts by *S. graminum*, whereas *R. padi* was more frequent on stems. Changes in populations from year to year and in distribution on the plants were noticed.

El-Hag and El-Meleigi (1991) mentioned that insect pests of spring wheat were surveyed in Central Saudi Arabia in 1986-87 and 1987-88 in 50 and 8 randomly selected fields, resp., using light-traps, sweep-nets and direct counts. In pre-sowing surveys, 25 potential wheat pests in 11 families and 6 orders were recorded, including 3 noctuids recorded for the first time from Arabia. Post-sowing surveys confirmed that *Schizaphis graminum*, *Rhopalosiphum padi* and a new species of cereal leaf miner in the genus Agromyza were major pests of wheat in the area. The latter pest dominated during the seedling stage, while the former 2 peaked after booting. Thirty-eight potential wheat pests in 14 families and 8 orders are reported.

Hashmi *et al.,* (1991) reported that a wheat aphid survey was carried out in the North Western Frontier Province and Punjab, Pakistan, during 1990-91. *Sitobion avenae* and *Rhopalosiphum padi* were the species most frequently recorded.

Aphids were more abundant in humid areas and areas shaded by trees. All wheat varieties were infested by aphids, but infestations were below the economic threshold level.

Kuroli and Nemeth (1991) in Hungary mentioned that favorable temperature prevailed in the 2nd week of June, and high relative humidity favored aphid multiplication, and swarming peaks were observed on 27 July. In response to maximum temperature of 30 °C at the beginning of July, aphid numbers fell almost to zero.

Barro (1992) found that in 21 trap locations across South Australia in 1989, *Rhopalosiphum padi* was the most commonly trapped species of cereal aphid. *Metopolophium dirhodum* and a species of Sitobion near *S. fragariae* were rarely trapped at any of the locations other than the Waite Institute. The trap catches of *R. padi* peaked twice. The first, an autumn peak, began in late April and continued through until the end of May, coinciding with the production of alatoid nymphs in perennial grass pastures. The second, winter peak commenced in July and continued through to the end of sampling (late September), coinciding with alatoid nymph production in annual volunteer grasses and wheat crops. *M. dirhodum* and *S. near fragariae* had only one peak, which occurred in winter-spring.

Sekkat and El-Bouhssini (1992) in Morocco in 1979-89, indicated that the most frequently encountered aphids were *Rhopalosiphum padi*, *Schizaphis graminum* and *Sitobion avenae*. In 1980, alate aphids appeared in the fields in the 2nd week of February and disappeared by mid-May. The relatively small size of the infestations that occurred were attributed to the activity of natural enemies such as *Aphidius ervi, A. matricariae, A. rhopalosiphi, Praon volucre* and *Coccinella septempunctata*.

Abd El- Salam (1993) mentioned that *R. maidis* (F.), *R. padi* (L.) and Aphis *gossypii* (Glover) were collected throughout the maize growing season in different regions in Egypt. These aphid species were found to vary in the time appearance, site and degree of infestations as follows: 1- The corn leaf *R. maidis* proved to be the most injurious and dominant on maize plants. Field observations showed that its infestation began prior the appearance of tassels in the furled leaves of maize plants after about 35 – 45 days from planting date.In all counts, infestation by this aphid was always high in population in the summer plantation that in the Nili plantation. Occurrence of this species on maize plants continued for 6-9 weeks according to planting date 2. The oat cherry bird aphid *R. padi* (L.) proved to be the second species of aphids infesting maize plants. It always attacks the lower surface of the unfurled leaves and the cab- husk especially around the third middle region of the plants. Occurrence of this aphid began after 15 days from the appearance of *R. maidis* i.e., after about 45 – 52 days from planting date.

Hussein (1993) studied the abundance and population dynamics of cereal aphids (*S. avenae, R. padi* and *Metopolophium dirhodum*) in wheat. He reported that the abundance of each species occurred with the emergency of grain ears at the beginning of the flowering period, after which population fell rapidly. Aphids preferred to feed on the wheat variety (Gesira 17) compared to (Maxiki)

Fatema *et al.*, (1995) indicated that cicadelloidea infesting various crops, grasses and vegetables were collected from different localities of North Western Frontier Province, Pakistan, during July 1991 to June 1992. A study of 700 samples showed that nearly 75% of the total number of insects belonged to the Cicadelloidea. Greatest numbers were found on grasses and lowest numbers on maize. The most numerous species was Psammotettix swatensis.

Li *et al.*, (1995) reported that systematic observations in situ and general surveys in 1991-94 on wheat aphids in fields in Gangu County, Gansu, China, showed that these were mainly *Schizaphis graminum, Macrosiphum avenae* [*Sitobion avenae*], *Rhopalosiphum padi* and *Acyrthosiphon dirhodum* [*Metopolophium dirhodum*]. *S. graminum* was dominant and mainly infested the abaxial surfaces of the wheat leaves. Populations of *S. avenae* increased gradually after heading. All 4 species were observed in January and showed peak occurrence in early June.

Aldryhim and Khalil (1996) mentioned that aphids were collected from colonies during a number of surveys carried out between October 1988 and April 1995, mainly in the Riyadh, Asir, Tabuk and Jizan areas of Saudi Arabia. Sixty-one aphid species and subspecies were recorded from 30 genera representing four subfamilies. Six species represented new records for the Arabian Peninsula and sixteen species were recorded for the first time in Saudi Arabia. The most common species were *Aphis gossypii, A. craccivora, Myzus persicae* and *Macrosiphum euphorbiae*. The most common aphid hosts were species of Poaceae, Fabaceae, Asteraceae and Solanaceae. Plant species were typically infested with one to seven aphid species. *Triticum aestivum* [wheat] was infested by seven aphid species.

Petrovic (1996) in Russia recorded ten aphid species on winter wheat in the region of Belgrade during 1989-1991. The aphid species were found on the upper parts of cereal plants, *S. avenae* being the most frequent species on all cereals, followed by *M. dirhodum* and *R. padi*. The most abundant species on winter wheat in the region of Belgrade were *S. avenae* and *M. dirhodum*. Aphids fed from mid-April to the end of June, with the greatest infestations being observed during early June (2.4 – 17.4 aphids/tiller). *S. avenae* was relatively more abundant on edge plants, whereas *M dirhodum* was more numerous on mid-field plants.

Hegab-Ola (1997) in Egypt mentioned that cereal aphid species *R. maidis, R. padi, S. graminum, S. avenae* and *Aphis gossypii* were collected from maize, wheat and barley plants. On wheat and barley plants, one peak representing *R. maidis* (F) was recorded at the end of March. One peak occurred also on maize plants at the third week of September. *R. padi* (L) was represented by one peak at the end of March on wheat and barley and also one peak on maize at the beginning of October.

Peters *et al.*, (1997) reported that surveys were carried out to determine biotypes of *Schizaphis graminum* in Oklahoma wheat and sorghum fields in 1991 and 1992 and again in 1995 and 1996. Biotypes B, C, F, and G were present in wheat fields surveyed in March 1991, but 87% of the aphids were biotype E. In 1992, biotype I was detected in survey samples, but 88% of the aphids were biotype E. During the summer of 1995, aphids collected in sorghum fields in the panhandle counties of

Oklahoma were 58% biotype I, but only 32% biotype I in the southwestern Oklahoma counties sampled. In the spring of 1996, only 29% of aphids from wheat fields in 35 counties were biotype I.

Abou El-Hagag and Abdel-Hafez (1998) collected the cereal aphid species *R. padi* , *S. graminum* *R. maidis* and *S. avenae* from wheat field in southern Egypt. They represented 73.13, 19.24, 6.88 and 0.75 % and 65.19, 27.34, 6.78 and 0.69 % of the grand total of the 1995/1996 and 1996/1997 seasons respectively. The fluctuation of cereal aphid populations during both seasons was determined.

Basky (1998) reported that Aphid flight was monitored in 1990-96 using a Rothamsted type suction trap in the middle of the Great Hungarion plain. Cereal aphids were the most abundant species found. The first individuals were caught in May, and abundance was greatest as cereals ripened between 10 June and 30 June *R. padi* were caught over a short period during the summer while *M. dirhodum* and *S. avenae* were caught over a longer periods and *S. graminum* and *D. noxia*, in- between these two periods a part from *R. padi*, none of the cereal aphids were trapped in large numbers during autumn. In four years, the autumn peak of *R. padi* was higher than the summer peak, *R. padi* was the most abundant cereal aphid, except in 1990 when *S. graminum* was the main species followed by *S. avenae* and *M. dirhodum*. The number of *D. noxia* increased over the period of sampling rising from 31 in 1990 to 2030 by 1996.

Rustamani *et al.*, (1999) indicated that six wheat varieties (Kohinoor, Soghat, Mehran-89, Sarsabz, ZA-77 and Sindh-81) were sown according to replicated randomized complete block design. The results indicated that the infestation of *Schizaphis graminum* appeared during the 3rd week of December on all wheat varieties. The increase in aphid population build-up was gradual during the vegetative growth stage and aphids multiplied rapidly during the reproductive stage. A peak population was recorded during the 2nd week of February on all varieties except Sarsabz, where greenbug attained a peak in February on all varieties except Sarsabz, where greenbug attained a peak during the 3rd week of February.

Sanjay and Rand (1999) recorded that the *R. maidis* population started appearing on plants 3 weeks after sowing (mid-January) and reached a peak during the 7th week (mid-February). In 7th week the aphid population ranged from 61.7 to 14.6 aphids per tiller.

Jauset *et al.*, (2000) reported that Karyotype occurrence and plant associations of *Rhopalosiphum maidis* were studied in Catalonia, Spain (northeastern Iberian Peninsula), a region with a Mediterranean climate. Populations with 2n=10, 2n=8 and 2n=9 chromosomes were found, the latter being much less common. Aphids with the 2n=10 karyotype were found mainly on barley (Hordeum vulgare), Setaria verticillata, and Echinochloa crus-galli. It is suggested that the partial overlap of the life cycles of these plants allows aphids with this karyotype to complete their annual cycle on local plants. The aphids with nine chromosomes were mainly found on barley, whereas those with the 2n=8 karyotype were found mainly on sorghum (Sorghum bicolor) and johnsongrass (Sorghum halepense); and maize (Zea mays) was an unsuitable food source.

Mannaa (2000) reported that experiments on wheat in New Valley, Egypt, during the 1998 season revealed three identified aphid species inhabiting wheat plants. These are the green bug aphid, *Schizaphis graminum (*Rondani), the bird-cherry oat aphid, *Rhopalosiphum padi* (L.), and the corn leaf aphid, *Rhopalosiphum maidis* (Fitch.). *Rhopalosiphum padi* (L.) was the predominant aphid species in the New Valley. Flying aphids showed three swarming peaks on Jan. 10th, Feb. 17th and Mar. 3rd using sticky traps against two main peaks of abundance on Mar. 3rd and 17th using water traps.

Sandstrom (2000) mentioned that the *R. padi* were found in barley in Sweden. There was positive correlation between growth rates of *R. padi* and phloem amino acid concentration.

Stalmachova *et al.*, (2000) in southwestern Slovakia. mention that *Metopolophium dirhodum, Rhopalosiphum padi* and *Sitobion avenae* were found to infest maize. Aphids were present from the first days of June, and the peak of abundance was recorded during the second half of June.

Hegab-Ola (2001) in Egypt recorded that cereal aphid species *R. maidis* (F.), *R. padi* (L.), *S. graminum* (R.), *Sitobion avenae* (Fabr) and Aphis gossypii (G.) were collected from maize and wheat plants. The seasonal abundance on wheat plants of *R. padi* (L.)was represented by one peak at the end of March on wheat and also one peak on maize plant at the end of September. On wheat plants one peak of *R. maidis* (F.) was recorded at the end of March. One peak occurred also on maize plants at the second week of September.

Kazemi *et al.*, (2001) showed that russian Wheat Aphid was reported from East Azarbaidjan province (Iran) a few years ago and it is now widespread in Tabriz, Ahar and Kaleybar wheat fields.

Lhaloui *et al.*, (2001) reported that the Russian wheat aphid (*Diuraphis noxia*) had become a serious problem for production of cereals in Morocco. The damage had first been limited to high altitude regions, but lately, the pest had spread to all the cereal growing areas of the country.

Li- Su *et al.*, (2001) reported that in experiments conducted at Zhengzhou, Henan, China [date not given], the population of wheat aphids (*Rhopalosiphum padi and Macrosiphum avenae* [*Sitobion avenae*]) was found to be dependent on the resistance of different wheat cultivars.

Akhtar (2002) mentioned that the aphid population on wheat fields in Lahore, Pakistan, as affected by temperature and humidity, was surveyed from 9 January to 14 April of 1998. Two species of aphids viz., *Schizaphis graminum* and *Rhopalosiphum padi* were recorded infesting wheat in the experimental field. Aphid density peaked on 26 February. During this time, pests started moving from the leaves to the ears. A decline in the aphid population was recorded on 11 March followed by an increased on 27 March. Tabulated data are presented on the mean values of temperature and relative humidity during the duration of the experiment.

Favret and Voegtlin (2004) reported that suction traps were used to catch alate aphids and measure their relative diversity in adjacent but different habitats for five Augusts (1996-2000) in east central Illinois, USA.

Muhammad (2004) studied the population of aphid (*Schizaphis graminum*) on wheat cultivars/lines Inqalab-91, Iqbal-2000, MH-97, BWP-97, PND-1, Punjab-96, 2333, 2210, 2486, 2045, 2049 and 2460, during 2001-02 in Multan, Pakistan. Aphid population appeared on all cultivars/lines on 19 January and increased gradually up to 19 February 2002. Thereafter, the aphid population increased exponentially and reached its peak on 16 March 2002 on all the cultivars/lines. A sudden decline in the aphid population was recorded after 23 March 2002 and was totally eliminated on 6 April 2002.

Youssef (2006) reported that in Egypt cereal aphid species *R. maidis* (F.), *R. padi* (L.), *S. graminum* (R.), *Sitobion avenae* (Fabr) and *Aphis gossypii* (G.) were collected from maize and wheat plants. The seasonal abundance on maiz and wheat plants were studied *R. maidis* (F.): On maize plants, one peak was recorded at mid of August. One peak occurred also on wheat plants at the first week of March.*R. padi* (L.) was represented by one peak at the second week of August on maize and also one peak on wheat the first week of March.. *S. graminum* (R) was represented by one peak at mid – March on wheat plants. *A. gossypii* (Glov.) One peak was recorded on maize plants at the third week of August.

2.1.1.2. Leafhoppers and Planthoppers

Table (1): Leafhoppers and planthoppers recorded on some graminaceous plants in Egypt and other countries

Insect species	Country	Reference
1. Auchenorrhynchan insects reported on maize :		
Balclutha hortensis Lin.	Canary Isla., Cyprus Iraq, Medter. Reg.	Metcalf (1967)
	Giza, Egypt	Ammar & Farrag (1975)
	Giza, Egypt	El-Bolok, (1976)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Upper Egypt	Aboul-Ata, (1978, 1983)
	Sharkia, Egypt	Hegab *et al.* (1987, 1988)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
Dalbulus maidis (Delong & Wolcott)	Brazil	Waquil *et al.* (1999)
	Brazil	Zurita *et al.* (2000)
	America	Paradell *et al.* (2001)
	Brazil	Silva *et al.* (2002)
C. bipunctella zeae (china)	Tanzania, Kenya	China (1926)
	Giza, Egypt	Metcalf (1967)
	India	Rupell, (1969)
	Egypt	Herakly, (1970)
	Giza, Egypt	Ammar & Farrag (1975)
	Giza, Egypt	El-Bolok, (1976)
	Kafr El-Sheikh, Egypt	Khodeir, (1976)

	Upper Egypt	Aboul-Ata, (1978, 1983)
	Sharkia, Egypt	Hegab *et al.* (1987)
	Philippines	Catindig,*et.al.*(1996)
	Sharkia,Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
C. chinai (Ghouri)	Egypt	Herakly (1970)
	Giza, Egypt	Ammar & Farrag, (1975)
	Giza, Egypt	El-Bolok, (1976)
	Upper Egypt	Aboul -Ata, (1978,1983)
	Sharkia, Egypt	Hegab *et al.* (1987)
	Egypt	Sewify, (1994)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
C. mbila	Uganda	Downham & Cooter (1998)
	West Africa	Bosque-Perze & Buddenhagen (1999)
E. decipiens (Poali)	Egypt	Herakly (1970)
	Giza, Egypt	Ammar & Farrag, (1975)
	Giza, Egypt	El-Bolok, (1976)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul -Ata, (1978,1983)
	Sharkia, Egypt	Hegab *et al.* (1987)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
E. decedens (Paoli)	Sharkia, Egypt	Hegab *et al.* (1987)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
E. Teaniaticeps (Kir)	Greece, Hungary,	Metcalf, (1967)

	Italy, Spain, Tunisia	
	Giza, Egypt	Ammar & Farrag, (1975)
	Giza, Egypt	El-Bolok, (1976)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul -Ata, (1978,1983)
	Sharkia, Egypt	Hegab *et al.* (1987)
Neolimnus aegyptiacus (Mat)	Giza, Egypt	Ammar & Farrag, (1975)
	Giza, Egypt	El-Bolok, (1976)
	Upper Egypt	Aboul -Ata, (1978,1983)
	Sharkia, Egypt	Hegab et al. (1987)
Nephotettix modulatus(Mel)	Africa	Metcalf (1967)
	Giza, Egypt	Ammar & Farrag, (1975)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul -Ata, (1978,1983)
P. stiriatus (L.)	Yugoslavia	Bogova. (1968)
	U.S.S.R	Razvyazkina & Peidantsera (1968)
	Bulgaria	Kharizenova, (1970)
	Giza, Egypt	Ammar & Farrag, (1975)
	Giza, Egypt	El-Bolok, (1976)
	Upper Egypt	Aboul Ata, (1978,1983)
	Sharkia, Egypt	Hegab *et al.* (1987)
Recilia schimdtgeni (Wag)	Giza, Egypt	Ammar & Farrag, (1975)
	Giza, Egypt	El-Bolok, (1976)
	Upper Egypt	Aboul Ata, (1978,1983)
Fam : Delphacidae		
Deplacodes sp.	Giza, Egypt	Ammar & Farrag, (1975)

	Upper Egypt	Aboul Ata, (1978,1983)
Flactoya aglauros (Fen.)	Giza, Egypt	Ammar & Farrag, (1975)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
Peregrinus maidis (Ash)	Africa	Storey (1936)
	America	Damsteegt (1981)
	Venezuela	Lastra & Carballo (1985)
	Egypt	Ammar (1987)
	Mauritius	Doyle *et al.*, (1992)
Perkinsiella insignis (Di.)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul-Ata, (1978, 1983)
Sogatella furcifera (Hor.)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul-Ata, (1978, 1983)
	Sharkia, Egypt	Hegab *et al.*, (1987)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
S. vibix (Hop.)	Israel	Harpaz, (1966)
	Giza, Egypt	Ammar & Farrag (1975)
	Giza, Egypt	El-Bolok, (1976)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul-Ata, (1978, 1983)
	Sharkia, Egypt	Hegab *et al.* (1987)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
Toya nigeriensis (Muir)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt	Khodeir, (1976)

	Upper Egypt	Aboul-Ata, (1978, 1983)
Tropidocephala elegans (Co.)	Giza, Egypt	Ammar & Farrag (1975)
	Upper Egypt	Aboul-Ata, (1978, 1983)
Fam : Cixiidae		
Oliarus frontalis (Mel)	Giza, Egypt	Ammar & Farrag (1975)
	Giza, Egypt	El-Bolok, (1976)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
	Upper Egypt	Aboul-Ata, (1978, 1983)
Fam : Menoplidae		
Nisia atrovenosa (Leth)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt	Khodeir, (1976)
2-Auchenorrhynchan insects reported on wheat :		
Fam : Cicadellidae		
B. hortensis (Lindb.)	Canary Isl., Iraq	Metcalf, (1967)
	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
B. rufofasciata (Meri)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
C. chinai (Ghauri)	Giza, Egypt	Ammar & Farrag (1975)
	Egypt	Aboul-Ata, (1983)
C. bipunctella zeae (China)	India	Rupel, (1969)
	Giza, Egypt	Ammar & Farrag (1975)

	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
E. decipiens (Paoli)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
E. decedens (Paoli)	Sharkia, Egypt	Hegab-Ola (1997,2001)
	Sharkia, Egypt	Youssef (2006)
Exitianus teaniaticeps (Ki)	Grece, Italy	Metcalf, (1967)
	Egypt	Metcalf, (1967)
	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
Nephotettix modulatus (Mel.)	Africa	Ishihara, (1964)
	Giza, Egypt	Ammar & Farrag (1975)
	Egypt	Aboul-Ata, (1983)
Neolimnus aegyptiacus	Egypt	Aboul-Ata, (1983)
Psamotettix stiriatus (L.)	Sweden	Lindsten, *et a.,l* (1970)
	Giza, Egypt	Ammar & Farrag (1975)
	Egypt	Aboul-Ata, (1983)
fam : Delphacidae		
Sogatella furcifera (Hor.)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
Laodelphax striatellus	China	Liu Jiakui (1998)
S. vibix (Haur.)	Italy	Harpaz, (1966)
	Giza, Egypt	Ammar & Farrag (1975)

	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
Toya niegeriensis (Muir.)	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)
Flactoya agalouros	Egypt	Aboul-Ata, (1983)
Perkinsiella insiginis	Egypt	Aboul-Ata, (1983)
Fam : Menoplidae		
Nisia atrovenosa	Egypt	Aboul-Ata, (1983)
Fam : Cixiidae		
Oliarus frontalis Mel.	Giza, Egypt	Ammar & Farrag (1975)
	Kafr El-Shikh, Egypt.	Khodeir (1976)
	Egypt	Aboul-Ata, (1983)

2.1.2. Effect of certain agricultural practices (Sowing dates, Varieties and Fertilization) on the population density of the aforementioned insects

2.1.2.1. Effect of sowing date of maize and wheat on aphids, leafhoppers and planthoppers infestation.

Abdelrahim *et al.*, (1992) reported that the relative susceptibility of maize cultivars to *Rhopalosiphum maidis* and the effects of sowing dates and nitrogen fertilizer were studied in Egypt during 1989-90. Cultivars sown on 1 May had low infestation, with the greatest percentage of infested plants being recorded for cultivars sown on 1 June.

Attia, Shahinaz (1993) showed that maize plants planted during the period from 15th March to the first of May and after the 15th of August, were found to be free from aphid infestation until harvest time. The plants were infested only by *R maidis* For 8 weeks during the different planting dates at Giza Governorate. In Qualubia Governorate, the plants were infested by each of *R. maidis*, *R. padi* and *A. gossypii* during the first planting date (May 15th 1991). The infestation period was ranged between 6-9, 7-8 and 5-8 weeks in the case of *R. maidis*, *R. padi* and A. gossypii, respectively.

Timmer (1996) reported that in the spring of 1995 in Numansdorp, the Netherlands, aphids (*Rhopalosiphum padi* and *Sitobion avenae*) were controlled in winter wheat to prevent serious crop damage by barley yellow dwarf luteovirus (BYDV). At the time of the earliest treatment (24 Apr.), large numbers of aphids were present on wheat already showing BYDV symptoms. Sowing winter wheat after mid Oct. is recommended to avoid primary infestations by aphids.

Lowles *et al.*, (1997) mentioned that the results of a 3 years HGCA (Home Grown Cereals Authority) project to determine the use of aphid and virus dynamics to improve forecasts of barley yellow dwarf luteovirus risk were presented. A field experiment incorporating 4 sites and 5 sowing dates was designed to study the effects of sowing date on the number and species of aphid vectors (*Sitobion avenae* and *Rhopalosiphum padi*) of BYDV and on virus incidence in the crop. Results showed that temp. in the period after inoculation was critical in determining the final virus levels regardless of growth stage at inoculation, but that the younger the plants when inoculated, the higher the level of virus when mature. However, plants inoculated at a later growth stage were a better source for subsequent virus transmission by aphids than those inoculated at an earlier growth stage.

Pons *et al.*, (1998) evaluated that the efficiency of an autumn insecticide application and sowing date management for controlling aphid populations and reducing BYD [bratty yellow dwarf luteovirus] incidence on durum wheat.

Marzouk and El-Bawab (1999) conducted field experiments at El-Giza Research Station, Egypt, during two successive seasons (1995-97) to determine the effect of sowing date of barley on infestation by the corn leaf aphid (*Rhopalosiphum maidis* (Fitch) (Homoptera: Aphididae)) and yield components. Sowing dates were 23 November, and 8 and 23 December in the first season and 26 November, 11 and 26 December in the second. In both seasons aphids colonized barley plants in the early stages of their life were in small numbers. The mean total numbers of aphids/tiller in 1995-96 was comparatively low for the three sowing dates (5.52, 4.64 and 2.75, respectively) compared with 1996-97 (40.71, 23.46 and 13.68, respectively). Peaks of infestation occurred at mean weather conditions of 10-11°C and 63-73% RH. Grain yield was affected under heavy aphid infestation. The first sowing date had the highest significant values of biological and straw yield. The highest grain yield occurred during the second sowing date.

Abdel-Megeed *et al.*, (2000) determined the effects of sowing date (5 and 20 November, 5 and 20 December 1996), sowing rate (70, 85, 100 and 110 kg seed/feddan) and nitrogen rate (80, 100, 120 and 140 kg N/feddan) on the population density of wheat aphids in 20 cultivars of wheat in a field experiment conducted in Egypt during 1996-97. The number of *Rhopalosiphum padi* and *Schizaphis graminum* was highest in wheat sown on 5 November.

El-Naggar (2000) reported that maize plants sown on the 2nd week of May showed the lowest mean numbers of aphids during the two seasons of the study.

Wangal *et al.*, (2000) studied the effects of the date of sowing and insecticide sprays on aphid populations and barley yellow dwarf virus (BYDV) incidence in barley in Mau Narok, Kenya.

Hegab- Ola (2001) mentioned the effects of the date of sowing on maize plants she reported the second sowing date (end of May) showed the lowest mean numbers of insects (Aphids, leafhoppers and planthoppers) followed by the third sowing date (mid of June) while the first sowing date showed the highest mean numbers of aforementioned insects. While the date of sowing on wheat plants in the second sowing date (The mid of November) showed the lowest mean number of insects per sample followed by the third sowing date (end of November) while the first sowing date (first of November) showed the highest mean numbers of insects per sample.

2.1.2.2. Susceptibility of plant varieties of graminaceous to aphids, leafhoppers and planthoppers infestations.

Valencic *et al.*, (1992) reported that during a field trial in the former Yugoslavia in 1990, 71 varieties of wheat were tested for resistance to aphids using the Banks scale (1-4). The varieties 'Osk 4.40/2' and 'Tangujovka' had a rating of 0, 13 varieties scored a 2, 2 varieties scored a 3 and none were given a rating of 4. The predominant aphid species was *Macrosiphum avenae* [*Sitobion avenae*].

Caillaud *et al.*, (1995) mentioned that the behaviour of *S. avenae* (F.) on resistant wheat lines of *Triticum monococcum* (L.) and a susceptible variety of *T. aestivum* (L.) firstly stylet penetration activates were monitored with the Electrical Penetration Graph (EPG) technique and subsequently analyzed using flow charts combined with correspondence analysis. Plant resistance was shown to be associated the xylem or the phloem and with numerous failures in starting a sustained sap ingestion. Access to sieve elements of the phloem did not seem to be much affected on resistant plants but it took the aphid three times as long to produce a sap ingestion pattern when maintained on the resistant line *T. monococcumn* 44 (Tm 44) as compared with aphids maintained on susceptible plants.

Liu *et al.*, (1996) recorded that *D. noxia* occurred in a wheat growing area in Xinjiang, China. Investigation on 197 wheat varieties showed that the wheat varieties Mg 4537 Mg 7458, Mg 8786, Mg 8256 and summer wheat (*Triticum dicoccum*) had the lowest natural susceptibility to the aphid, and Maodatou, Hongfuer, Mogudaosui, 2432- 15-0-21 and gaomaobei were more susceptible. *D. noxia* did not cause heavy yield losses in wheat in Xinjiang, because the main cultivated varieties were resistant.

Niraz *et al.*, (1996) in Poland mentioned that during 1976-94, the natural resistance of cereals to the grain aphid *S. avenae.* Two resistant (Grana and Saga) and 2 susceptible (Eimica and Liwilla) wheat cultivators were selected for detailed study of resistance mechanisms. Antibiosis was identified as the main component and lack of acceptance as the minor component of resistance.

Havlickova (1997) analysed five winter wheat cultivars (Hana, Regina, Sparta, Viginta and Zdar) for their level of tolerance to the cereal aphids *Metopolophium dirhodum, R. padi* and *S. avenae* infestation under green house conditions. The individual aphid species differed in their effect on seed weight of wheat cultivars. A joint evaluation of all cultivars proved the losses in seed weight caused by all aphid species to correlate positively with aphid densities and dry mass production per tiller (ear). Comparison of losses in seed weight of individual cultivars related to 1mg of aphid dry mass production showed differences in the level of tolerance (sensitivity) to aphid feeding among the cultivars tested. A high level of tolerance to *M. dirhodum* and *R. padi* was found in Regina and zdar and to *S. avenae* in Hana. Sparta was the only sensitive (intolerant) cultivar to all aphid species. Tolerance as a component of plant resistance to cereal aphids was discussed.

Michels *et al.*, (1997) mentioned that biotype E of *S. graminum* was reared through three generations on resistant winter wheat germplasum line, TXGBE 273, that differed genetically from the susceptible wheat cultivar TAM 105, at the Gb2 and Gb3 aphid-resistance loci, showed a significant reduction in total number of nymphs produced per adult. The nymphal period for the same aphid reared on TXGBE 273 was significantly longer than for those reared on TAM 105.

Youssef *et al.*, (1997) carried out field and laboratory studies during 1990-95 in Egypt to evaluate 200 wheat lines for resistance against *S. graminum* and *R. padi*. Three to four cycles of selfing and selection were sufficient to combine aphid resistance with medium height and high grain yields. A greenhouse study of 1042 wheat lines from completely new crosses showed that 15 lines were resistant and 12 lines were tolerant at the seedling stage.

Li-Su *et al.*, (1998) found that the wheat varities chul (1497), kok (1679), jpo, awnless zhong4, L1, Zheng Zhou 831, Beijing 10 and Luofulin 10 had relatively high resistance to the aphid *Sitobion avenae*.

Abdel-Hafez and El-Hagag (1999) evaluated eleven wheat (*Triticum aestivum*) cultivars for resistance to three aphid species (*S. graminum*, *R. padi* and *R. maidis*) in Egypt. During two seasons of investigation, *R. padi* was the dominant grain aphid on several cultivars, representing 58.3% of the total population comp *R. maidis* ared with 27.6 and 14.1% for *R. maidisand S. graminum*, respectively. No immune accessions identified in either season. Giza 163 and Sakha 69 were moderately resistant to *S. graminum*, Sakha 8 and Sakha 69 were moderately resistant to *R. padi* and Giza 163 and sids, were moderately resistant to *R. maidis*.

Heseler *et al.*, (1999) showed that low levels of antibiosis in wheat MV4 may limit infestations of *R. padi* on wheat, and this may indirectly slow the spreads of plant viruses and reduce the need for insecticide applications in wheat fields.

Rai and Sharma (1999) mentioned that Screening of seven different maize varieties (Naveen, Sweta, Kanchan, D-765, Tarun, Ganga - 2 and Surya) for resistance to *Rhopalosiphum maidis* Fich was carried out at Crop Research Centre, G.B. Pant

University of Agriculture and Technology, Pantnagar, India. The maximum percent infestation of *R. maidis* was recorded on the varieties Naveen and Ganga - 2, and minimum infestation was recorded on the variety Surya. The relative susceptibility to the aphid was as follows: Ganga - 2, > Naveen > Sweta > Tarun > D - 765 > Kanchan > Surya.

El-Bouhssini and Nachit (2000) mentioned that *D. noxia* is a serious pest of wheat and barley in North America, North Africa, Ethiopia and South Africa, very few sources of resistance have been identified in durum wheat (*Triticum durum*). Thus for the past four years, thousands of durum wheat lines and wild species were screened for resistance to *D. noxia*, both in the field and in the green house under artificial infestation at Tel Hadya, Syria. Eight lines of durum wheat and 19 accessions of wild species (mostly T. monococcum) were resistant to *D. noxia*. These sources of resistant are being used in the durum wheat breeding program to develop resistant varieties to D. noxia.

Marzouk (2000) investigated was investigated the influence of aphid (*R. padi* and *S. graminum*) infestation on traits (length of first and second leaf blade, and seedling dry weight) of 39 durum wheat cultivars. Highest (14.37) and lowest (6.34) aphid number were recorded on cultivars 6.Sc.DWL and 14.Sc-1-DWI, respectively. The largest reduction in first leaf blade length was recorded in S.Y.T.D.W.5 (35.1%), while the lowest reduction was recorded in 6.Sc.DWL (2.06%). Highest and lowest infestation reduction in the length of the second leaf were recorded in S.Y.T.D.W.5 and S.Y.T.D.W.41, respectively. Highest seedling dry weight was recorded in S.Y.T.D.W.51 and the lowest was recorded in S.Y.T.D.W.24.

Kazemi *et al.*, (2001) mentioned that the analysis of variance for Russian Wheat Aphid indicated that, there were significant differences ($P<0.05$) between the varieties. The highest (43.21+or-5.45) and the lowest (34.43+or-8.91) average numbers of progeny within the first 10 days were observed in those reared on the Sardari and Zarrin varieties respectively but the figures obtained within the first 15 days were found to be 49.43+or-13.31 on Alamoot and 58.86+or-9.45 on Sardari. Also the highest mean "rm" value (0.3399+or-0.01) was estimated for rearings on Sardari with the smallest (0.2889+or-0.03) on the latter. At present, Sardari seems to be more likley susceptible to the aphid amongst the others.

Li-Su *et al.*, (2001) mentioned that five hundred and ninety wheat varieties or lines were evaluated in 1996-2000 for their natural resistance to wheat aphids in the field. The differences in resistance among different wheat varieties were significant. The resistance of the same variety (line) to two species of wheat aphids had obvious difference. Of the varieties tested, the highly resistant, moderately resistant, and less resistant varieties to wheat aphids, accounted for 3.39, 5.76, and 11.86%, respectively, while 7.63% of the varieties showed better resistance to *Sitobion miscanthi* (T.) and 19.49% showed better resistance to *Rhopalosiphum padi* (L.).

Hegab- Ola (2001) mentioned that within varieties of maize plants Bashayer variety proved to be the least susceptible host for insects (Aphids, leafhoppers and planthoppers) infestation, followed by Tirble cross 320 variety while the Balady variety appeared to be the most susceptible maize variety. While wheat plants Sakha 69 variety proved to be the least susceptible host plant for insects (aphids and leafhoppers) infestation followed by Giza 163 whereas Balady variety variety appeared to be the most susceptible wheat variety.

Cai *et al.*, (2004) reported that indole alkaloid contents of five winter wheat varieties at different growth stages, and the relationship between indole alkaloids and carboxylesterase activities of *Sitobion avenae* (F.) from wheat ears of different varieties were studied. The results indicated that KOK1679 and My295, highly and moderately aphid-resistant varieties, had a high indole alkaloid content during vegetative growth. During their reproduction growth, resistant varieties had a high alkaloid content in penultimate leaves, and indole alkaloid contents of KOK1679 were significantly higher than that of other varieties in wheat ears. The indole alkaloid contents of all varieties were low in flag leaves except for Han4564. A significant correlation was shown between carboxylesterase activity in aphids collected from wheat ears and indole alkaloid contents in ears of the wheat varieties (r=0.9646).

Hu *et al.*, (2004) investigated cereal aphid *Sitobion avenae* resistance on three winter wheat cultivars (Astron, Batis and Xanthos, from Germany) that has introduced into China in the laboratory and field. They found that the result of aphid resistance in field was the same as the result in laboratory on the whole when evaluated by the number of aphids dynamic curve and susceptibility index during different crop growth stages. The aphid resistance level of Astron and Xanthos was the same as the resistant winter wheat cultivars Xiaoyan-22 and Amigo,.

Sharma and Ashok-Bhatnagar (2004) mentioned that yield losses caused by the maize aphid, *R. maidis*, on eight barley cultivars (RS 6, RD 31, RD 57, RD 103, RD 137, RD 387, RDB 1 and BL 2) recommended for cultivation in Rajasthan (India) were estimated at Jaipur. Aphid infestation adversely affected growth parameters such as plant height, ear head length, number of grains per ear head and grain yield. However, all the cultivars were equally susceptible to aphid attack as manifested in terms of reduction in grain yield due to aphid infestation, which varied from 24.52 to 29.61% among different cultivars.

Kiplagat (2005) studied the effect of the Russian wheat aphid (RWA) (*D. noxia*) infestation on seedlings and adult plants of eight Kenyan wheat (*T. aestivum*) cultivars. The Kenyan cultivars were 91B33, Fahari, Kwale, Mbuni, Chiriku, Kongoni, Nyangumi and Mbega. Two RWA resistant wheats, Halt and PI 294994, were also tested against Kenyan isolates of the aphid. All the Kenyan cultivars were susceptible to RWA when compared with the resistant line PI 294994. Halt, which is a resistant cultivar developed in the USA, was susceptible to Kenyan isolates of RWA. This indicates that the Kenyan RWA isolates are different from the USA ones. In seedlings, the RWA damage was expressed mainly as leaf chlorosis and leaf rolling, with damage scores increasing with time. Differences among the Kenyan cultivars in the extent of leaf chlorosis were observed. The most devastating effect of RWA infestation of adult plants of the Kenyan varieties was the reduction in seed set. The tight rolling of flag leaves caused by the aphid delayed ear emergence, leading to floret sterility. Infestation also reduced the quality of the seeds produced, as shown by increased rate of seed deterioration under accelerated ageing conditions, and reduced seedling vigour. The effect of infestation on seed quality was more pronounced under dry conditions.

Youssef (2006) reported that within varieties of maize plants Single cross 10 variety proved to be the least susceptible host for insects (Aphids, leafhoppers and planthoppers) infestation, followed by Nevartity variety while the Trible cross 310 variety appeared to be the most susceptible maize variety. While wheat plants Gimaza 9 variety proved to be the least susceptible host plant for insects (aphids and leafhoppers) infestation followed by Sakha 93 variety whereas Sakha 69 variety appeared to be the most susceptible wheat variety.

2.1.2.3. Effect of potassium fertilization on maize and wheat infestation with aphids, leafhoppers and planthoppers insects.

Abdel Rahim *et al.*, (1984) in Romania the effects of applying chemical fertilizers to wheat plants, on populations of *S. avenae* infesting the plants. They found that population increased dramatically after application of ammonium nitrate, especially at 0.4 and 0.8 g/kg soil. Super phosphate and potash also increased the fecundity of the aphid but to a lesser extent.

Gaponova (1991) studied that the effects of fertilization with NPK on summer and spring wheat plants and the development of infestation with wheat brown belight and green bug aphid, *S. avenae*. She stated that balanced fertilizer (N, 120, P, 120, K, 120) increased the rate of development of infestation with both disease and aphid, while unbalanced fertilizer (the same without N) was unfavorable for both pests.

Gimenez *et al.*, (1997) recorded that the phosphate influx by root of susceptible and tolerant barley (Hordeum vulgare) plants was evaluated as an estimate of aphid systemic damage. Phosphate. (P)- influx was determined at two plant growth stages, with two levels of aphid infestation, at two different aphid life stages. They found that the intensity of aphid induced systemic damage was greater when young plant stages were infested by the aphid. Reductions of P-influx may become critical under increasing natural infestation levels.

Havlickova and Smetankova (1998) reported that the effect of potassium (K) and magnesium (Mg) on the preference of the bird cherry oat aphid *R. padi* for barley and on the suitability of the plants for aphids in pot experiments. Plants of the spring barley cv. Zenit cultivated in Caslav soil with a low K. content and in Ruzyne soil rich in K, were treated with four fertilizers. Combinations (NP, NPK, NPMg, NPK Mg). Under conditions of free host choice aphids showed a higher preference for plants growing in K deficient Caslav soil or treated with fertilizers devoid of K (NP, NPMg, variants), while plants cultivated in Ruzyne soil rich in K or treated with NPK showed low attraction. A significant positive correlation was found between plant preference by aphids and their suitability for aphids evaluated by means of artificial infestation. Treatment of the plants with Mg increased their attractively for aphids and aphid reproduction while the damage caused by the insect was reduced joint application of both elements (NPK Mg variants) increased the preference for the plant by aphids while plant suitability for the insects was the same as in NPK variants.

Salem (1999) mentioned that in an experiment to push the infested host plant with aphid in the direction of protein synthesis, the plants were sprayed with different concentrations of potassium either direct with aphid or 2hr.before replacing aphid to avoid the direct contact effect of potassium on aphid. Results revealed mortalities were obtained.

Hegab-Ola (2001) studied the effect of fertilization on population density of aphid, leafhopper and planthopper insects on maize plants. She mentioned that the highest mean numbers of aforementioned insects/sample occurred on the control treatment (without potassium fertilization) whereas the lowest population density of these insects recorded with (72 unit of potassium/feddan) while wheat plants.

Youseef (2006) studied the effect of fertilization on population density of aphid, leafhopper and planthopper insects on maize plants. He mentioned that the highest mean numbers of aforementioned insects/sample occurred on the control (without potassium fertilization) whereas the lowest population density of these insects recorded with (36 unit of potassium / feddan).While wheat plants the highest mean numbers of insects per sample occurred with control (without potassium fertilization) whereas the lowest population density of these insects recorded with 36 unit of potassium / feddan.

2.2. Effect of chemical contents of certain graminaceous varieties and its relation with the population density of homopterous insects.

Niraz *et al.*, (1996) showed that constitutive-resistance was positively correlated with higher concentrations of cereal allelochemicals (phenols, Flavonoids, hydroxamic acids and alkaloids and some Non-protein amino acids). Except for saga (wheat resistant variety) , nutrient levels, including soluble sugars, were negatively correlated with feeding stimulated aphid resistance. After infection levels of cereal allelochemicals and the enzymes involved in their biosynthesis increased *S. avenae* possessed some detoxifying enzymes and could metabolize some cereal allelochemicals.

Narang *et al.*, (1997) studied the morphological characteristics (Leaf colour, glossiness of leaf, days to earing, days to maturity, number of tillers/meter row and biochemical constituents (leaf surface wax, total free amino acids, total sugars, Soluble proteins, phenols) of barley genotypes and their effect on resistance/ susceptibility of these genotypes against corn leaf aphid. The results showed that biochemical constituent viz leaf surface wax and phenols contributed twards resistance as the genotypes having high amount of these tow constituents. Supported fewer aphids per plant. The other constituents (total free amino acids, total sugars, Soluble proteins) were responsible for susceptibility of the plants.

Gao *et al.*, (1998) determined the amino acid content of resistant varieties of wheat at the jointing stage and it relation to population levels of *S. avenae*. of 17 amino acids, leucine, isoleucine, valine, methionine, proline, phenylalanine, glutamine and alanine were the most abundant. The greater the concentration of glutamine, alanine, lysine and asparagine in flag leaves, the greater the innate capacity of increase (rm value) of *S avenae*. However the greater the concentration of Lucien, isoleucine, protein and valine in flag leaves, the lower the rm value

Liang *et al.*, (1999) studied the effect of calcium and silicon on the acidification of red soil, and on growth and nutrient uptake by wheat (*Triticum aestivum*) cv. Yangmai No.5 exposed to simulated acid rain. Simulated acid rain of pH 3.0 decreased soil pH, but had no significant negative effect on the growth of wheat. Application of calcium carbonate and sodium silicate to the soil before exposure to acid rain inhibited soil acidification and aluminium activation. Results showed that application rates of calcium carbonate should not exceed 2.0 g/kg, otherwise, soil P availability and plant growth would be decreased. In contrast, adding silicate significantly increased soil available P and P, N and K uptakes by wheat. In addition, Si-fed wheat plants were more resistant to wheat aphid.

Chen *et al.*, (2000) mentioned that studies of rice plants infested by *S. furcifera* showed that photosynthesis rate and chlorophyll contents in leaves of susceptible cultivars (TNI and Shanyou 63) decreased compared with those of the resistant cultivar N22; activity of superoxide dismutase (SOD) increased and of catalase (CAT) and peroxides (POD) decreased in the susceptible cultivars, while activity of SOD and POD increased and that of CAT decreased in N22. In the susceptible cultivar, except for Ala, contents of free amino acid increased, with contents of Asp, Thr, Val and Met increasing rapidly. In N22, contents of Asp and Val increased, while those of Thr, Met and Ala decreased significantly.

Porter and Webster (2000) reported that the Russian wheat aphid (RWA, *Diuraphis noxia*), has become a perennial serious pest of wheat (*Triticum aestivum*) in the western USA. Current methodologies used to enhance RWA resistance in wheat germplasm could benefit from an understanding of the biochemical mechanisms underlying resistance, to RWA. This study was initiated to identify specific polypeptides induced by RWA feeding that may be associated with RWA resistance. The effects of RWA feeding on PI 140207 (an RWA resistant spring wheat) and Pavon (an RWA – susceptible spring wheat) were examined by visualizing silver- stained denatured leaf proteins separated by two dimensional polyacrylamide gel electrophoresis. Comparisons of protein profiles of non-infested and RWA- infested Pavon and P1 140207 revealed a 24-kilodalton-protein complex selectively inhibited in Pavon that persisted in P1 140207 during RWA attack. No other significant qualitative or quantitative differences were detected in RWA induced alterations of protein profiles. These results suggest that RWA feeding selectively inhibit synthesis and accumulation of proteins necessary for normal metabolic functions in susceptible plants.

Sandstrom (2000) indicated that host alternation in aphids has been attributed to complementary growth of host plants, or more specifically to seasonal changes in the nitrogen quality of the phloem sap. In this report, seasonal fluctuation of free amino acids in phloem of the winter and summer host plants (Prunus padus, bird cherry and Hordium vulgare, barley) of Rhopalosiphum padi (the bird cherry oat aphid) were investigated in the context of aphid growth and behavior. Amino acid concentration may explain the existence of host alternation in *R. padi*.

Zhang *et al.*, (2000) reported that mechanisms of resistance to aphids at different developmental stages were studied in the field in 4 winter wheat varieties differing in resistance. Analysis of plant anatomy and amino acids showed that resistance to aphids (1) had a positive correlation with thickness of the surface layer of exterior cells from the turning green to the filling stage, (2) had a negative correlation with the density of exterior cells at the heading stage, and (3) had no relationship with the gap between or the thickness of exterior cells. Amino acid content and composition differed between different developmental stages. The content of amino acids such as Tyr, Met, His, Thr, Ser, Ile and Leu had a positive correlation with aphid resistance. The ratio between Met, Tyr and His dwas higher and more stable in the varieties with high resistance, which could be used as a stanard for detecting resistance in winter wheat.

2.3. Transmission of plant pathogenic virus associated with barley yellow dwarf by aphid vectors.

Jorda and Alfaro-Garcia (1988) reported that durum and soft wheat, triticale, barley and rice with typical BYDV symptoms were collected from 32 locations. The virus was identified by ELISA, by transmission with *Rhopalosiphum padi, Sitobion avenae, Schizaphis graminum* and *R. maidis* and by immuno SEM. The predominant race of the virus had a biological and serological response similar to that of the American PAV isolate. A race closely resembling the American MAV was found in one area in Upper Douro. The virus isolated from rice appeared to behave differently from the other isolates.

Coceano and Peressini (1989) mentioned that the contribution by maize to the spread of aphid vectors *(Aphis fabae, Aphis spp., Rhopalosiphum padi* and *Sitobion avenae*), and in the maintenance of barley yellow dwarf luteovirus (BYDV) was evaluated in field plots planted with the varieties Carola and First (a hybrid) in Italy in 1985. Tests were carried out on 3-5 July and 2-17 September at the pre-blooming stage and the cereous maturing stage, resp. On average, 9% of the maize plants colonized by aphids were infected. Although statistical analysis did not show that the crop with the highest aphid colonization carried the highest level of virus infection, it was thought that First hybrid, in comparison with Carola, represented the major source of viral inoculum for BYDV. *R. padi* could transmit BYDV from apparently dessicated maize plants previously damaged by the pyralid *Ostrinia nubilalis*. Some aspects of plant colonization and the frequency of BYDV in the 2 maize cultivars are discussed.

Farrell and Sward (1989) reported that barley yellow dwarf luteovirus infections present in barley and oats at Lincoln, in the Canterbury area of New Zealand, in 1986 and 1987 were identified by ELISA as PAV-, MAV-, RPV- and RMV-like serotypes. Transmission of these serotypes by the aphid vectors *Metopolophium dirhodum, Rhopalosiphum maidis, Rhopalosiphum padi* and *Sitobion fragariae* conformed generally to vector relationships described previously from Australia, but anomalous transmissions also occurred.

El-Yamani and Hill (1990) mentioned that Rhopalosiphum *padi*-specific; *R. maidis*-specific and nonspecific strains of barley yellow dwarf luteovirus (BYDV) were identified in Morocco during 1980-82. Five species of aphids (*R. padi, R. maidis*, *Sitobion avenae*, *Schizaphis graminum* and *Sipha maydis*) were identified as vectors of the virus. Inoculation of 12 grass species endemic to the area showed that 2 were immune and 10 were susceptible, of which 3 were symptomless.

Gray *et al.*, (1991) reported that the duration of access periods and the availability of virus in source plants are 2 factors that influence the transmission of barley yellow dwarf luteovirus (BYDV) by its aphid vectors. This study was conducted to quantify the relationships among acquisition access period (AAP), virus titre in infected oats, and transmission of 3 isolates of BYDV from New York by 2 aphid vector species. Thirteen AAPs, ranging from 15 min to 72 h, were examined, and virus titre was quantified from each virus source leaf by ELISA. Two leaves from each plant were used as independent virus sources to test the effect of leaf age, in addition to virus titre, on acquisition efficiency. The older leaf on each source plant almost always contained less virus. The NY isolates of BYDV, RPV and PAV, were acquired by *Rhopalosiphum padi* within a 15-min AAP; however, a 1- to 2-h or 2- to 3-h APP was required for 50% of the aphids to transmit PAV or RPV, respectively. The difference in virus titre among source leaves did not affect the ability of *R. padi* to transmit RPV, but did influence the transmission of PAV. *Sitobion avenae* required a 30-min AAP to acquire the MAV and PAV isolates of BYDV. Fifty percent of the aphids were able to transmit MAV or PAV after a 4- to 6-h or 10- to 12-h AAP, respectively. The ability of *S. avenae* to transmit MAV and PAV was significantly lower for older leaves. Analyses of the transmission and titre data revealed that the lower virus content of the older leaves accounted for the significant reduction in virus transmission by *S. avenae*. The transmission efficiency of various BYDV isolates is differentially influenced by several factors including aphid vector, length of acquisition feeding period and physiological age of source tissue. In addition, the results suggest that virus titre can have a strong influence on acquisition and transmission efficiency of aphid vectors.

Power *et al.*, (1991) examined that the efficiency of transmission of 3 isolates of barley yellow dwarf luteovirus (BYDV) on oats from New York by 2 aphid species for the purpose of assessing the relative importance of these species as vectors. The influence of the duration of the aphid inoculation access period (IAP) on transmission was investigated for RPV and PAV isolates of BYDV transmitted by *Rhopalosiphum padi* and for MAV and PAV isolates transmitted by *Sitobion avenae*. For each aphid-isolate combination, 15 IAPs, ranging from 30 min to 72 h, were tested. R. padi was equally effective at transmitting the RPV and PAV isolates; 33.3 and 24.6% of individual aphids transmitted RPV anf PAV, respectively, given a 30-min IAP. For both isolates, 50% transmission required an IAP of approx. 2 h. In contrast, S. avenae was less efficient in transmitting PAV and MAV. Given a 30-min IAP, 1.8% of individual aphids of *S. avenae* transmitted PAV, while 10.0% transmitted MAV. Fifty percent transmission required an IAP of 4-6 h for MAV and approx. 72 h for PAV. After a 72-h IAP, 86.7% of individual aphids of *R. padi* transmitted PAV, but only 53.3% of individual aphids of *S. avenae* had done so. These results suggest that *S. avenae* is likely to play a secondary role in the spread of BYDV when it co-occurs with *R. padi* and when

PAV-like isolates predominate. Moreover, these data may help to explain the coincident increase of PAV and decline of MAV in upstate New York, USA during the past several decades.

Brumfield *et al.*, (1992) mentioned that in 1986, 3 RMV-like isolates of barley yellow dwarf luteovirus (BYDV) collected from Choteau (MT-RMV-C), Fort Ellis (MT-RMV-FE) and Valier (MT-RMV-V) in Montana (MT), USA, were characterized on the basis of transmission, virulence, serology and cross-protection studies. Aphid transmission characteristics of MT RMV-like isolates were determined and compared with those of New York (NY) RMV, SGV, RPV, PAV and MAV isolates. Aphid vectors tested were *Rhopalosiphum maidis*, collected at 4 locations in Montana, and the NY biotypes of *R. maidis*, *Schizaphis graminum, R. padi* and *Sitobion avenae*. Two different populations of each MT *R. maidis* karyotype, 2n=8, which is predominant on maize, and 2n=10, which colonizes barley, were used as vectors in this study. Although both karyotypes were efficient vectors of MT RMV-like isolates, there were differences in transmission efficiency between each of the 4 populations. Unlike NY-RMV, which is transmitted efficiently only by *R. maidis*, all MT RMV-like isolates were transmitted efficiently by *R. maidis* and *S. graminum*, 2 were occasionally transmitted by *R. padi*, and none were transmitted by *S. avenae*. MT RMV-like isolates were similar to NY-RMV isolates in that they reacted with NY-RMV immunoglobulin but not with NY-SGV, NY-RPV, NY-PAV or NY-MAV immunoglobulins in ELISA. MT RMV-like isolates were more virulent in oats than either NY-RMV or NY-SGV. MT-RMV-C and MT-RMV-V isolates were each used individually in cross-protection experiments to determine if either could cross-protect against NY-SGV in oats. Little or no cross-protection was found.

El-Yamani *et al.*, (1992) reported that strain identification, distribution, host range and aphid vectors of barley yellow dwarf luteovirus (BYDV) were studied in the Souss-Massa region, southern Morocco. Aphid transmission experiments showed that at least 4 aphid species (*Rhopalosiphum padi*, *R. maidis, Sitobion avenae* and *Schizaphis graminum*) can transmit the local virus isolates. Direct and indirect ELISA were used to identify 4 BYDV types: PAV, MAV, RPV and SGV, with MAV being the most common. In addition to the main cereals grown in the area, 9 native grasses were found to serve as BYDV hosts. Many of these grasses are perennial weeds.

Halbert *et al.*, (1992) reported that plants with symptoms of barley yellow dwarf luteovirus (BYDV) obtained in infection feeding assays of aphids collected in the field in Idaho between 1986 and 1988 were tested for virus transmissibility by possible aphid vectors. Isolates obtained during 1987-88 were also tested with a range of polyclonal antisera which distinguished PAV, MAV, SGV, RPV and RMV serotypes. In 1989 some Idaho (ID) BYDV isolates, maintained as standards for comparison, were serotyped and tested for aphid transmissibility, using 11 species of aphids. There was not always the expected correspondence between serotype and vector specificity for ID isolates. For isolates obtained from field-collected *Rhopalosiphum padi*, vector transmissibility and serotype corresponded with previous reports; however, 44% of isolates which were serotyped as RMV were also transmissible by species other than *Rhopalosiphum* *maidis*. Similarly, the transmissibility of the ID lab. standards did not always conform to the reported vector specificity of serotypes. The lab. ID-MAV culture was transmitted by *Metopolophium dirhodum* and *Myzus persicae* as well as by *Sitobion avenae*. The lab. ID-SGV culture was transmitted by *R. padi* and *S. avenae* as well as by *Schizaphis graminum*. The ID-PRV culture was transmitted by *S. graminum* and Rhopalosiphum insertum as well as *R. padi*. Both of 2 lab. ID-RMV cultures were transmissible by *R. insertum* and *R. padi* transmitted one of them. The results indicate that, for isolates collected in Idaho, vector specificity cannot be assumed from their serotypes.

Wangai (1992) recorded that barley yellow dwarf luteovirus was first reported in Kenya in 1984, but only recently has it been reported to cause serious damage in barley, wheat and oat crops. Epiphytotics associated with the virus complex were observed in 1986-89 in all the major cereal growing regions. The situation appeared to be aggravated by the continuous cultivation of cereals. Serological tests carried out at Rothamsted, UK, on wheat and barley samples collected in 1986 indicated the presence of PAV, MAV and RPV isolates. Aphid vectors of BYDV in Kenya are *Rhopalosiphum padi, R. maidis, R. insertum, Metopolophium dirhodum, M. festucae, Sitobion avenae, S. fragariae* and *Schizaphis graminum*. At altitudes of 2500 m or more above sea level *R. padi* appears to be the most important, while *M. dirhodum* occurs in large numbers in all areas.

El-Yamani (1993) reported that PAV (56%), MAV (35%) and RPV (9%) strains of barley yellow dwarf luteovirus

(BYDV) were identified in west-central Morocco. The disease reached epiphytotic levels during the 1986-87 growing season, being particularly destructive in the spring season. The main aphid vector *Rhopalosiphum padi* was found throughout the year. The host range of BYDV included 31 grass species. Of 10 grass aphid species, 3 were newly identified as BYDV vectors. Melanaphis donacis failed to transmit any of the 3 strains of BYDV. Yield losses on the bread wheat cultivars Nesma and Saada are outlined. In variety tests, 3 of 8 durum wheat, 4 of 19 bread wheat, 3 of 8 oat and none of 17 barley cultivars showed resistance to the PAV strain. Antiserum was prepared against a Moroccan PAV-like isolate of BYDV with a homologous titre of 1/3000 in indirect ELISA. Purification using chloroform, precipitation with polyethylene glycol and centrifugation through sucrose gradients were used to obtain 1.45 mg virus/kg FW of the oat cv. Clintland 64.

Moriones *et al.,* (1993) mentioned that the epidemiology of RPV- and PAV-like serotypes of barley yellow dwarf luteoviruses (BYDVs) on winter barley in central Spain was studied by monitoring BYDV incidence and the population dynamics of BYDV aphid vectors in plots in a barley field. Virus incidence and virus vector populations were also monitored on alternative hosts, such as volunteer cereals and grass weeds in the autumn and winter, or grass weeds and irrigated maize in the summer. Two separate epidemiological systems, for RPV- and for PAV-like serotypes of BYDV, seem to be superimposed. For the RPV-like BYDV, local sources of virus and virus vectors are important and there is a high incidence of BYDV infection of barley during winter. For the PAV-like BYDV system, long-distance sources for virus and vectors are most important and cause infection of barley in the spring. It is suggested that irrigated maize does not appear to be an important vector and virus reservoir for the infection of winter barley, but can be infected by aphids migrating from barley in early summer.

Fuchs *et al.*, (1994) mentioned that descriptions are given of the 3 predominant viruses occurring on maize in central Germany: sugarcane mosaic potyvirus (SCMV), maize dwarf mosaic potyvirus (MDMV) and barley yellow dwarf luteovirus (BYDV). Annual occurrence of the potyviruses has increased since 1982, and SCMV occurrence has increased relative to that of MDMV since 1985; annual occurrence of BYDV during 1990-93 has ranged from 4.1 to 35.8%. Symptoms are described and illustrated, and notes are given on yield losses, aphid vectors, sources of infection and control measures.

Sengonca *et al.*, (1994) reported that in field studies carried out in Koln/Wahn, Germany in 1990-91, the susceptibility of 10 varieties of winter wheat and 10 varieties of winter barley to cereal aphids was investigated. Barley cv. Franka had the lowest number of aphids per plant and also the lowest incidence of barley yellow dwarf luteovirus (BYDV). Lowest numbers of aphids were recorded on wheat cv. Area.

Geissler *et al.*, (1995) mentioned that cereal aphids have been monitored for 10 years at Aschersleben (Sachsen-Anhalt) using a suction trap. In this region, *Sitobion avenae* and *Rhopalosiphum maidis* are the most important vectors of barley yellow dwarf luteovirus. The importance of cereals and cultivated and wild grasses, especially Echinochloa crus-galli, in the epidemiology of vectors and virus is described.

Comas *et al.*, (1996) reported that *Rhopalosiphum padi* and *Sitobion avenae* alates were collected from colonised winter cereals and maize in N.E. Spain and fed on young wheat plants for 7-10 days in the glasshouse. Aphids were then killed and the plants on which the aphids reproduced were kept in the glasshouse for 30-40 days. ELISA of infested plants was made using polyclonal and monoclonal antisera against PAV-, RPV- and MAV-like isolates. In autumn and spring, MAV serotypes were transmitted by *S. avenae* and *R. padi*, mainly in mixed infections with PAV serotypes. This could explain the high frequency of MAV-like isolates and their previously recorded year-to-year stability in maize, grain and forage winter cereals and cereal volunteers. PAV-like isolates were rarely transmitted by *S. avenae* and its spread thus depends almost exclusively on *R. padi*. These results confirm the importance of forage cereals and cereal volunteers as virus sources for winter cereal infection in the autumn, and the latter as a source of BYDV for maize in spring.

Timmer (1996) mentioned that aphids *R. padi* and *S. avenae* caused serious crop damage by barley yellow dwarf luteovirus in winter wheat.

El-Yamani and Bencharki (1997) reported that the ability of the Russian wheat aphid (*D. noxia*) and the green peach aphid (*Myzus persicae*) to vector Moroccan isolates of barley yellow dwarf luteovirus (BYDV -PAV) was evaluated on oat cv. Clintland 64 and the results of virus transmission were checked by direct ELI SA. No evidence of biotype variability in virus transmission efficiency among 5 different clones of the Russian wheat aphid was found when BYDV -PAV isolates derived from

5 different sites in Morocco from cereals showing BYDV symptoms were used. Longer periods of virus acquisition and inoculation were required for the Russian wheat aphid compared with those of *R. padi, R. maidis, S. avenae* and *S. graminum*. The incubation period of BYDV in test – plants was 16-19 days for *R. padi* and S. avenae and 22-25 days for *R. maidis*, *S. graminum* and D. noxia. After 72h of virus acquisition, transmission rates, using one aphid/test–plant, were 93%, 62%, 22%, 18% and 16% for *R. padi, S. avenae, S. graminum*, *R. maidis* and *D. noxia* respectively. After an inoculation access of 72h , the maximum rate of virus transmission was 82% for *R. padi* , 53% for *S. avenae*, 22% for *S. graminum*, 16% for *R. maidis* and 13% for *D. noxia*.

Guo *et al.*, (1997) mentioned that twenty-one aphid clones of *R. padi* and 21 clones of S. avenue were evaluated for vector efficiency in transmitting a French PAV- type isolate (PAV – RG) of barley yellow dwarf luteovirus (BYDV). All aphid colonies transmitted the isolate but vector efficiency was variable. The most efficient *R. padi* clone transmitted PAV-RG about twice as often as the least efficient one, Rp-cH (93 compared with 38%). The most efficient S. avenap clone, however transmitted PAV-RG 8 times more often than the least efficient one, Sa-R5 (76 compared with 8%). All aphid clones acquired virus as determined by triple antibody sandwich-ELISA (TAS-ELISA) but the amount of virus acquired differed among the clones. After a 5-day inoculation access period on healthy barley (cv. Plaisant) plants, virus titre in some aphid clones was not detectable by TAS-ELISA in samples of 10 aphids, but immunocapture-polymerase chain reaction (IC-PCR) could detect the virus in the extract of all the clones. In most cases, a rapid reduction of PAV-RG titre in the aphids was associated with lower transmission efficiency. In a serial transmission test of 11 days, clonal variations in vector efficiency were consistently observed. After a 5 –day transfer, vector efficiency of the 6 clones tested declined vector efficiency was significantly correlated with the level of virus titre in the aphids. Following the serial transfer, decline of virus titre in feeding aphids was triphasic, with an initial decrease occurring rapidly after the first transfer, then decreasing slowly. A second rapid reduction in virus titre often occurred after 7 days of transfer. In the serial transmission test, all 3 *R. padi* clones tested transmitted and retained virus until the last transfer all 11 days. The Sa-chatl and Sa-V clones of S. avenae successively transmitted and retained PAV-RG. For 11 and 9 days, respectively. The Sa-R5 clone transmitted PAV-RG until the 9-day transfer but retained the virus for 11 days. It is concluded that the clonal variations in vector efficiency were not ascribed to poor ability to acquire the virus but were associated with a possible transmission barrier of virions, as well as a more rapid reduction of virus titre in aphids.

Lowles *et al.*, (1997) showed that temperature in the period after inoculation was critical in determining the final virus levels regardless of growth stage at inoculation, but that the younger the plants when inoculated, the higher the level of virus when mature. However, plant inoculated at a later growth stage were a better source for subsequent virus transmission by aphids than those inoculated at an earlier growth stage

Sadeghi *et al.*, (1997) evaluated vector efficiencies of 17 *R. padi* clones originating from Europe, North America and

North Africa, by transmitting 2 isolates of barley yellow dwarf luteovirus serotype MAV, for which this species is normally an inefficient vector. When barley was inoculated by batches of 3 batches of 3 aphids, both isolates were well transmitted by clone Rp5, isolate MAV2 was poorly transmitted by all other clones tested, and isolate MAV 11 was not transmitted by 8 clones and was poorly transmitted by 2 clones when 8 aphids were used by test plants, all clones transmitted both isolates. The epidemiological consequences of MAV transmission by some *R padi* clones are discussed together with the interest of these clones for studying aphid derived components of luteovirus transmission.

Chen *et al.*, (1999) mentioned that Maize dwarf mosaic virus strain B (MDMV-B), maize rough dwarf virus (MRDV) and barley yellow dwarf virus (BYDV) were identified as the causal agents for the main maize virus diseases in Shaanxi, China.

Haack *et al.*, (1999) studied the distribution of the PAV and MAV strains of barley yellow dwarf luteovirus in maize (cv. Dea) in 1996 and 1997 at plant and field levels at Le Rheu in western France. The distribution of viruses was studied in individual maize plants grown in a glasshouse and inoculated in the laboratory by viruliferous *Rhopalosiphum padi* (PAV) and *Sitobion avenae* (MAV). In the first experiment, the influence of the growth stage of maize when inoculated on the success of infection was studied. For both virus strains 100 % infection was obtained in maize plants inoculated at the 2, 4 and 6 leaf stages. The percentage of infection decreased drastically for PAV and more slowly for MAV in plants inoculated at an older stage. In the second experiment the kinetics of PAV and MAV was studied in maize plants inoculated at the 4 leaf stage. PAV was detected more frequently than MAV in roots and both viruses developed mainly in the upper leaves. Leaves 8 and 9 were the most consistently infected by PAV and could be used for field sampling. The distribution of MAV and PAV was studied weekly in a maize field during spring and summer 1997, by regular sampling of several hundreds of plants. The results clearly showed a lack of secondary spread of the viruses: 50-80 % of the plants were infected in a few days following the infestation of the maize crop by the alate aphid vectors in mid-June and this percentage of infected plants remained unchanged during the summer.

Moon *et al.*, (2000) reported that in consecutive annual statewide surveys of the incidence of barley yellow dwarf viruses (BYDVs) in Illinois wheat and oat fields, 27 BYDV-PAV-like isolates were identified. Using polymerase chain reaction (PCR), the coat protein regions of all 27 isolates were analysed for restriction fragment length polymorphisms. The PCR products of two isolates, one from each year, had restriction fragment profiles after digestion with HaeIII that differed from the other isolates. The nucleotide sequences of the coat protein regions of a laboratory isolate, BYDV-PAV-IL (PAV-IL), two of the isolates with the common restriction profile, and the two isolates with polymorphic profiles were more than 98% identical. The relatively rare isolate identified during the first year was designated BYDV-PAV-DK1 (PAV-DK1) and further characterized biologically. PAV-DK1 and PAV-IL did not differ significantly in symptom expression, but did differ significantly in rates of transmission by two of the three biotypes of *Rhopalosiphum padi* examined. Since PAV-DK1 does not occur in high levels in the state of Illinois, and its PCR products have a unique restriction enzyme profile, it has the potential to be used as a traceable isolate in field epidemiological experiments.

Hegab-Ola (2001) showed that in the course of the transmission experiments, it is demonstrated that *R. padi* is a vector transmitting Barley yellow dwarf virus.The results of insect transmission experiment the acquisition threshold feeding periods ranged between 1 hr and 3 days, incubation periods in insects ranged between 34 - 96 hr, inoculation threshold feeding periods ranged between 1 - 6 hr, incubation periods in the host plants were 24 to 32 days in celery plants and 28 - 42 days in wheat plants and retention periods of the virus in the infective aphid vector *Rhopalosiphum padi* ranged between 56 - 112 hr.

Jimenez *et al.*, (2004) evaluated the attractiveness of Barley yellow dwarf luteovirus (BYDV)-infected wheat plants to *Rhopalosiphum padi* L. under laboratory conditions. Two untransformed wheat varieties, virus-susceptible Lambert and virus-tolerant Caldwell, and one transgenic wheat genotype (103.1J) derived from Lambert and expressing the BYDV coat protein gene, were tested in three bioassays. First, *R. padi* responses to BYDV-infected or noninfected Lambert and Caldwell were evaluated. Significantly more aphids settled onto virus-infected than noninfected plants when aphids were able to contact the leaves. Second, aphid responses to headspace from virus-infected or noninfected Lambert and Caldwell were tested. Significantly more aphids congregated on screens above headspace of BYDV-infected plants than above headspace of noninfected plants of both varieties. Third, aphid responses to headspace from virus-infected or noninfected and sham-inoculated (exposed to nonviruliferous aphids) Lambert and 103.1J plants were examined. Significantly more aphids congregated on screens above BYDV-infected than above noninfected or sham-inoculated Lambert. No significant differences in *R. padi* preferences for headspace above BYDV-infected compared with noninfected or sham-inoculated 103.1J plants were observed. The concentration of volatiles extractable from whole plant headspace was greater on BYDV-infected Lambert than on BYDV-infected 103.1J, noninfected, or sham-inoculated plants of either genotype. This is the first report of volatile cues associated with BYDV infection in wheat plants influencing the behavior of the vector *R. padi*. Additionally, these findings show for the first time that transgenic virus resistance in wheat can indirectly influence the production of volatiles making virus-infected plants less attractive or arrestant to aphids than are infected untransformed plants.

Zahn (2004) reported that a process was developed for the detection of barley yellow dwarf luteovirus in aphid vectors (*Sitobion avenae, Rhopalosiphum padi* and *Metopolophium dirhodum*) using a combination of ELISA and polymerase chain reaction. It has been used in Hannover, Germany, for 2 years to improve forecasting of the course of infection.

3-MATERIALS AND METHODS

3.1 Ecological studies:

The present work of the ecological studies on the three important common homopterous insect pests leafhoppers, planthoppers and aphids were carried out in regions of Diarb-Nigm district, Sharkia governorate planted with maize and wheat crops during the two successive seasons 2003/2004 and 2004/2005.

The present work aimed to survey and investigate the seasonal abundance of the aforementioned homopterous insects infesting maize and wheat plants, more over the efficiency of different sampling techniques and the effect of some climatic factors on the population density of these insect pests were also taken in consideration.

3.1.1 Survey and seasonal abundance of certain homopterous insects on maize and wheat crops.

a) Maize plants

All field experiments of this study were carried out in Diarb-Nigm district, Sharkia governorate, during two successive seasons of 2003/2004 and 2004/2005. An area of about 1200 was prepared and divided into 36 plots (each of 30 m). All plots were cultivated on end of may in 2004 and 2005 seasons, using maize cultivar Single cross 18, Single cross 123 and Single cross 129. All recommended agriculture practices were followed along the growing season and maize plants were exposed to natural infestation condition without insecticide application.

Since the insects under investigation differed in their living habits, activities and distribution on various parts of the host plants, it was necessary to use different sampling methods for each group of the tested insect pests.

Sampling started when the age of maize plants reached about 21-28 days and continued at weekly intervals throughout the period of growth until mid of September

i) Aphids

To survey the aphid species infesting maize plants the following two procedures of sampling were followed.

1- Plant samples; Weekly samples of six leaves per plant representing different strata, viz. terminal, middle and bottom parts and tassel were randomly taken from chosen 5 plants of each variety. The infested tassels and leaves were placed in paper bags and transferred to the laboratory for examining. The numbers of individuals of each stage alatae forms, apterous and nymphs were separately counted using a hand lens. A simple apparatus was used for this purpose, which was consisted of a wood en desk, a white card board paper divided into 4 cm a part columns put in the bottom, on which a glass plate was placed and the upper surface of the glass plate was allowed to be wet with fine drop lets of water to reduce the movement of counted aphids (**Abd alla Zeinab, 1984 ; Hegab, *et al.,* 1987**). The leaves were carefully shaken off on to the plate and the aphid insects were counted using a small brush in each column.

2- Yellow sticky board traps.

To survey and study the population abundance of the aphid species, yellow sticky board traps measured 20 X 20 cm were used to capture aphid species in maize fields. 9 traps were prepared each composed of yellow wooden boards fixed on two wooden stands, where the sticky was carefully distributed on the yellow wooden board. Traps were distributed in regular distance (400 m from each other) along the longitudinal axis of the selected area cultivated by maize variety (Single cross 18, Single cross 123 and Single cross 129) in 2004 and 2005 seasons. Traps were kept always over the plants by about 20 cm by changing their heights as long as the plant height increased, and parallel to cardinal directions from north to south, not to obstruct the winds. At weekly intervals, the yellow wooden board was subject to change by a new one and the trapped insects were sorted, identified and counted.

ii) Leafhoppers and planthoppers.

In order to survey the leafhopper and planthopper insects infesting maize plants, the following two procedures of sampling were followed.

1-The sweeping nets

It is just the well ordinary loop used to collect insects. It consists of a wooden handle 100 cm, long with a metal circle of 30 cm. Diameter adapted with cheese cloth bag of 60 cm deep. Sampling was started 21-28 days after sowing, where a weekly sample of 100 double strokes was taken by walking diagonally. Insects were transferred to paper bags containing pieces of cotton wool moistened with chlorophorme to anesthetize the insects. The collected insect was transferred to the laboratory for sorting, identifying and counting.

2-The yellow sticky board traps

To survey and study the population abundance of the leafhopper and planthopper species, yellow sticky board traps measured 20 X 20 cm were used to capture leafhopper and planthopper species in maize fields. 9 traps were prepared each composed of yellow wooden boards fixed on two wooden stands, where the sticky was carefully distributed on the yellow wooden board. Traps were distributed in regular distance (400 m from each other) along the longitudinal axis of the selected area cultivated by maize variety (Single cross 18, Single cross 123 and Single cross 129) in 2004 and 2005 seasons. Traps were kept always over the plants by about 20 cm by changing their heights as long as the plant height increased, and parallel to cardinal directions from north to south, not to obstruct the winds. At weekly intervals, the yellow wooden board was subject to change by a new one and the trapped insects were sorted, identified and counted.

b) Wheat plants.

All field experiments of this study were carried out in Diarb-Nigm district, Sharkia governorate, during two successive seasons of 2003/2004 and 2004/2005. An area of about 1200 was prepared and divided into 36 plots (each of 30 m). All plots were cultivated on mid of November in 2003/2004 and 2004/2005 seasons, using wheat cultivar Sakha 61, Gomaza 7 and Giza 168. All recommended agriculture practices were followed along the growing season and wheat plants were exposed to natural infestation condition without insecticide application.

Sampling started when the age of wheat plants reached about 21-28 days continued at weekly intervals throughout the period from the mid-December till the third of may.

i) Aphids.

To survey the aphid species infesting wheat plants the following two procedures of sampling were followed.

1- Plant samples: weekly samples of 25 tillers were taken randomly, the leaves were examined in the laboratory using a binocular microscope and the total number of aphid individuals on both surfaces of the leaves were recorded. The same simple apparatus which was used to survey aphid on wheat plants was also used for this purpose.

2- Yellow sticky board traps.

The weekly counts of captured aphid species were recorded for trap as previous described.

ii) Leafhoppers.

In order to survey the leafhoppers infesting wheat plants two procedures of sampling were followed:

1- The sweeping nets.

2- Yellow sticky board trap.

In case of wheat plants both of sweep net and yellow sticky board trap were also used as previous described to survey the leafhopper and planthopper in maize fields in addition to study the seasonal abundance of them.

3.1.2. Effect of certain climatic factors (maximum and minimum temperatures and relative humidity) on the population density of the considered homopterous insects infesting maize and wheat crops

Daily records of both maximum and minimum temperatures along with relative humidity were obtained from the Agrometeorological station at ABokaber city which is located closely to the experimental areas during 2003/2004 and 2004/2005seasons.

The relationship between the weekly mean number of collected homopterous insects and the corresponding weekly means of maximum, minimum temperatures and relative humidity were estimated. Partial regression was applied to show the effect of each factor on population density of each leafhoppers, planthoppers and aphid species.

The results obtained were statistically analyzed, correlation coefficient, explained variances and partial regression values were estimated according to **Svab (1973).**

3.1.3. Effect of certain agricultural practices (Sowing date, Varieties and Fertilization)on the population density of the considered insects.

An area about 3600 m was chosen to carry out these investigation in Diarb - Nigm district. The experimental design used in all growing seasons of maize and wheat was a split-split plot design with three replications. Treatments were distributed as split-split plot within replications each sub-sub plot consisted four ridges (4 meters long and 7.5 meters wide). The replication in wheat divided into 10 lines and the space between lines was 15-20 cm. In maize the replication divided into 10 lines/ the space between holes was 25-30 cm

a)- Maize.

i) Sowing date

Including three sowing dates, mid of may, end of may and mid of June during the seasons of 2004 and 2005 seasons.

ii) Maize varieties.

In these experiments, the following three maize varieties were used Single cross 18, Single cross 123 and Single cross 129. These varieties are commonly cultivated in Egypt for local consumption.,

iii) Fertilization.

For fertilization experiments, 200 kg per feddan phosphorus fertilizers in the form (calcium superphosphate 15% P2O5)was applied during preparing the soil. Whereas, fertilizer in the form of urea (33.5 N) was applied (200 kg per feddan). In three equal portions (80 kg/feddan at sowing, 60 kg at the first irrigation and at the second irrigation.). Four potassium fertilization rates were applied 75, 50, 25 and zero kg /feddan, respectively. In the form of potassium sulphate (k2O)when plants become 20 day in age.

b) Wheat plants

i) Sowing date.

Three planting dates, beginning of November , mid of November and end of November were used during 2003/2004 and 2004/2005 seasons.

i) Wheat varieties

In these experiments, the following three wheat varieties were used Sakha 61, Gomaza 7 and Giza 168. These varieties are commonly cultivated and used in Egypt for local consumption.

iii) Fertilization.

For fertilization experiments the rate of 200 kg/feddan phosphorus fertilizers in the form of (calcium superphosphate 15% P2O5) was applied during preparing the soil. Whereas ;

fertilizer in the form of nitrate (33.5% N) was applied at a rate of 150 kg per Feddan in three portions (40, 55 and 65.5 kg/Feddan) at sowing, the first irrigation and the second irrigation respectively.

Four potassium fertilization levels were applied using 75, 50, 25 and zero kg/feddan , respectively in the form of potassium sulphate (k2O) when plants become 20 days in age.

Effect of the aforementioned certain practices factors on the population density of certain aphids, leafhoppers, planthoppers and were analyzed according split-split design analysis **(Little and Hills, 1975).**

3.2. Relationship between certain chemical contents of maize and wheat plant varieties and its relation with the population density of the considered homopterous insects.

Determination of protein, carbohydrates, phosphorus and pH.

Plant samples were taken at random from each sub plot in both seasons and oven dried at 60°C till constant weight. The dried plants, (maize and wheat) were finely ground and digested with a mixture of perchloric acid and nitric acid (2:1).

1-Determination of protein content

Total N in maize and wheat plants was estimated according to **Bremner and Mulvaney (1982).** The crude protein content was obtained by multiplying the N content by the factor 6.25.

2- Determination of carbohydrate content.

The total carbohydrate content in maize and wheat plants were determined colourimetrically using the anthrone reagent and the colour intesity was measured at 240 mu following the method described by **Dubois *et al.*, (1956).**

3- **Determination of potassium contents:** Potassium content was determined by flame photometrically according to the method described by **Jackson (1970).**

4- **Determination of phosphorus:** It was estimated colorimetrically according to **Olsen and Sommers (1982).**

5- **Determination of pH value:** It was estimated in the plant sap using pH meters.

3.3. Effect of fertilization by potassium on the thickness of maize and wheat plants epidermal cells and its relation with the population density of homopterous insects.

The anatomical studies were carried out only in the first season, 2003/2004.

In the laboratory samples were cleaned with tap water, cutter into suitable parts, killed, fixed in Formalin , acetic acid, alcohol (F.A.A) solution for at least 36 hours, dehydrated with n-butyl alcohol , infiltrated and embedded in pure paraffin wax (M.P.56-58 °C) **(Johansen,1940)**. Sectioning at thickness of 14 micron .was performed by using a rotary microtome.

Paraffin ribbons were mounted on thin studies and stained with safranin and light green **(Corgan and Widmoyer,1970)**. Sections were mounted in canda balsam then examined microscopically.

The epidermal cell thickness was measured by planimeter **(Saeed, 1992)**.

3.4. Transmission of plant pathogenic virus associated with barley yellow dwarf disease by aphid vectors *Rhopalosiphum maidis.*

Individuals of aphids, *Rhopalosiphum maidis* (Fitch) were collected from different maize cultivations in Diarb-Nigm district, Sharkia Governorate, Egypt. The collected aphids were critically examined to be free from any contaminating pathogen before using in test by placing them directly after collection from fields on healthy celery plants for 4-6 weeks, the test plants were kept under observation in the laboratory for symptoms development. The plants without disease symptoms confirmed that these adults used in feeding were free from disease pathogen, Microisolators of the plastic leaf cages (1.5 cm in length and 2.5 cm in diameter) were especially constructed to ensure the continuous stay of the aphids on the host plant throughout the periods of acquisition and inoculation feeding **Hegab (1981)** and **Hegab-Ola (2001).** Individuals of aphids were classified into different groups according to the length of the acquisition feeding period on infected plants with barley yellow dwarf virus.

In order to confirm the ability and the efficiency of the tested aphid species as important vector of this agent in maize, subsequent transmission were carried out from artificially infected celery plants (showing clear symptoms) to healthy ones and retransmission experiments were also carried out to transmit these agent from infected celery plants to healthy maize plants as the principle host plant.

In both acquisition and inoculation feeding periods, 10-15 individuals of aphids were placed on each plant using 3 plants (replicates) for each test. The acquisition feeding period ranged from 30 mn to 5 days while the inoculation feeding period lasted for 5-7 weeks, during which, aphids were transferred weekly to new indicator plants one after the other and the plants were kept under observation in the laboratory for symptoms development.

To determine the length of the virus latent period in the insects after acquiring the agents, the insects were transferred to new healthy plants, one after the other and the plants were kept under observation in the laboratory for symptoms development.

4-RESULTS AND DISCUSSION

4.1. Ecological studies :

4.1.1. Survey of certain homopterous insects infesting maize and wheat crops.

i) Aphids

In the present work the next five aphid species were surveyed using two methods of collections. These five aphid species harbourd on maize and wheat Table (2):

1- ***Rhopalosiphum maidis* (Fitch).**

2- ***Rhopalosiphum padi* (Linnaeus).**

3- ***Aphis gossypii* (Glover).**

4- ***Schisaphis graminum* (R.).**

5- ***Sitobion avenae* (Fabr).**

The results given in Table (2) revealed that plant sample proved an to be efficient method for collecting aphids while yellow sticky board traps was less attractive to aphid species during the two successive seasons of investigation 2003/2004 and 2004/2005 .These results agreed with those of **Hegab *et al.*, (1987)** who mentioned that yellow sticky board seemed to be the most attractive to aphid species in maize fields in newly reclaimed sandy areas. This trend was also recorded on wheat, barley and maize crops. But **Hegab, Ola (1997, 2001)** who mentioned that sticky trap method is one of the best sampling methods available for estimating winged aphids population in wheat and maize fields as more winged aphids were caught on sticky traps than those on yellow pan traps .Therefore, sticky traps could be used to determine the relative density of winged aphids.

Table (2): Total number of aphid species infesting maize and wheat field crops in Diarb-Nigm district, Sharkia governorate collected by using plant samples and yellow sticky board traps during 2003/2004 and 2004 /2005 seasons.

Aphid species	Host Plant	Varieties	Total number of aphid / sample			
			2003/2004		2004 /2005	
			Plant S.	Y.S.B.T	Plant S.	Y.S.B.T.
R. maidis	Maize	Single cross 129	175632	1063	177298	1163
		Single cross 123	134178	988	139986	1010
		Single cross 18	108174	807	114081	918
		Total	417984	2858	431365	3091
	Wheat	Gimaza 9	10443	388	12795	562
		Giza 168	14295	457	15715	593
		Sakha 61	8870	338	10673	452
		Total	33608	1183	39183	1607
R. padi	Maize	Single cross 129	112587	896	117651	936
		Single cross 123	74208	791	92426	882
		Single cross 18	59082	662	77710	712
		Total	245877	2349	287787	2530
	Wheat	Gimaza 9	15840	459	17763	619
		Giza 168	20039	568	21626	682
		Sakha 61	13303	404	15824	497
		Total	49182	1431	55213	1798
A. gossypii	Maize	Single cross 129	14184	318	17812	383
		Single cross 123	11145	255	14450	306
		Single cross 18	10227	222	9881	297
		Total	35556	795	42143	986
S. graminum	Wheat	Gimaza 9	4787	311	5229	380
		Giza 168	5399	333	6209	421
		Sakha 61	3956	254	4436	296
		Total	14142	898	15874	1097
S. avenae	Wheat	Gimaza 9	1024	184	1130	220
		Giza 168	1172	239	1348	297
		Sakha 61	876	169	978	209
		Total	3072	592	3456	726

Plant S. =plant sample. Y.S.B.T. = yellow sticky board traps

It is worth to mention that the most extensive infestation by *R. maidis* (F.) was recorded on maize plants followed by wheat plants. Concerning the total number of *S. avenae* (Fabr) it was found that wheat plants harboured high population of such pest followed by maize plants. Similar results were obtained by **Hegab *et al.*, (1987), Attia, Shahinaz (1993) ,El-Komy (1999) and Hegab – Ola (1997, 2001).**

ii)Leafhoppers and planthoppers

The data presented in Table (3) show the total number of the leafhopper and planthopper species collected by the two different techniques, i.e. sweeping net and yellow sticky board in the investigated areas. Insect species obtained by such means belong to two families ; Cicadellidae and Delphacidae. Leafhopper and planthopper species collected from each host were as follows:-

1) Maize plants

Five leafhopper species and two planthopper species occurred on maize plants. leafhopper species were collected and arranged descendingly according to their abundance: *Empoasca decipiens* (Paoli), *Cicadulina chinia* (Ghauri), *Empoasca decedens* (Paoli), and *Cicadulina bipunctella zeae* (China) such species were collected by the two methods of collections.

Balclutha hortensis (Lindb) was the most abundant species on maize plants during 2004 and 2005 seasons.

Two planthopper species were collected and arranged descendingly according to their abundance: *Sogatella vibix* (Haupt) and *Sogatella furcifera* (Horv). Only one planthopper specie *Sogatella vibix* (Haupt) was captured by sticky board.

Sogatella vibix (Haupt) was the most abundant planthopper species on maize plants during 2004 and 2005 seasons.

2) Wheat plants

Two leafhopper species were collected and arranged descendingly according to their abundance:

Empoasca decipiens (Paoli) and *Empoasca decedens* (Paoli) were collected by sweeping net and sticky board trap .

The present data indicated that the sweeping net technique proved to be the most efficient method to collect more leafhopper and planthopper species than the other method for the cereal field crops.

The yellow sticky board has a remarkable selectivity for attracting certain leafhopper and planthopper species.

These finding agreed with those recorded by **Hegab (1981 & 1993), Alla-Zeinab (1984), Hegab *et al.*, (1987, 1989) and Hegab, Ola (1997 & 2001).**

Table (3): Total number of leafhoppers and planthopper species infesting maize and wheat crops in Diarb-Nigm district, Sharkia governorate collected by using sweeping nets and yellow sticky board traps. during 2003/2004 and 2004/2005 seasons.

Leafhopper and planthopper species	Host Plant	Varieties	Total number of leafhoppers and			
			2003/2004		2004 /2005	
			S.N.	Y.S.B.T	S.N.	Y.S.B.T
E .decipiens	Maize	Single cross 129	5802	471	6123	539
		Single cross 123	5136	387	5311	426
		Single cross 18	4635	337	4898	371
		Total	15573	1195	16332	1336
	Wheat	Gimaza 9	1730	323	1969	389
		Giza 168	2139	347	2332	444
		Sakha 61	1592	258	1687	323
		Total	5461	928	5988	1156
E. decedens	Maize	Single cross 129	4734	386	4886	446
		Single cross 123	3672	360	3879	390
		Single cross 18	3525	284	3494	330
		Total	11931	1030	12259	1166
	Wheat	Gimaza 9	1256	209	1364	274
		Giza 168	1576	258	1798	330
		Sakha 61	1077	182	1290	239
		Total	3909	649	4452	843
C. chinai	Maize	Single cross 129	3099	251	3826	261
		Single cross 123	2703	215	3172	259
		Single cross 18	1884	177	3051	222
		Total	7686	643	10049	742
C. bipunctalla zeae	Maize	Single cross 129	266	142	393	201
		Single cross 123	216	122	294	124
		Single cross 18	139	122	207	130
		Total	621	386	894	455
B. hortensis (Lindb)	Maize	Single cross 129	2040	247	2523	298
		Single cross 123	1656	195	2150	188
		Single cross 18	1542	157	1931	185
		Total	5238	599	6604	671
S.vibix (Haupt)	Maize	Single cross 129	3462	307	3852	350
		Single cross 123	2754	262	3326	294
		Single cross 18	2520	237	3101	259
		Total	8736	806	10279	903
S. furcifera (Horv)	Maize	Single cross 129	2961	258	3412	282
		Single cross 123	2631	237	2929	249
		Single cross 18	2481	198	2740	218
		Total	8073	693	9081	749

S.N. = Sweeping net **Y.S.B.T. = yellow sticky board traps**

4.1.2. Seasonal abundance of certain homopterous insects infesting maize and wheat crops.

1) Aphids

a) Maize plants.

i) ***Rhopalosiphum maidis* (F)**

The mean numbers of aphid collected from maize plants during 2004 and 2005 seasons at Diarb - Nigm district, Sharkia Governorate are shown in Table (4) and illustrated graphically in Figure (1). According to the obtained results it could be mentioned that the aphids were found under the field conditions of maize during the period from 2nd week of July to 2nd of September. The mean numbers of initial occurrence were 20.917 and 16.361 aphid/plant sample at a mean temberature of 30.29°C with 71% R.H and 27.39°C with 73.46 % R.H for the two seasons, respectively.

The results given in Table (4) and Fig. (1) show that the highest population density of *R. maidis* individuals occurred in third of August with a mean number, 1230.5 and 1467.528 aphid/plant sample in 2004 and 2005, respectively at a mean temperature of 29.71 °C with 66.07 % RH and 30.07 with °C 66.29 % RH for the two seasons, respectively. After this peak the aphids number tended to decline until reached its minimal number in second of September with a mean number 25.166 and 44.25 aphid/plant sample in 2004 and 2005 seasons, respectively at 27.11°C with 63.93 %RH and 26.79 °C with 63.54 %RH for the two seasons, respectively.

ii) Rhopalosiphum padi (L)

Samples of 5 plants were picked up weekly from maize plants during the period from third of July to second of September for three experimental seasons. The mean number of aphid *R. padi* infesting maize plants are given in Table (4) and illustrated graphically in Figure (2).

The first sample of *R. padi* was collected in third of July on maize plants. The mean numbers of initial appearance were 40.167 and 29.444 aphid/plant sample at a mean of 28.36 °C with 66.5 % R.H and 27.64 °C with 68.92 % R.H in 2004 and 2005 seasons, respectively.

Date obtained show one peak of activity of *R. padi* on maize plants occurred in third week of August with a mean number of 846.25 and 886.861 aphid/plant sample in 2004 and 2005 seasons, respectively at a mean temperature of 29.71 °C with 66.07 % R.H and 30.07 °C with 66.29 % R.H for the two seasons, respectively. After this peak the aphids number tended to decline until reached its minimal number in second week of September with a mean number 14.417 and 43.833 aphid/plant sample in two seasons, respectively at 27.11°C with 63.93 %RH and 26.79 °C with 63.54 %RH for the two seasons, respectively.

Regarding the weekly counts of *R. padi* it is clear that this species was slightly a abundant in 2004 and 2005.

iii) *Aphis gossypii* (Glov.)

The mean number of *A. gossypii* collected from maize plants by plant sample during 2004 and 2005 seasons are shown in Table (4) and represented graphically in Figure (3).

It can be stated that *A. gossypii* was present under the field conditions on the maize plants during the period from end week of July to the second week of September. The results given in Table (4) indicated that mean numbers of initial occurrence were 6.5 and 12.389 aphid/plant sample at 29.59 °C with 68.64 % R.H and 28.3 °C with 73.94 % R.H for the two seasons 2004 and 2005, respectively.

Figure (3) indicated that the mean number of *A. gossypii* on maize plants tended to increase until it reached its only peak in the end week of August with a total number of 98.417 and 119.722 aphid/plant sample in 2004 and 2005 seasons, respectively at 29.72°C with 68 % R.H and 30.21°C with 64.1 % R.H for the two

seasons respectively. After this peak the number *A. gossypii* tended to decline until its minimum in the second September with a mean number of 25.417 and 20.417 aphid/plant sample in 2004 and 2005 seasons, respectively at 27.11°C with 63.93 %RH and 26.79 °C with 63.54 %RH for the two seasons, respectively.

Generally to the weekly counts of *A. gossypii* on maize plants Table (4) it was clearly more abundant during 2005 than 2004 seasons.

Regarding the weekly counts of *A. gossypii* it is clear that this species was slightly abundant in 2004 and 2005. Results in general concerning the populations of *R. padi, R. maidis* and *A. gossypii* in maize and wheat field crops show clearly that these species have one peak on maize and wheat plants. This result agree with the findings of **Abd-Alla (1985), Hegab *et al.*, (1987), Attia, Shahinaz (1993), Hegab-Ola (1997, 2001) and Youssef (1999, 2006)**. Showed that the fieght activity of *R. maidis* , *R. padi* and *A. gossyppii* have one peak maize plants during summer plantation.

Table (4): Mean number of aphids *Rhopalosiphum padi* (L.), R. *maidis* (F.) and *Aphis gossypii infesting* maize plants collected by plant samples at Diarb – Nigm district, Sharkia Governorate during 2004 and 2005 seasons.

Date of inspection (weekly)		Mean number of aphids / sample						Mean of			
		R. maidis		*R. padi*		*A. gossypii*		Temp. C°		R.H.%	
		2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
July	1st	0	0	0	0	0	0	29.96	26.5	67.86	71.02
	2nd	20.917	16.361	0	0	0	0	30.29	27.39	71	73.46
	3rd	32.167	33.444	40.167	29.444	0	0	28.36	27.64	66.5	68.92
	4th	73.917	192.167	119.583	81.611	6.5	12.389	29.59	28.3	68.64	73.94
Aug.	1st	378.75	272.861	279.667	148.556	16.833	21.083	29.5	31.16	68.71	67.14
	2nd	1140.5	465.556	545.917	563.667	25	42.11	30.04	30.36	68.79	63.04
	3rd	1230.5	1467.528	846.25	886.861	48.583	72.472	29.71	30.07	66.07	66.29
	4th	264.833	590.472	148.5	329.028	98.417	119.722	29.72	30.21	68	64.1
Sep.	1st	64.583	160.028	32.583	126.667	50.75	49.111	30.19	28.29	68.29	63.87
	2nd	25.166	44.25	14.417	43.833	25.417	20.417	27.11	26.79	63.93	63.54
	3rd	0	0	0	0	0	0	27.33	29.65	62.43	66.61
Total		3231.333	3242.667	2027.083	2209.667	271.5	337.305				

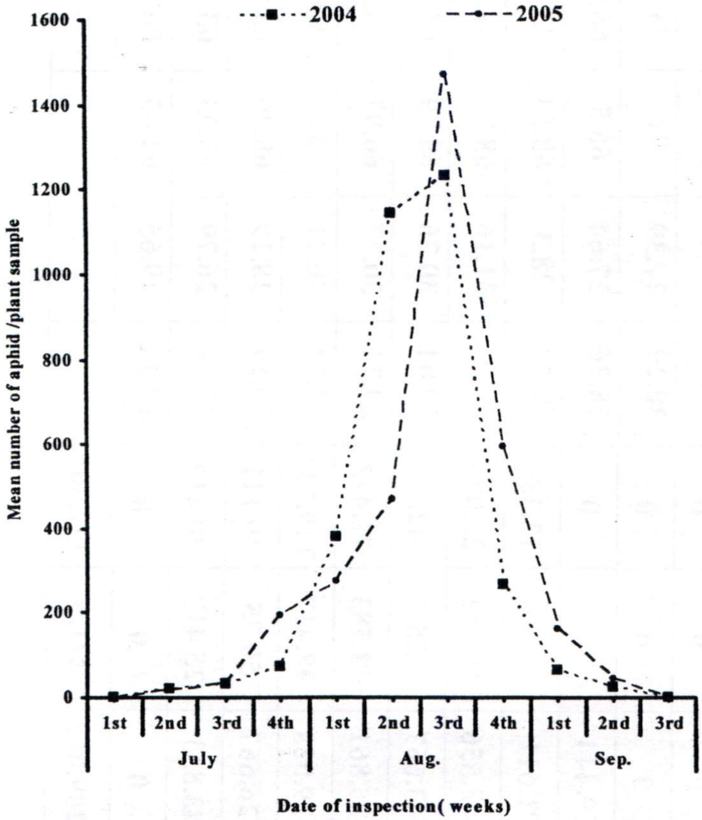

Fig. (1) :Seasonal abundance of *Rhpalosiphum maidis* (F.) infesting maize plants collected by plant samples at Dirab-Nigm district , Sharkia Governorate during 2004 and 2005 seasons.

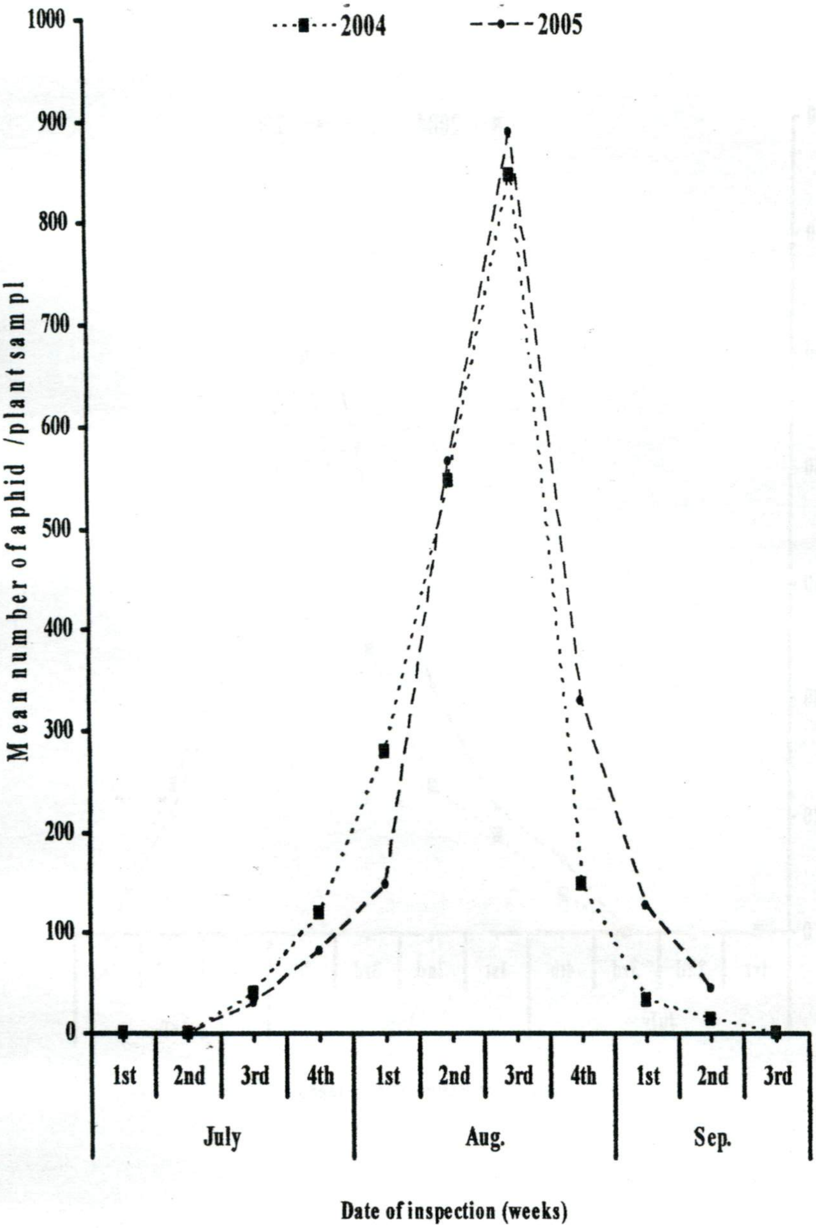

Fig. (2) :Seasonal abundance of aphid *Rhpalosiphum padi* (L.) infesting maize plants collected by plant samples at Dirab-Nigm district , Sharkia Governorate during 2004 and 2005 seasons.

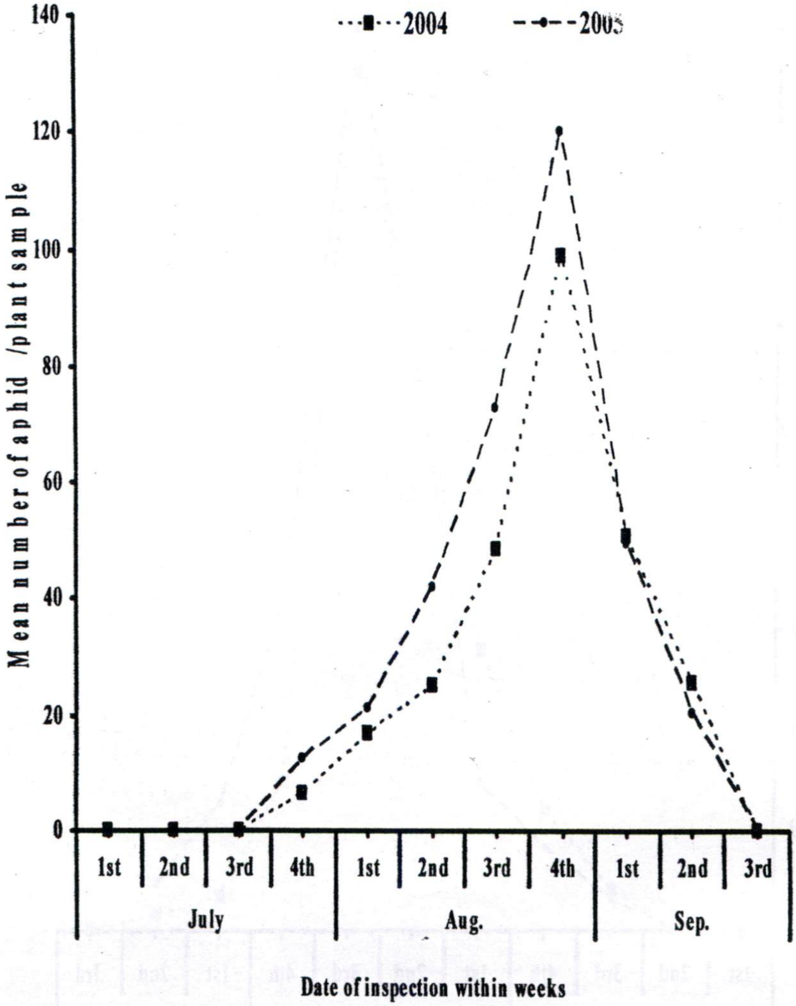

Fig. (3) :Seasonal abundance of *Aphis gosspii* (Glov.) infesting maize plants collected by plant samples at Dirab-Nigm district , Sharkia Governorate during 2004 and 2005 seasons.

b) Wheat plants

i) *Rhopalosiphum padi* (F)

The total number of *R. padi* counted on wheat plants during 2003/2004 and 2004/2005 seasons by plant samples are shown in Table (5) and presented graphically in Figure (4). According to Figure (4) it can be pointed out that *R. padi* was present under the field conditions on the wheat plants during the period from end of December to the end of April. The mean numbers of initial occurrence were 3.667 and 3.61 aphid/plant sample in 2003/2004 and 2004/2005 seasons, respectively at 15.14 °C with 60.72 % R.H and 17.43°C with 61.43% R.H for the two seasons, respectively.

Figure (4) indicated that the mean number of *R. padi* on wheat plants tended to increase until it reached the peak at end of March with a mean number of 93.278 and 123.611 aphid/plant sample in in 2003/2004 and 2004/2005 seasons, respectively at 17.98°C with 63.11 % R.H and 17.7 °C with 61.38 % R.H for the two seasons, respectively .After the peak the number of *R. padi* decreased with a minimal number at the end of April with a mean number of 10.639 and 10.833 aphid/plant sample in both seasons, respectively at 22.33°C with 57.29 % R.H and 23.16 °C with 55.39 % R.H for the two seasons, respectively.

ii)*Rhopalosiphum maidis* (F)

The numbers of *R. maidis* collected from wheat plants in Diarb-Nigm district during 2003/2004 and 2004/2005 seasons using plant samples are recorded in Table (5) and illustrated graphically in Figure (5).

Specimens of *R. maidis* appeared during the 2nd week of January. The mean number of initial occurrence was 5.667 and 6.166 aphid/plant sample at 15.29 °C with 60.07 % R.H and 14.11°C with 64.57 % R.H for the two seasons, respectively. One peak on wheat plants occurred at end of February with a mean number 90.389 aphid/plant sample in 2003/2004 season and at mid of March with a mean number 94.777 aphid/plant sample in 2004/2005 season at mean temperature of 16.72°C , 19.08 °C with R.H of 62.64 % and 59.97 % for the two seasons, respectively.

After this the aphids population declined until reached its minimum number at mid of April with a mean number 15.778 and 16.278 aphid/plant sample in 2003/2004 and 2004/2005 seasons, respectively at mean temperature 20.14°C with 60.15 % R.H and 20.38°C with 57.58 % R.H for two seasons, respectively.

Regarding the biweekly counts of *R. maidis* it is clear that this species indicated slightly higher abundant during 2003/2004 than 2004/2005.

iii) *Schizaphis graminum* (R.)

The biweekly numbers of *S. graminum* collected from wheat plant during 2003/2004 and 2004/2005 seasons in Diarb-Nigm district are shown in Table (5) and illustrated graphically in Figure (6).

The individuals of *S. graminum* were collected from wheat plants starting end-January for both experimental years Table (5). The mean numbers of initial occurrence were 3.5 and 6.444 individuals/plant samples at a mean temperature of

15.62°C with 62.12 % R.H and 14.5°C with 58.86 % R.H the for two seasons respectively.

The number of individuals increased gradually to reach the peaks at the mid of March with a mean number of 39.694 and 47.139 individuals/samples at 18.07°C , 19.08°C with R.H was 66.22 and 59.97 % for the two seasons, respectively.

After the peak the number of *S. graminum* on wheat plants tended to decline until it reached its minimal number at the mid of April with a mean number of 5.722 and 6.944 individuals/plant samples at 20.14°C with 60.15 % R.H and 20.38°C with 57.58 % R.H for two seasons, respectively.

Table (5): Mean number of aphids *Rhopalosiphum padi* (L.) ,*R. maidis* (F.) and *Schizaphis graminum* (R.) infesting wheat plants collected by plant samples at Diarb – Nigm district ,Sharkia Governorate during 2003/2004 and 2004/2005 seasons .

Date of inspection (weekly)		Mean number of aphids / sample						Mean of			
		R. padi		*R. maidis*		*S.graminum*		Temp. C°		RH%	
		2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005
Dec.	2nd	0	0	0	0	0	0	18.74	19.06	66.22	61.54
	4th	3.667	3.61	0	0	0	0	15.14	17.43	60.72	61.43
Jan.	2nd	10.056	11.361	5.667	6.166	0	0	15.29	14.11	60.07	64.57
	4th	28.555	17.611	17.444	25	3.5	6.444	15.62	14.5	62.12	58.86
Feb.	2nd	29.333	38.889	43.611	48.528	15.806	16.75	14.59	13.75	69.86	61.25
	4th	42.056	67.75	90.389	74.917	31.833	30.528	16.72	18.34	62.64	61.36
March	2nd	63.222	96	60.639	94.777	39.694	47.139	18.07	19.08	66.22	59.97
	4th	93.278	123.611	35.75	44.445	15.472	23.223	17.98	17.7	63.11	61.38
April	2nd	63.611	91.222	15.778	16.278	5.722	6.944	20.14	20.38	60.15	57.58
	4th	10.639	10.833	0	0	0	0	22.33	23.16	57.29	55.39
May	2nd	0	0	0	0	0	0	30.43	24.14	55.13	54.32
Total		344.417	460.638	269.278	310.111	112.027	131.028				

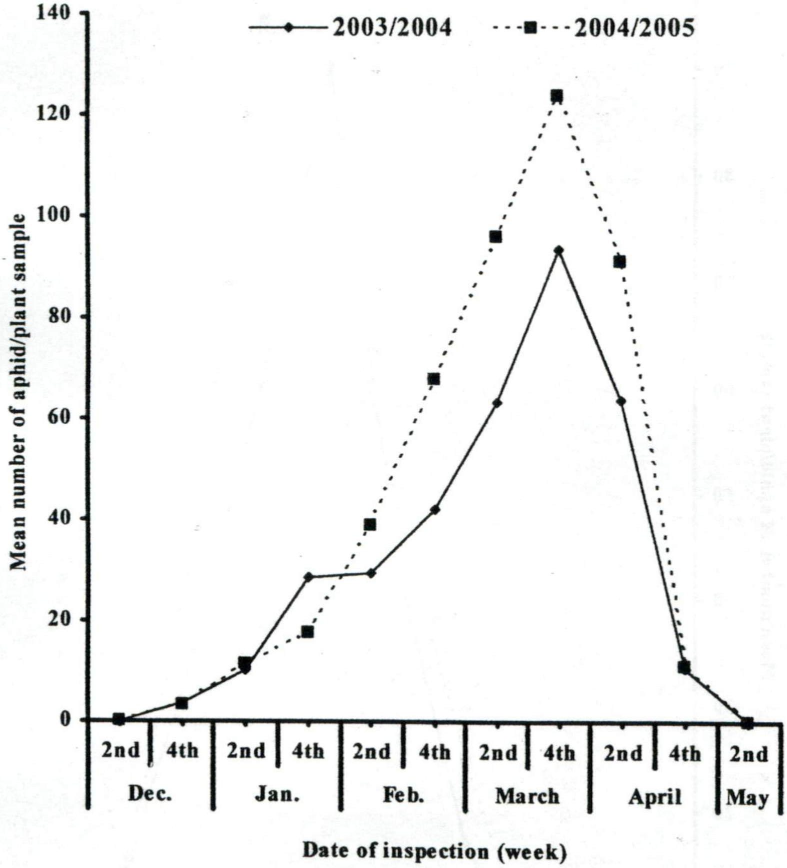

Fig. (4) :Seasonal abundance of aphid *Rhopalosiphum padi* (L.) infesting wheat plants collected by plant samples at Dirab-Nigm district ,Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

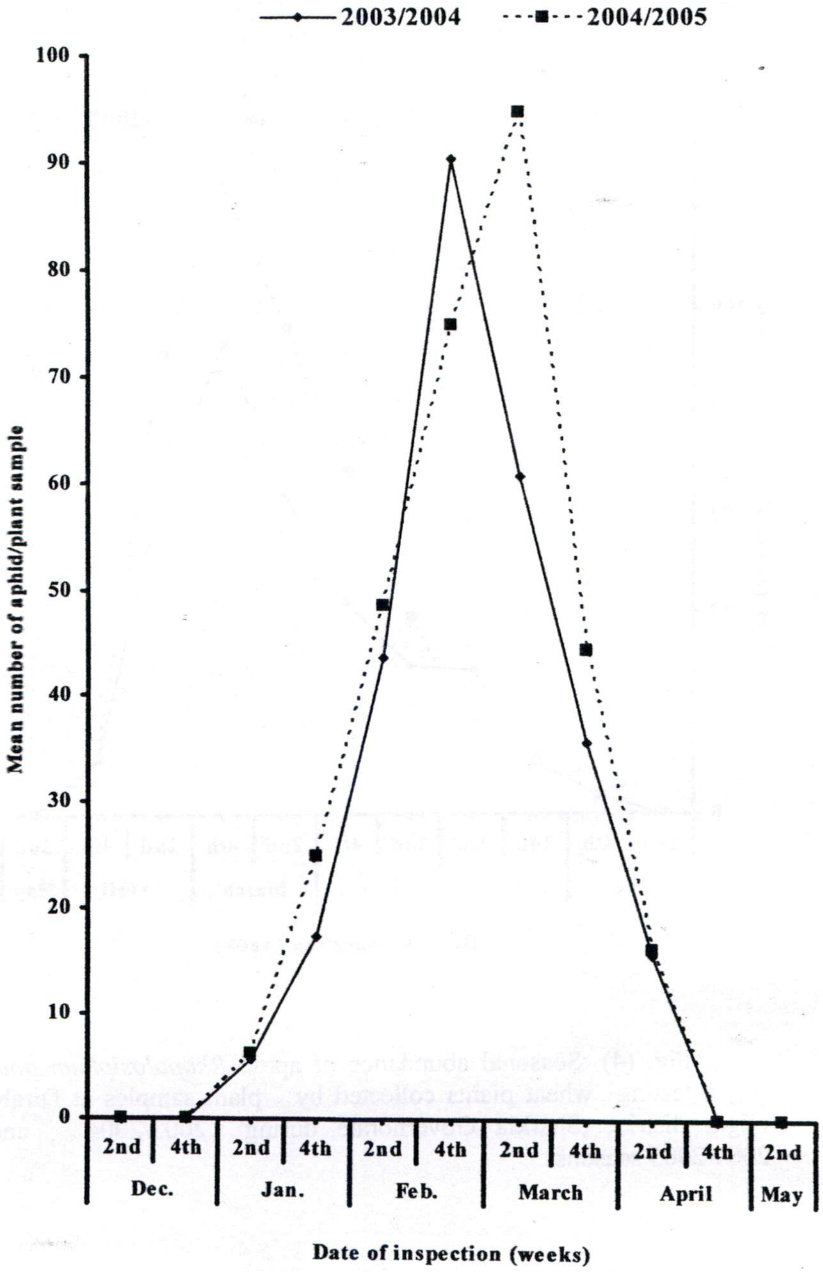

Fig. (5) :Seasonal abundance of aphid *Rhopalosiphum maidis* (F.) infesting wheat plants collected by plant samples at Dirab-Nigm district ,Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

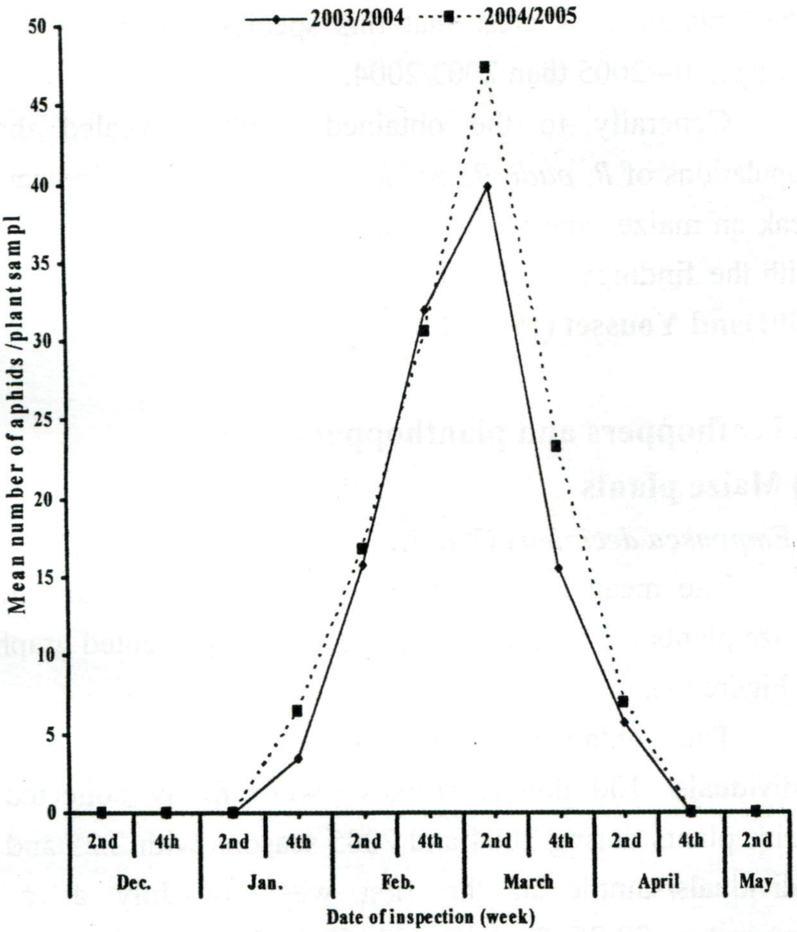

Fig. (6) :Seasonal abundance of aphid *Schzaphis graminum* (R.) infesting wheat plants collected by plant samples at Dirab-Nigm district ,Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

Regarding the biweekly counts of *S. graminum* on wheat plants, it is clear that this species was more abundant during 2004/2005 than 2003/2004.

Generally to the obtained results revealed that the populations of *R. padi, R. maidis* and *S. graminum* indicated one peak on maize and wheat plants. These results are in harmony with the findings of **Hegab *et al.*, (1987), Hegab - Ola (1997, 2001)and Youssef (1999, 2006).**

2. Leafhoppers and planthoppers

a) Maize plants

i) *Empoasca decipiens* (Paoli):

The mean number of *E. decipiens* individuals infesting maize plants are recorded in Table (6) and presented graphically in Figure (7).

The obtained results indicated that *E. decipiens* individuals/ 100 double strokes were firstly collected from maize plants during 2004 and 2005 seasons with 2.25 and 3.944 individuals/sample at the first week of July at a mean temperature 29.96, 26.5 °C with 67.86 %, 71.02 % R.H for the two seasons, respectively. Two peaks were recorded during 2004 and 2005 seasons on maize plants. The first peak occurred at the third week of July with a mean number of 16.33 and 13.75 individuals /100 double strokes at 28.36, 27.64°C with 66.5 %, 68.92 % R.H for the two seasons, respectively. The second peak was noticed in mid of August, with a mean numbers of 34.833 and 36.694 individuals/100 double strokes in 2004 and 2005 seasons at a mean temperature 30.04, 30.36°C with 68.79 %, 63.04 % R.H for the two seasons, respectively. After that the number of *E. decipiens* declined until reached it's minimal at the mid of September with a mean number of 5.25 and 3.972 individuals/100 double strokes at a mean temperature of 27.11, 26.79°C with 63.93 %, 63.54% R.H for the two seasons, respectively.

ii)*Empoasca decedens* (Paoli)

The mean numbers of *E. decedens* individuals collected through weekly samples from maize plants using the sweeping nets during 2004 and 2005 seasons are shown in Table (6) and illustrated graphically in Figure (8).

The number of leafhopper firstly collected from maize plants were 2.417 and 4 individuals/100 double strokes at the first week of July at a mean temperature of 29.96, 26.5 °C with 67.86 %, 71.02 %R.H for the two seasons, respectively. Two peaks were recorded during 2004 and 2005 seasons on maize plants. The first peak occurred at the end week of July with a mean number of 16.083 and 16.5 individuals /100 double strokes at 29.59, 28.3°C with 68.64%, 73.94% R.H for the two seasons, respectively. The second peak was noticed at third of August, with a mean numbers of 18.75 and 20.472 individuals /100 double strokes in 2004 and 2005 seasons at a mean temperature 29.71, 30.07°C with 66.07%, 66.29% R.H for the two seasons, respectively. Then, the number of *E. decedens* tended to decline and reached its minimal value at the mid of September with a mean number of 3.333 and 5.194 individuals/100 double strokes at a mean temperature of 27.11, 26.79°C with 63.93 %, 63.54% R.H for the two seasons, respectively.

iii) *Cicadulina chinai* (Ghauri)

The mean numbers of *C. chinai* individuals collected through the weekly samples from maize plants using the sweeping nets during 2004 and 2005 seasons are shown in Table (6) and illustrated graphically in Figure (9).

The individuals of *C. chinai* at the first week of July in were 1.583 and 1.972 individuals/100 double strokes at a mean temperature of 29.96, 26.5 °C with 67.86 %, 71.02 %R.H for the two seasons, respectively. One peak for *C. chinai* on maize plants occurred in the third week of August, with mean a numbers of 19.667 & 16.944 individuals /100 double strokes in 2004 and 2005 seasons at mean temperature of 29.71, 30.07 °C with 66.07%, 66.29 % R.H for the two seasons respectively. Then, the number of insects decreased until reached its minimal value at the mid of September with a mean number of 4.667 and 6.861 individuals/100 double strokes at a mean temperature of 27.11, 26.79°C with 63.93 %, 63.54% R.H for the two seasons, respectively.

iv) *Balclutha hortensis* (Lindb)

The mean numbers of *B. hortensis* individuals collected from maize plants using the sweeping nets during 2004 and 2005 seasons are shown in Table (6) and illustrated graphically in Figure (10).

The number of leafhopper firstly collected from maize plants during 2004 and 2005 seasons were 1.417 and 2.028 individuals/100 double strokes at the second of July at a mean temperature of 30.29, 27.39°C with 71, 73.46% R.H for the two seasons, respectively. One peak was noticed at the third week of August with a mean number of 15.833 and 14.444

individuals/100 double strokes at a mean temperature of 29.71, 30.07°C with 66.07%, 66.29 % R.H for the two seasons, respectively.

The numbers tended to decline again until reached its minimal at the mid of September with a mean number of 1.75 and 3.722 individuals/100 double strokes at a mean temperature of 27.11, 26.79°C with 63.93 %, 63.54% R.H for the two seasons, respectively.

It could be concluded that the populations of *E. decipiens* has two peaks (at the third week of July and mid of August), *E. decedens* has one peak (at the end week of July and the third week August), *C. chinai* has one peaks (at the third of August), while *B. hortensis* had one peak (at the third week of August).

Table (6) : Mean number of leafhoppers *Empoasca decipiens* (Paoil),*E decedens decedens*,. (Paoil) *Cicadulina chinai* (Ghauri) and *Ballutha hortensis* (Lindb) infesting maize plants collected by sweeping nets at Diarb – Nigm district ,Sharkia Governorate during, 2004 and 2005 seasons .

Date of inspection (weekly)		Mean number of leafhoppers / sample								Mean of			
		E decipiens		*E. decedens*		*C. chinai*		*B. hortensis*		Temp. C°		RH%	
		2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
June	4th	0	0	0	0	0	0	0	0	27.97	29.03	62.64	61.57
July	1st	2.25	3.944	2.417	4	1.583	1.972	0	0	29.96	26.5	67.86	71.02
	2nd	2.917	7.861	4.917	5.417	1.583	2.694	1.417	2.028	30.29	27.39	71	73.46
	3rd	16.333	13.75	8.25	7.722	1.667	3.27	1.917	2.917	28.36	27.64	66.5	68.92
	4th	8.583	9.139	16.083	16.5	2.75	5.167	2.917	4.889	29.59	28.3	68.64	73.94
Aug.	1st	24.167	22.833	7.916	8.695	4.75	9.306	3.5	7.555	29.5	31.16	68.71	67.14
	2nd	34.833	36.694	12.5	10.111	7.833	10.139	9.083	7.917	30.04	30.36	68.79	63.04
	3rd	19.083	16.528	18.75	20.472	19.667	16.944	15.833	14.444	29.71	30.07	66.07	66.29
	4th	11.667	13.278	14.417	18.5	14.667	8.889	6.75	10.028	29.72	30.21	68	64.1
Sep.	1st	6	9.056	6.917	8.139	5.833	7.861	3.166	6.139	30.19	28.29	68.29	63.87
	2nd	5.25	3.972	3.333	5.194	4.667	6.861	1.75	3.722	27.11	26.79	63.93	63.54
	3rd	0	0	0	0	0	0	0	0	27.33	29.65	62.43	66.61
Total		131.083	137.055	95.5	104.75	65	83.111	46.333	59.639				

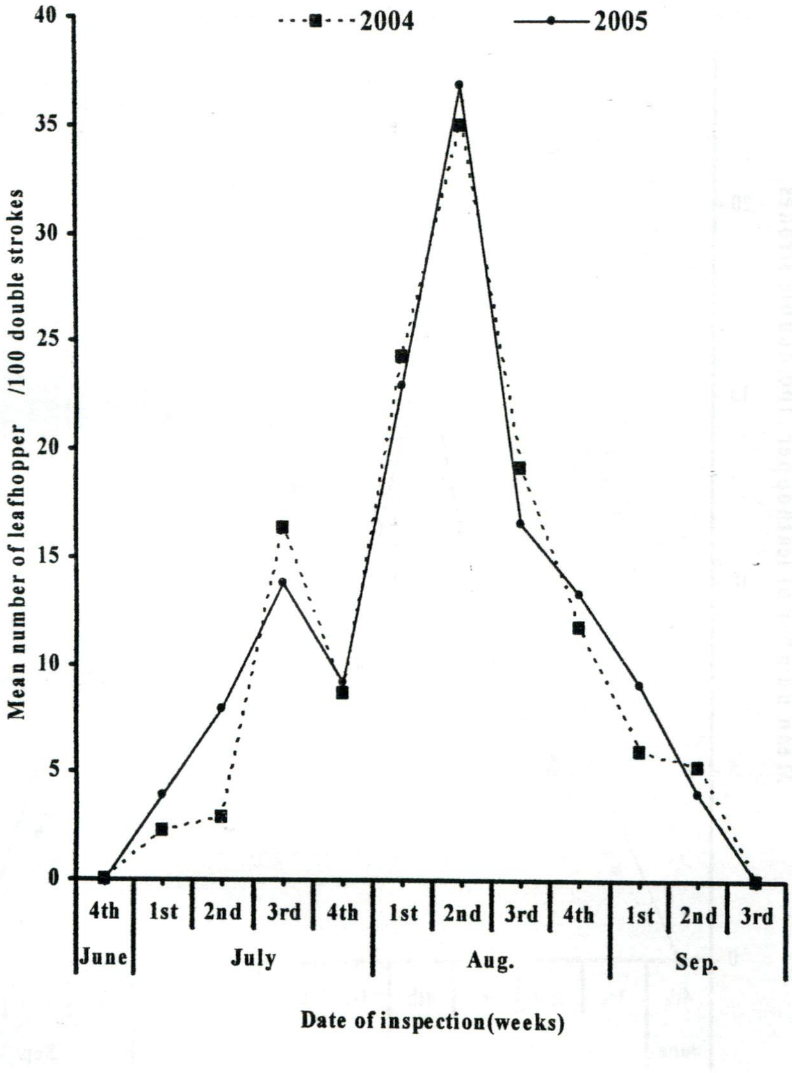

Fig. (7) :Seasonal abundance of leafhopper *Empoasca decipiens* (Paoli) infesting maize plants collected by sweeping nets at Dirab-Nigm district ,Sharkia Governorate during 2004 and 2005 seasons.

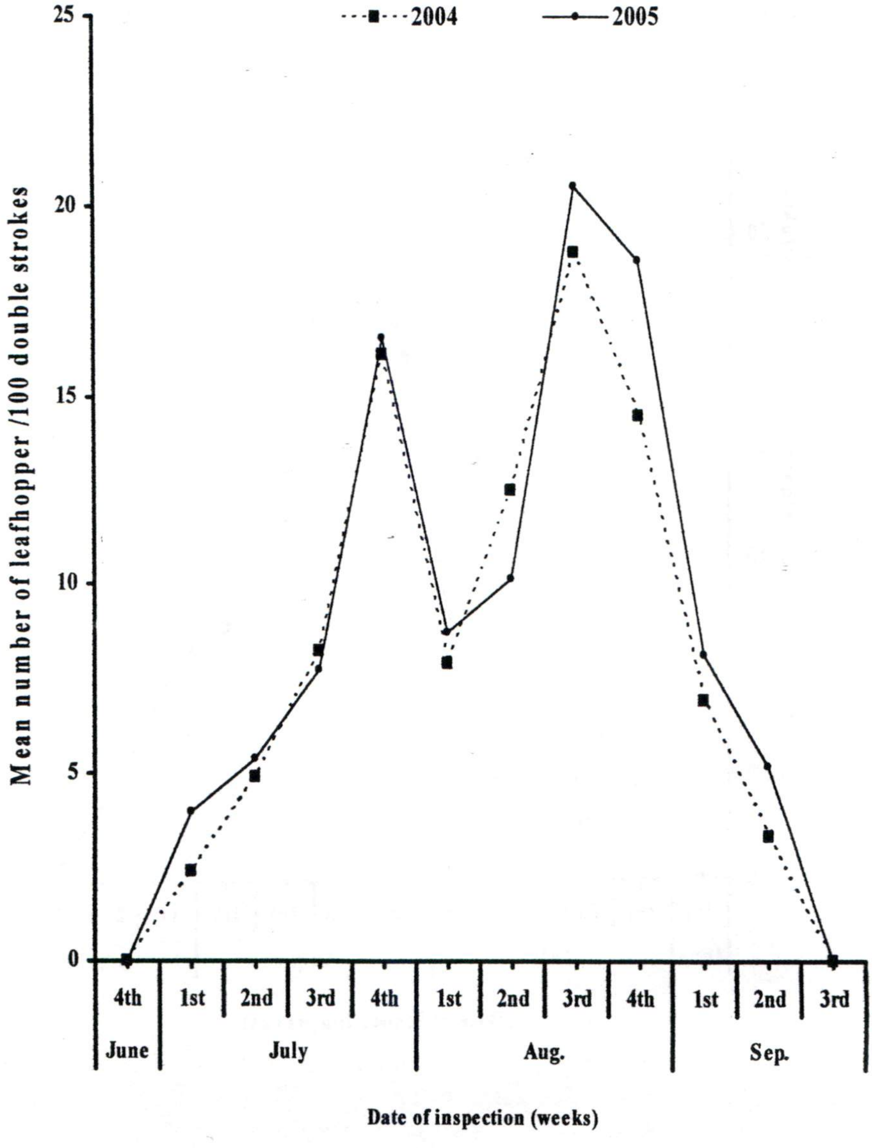

Fig. (8) :Seasonal abundance of leafhopper *Empoasca decedens* (Paoli) infesting maize plants collected by sweeping nets at Dirab-Nigm district ,Sharkia Governorate during 2004 and 2005 seasons.

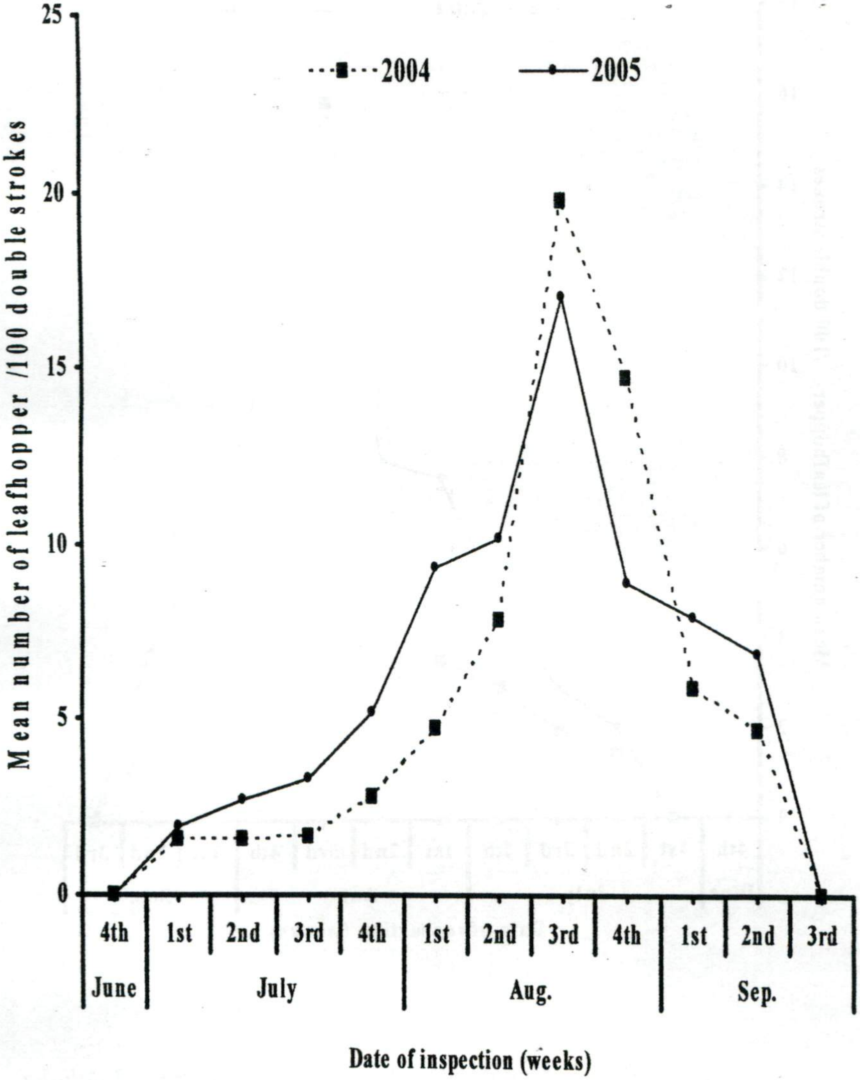

Fig. (9) :Seasonal abundance of leafhopper *Cicadulina chinai* (Ghauri) infesting maize plants collected by sweeping nets at Dirab-Nigm district ,Sharkia Governorate during 2004 and 2005 seasons.

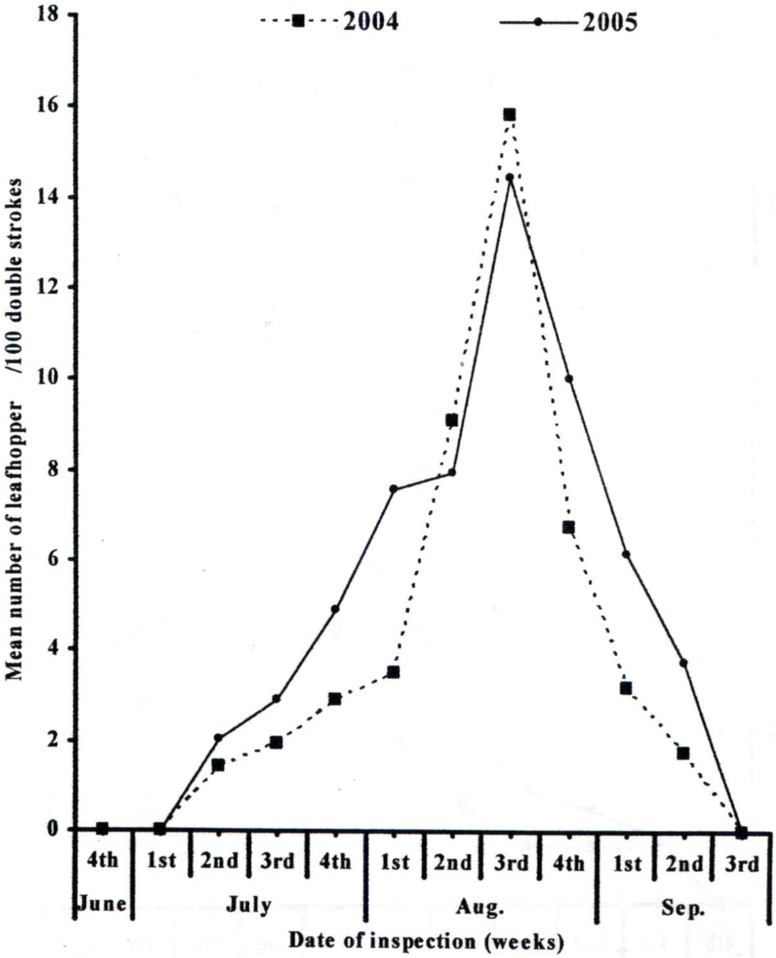

Fig. (10) :Seasonal abundance of leafhopper *Balclutha hortensis* (Lindb) infesting maize plants collected by sweeping nets at Dirab-Nigm district ,Sharkia Governorate during 2004 and 2005 seasons.

These results are in agreement wi th the findings of **Hegab *et al.,* (1988, 1989), Hegab-Ola (1997 and 2001)and Youssef (1999, 2006)** who mentioned that *B. hortensis* has one peak on maize plants and disagreed with **EL- Sharkawy (1989) and EL-Gindy (1997)** who mentioned that both of *E. decedens* and *E. decipiens* has three and two peaks for two species respectively on certain solanaceous and ceuciferous vegetable plants during winter plantation. These variations in results may be attributed to various localities of investigation which may differ in the environmentals conditions prevailing during execution of these experimentals.

v) *Sogatella vibix* (Haupt)

The mean numbers of planthopper *S. vibix* individuals collected through weekly samples from maize plant using the sweeping nets during 2004 and 2005 seasons are shown in Table (7) and illustrated graphically in Figure (11).

The individuals of *S. vibix* were first collected from maize plants

at the second week of July with a mean number of 2.167 and 3.444 individuals/100 double strokes at a mean temperature of 30.29, 27.39°C with 71%, 73.46% R.H for the two seasons, respectively. One peak was recorded at the third week of August at a mean temperature of 29.71, 30.07 °C with 66.07%, 66.29 %for the two seasons, respectively with a mean number of 18.416 and 21.833 individuals/100 double strokes, respectively.

Then the number of *S. vibix* tended to decline until reached its minimal at the mid of September with a mean number of 3.583 and 4.444 individuals/100 double strokes at a mean temperature of 27.11°C, 26.79°C with 63.93 %, 63.54% R.H for the two seasons, respectively.

vi) *Sogatella furcifera* (Horv.).

The mean numbers of planthopper *S. furcifera* individuals collected through weekly samples from maize plant using the sweeping nets during 2004 and 2005 seasons are shown in Table (7) and illustrated graphically in Figure (11).

The individuals of *S. furcifera* were first collected from maize plants at the second week of July with a mean number of 1.75 and 2.583 individuals/100 double strokes at a mean temperature of 30.29°C, 27.39°C with 71%, 73.46% R.H for the two seasons, respectively. One peak was recorded at the third week of August at a mean temperature of 29.71, 30.07 °C with 66.07%, 66.29 % R.H for the two seasons, respectively with a mean number of 20.833 and 22.639 individuals/100 double strokes, respectively.

Then the number of *S. furcifera* decreased until reached its minimal at the mid of September with a mean number of 3 and 4.111 individuals/100 double strokes at a mean temperature of 27.11, 26.79°C with 63.93 %, 63.54% R.H for the two seasons, respectively.

Table (7) : Mean number of planthoppers *Sogatella vibix* (Haupt) and *Sogatella furicfera* (Horv.) infesting maize plants collected by sweeping nets at Diarb – Nigm district ,Sharkia Governorate during, 2004 and 2005 seasons.

Date of inspection (weekly)		Mean number of planthoppers / sample				Mean of			
		S. vibix		*S. furicfera*		Temp. C°		RH%	
		2004	2005	2004	2005	2004	2005	2004	2005
July	1st	0	0	0	0	29.96	26.5	67.86	71.02
	2nd	2.167	3.444	1.75	2.583	30.29	27.39	71	73.46
	3rd	2.917	3.333	4.417	3.695	28.36	27.64	66.5	68.92
	4th	4.667	6.778	6.834	6.639	29.59	28.3	68.64	73.94
Aug.	1st	7.667	8.917	7.5	7.611	29.5	31.16	68.71	67.14
	2nd	12.833	13.639	9.833	12.25	30.04	30.36	68.79	63.04
	3rd	18.416	21.833	20.833	22.639	29.71	30.07	66.07	66.29
	4th	13.75	15.167	10.5	11.833	29.72	30.21	68	64.1
Sep.	1st	8.583	8.361	6.333	6.972	30.19	28.29	68.29	63.87
	2nd	3.583	4.444	3	4.111	27.11	26.79	63.93	63.54
	3rd	0	0	0	0	27.33	29.65	62.43	66.61
Total		74.583	85.916	71	78.333				

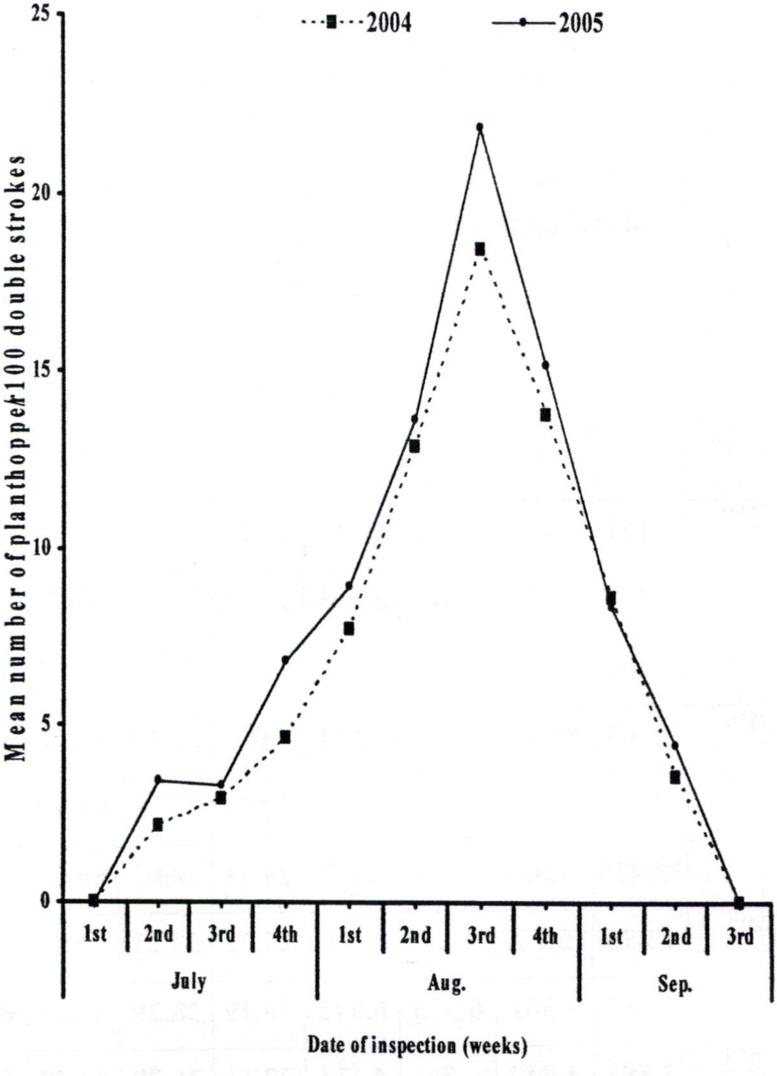

Fig. (11) :Seasonal abundance of planthopper *Sogatella vibix* (Haupt) infesting maize plants collected by sweeping nets at Dirab-Nigm district , Sharkia Governorate during 2004 and 2005 seasons.

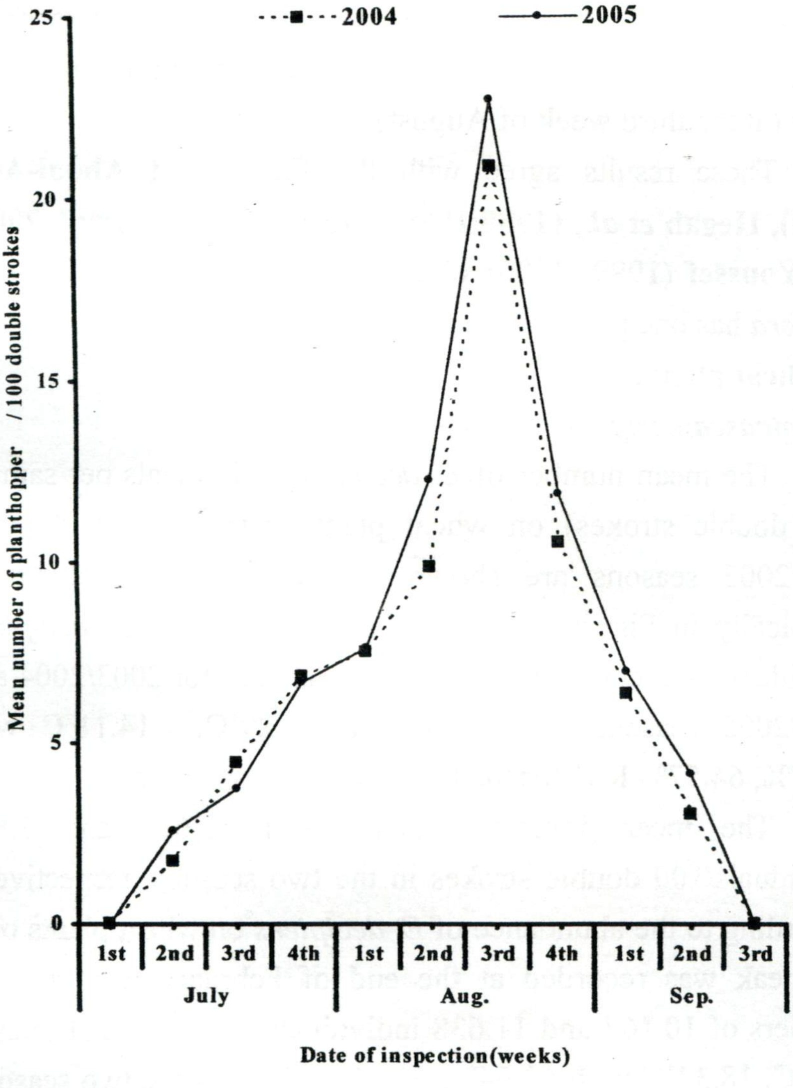

Fig. (12) :Seasonal abundance of planthopper *Sogatella furcifera* (Horv)infesting maize plants collected by sweeping nets at Dirab-Nigm district ,Sharkia Governorate during 2004 and 2005 seasons.

Results in general concerning the population density of plant hoppers *S. vibix* and *S. furcifera* on maize plants show clearly that both planthoppers had one generation on maize plants (at the third week of August).

These results agree with the findings of **Aboul-Atta (1983), Hegab *et al.*, (1988,1989) and Hegab Ola (1997, 2001) and Youssef (1999, 2006)** who mentioned that *S. vibix* and *S. furcifera* has one peak on maize plants

b) Wheat plants

i) *Empoasca decipiens* (Paoli)

The mean number of *E. decipiens* individuals per sample (100 double strokes) on wheat plants during 2003/2004 and 2004/2005 seasons are shown in Table (8) and illustrated graphically in Figure (13). The first collection of *E. decipiens* individuals was counted at the first of January for 2003/2004 and 2004/2005 seasons, respectively at 15.29°C, 14.11°C with 60.07%, 64.57% R.H for the two seasons, respectively.

The mean initials numbers were 3.611 and 3.888 individuals/100 double strokes in the two seasons, respectively. According to the abundance of *E. decipiens* on wheat plants only one peak was recorded at the end of February with a mean numbers of 10.167 and 11.638 individuals/100 double strokes at 16.7°C, 18.34°C with 62.64%, 61.36 % R.H for the two seasons, respectively.

The mean number of *E. decipiens* tended to decline until reached its minimal at the mid of April with a total number of 2.028 and 2.611 individuals/100 double strokes at a mean temperature 20.14, 20.38°C with 60.15, 57.58% R.H for the two seasons, respectively.

ii) *Empoasca decedens* (Paoli)

The mean number of *E. decedens* individuals infesting wheat plants were recorded in Table (8) and represented graphically in Figure (14) The mean number of *E. decedens* which firstly collected from wheat plants during 2003/2004 and 2004/2005 seasons were 2.277 and 3.555 individuals/100 double strokes at the end of December at a mean temperature of 15.29, 14.11°C with 60.07%, 64.57% R.H for the two seasons, respectively.

One peak was recorded for *E. decedens* on wheat plants at end of February with a mean number of 8.778 and 8.083 individuals/100 double strokes at a mean temperature 16.72, 18.34°C with 62.64, 61.36 % R.H for the two seasons, respectively. The number of *E. decedens* decreased to until reached its minimal at the mid of April with a mean number of 2.167 and 1.695 individuals/100 double strokes at 20.14°C 20.38 °C with 60.15, 57.58 % R.H for two seasons, respectively.

Results in general concerning the population density of leafhopper species on wheat plants show clearly that both *Empoasca decipiens* and *E. decedens* had one peak at end of February for the two leafhoppers, respectively.

These results agree with the findings of **Hegab-Ola (1997 and 2001) and Youssef (1999, 2006)** who mentioned that *E. decipiens* and *E. decedens* had one

peak on wheat plants. Similar trends were also recorded by **Aboul Atta (1983), Hegab *et al.*, (1989) and Hegab (1993).**

Table (8): Mean number of leafhoppers *Empoasca decedens* (Paoil) and *E. decipiens* (Paoil)] infesting wheat plants collected by plant samples at Diarb – Nigm district ,Sharkia Governorate during 2003/2004 and 2004/2005 seasons .

Date of inspection (weekly)		Mean number of leafhoppers / sample				Mean of			
		E. decipiens		*E. decedens*		Temp. C°		RH%	
		2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005
Dec.	4th	0	0	0	0	15.14	17.43	60.72	61.43
Jan.	2nd	3.611	3.888	2.277	3.555	15.29	14.11	60.07	64.57
	4th	4.916	6.112	3.389	4.75	15.62	14.5	62.12	58.86
Feb.	2nd	8.583	9.556	4.583	6.306	14.59	13.75	69.86	61.25
	4th	10.167	11.638	8.778	8.083	16.72	18.34	62.64	61.36
March	2nd	10.028	8.388	6.445	7.111	18.07	19.08	66.22	59.97
	4th	5.056	7.722	4.833	5.972	17.98	17.7	63.11	61.38
April	2nd	2.028	2.611	2.167	1.695	20.14	20.38	60.15	57.58
	4th	0	0	0	0	22.33	23.16	57.29	55.39
Total		44.389	49.917	32.472	37.472				

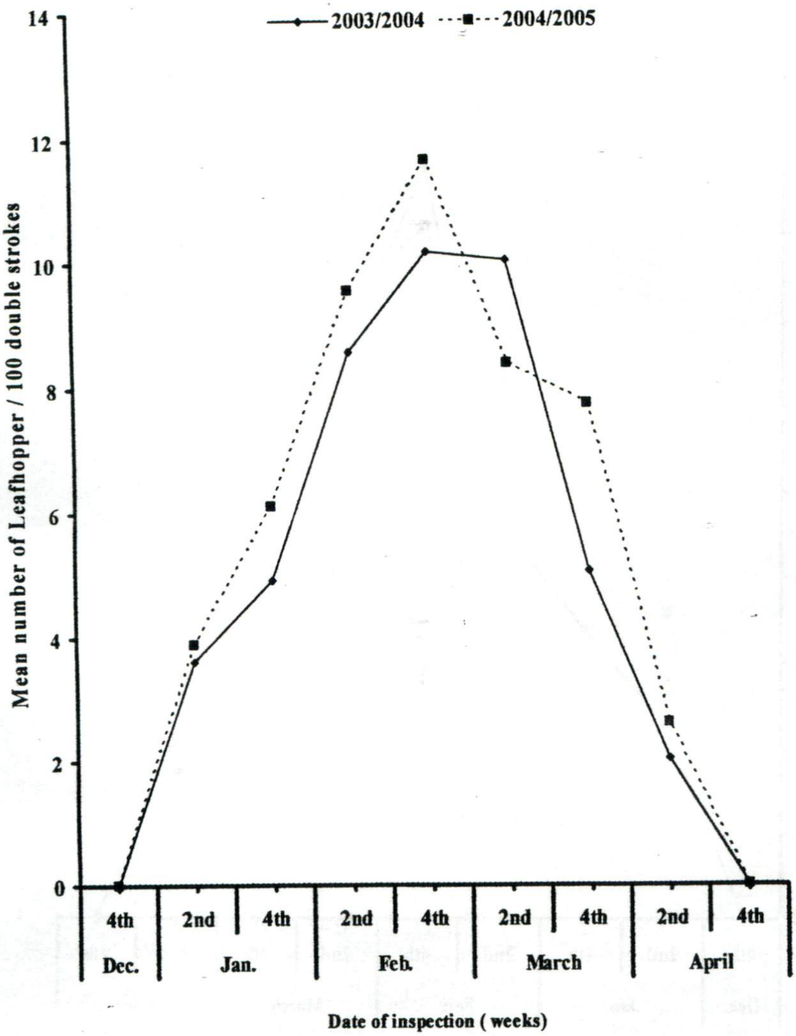

Fig. (13) :Seasonal abundance of leafhopper *Empoasca decipiens* (Paoli) infesting wheat plants collected by sweeping nets at Dirab-Nigm district ,Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

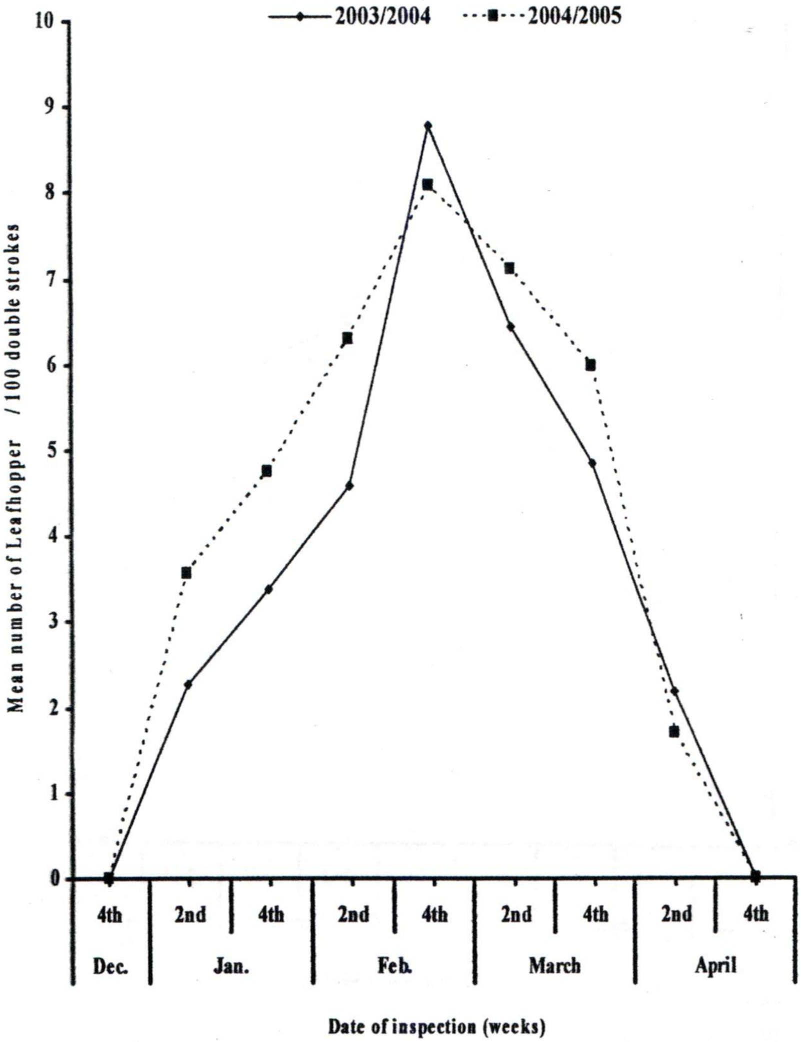

Fig. (14) :Seasonal abundance of Eecedens decedens (Paoli) infesting whaet plants collected by plant samples at Dirab-Nigm district , Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

4.1.3. Effect of certain climatic factors on the population density of the dominant homopterous insects infesting some maize and wheat crops.

1. Aphids

i) *Rhopalosiphum padi* (F.)

The results obtained in Table (9) revealed that the correlation coefficient between activity of *R. padi* (F.) and maximum temperature was negative insignificant (r1 = -0.164) in 2004 season but it was positive insignificant (r1 = 0.373) in 2005 season .

While the correlation coefficient between and minimum temperature was positive insignificant (r2 = 0.376) in 2004 season but it was positive significant (r2 =0.587*) in 2005 season.

Concerning the correlation between *R. padi* population and relative humidity, it was positive high significant (r3 = 0.729**) in 2004 season but it was positive insignificant (r3 = 0.159)in 2005 season

The partial regression between *R. padi* (F.) activity and maximum temperature, it was negatively and insignificant (b1 =-0.453) in 2004 season but it was positive and insignificant (b1 =248.84) in 2005 season. There was positively and insignificant partial regression between the population of *R. padi* (F.) and minimum temperature (b2 = 4.004) and (b2 =331.78) in 2004 and 2005 seasons, respectively. While the partial regression between *R. padi* and relative humidity was positive and significant (b3=2.129*) in 2004 season but it was positive and insignificant (b 3=73.533) in 2005 season.

ii) *Rhopalosiphum maidis* (L.)

The correlation coefficient between *R. maidis* and maximum temperature was negatively insignificant (r1 =-0.115) in 2004 season but it was positive insignificant (r1 =0.360) in 2005 season. The number of *R. maidis* was positive and insignificant correlated with minimum temperature (r2= 0.191) in 2004 season but it was positive significant (r =0.579*) in 2005 season. The correlation between *R. maidis* (L.) and relative humidity was positive and insignificant (r3 =0.548) in 2004 season but it was negatively insignificant (r3 = -0.162) in 2005 season.

The partial regression between *R. maidis* and maximum temperature was positive and insignificant (b1=1.505) and (b1 =132.44) in 2004 and 2005 seasons, respectively. The partial regression between *R. maidis* and minimum temperature was positive and insignificant (b2 =73.304) and (b2 =181.01) in 2004 and 2005 seasons, respectively.

Also, the partial regression between *R. maidis* and relative humidity was positive insignificant (b3 =95.543) and (b3 =39.637) in the two seasons, respectively.

iii) *Aphis gossypii* (Glov.).

The mean numbers of *A. gossypii* was negative high significant correlation with maximum temperature, was and positively insignificant (r1= 0.193) and (r1= 0.527) in 2004 and 2005 season . The relationship between the numbers of *A. gossypii* and minimum temperature was positive and insignificant (r2 = 0.043) in 2004 season and it was negative and insignificant in 2005 season (r 2= -0.039). There was positive and insignificant correlation coefficient between the population density of *A. gossypii* and relative humidity (r3 = 0.302) in 2004 seasons, and it was negative and insignificant (r3 = -0.108) in 2005 season.

The partial regression between *A. gossypii* and maximum temperature was positive and insignificant (b1 = 20.507) in 2004 seasons and positive significant (b1 =37.646*) during 2005 season. While partial regression between the numbers of *A. gossypii* and minimum temperature was negatively and insignificant (b2 = -9.521) and (b2 = -39..271) in 2004 and 2005 seasons. There was positive and insignificant partial regression between the numbers of *A. gossypii* and relative humidity (b3 = 7.976) and (b3 = 10.667) in 2004 and 2005 seasons respectively.

iv) *Schizaphis graminum* (R.)

The mean numbers of *S. graminum* was positive and insignificant correlation with maximum temperature (r1 = 0.060) in 2003/2004 season, while it was negative and insignificant (r1 = -0.370) in 2004/2005 season. The relationship between the numbers of *S. graminum* and minimum temperature was negative and insignificant (r2 = -0.056) and (r2= -0.230) in 2003/2004 and 2004/2005 seasons, respectively. There was positive and insignificant correlation coefficient between the population density of *S. graminum* and relative humidity (r 3= 0.447) and (r 3= 0.069) in 2003/2004 and 2004/2005 seasons, respectively.

The partial regression between *S. graminum* and maximum temperature was positive and in significant (b1 = 1.656) in season 2003/2004 and negative insignificant (b1 = -4.567) during 2004/2005 season. While partial regression between the numbers of *S. graminum* and minimum temperature was negative and insignificant (b2 = -2.189) in 2003/2004 season and positive insignificant (b2 = 4.033) in 2004/2005 season. There was positive and significant partial regression between the numbers of *S. graminum* and relative humidity (b3 = 1.725*) in 2003/2004 and negative insignificant (b3 = -0.545) in 2004/2005 season.

2) Leafhoppers and planthoppers

i) *Empoasca decipiens* (Paoli)

The correlation coefficient between *E. decipiens* and maximum temperature was negatively insignificant (r1 =-0.523) in 2004 seasons, respectively and positively significant (r1 = 0.292) in 2005 season.

Concerning the relationship between *E. decipiens* and minimum temperature, there was positive and insignificant (r2=0.254) in during 2004 seasons and positively significant (r2 = 0.560*) in 2005 season. The correlation coefficient between the population of *E. decipiens* and relative humidity was positively insignificant (r3 =0.567) and (r3 = o.308) in 2004 and 2005 seasons.

The partial regression between population of *E. decipiens* and maximum temperature was negatively insignificant (b1 = -6.339) in 2004 seasons respectively and positively insignificant (b1 = 4.386) in 2005 season.

There was positive and insignificant partial regression between *E. decipiens* population and minimum temperature (b2 = 5.248) and (b2 = 2.770) in the two seasons, respectively. The partial regression between *E. decipiens* and relative humidity was positive and insignificant (b3 = 1.624) and (b3 = 1.779) in during 2004 and 2005 seasons, respectively.

ii) *Empoasca decedens* (Paoli)

The correlation coefficient between *E. decedens* and maximum temperature was negatively insignificant (r1= -0.152) in 2004 season and positively insignificant (r1= 0.425) in 2005 season.

Concerning the relationship between *E. decedens* and minimum temperature, there was positive and significant (r 2= 0.114) and (r 2= 0.532) in 2004 and 2005 seasons, respectively. The correlation coefficient between the population of *E. decedens* and relative humidity was positive and insignificant (r3 = 0.581) and (r3 = 0.262) during 2004 and 2005 seasons, respectively.

The partial regression between population of *E. decedens* and maximum temperature was negatively insignificant (b1 = -0.148) in during 2004 season and positively significant (b1 = 5.213*) in 2005 season. There was negatively insignificant partial regression between *E. decedens* population and minimum temperature (b2 = -0.137) in the 2004 season and it was positively insignificant (b2 =0.627) in during 2005 season. The partial regression between *E. decedens* and relative humidity was positive and insignificant (b3 = 3.018) in during 2004 and positively significant (b3 = 1.895*) in 2005 season..

iii) *Cicadulina chinai* (Ghauri)

Positive and insignificant correlation coefficient was obtained between number of *C. chinai* and maximum temperature (r1 = 0.022) and (r1 = 0.207) in 2004 and 2005 seasons, respectively. The correlation coefficient between *C. chinai* and minimum temperature was positive and insignificant (r2 = 0.436) in 2004 season and positively significant (r2=

0.579*) in 2005 season. There was positive and insignificant correlation coefficient between *C. chinai* and relative humidity (r3=0.558) and (r3= 0.449) in 2004 and 2005 seasons, respectively.

The partial regression between *C. chinai* and maximum temperature was positive and insignificant (b1 = 0.913) in 2004 season and positively significant (b1 = 2.519*)in 2005 season. The partial regression between *C. chinai* and minimum temperature was positive and insignificant (b2 = 4.656) and (b2 = 1.121) in 2004 and 2005 seasons, respectively.

The partial regression between *C. chinai* and relative humidity was positive and insignificant (b3 = 1.501) in 2004 season but it was positive and significant (b1 = 1.222*) in 2005 season.

iv) *Balclutha hortensis* (Lindb).

The total number of *B. hortensis* was negative and insignificant correlated with maximum temperature (r1= -0.333) in 2004 season but it was positively insignificant (r1 = 0.131) in 2005 season. There was positively insignificant correlation coefficient between the number of the insect and minimum temperature (r2= 0.384) and (r2= 0.545) in 2004 and 2005 seasons, respectively. There was positive and high significant correlation coefficient between *B. hortensis* and relative humidity (r3 =0.670**) in 2004 season and but it was positively insignificant (r 3= 0.429) in 2005 season.

The partial regression between *B. hortensis* and maximum temperature was negative and insignificant (b1 = -1.809) in 2004 season and positively significant (b1 = 1.178*) in 2005 season. There was positive and insignificant partial regression between the number of *B. hortensis* and minimum temperature (b2 =3.455) in 2004 season but it was positive and high significant (b2=3.708**) in 2005 season. While the partial regression between *B. hortensis* and relative humidity was positively insignificant (b3 =1.162) in 2004 season but it was and negative insignificant (b3 = -0.663) in 2005 season.

v) *Sogatella vibix* (Haupt).

The correlation coefficient between *S. vibix* and maximum temperature was negative and insignificant (r1= -0.164) in 2004 season but it was positively significant (r1= 0.572*) in 2005 season. The correlation coefficient between *S. vibix* and minimum temperature was positive and insignificant (r 2= 0.376) and (r 2= 0.451) in 2004 and 2005 seasons, respectively. The correlation coefficient between *S. vibix* and relative humidity was positive and high significant (r3 = 0.729**) in 2004 season and positively insignificant (r3 = 0.087) in 2005 season.

The partial regression between *S. vibix* and maximum temperature was negative and insignificant (b1 = -0.453) in 2004 season but it was positively high significant (b1 = 6.175**) in 2005 season. The partial regression between *S. vibix* and minimum temperature was positively insignificant (b2 = 4.004) in 2004 season but it was negative and insignificant (b2 = -0.368) in 2005 season. The partial regression between *S. vibix* and relative humidity positive and significant (b3 = 129*) in 2004 season but it was positively significant (b3 = 1.827) in 2005 season.

vi) *Sogatella furcifera* (Horv).

The correlation coefficient between *S. furcifera* and maximum temperature was negative and insignificant (r1= -0.171) in 2004 season but it was positive and insignificant (r1= 0.512) in 2005 season. The correlation coefficient between *S. furcifera* and minimum temperature was positive and insignificant (r 2= 0.253) and (r2= 0.502) in 2004 and 2005 seasons, respectively. The correlation coefficient between *S. furcifera* and relative humidity was positive and high significant (r3 = 0.739**) in 2004 season but it was positive and insignificant in (r3 = 0.123) 2005 in season. The partial regression between *S. furcifera* and maximum temperature was negative and significant (b1 = -0.143) in 2004 season and positively significant (b1 = 4.615*) in 2005 season.

The partial regression between *S. furcifera* and minimum temperature was positive and insignificant (b2 = 1.691) and (b2 = 0.911) in 2004 and 2005 seasons, respectively. The partial regression between *S. furcifera* and relative humidity was positive significant (b3 = 2.212*) in 2004 season but it was positive insignificant (b3 = 1.390) in 2005 season.

4.1.4. Combined effects of meteorological factors and path analysis.

The effect of maximum temperatures, minimum temperatures and relative humidity on aphids, leafhoppers and planthoppers populations was estimated by calculating the partial regression analysis (least square regression equation).

Data in Table (10) values of explained variance by the three aforementioned meteorological factors show that the considered factors have played a conspicuous role in detecting the activity of these pests during the two seasons.

These results ensure that the tested climatic factors play a great role in regulating the population density and seasonal abundance of such insect pest.

Similar findings were reported by **Parh (1986), Hegab *et al.*, (1987, 1988 and 1989) ; EL-Sharkawy (1989) Hegab (1993); Hegab-Ola (1997, 2001), El-Gindy (1997) and Youssef (1999 , 2006)** which greatly correspond with the present results.

Path analysis

The method of path coefficient included the independent variable i.e. maximum temperature, minimum temperature and relative humidity.

Path analysis was practiced in order to find out the relative importance of these variable in contributing numbers of insects Table (10) presented the relative importance in contributing numbers of insects as recorded in percentage of variation of maximum temperature; minimum temperature and relative humidity in 2003/2004 and 2004/2005 seasons.

Table (9): Simple correlation coefficients and partial regression between maximum temperature , minimum temperature and mean relative humidity and total number of certain insects infesting maize and wheat plants during 2003/2004 and 2004/2005 seasons.

Insect species	Simple correlation coefficients						Partial regression					
	2003/2004			2004/2005			2003/2004			2004/2005		
	r1	r2	r3	r1	r2	r3	b1	b2	b3	b1	b2	b3
R. padi	-0.164	0.376	0.729**	0.373	0.587*	0.159	-0.453	4.004	2.129*	248.84	331.78	73.353
R. maidis	-0.115	0.191	0.548	0.360	0.579*	-0.162	1.505	73.303	95.543	132.44	181.01	39.637
A.gossypii	0.193	0.043	0.302	0.527	-0.039	-0.108	20.507	-9.521	7.976	37.646*	-39.271	10.667
S.graminum	0.060	-0.056	0.447	-0.370	-0.230	0.069	1.656	-2.189	1.725*	-4.567	4.033	-0.545
E. decipiens	-0.523	0.254	0.567	0.292	0.560*	0.308	-6.339	5.248	1.624	4.386	2.770	1.779
E. decedens	-0152	0.114	0.581	0425	0.532	0.262	-0.148	-0.137	3.018	5.213*	0.627	1.895*
C. chinai	0.022	0.436	0.558	0.207	0.579*	0.449	0.913	4.656	1.501	2.519*	1.121	1.222*
B. hortensis	-0.333	0.384	0.670**	0.131	0.545	0.429	-1.809	3.455	1.162	1.178*	308**	-0.663
S. vibix	-0.164	0.376	0.729**	0.572*	0.451	0.087	-0.453	4.004	2.129*	6.175**	-0.368.7	1.827
S. furcifera	-0.171	0.253	0.739**	0.512	0.502	0.123	-0.143	1.691	2.212*	4.615*	0.911	1.390

r1=correlation coefficient between max. temp. and number of insects

r2=correlation coefficient between min. temp. and number of insects

r3=correlation coefficient between R.H. and number of insects

B1=Partial regression between max. temp. and number of insects

b2=Partial regression between min. temp. and number of insects

b3=Partial regression between R.H. and number of insects

Table(10):Explained and unexplained variance and the effects of maximum, minimum temperature and mean relative humidity on the total numbers of homopterous insects infesting maize and wheat plants during 2003/2004 and 2004/2005 seasons in Diarb-Nigm Sharkia Governorate.

Insect species	Explained variance		Unexplained variance	
	2003/2004	2004/2005	2003/2004	2004/2005
R. maidis	0.457	0.449	0.543	0.551
R. padi	0.447	0.314	0.553	0.686
A. gossypii	0.174	0.542	0.826	0.458
S. graminum	0.314	0.233	0.686	0.767
E. decipien	0.479	0.505	0.521	0.495
E. decedens	0.314	0.521	0.686	0.479
C. chinai	0.426	0.622	0.574	0.378
B. hortensis	0.569	0.685	0.431	0.315
S. vibix	0.585	0.668	0.415	0.332
S. furcifera	0.557	0.605	0.443	0.395

4.2. Effect of certain agricultural practices on population density of certain insects (Aphids, Leafhoppers and planthoppers).

The influences of certain agricultural practices such as sowing date, varieties and fertilization on the occurrence of certain insects attacking some Graminaceous crops (Maize and wheat) under the natural environmental conditions of Asaid village, Diarb-Nigm distract were studied during two consecutive growing seasons on maize and wheat 2003/2004 and 2004/2005 .

a) Maize.

1) Effect of sowing dates.

Aphids

i) *Rhopalosiphum maidis*. (F.)

Data presented in Table (11) show that *R. maidis* infested maize plants sown in the tested dates during the two seasons of investigations 2004 and 2005. Statistical analysis of the obtained results revealed that the differences between the insect numbers recorded in the different sowing dates were highly significant during the first and second seasons. Maize plants sown on the end of May showed the lowest mean numbers of *R. maidis* recording (359.037 and 360.296) insects/sample in 2004 and 2005 seasons, respectively. Whereas, those of the three sowing dates appeared relatively high numbers of *R. maidis* recording (558.13 & 587.247) insects/sample in case of mid of May during the first and second seasons, respectively.

In the two seasons, statistical analysis clearly revealed that differences between the insect population density occurred on maize sown in the period from mid of May to mid of June were highly significant.

ii) *Rhopalosiphum padi*.(L.)

Results given in Table (11) show that *R. padi* infested maize plants sown in the tested dates during the two seasons of investigation 2004 and 2005. Statistical analysis of the obtained results revealed that the differences between the insect numbers recorded in the different sowing dates were highly significant during the first and second seasons Maize plants sown on the end of May showed the lowest mean number of *R. padi* recording (253.385 and 276.208) insects/sample in the two seasons, respectively.

In the other hand high numbers of *R. padi* recording (331.302 and 401.892) insects/sample in the two seasons, respectively. In 2004 and 2005 seasons, respectively statistical analysis clearly revealed that differences between the insect population density occurred on maize sown in the period from mid of May to mid of June were high significant.

iii) *Aphis gossypii* (Glov.)

Data presented in Table (11) show that *Aphis gossypii* infested maize plants sown in the tested dates during the two seasons of investigations 2004 and 2005. Statistical analysis of the obtained results revealed that the differences between the insect numbers recorded at different sowing dates were highly significant during the first and second seasons. Maize plants sown on the end of May showed the lowest mean numbers of *R. maidis* recording (38.786 and 48.187) insects/sample in 2004 and 2005 seasons, respectively. Whereas, those of the three sowing dates appeared relatively high numbers of *A. gossypii* recording

(51.333 and 61.841) insects/sample in case of mid of May during the first and second seasons, respectively.

In the two seasons, statistical analysis clearly revealed high differences between the insect population density occurred on maize sown during the period from mid of May to D3 mid of June

Leafhoppers and planthoppers.

i) *Empoasca decipiens*.(Paoli)

As clearly shown in Table (11) maize plants sown in the three different dates at 15 day intervals from (mid of May) to (mid of June) were infested by *E. decipiens* individuals. In two investigation seasons, the insect population density was high significantly affected by time of sowing. The highest mean number of *E. decipiens* (16.508 and 16.856) individuals per sample were recorded for the first sowing date of both 2004 and 2005 seasons, respectively. Whereas, the lowest population densities of (13.108 and 13.705) in the 2004 and 2005 seasons, respectively were recorded on maize sown on the second dates. Statistical analysis indicated that the differences between mean numbers of *E. decipiens* on maize plants sown on the 1st, 2nd and 3rd dates were highly significant in 2004 and 2005 seasons.

ii) *Empoasca decedens*. (Paoli)

Data given in Table (11) indicated that the high numbers of *E. decedens* recording (12.467 and 12.825) insects/sample in case of mid of May during the first and second seasons, respectively. The lowest number of insect per sample was recorded in end of May (9.55 and 10.475) insects/sample in 2004 and 2005 seasons, respectively.

iii) *Cicadulina chinai.* (Ghauri)

Data presented in Table (11) show that *C. chinai* infested maize plants sown in the tested dates during the three seasons of investigation 2004 and 2005. Statistical analysis of the obtained results revealed that the difference between the insect numbers recorded for different sowing dates was highly significant during the first and second seasons. Maize plants sown on the end of May showed the lowest mean numbers of *C. chinai* recording (6.5 and 8.311) insects/sample in 2004 and 2005 seasons respectively whereas, those of the three sowing dates appeared relatively high numbers of *C. chinai* recording (8.125 and 10.825) insects/sample for the two successive seasons respectively in case of mid of May. The differences between the insect population density occurred on maize plants sown in the period from mid of May to mid of June were statistically significant.

iv) *Balclutha hortensis*. (Lindb)

With respect to the infestation of maize plants sown on different dates with *B. hortensis*, it could be concluded that the differences between *B. hortensis* numbers recorded at the three tested sowing dates were highly significant during the first and second seasons.

Data shown in Table (11) indicated that the tested sowing dates can be arranged descending according to the degree of maize infestation with *B. hortensis* as follows ; mid of May (5.741 and 6.932) , mid of June (5.277 and 6.824) and end of May (5.148 and 6.627) insect/sample for the first and second seasons, successively. Therefore, it can be stated that sowing maize plants in the second date was very suitable to maize cultivation since *B. hortensis* population was the lowest.

v) *Sogatella vibix*(Haupt).

Data shown in Table (11) indicated that the tested sowing dates can be arranged descending according to the degree of maize, infestation with *S. vibix* as follows; mid of may (10.009 and 12.015), mid of June (8.667 and 10.164) and end of May (8.287 and 9.546) insects/sample for the first and second seasons, successively.

Therefore, it can be stated that sowing maize plants in end of May was very suitable to maize cultivation since *S. vibix* population was the lowest.

Statistical analysis of the obtained results revealed that the differences between the insect numbers recorded for the different sowing dates were highly significant during the first and second seasons

i) *Sogatella furcifera*.(Horv)

Maize plants sown on the end of May showed the lowest mean numbers of *S. furcifera* recording (7.889 and 8.704) insects/sample in 2004 and 2005 seasons, respectively. Whereas, those of the three sowing dates appeared relatively high numbers of *S. furcifera* recording (8.787 and 9.981) insects/sample in case of mid of May during the first and second seasons respectively. In 2004 and 2005 seasons, the differences between the insect population density occurred on maize plants sown in the period from mid of May to mid of June were statistically significant.

Generally, from the obtained results it could be concluded that the second sowing date (end of May) showed the lowest mean number of Aphids, leafhoppers, and planthoppers while the first sowing date (mid of May) showed the highest mean number of aforementioned insects infesting maize in 2004 and 2005 seasons. These results are in agreement with the findings of **Attia Shahinaz (1993) and Hegaba, Ola** who recorded that maize planted, in the 1st of June showed the lowest mean number of Aphids *R. maidis* and *A. gossypii* while maize plants planted at mid of May showed highest mean numbers of *R. maidis*, and *A. gossypii* . These results are in partial agreement with the finding of **EL-Naggar (2000)** who recorded that the second week of May was the sowing date which showed lowest mean number of *R. maidis* followed by the sowing date in the first week of June while the maize plants planted in the first week of July showed the highest mean numbers of *R. maidis*.

Mean of yield quantity (kg/plot).

With regard to influence of maize plants cultivars on maize yield, data presented in Table (11) show that cultivars sowing at end of May yielded the highest mean of 30.63 and 28 kg/ plot in 2004 and 2005 seasons, respectively. Followed by cultivars sowing in mid of June yielded a mean of 27.63 and 25.04 kg /plot in two seasons, respectively. While the first sowing cultivars (mid of May) yielded the lowest mean of 24.81 and 23.73 kg /plot in 2004 and 2005 seasons, respectively

Table (11) : Effect of different sowing dates on the infestation of maize plants by aphids, leafhoppers and planthopper insects at Diarb- Nigm district in Sharkia Governorate during 2004 and 2005 seasons.

Sowing dates	Mean of aphids/ sample						Mean of leafhoppers/ sample								Mean of planthoppers/ sample				Mean of yield Kg/ plot	
	R. maidis		*R. padi*		*A. gossypii*		*E. decipiens*		*E. decedens*		*C. chinai*		*B. hortensis*		*S. vibix*		*S. furecifera*			
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
D1	558.13	587.247	331.302	401.892	51.333	61.841	16.508	16.856	12.467	12.825	8.125	10.825	5.741	6.932	10.009	12.015	8.787	9.981	24.81	23.73
D2	359.037	360.296	253.385	276.208	38.786	48.187	13.108	13.705	9.55	10.475	6.5	8.311	5.148	6.627	8.287	9.546	7.889	8.704	30.63	28.0
D3	372.907	383.83	269.052	321.16	50.976	57.206	13.642	14.805	11.125	10.753	6.725	8.778	5.277	6.824	8.667	10.164	8.241	9.343	27.63	25.04
F	97.5**	446.5**	83.1**	94.1**	84.2**	12.7**	122.6**	23.7**	57.6**	44.1**	22.6**	4.3	10**	8.3**	8.9**	27.2**	16.7**	18.1**	104.6**	13.9**

D1 = First sowing date at mid of May D2 = Second sowing date at end of May

D3 = Third sowing date at mid of June

2) Effect of maize varieties.

Aphids.

i) *Rhopalosiphum maids*.(F.)

Data given in Table (12) revealed that the differences between mean numbers of *R. maidis* on the three tested maize varieties were statistically significant for the two seasons of study.

The intensity of *R. maidis* infestation in 2004 and 2005 seasons, measured as mean number of insects/sample could be arranged in the three seasons in descending order as follows; Single cross 129 (542.074 and 547.216) , Single cross 123 (414.13 and 432.055), Single cross 18 (333.87 and 352.102) insects/sample in 2004 and 2005 seasons, respectively.

It was obvious that in the two seasons of study, cultivar Single cross 18 proved to be the least susceptible host plant for *R. maidis* infestation, while the variety Single cross 129 appeared to be the most susceptible maize variety.

Generally, it was obvious that all tested maize cultivars showed higher infestion in second season than in first one, Table (12) This may be due to the differences in environmental factors e.g wheather factors and natural enemies prevailing during the two seasons of investigation.

ii) *Rhopalosiphum padi*.(L.)

Data in Table (12) showed that Single cross 18 recorded the lowest number of (205.145 and 269.826) insects/sample in 2004 and 2005 seasons respectively. While the Single cross 129 recorded the highest number of (390.987 and 408.51) insects/sample in the two successive seasons.

iii) *Aphis gossypii* (Glov).

Results given in Table (12) revealed that Single cross 18 proved to be the least susceptible host plant for *A. gossypii* infestation (40.583 and 39.21) insects/sample for the first and second seasons, respectively. While the variety Single cross 129 appeared to be the most susceptible maize variety (56.286 and 70.683) insects/sample for the first and second seasons, respectively.

Leafhoppers and planthoppers

i) *Empoasca decipiens*.(Paoli)

Results given in Table (12) revealed that in the two seasons of study, Single cross 18 proved to be the least susceptible host plant for *E. decipiens* infestation (12.875 and 13.605) insects/sample for the first and second seasons, respectively. While the variety Single cross 129 appeared to be the most susceptible maize variety (16.117 and 17.008) insects/sample for the first and second seasons, respectively.

ii) *Empoasca decedens*.(Paoli)

As seen from Table (12), the most susceptible cultivar was Single cross 129 (13.15 and 13.572) insects per sample while the least susceptible cultivar was Single cross 18 (9.792 and 9.706) insects per sample during the first and second seasons, respectively.

iii) *Cicadulina chinai*. (Ghauri)

Highly significant differences were obtained between *C. chinai* infestation on the three tested varieties Table (12). It was clear obvious that in the two seasons of study, cultivar Single cross 18 proved to be the least susceptible host plant for *C. chinai* infestation, (5.23 and 8.475) insects/sample during the first and second seasons respectively. While the variety Single cross 129 appeared to be the most susceptible maize variety

(8.61 and 10.628) insects/sample during 2004 and 2005 seasons, respectively.

iv) *Balclutha hortensis*. (Lindb)

Data in Table (12) revealed that the differences between mean numbers of *B. hortensis* on the three tested maize varieties were highly significant for the two seasons of study. It was obvious that in the two seasons of study, cultivar Single cross 18 proved to be the least susceptible host plant for *B. hortensis* infestation (4.759 and 5.96) insects/sample in the first and second seasons, respectively. While the variety Single cross 129 appeared to be the most susceptible maize variety (6.296 and 7.787) during the first and second seasons, respectively.

v) *Sogatella vibix*. (Haupt)

Data given in Table (12) indicated that the differences between mean numbers of *Sogatella vibix* on the three tested maize varieties were highly significant for the two seasons of study.

Cultivar Single cross 18 was the least susceptible host plant for *S. vibix* infestation, (7.778 and 9.571) insects per sample while the variety Single cross 129 appeared to be the most susceptible maize variety (10.685 and 11.889) insects/sample during 2004 and 2005 seasons respectively.

vi) *Sogatella furcifera*.(Horv)

Results given in Table (12) revealed that the differences between mean numbers of *S. furcifera* on three tested maize varieties were highly significant for the two seasons of study.

It was obvious that in the two seasons of study, cultivar Single cross 18 proved to be the least susceptible host plant for *S. furcifera* infestation (7.657 and 8.457) insects/sample while the variety Single cross 129 appeared to be the most susceptible maize variety (9.14 and 10.531) insects/sample during 2004 and 2005 seasons, respectively.

Generally, from the obtained results, it could be concluded that Single cross 129 variety was more susceptible to aphids, leafhoppers and planthoppers infestation, whereas Single cross 18 variety was the least susceptible cultivars. The results agree with the findings of **Hegab, Ola (2001) and Youssef (2006)** who mentioned that varieties of maize plants had a great effect on the incidence of some homopterous insects.

Mean of yield quantity (kg/plot)

With regard to the influence of maize plants cultivars on maize yield , data presented in Table (12) show that Single cross 18 variety yielded the highest mean of 29.81 and 27.58 kg / plot in 2004 and 2005 seasons , respectively. Followed by Single cross 123 cultivars which yielded a mean of 27.81 and 25.52 kg /plot in two seasons, respectively. While Single cross 129 yielded the lowest mean of 25.48 and 23.67 kg /plot in 2004 and 2005 seasons, respectively.

4.2.1.3. Effect of maize fertilization.

Aphids

i) *Rhopalosiphum maidis*.(F.)

Data given in Table (13) show that the highest mean numbers of the *R. maidis*, (548.654 and 611.066) insects/sample occurred on the Zero or without potassium fertilization during 2004 and 2005 seasons, respectively.

Whereas, the lowest population density of *R. maidis* was recorded for 75 Kg. potassium/feddan (279.395 and 315.395) insects/sample in the first and second seasons respectively.

In the two seasons the four treatment could be arranged in a descending order according to their influence on maize

Table (12) : Effect of different maize varieties on the infestation of maize plants by aphids, leafhoppers and planthopper insects at Diarb- Nigm district in Sharkia Governorate during 2004 and 2005 seasons.

Varieties	Mean of aphids/ sample						Mean of leafhoppers/ sample								Mean of planthoppers/ sample				Mean of yield Kg/ plot	
	R. maidis		*R. padi*		*A. gossypii*		*E. decipiens*		*E. decedens*		*C. chinai*		*B. hortensis*		*S. vibix*		*S. furecifera*			
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
V1	542.074	547.216	390.927	408.51	56.286	70.683	16.117	17.008	13.15	13.572	8.61	10.628	6.296	7.787	10.685	11.889	9.14	10.531	25.48	23.67
V2	414.13	432.055	257.667	320.924	44.226	57.341	14.266	14.753	10.2	10.775	7.51	8.811	5.111	6.636	8.5	10.265	8.12	9.04	27.81	25.52
V3	333.87	352.102	205.145	269.826	40.583	39.21	12.875	13.605	9.792	9.706	5.23	8.475	4.759	5.96	7.778	9.571	7.657	8.457	29.81	27.58
F	68.9**	125.6**	481.9**	164.5**	124.8**	244.9**	355.3**	56.2**	118.3**	74.2**	356.8**	34.8**	39.2**	71.1**	27.3**	19.1**	54.4**	30**	59.4**	23.6**

V1 = Singl cross 129 V2 = Singl cross 123 V3 = Singl cross 18 infestation with *R. maidis* as follows ; control or Zero level (548.654 and 611.066), 25 Kg. potassium/feddan (480.79 and 477.144), 50 Kg. potassium/feddan (411.259 and 371.559) and 75 Kg. potassium/feddan (279.395 and 315.395) insects /sample in the first and second seasons respectively.

ii) ***Rhopalosiphum padi***.(L.)

Results recorded in Table (13) show that the effect of using various level of potassium fertilization on the rate of infestation of maize plants with aphid *R. padi* was statistically significant during the two seasons of study.

The highest mean number of *R. padi* (357.083 and 447.315) occurred on F4 during 2004 and 2005 seasons respectively. The four treatments could be arranged in a descending order according to their influence on maize infestation with aphid *R. padi* as follows ; control without potassium fertilization/feddan (357.083 & 447.315), 25 Kg. potassium fertilization/feddan (309.458 and 394.055), 50 Kg. potassium fertilization/feddan (254.778 and 295.019) and 75 Kg. potassium fertilization/feddan (217 and 240.958) insects/ sample during 2004 and 2005 seasons respectively.

iii) ***Aphis gossypii***

Results recorded in Table (13) show that the effect of using various level of potassium fertilization on the rate of infestation of maize plants with aphid *A. gossypii* was statistically significant during the two seasons of study.

The highest mean number of *A. gossypii* (60.206 and 72.609) occurred on F4 during 2004 and 2005 seasons respectively. The four treatments could be arranged in a descending order according to their influence on maize infestation with aphid *A. gossypii* as follows ; control without potassium fertilization/feddan (60.206 &72.609), 25 Kg. potassium fertilization/feddan (52.587 and 59.116), 50 Kg. potassium fertilization/feddan (40.984 and 48.709) and 75 Kg. potassium fertilization/feddan (34.349 and 42.545) insects/ sample during 2004 and 2005 seasons respectively.

Leafhoppers and planthoppers.

i) *Empoasca decipiens*.(Paoli)

Analysis of variance of the data recorded in Table (13) showed that the effects of various tested fertilization treatments on the rate of infestation of maize by these species of leafhoppers were highly significant in the first and second seasons.

During 2004 and 2005 seasons, the four treatments could be arranged in a descending order according to the mean numbers of *E. decipiens* recorded per sample as follows ; zero level of potassium fertilization/feddan (17.767 and 18.441), 25 Kg. potassium fertilization/ feddan (15.156 and 15.767), 50 Kg. potassium fertilization/feddan (13.022 and 13.644) and 75 Kg. potassium fertilization/feddan (11.733 and 12.637) for two seasons respectively.

ii) ***Empoasca decedens***.(Paoli)

Analysis of variance of the data recorded in Table (13) showed that the effects of the four tested fertilization treatments on the rate of infestation of maize plants by *E. decedens* were highly significant in the first and second seasons.

During 2004 and 2005seasons, the four treatments could be arranged in a descending order according to mean numbers of *E. decedens* recorded per sample as follows ; zero level of potassium fertilization/feddan (13.856 and 14.274), 25 Kg.

potassium fertilization/feddan (11.744 and 11.907), 50 Kg. potassium fertilization/feddan (10.2 and 10.17) and 75 Kg. potassium fertilization/feddan (8.389 and 9.052) insects/sample during two seasons respectively.

iii) ***Cicadulina chinai***. (Ghauri)

According to the same table the highest mean numbers of *C. chinai* (9.367 and 11.637) insects/sample recorded zero level of potassium fertilization/feddan during 2004 and 2005 seasons respectively. While the lowest/mean numbers of *C. chinai* was recorded with 75 Kg. potassium fertilization/feddan (5.478 and 7.522) insects/ sample during two seasons respectively.

iv)***Balclutha hortensis***. (Lindb)

Results in Table (13) show that the effect of the used four treatments on the rate of infestation of maize plants with *B. hortensis* was statistically significant during the two seasons of study.

The highest mean numbers of *B. hortensis* (6.913 and 8.716) insects/sample occurred on the zero level of potassium fertilization/feddan maize plants during 2004 and 2005 seasons, respectively. Whereas the lowest population density of this pest was recorded with 50 Kg. potassium fertilization/feddan and 75 Kg. potassium fertilization/feddan (4.062 and 5.239) insects/sample during two seasons respectively.

v) ***Sogatella vibix***.(Haupt)

Analysis of variance, Table (13) showed that the effects of the four tested fertilization treatments on the rate of infestation on maize by these species of planthopper were highly significant in the first and second seasons.

During 2004 and 2005 seasons, the four treatments could be arranged in a descending order according to mean numbers of *S. vibix* recorded per sample as follows ; zero level of potassium fertilization/feddan (10.975 and 13.831), 25 Kg. potassium fertilization / feddan (9.519 and 11.066), 50 Kg. potassium fertilization/feddan (8.247 and 9.259) and 75 Kg. potassium fertilization/feddan (7.21 and 8.144) insects/sample during two seasons respectively.

vi) *Sogatella Furcifera*.(Horv)

Data presented in Table (13) showed also that the highest mean number of *S. furcifera* recorded zero level of potassium fertilization/feddan (10.63 and 11.86) insects/sample while the lowest mean number of *S. furcifera* recorded with 75 Kg. potassium fertilization/feddan (6.629 and 7.44) insect/sample during two seasons, respectively.

Mean of yield quantity (kg/ plot).

As clearly shown from the results in Table (13) the yield of maize plants treated with the different tested treatments was highly significant influenced by changing the fertilization program in the two seasons . The highest yield (32.67 and 29.81)kg / plot was recorded with F1 (75 Kg./ feddan) in 2004 and 2005 seasons whereas , the lowest yield of (23.17 and 21.14) kg / plot was obtained in case of F4 (control without potassium fertilization / feddan) treatments during the first and second seasons, respectively . The other tested treatments gave a moderate yield

In general, it could be concluded that the potassium fertilization levels influenced pronouncedly on the insects infestation and yield quantity. As the results show the highest number of insects recorded with the least level of potassium fertilization treatment (zero kg potassium sulphate/feddan) and lowest quantity of yield, while increasing this level to 75 kg potassium fertilization/feddan reduced the insect infestation and markedly increased the yield quantity. Therefore it could be recommended that fertilization with 75 kg potassium fertilization/feddan is very suitable to decrease insect infestation and increasing the resulted yield.

These results are in agreement with the findings of **Attia-Shahinaz (1993), Hegab-Ola (2001) and Youssef (2006)** who mentioned that there were significant differences between fertilization potassium on maize plants and mentioned that the highest mean number aphids, leafhoppers and planthoppers recorded in the zero level of potassium fertilization These results agreed with those of **El-Komy (1999)** who mentioned that fertilization potassium 36 unit /feddan was the lowest mean of cereal aphids *R. maidis* and *R. padi* and leafhoppers and planthoppers.

Table (13) : Effect of different potassium fertilization rates on the infestation of maize plants by aphids, leafhoppers and planthopper insects at Diarb- Nigm district in Sharkia Governorate during 2004 and 2005 seasons.

Fertilization rates	Mean of aphids/ sample						Mean of leafhoppers/ sample								Mean of planthoppers/ sample				Mean of yield Kg/ plot	
	R. maidis		*R. padi*		*A. gossypii*		*E. decipiens*		*E. decedens*		*C. chinai*		*B. hortensis*		*S. vibix*		*S. furecifera*			
	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005	2004	2005
F1	279.395	315.395	217	240.958	34.349	42.545	11.733	12.637	8.389	9.052	5.478	7.522	4.062	5.239	7.21	8.144	6.629	7.44	32.67	29.81
F2	411.259	371.559	254.778	295.019	40.984	48.709	13.022	13.644	10.2	10.17	6.1	8.378	4.864	5.959	8.247	9.259	7.247	8.4	29.75	27.69
F3	480.79	477.144	309.458	394.055	52.587	59.116	15.156	15.767	11.744	11.907	7.622	9.681	5.716	7.263	9.519	11.066	8.716	9.67	25.17	23.72
F4	548.654	611.066	357.083	447.315	60.206	72.609	17.767	18.441	13.856	14.274	9.267	11.637	6.913	8.716	10.975	13.831	10.63	11.86	23.17	21.14
F	77.7**	201.2**	140.1**	231.8**	199.1**	143.7**	614.5*	42.9**	112.1*	117.7*	223.6*	86.1**	133.9**	67.**	25.1**	157**	151.7**	141.7*	172.9*	67.8**

F1=75 Kg./ feddan F2=50 Kg./ feddan

F3= 25 Kg./ feddan F4= control (without potassium fertilization)

b) Wheat plants

1) Effect of sowing dates.

Aphids

i) *Rhopalosiphum padi* (L.)

With regard to the effect of planting date on the population density of *R. padi* infesting wheat plants, Table (14), it could be stated that highly significant differences in the *R. padi* numbers in the different tested dates in both investigation seasons were detected.

The highest mean numbers of *R. padi* (32.5 and 36.674) individuals/sample were recorded in the first sowing date (first of November) for both 2003/2004 and 2004/2005 seasons, respectively. Whereas, the lowest population densities of (21.526) in the first season and (28.79) in the second one were recorded on wheat sown on the second date (mid of November). Statistical analysis indicated that the differences between mean numbers of *R. padi* on wheat plants sown on the 1st date (first of November) , 2nd (mid of November) and 3rd (end of November) dates were highly significant in 2003/2004 and 2004/2005 seasons.

ii) *Rhopalosiphum maidis* (F.)

Data presented in Table (14) show that *R. maidis* individuals appeared on wheat plants sown in the tested dates during the two seasons of investigation, 2003/2004 and 2004/2005. Statistical analysis of the obtained results revealed that the differences between the insect numbers recorded in the different sowing dates were highly significant during the two seasons of study. Wheat plants sown on mid of November showed the lowest mean numbers of *R. maidis* recording (19.234

and 22.151) insects per sample during the first and second seasons, respectively. Whereas, those of the first sowing date appeared relatively high numbers of *R. maidis* recording (26.603 and 31.813) insects/sample during the first and second seasons, respectively.

iii) *Schizaphis graminum* (R.)

Data presented in Table (14) show that *S. graminum* individuals appeared on wheat plants sown in the tested dates during the two seasons of investigation, 2003/2004 and 2004/2005. Statistical analysis of the obtained results revealed that the differences between the insect numbers recorded in the different sowing dates were highly significant during the two seasons of study. Wheat plants sown on mid of November showed the lowest mean numbers of *S. graminum* recording (9.336 and 10.919) insects per sample during the first and second seasons, respectively. Whereas, those of the first sowing date appeared relatively high numbers of *S. graminum* recording (12.544 and 14.213) insects/sample during the first and second seasons, respectively.

Leafhoppers

i) *Empoasca decipiens* (Paoli).

The results given in Table (14) show also that the highest mean numbers of *E. decipiens* recording (4.29 and 4.917) insects/sample during 2003/2004 and 2004/2005 seasons respectively in the first sowing date (first of November), while in the second sowing date (mid of November), the lowest mean numbers of *E. decipiens* (3.415 and 3.839) insects/sample were recorded during the first and second seasons, respectively.

Statistical analysis indicated that the differences between mean numbers of *E. decipiens* on wheat plants sown on the three tested dates were highly significant in 2003/2004 and 2004/2005 seasons.

ii) *Empoasca decedens* (Paoli).

With regard to the effect of planting date on the population density of *E. decedens* infesting wheat plants, Table (14), highly significant differences for the *E. decedens* numbers in the different tested dates in both investigation seasons were detected.

The highest mean numbers of *E. decedens* of (3.043 and 3.635) insects/sample were recorded in the first sowing date (first of November) for both 2003/2004 and 2004/2005 seasons, respectively. Whereas, the lowest population densities of (2.498 and 2.882) insects/sample in the first and second seasons respectively were recorded on wheat sown on the second date (mid of November).

Mean of grain yield quantity (kg/plot)

With regard to the influence of wheat plants cultivars on wheat yield, data presented in Table (14) show that cultivars sowing in first of November yielded the highest mean of 15.77 and 15.21 kg / plot in 2003/2004 and 2004/2005 seasons, respectively. Followed by cultivars sowing in mid of November yielded a mean of 18.52 and 17.47 kg /plot in two seasons, respectively. While cultivars sowing in end of November yielded the lowest mean of 17.50 and 16.54 kg /plot in 2003/2004 and 2004/2005 seasons, respectively.

Table (14): Effect of different sowing dates on the infestation of wheat plants by aphids and leafhopper insects at Diarb- Nigm district in Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

Sowing dates	Mean of aphids / sample						Mean of leafhoppers / sample				Mean of grain yield kg/plot	
	R. padi		*R. maidis*		*S. graminum*		*E. decipiens*		*E. decedens*			
	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005	2003/2004	2004/2005
D1	32.5	36.674	26.603	31.813	12.544	14.213	4.29	4.917	3.043	3.635	15.77	15.29
D2	21.526	28.79	19.234	22.151	9.336	10.919	3.415	3.839	2.498	2.882	18.52	17.47
D3	31.359	30.392	20.845	23.78	10.856	11.613	3.964	4.039	2.812	2.966	17.50	16.54
F	345.7**	3410.8**	130.2**	17.6**	64.5**	192**	23.1**	159.2**	43.7**	31.1**	19.9**	19.9**

D1 = First sowing data at first of November D2 = Second sowing date at mid of November

D3 = Third sowing date at end of November

Generally, from obtained results it could be concluded that the second sowing date (mid of November) showed the lowest population densities of Aphids and Leafhoppers in 2003/2004 and 2004/2005 seasons on wheat, while the first sowing date (first of November) accompanied with the highest mean numbers of the aforementioned insects.

Wangal *et al.*, (2000) mentioned that the incidence of Barley Yellow Dwarf Virus (BYDV) was significant different between the early planted and the late planted crop.

2) **Effect of wheat varieties.**

Aphids

i) ***Rhopalosiphum padi*** **(L.)**

Highly significant differences were obtained between *R. padi* infestation on all tested wheat varieties during 2003/2004 and 2004/2005.seasons,

Table (15). The most susceptible variety was Giza 168 (34.79 & 37.454) insects/sample in the first and second seasons respectively while the least susceptible variety was sakha 61 (23.095 and 27.472) insects/sample during 2003/2004 and 2004/2005 seasons, respectively.

ii) ***Rhopalosiphum maidis*** (F.)

Data given in Table (15) revealed that the differences between mean numbers of *R. maidis* on the three tested wheat varieties were highly significant for the two seasons of study. The most susceptible wheat variety was Giza 168 (28.363 and 31.180) insects while the least susceptible wheat variety was Sakha 61 (17.599 and 21.177) insects/sample in the 2003/2004 and 2004/2005 seasons, respectively.

iii) ***Schizaphis graminum*** (R.)

Data given in Table (15) revealed that the differences between mean numbers of *S. graminum* on the three tested wheat varieties were highly significant for the two seasons of study. The most susceptible wheat variety was Giza 168 (12.498 and 14.373) insects while the least susceptible wheat variety was Sakha 61 (9.157 and 10.268) insects/sample in the 2003/2004 and 2004/2005, seasons, respectively.

Leafhoppers.

i) ***Empoasca decipiens*** (Paoli).

From results given in Table (15) high significant differences could be noticed between three tested varieties. The most susceptible variety was Giza 168 (4.57 and 4.983) insects/sample in 2003/2004 and 2004/2005 seasons respectively while the least susceptible variety was Sakha 61 (3.402 and 3.605) insects/sample in both seasons, respectively.

ii) ***Empoasca decedens*** (Paoli).

As seen from Table (15) also *E. decedens* infestation on the three tested wheat varieties were highly significant during the 2003/2004 and 2004/2005 seasons. The most susceptible variety was Giza 168 followed by Gimaza 7 whereas Sakha 61 variety was the least susceptible recording the respective values (3.368, 2.684 and 2.301) insect/sample in the first season and (3.842, 2.915 and 2.756) insects/sample in the second season.

Mean of grain yield quantity (kg/plot)

With regard to the influence of wheat plants cultivars on wheat yield, data presented in Table (15) show that Gimaza 7 variety yielded the highest mean of 16.89 and 16.25 kg / plot in

2003/2004 and 2004/2005 seasons, respectively, followed by Giza 168 variety cultivars yielded a mean of 15.88 and 14.79 kg /plot in two seasons, respectively. While Sakha 61 variety yielded the lowest mean of 19.02 and 18.17 kg/plot in 2003/2004 and 2004/2005 seasons, respectively.

Generally, from the obtained results it could be concluded that Giza 168 wheat variety was more susceptible to aphids and leafhoppers. Infestation, whereas Sakha 61 was the least susceptible ones. These results are in agreement with the findings of **Abdel-Hafez and Abou El Hagag (1999)** and **El Komy (1999)**

3) Effect of wheat fertilization

Aphids

i) ***Rhopalosiphum padi*** (L.).

Data recorded in Table (16) showed that differences between the four tested fertilization treatments proved to be highly significant during the two seasons of study.

During 2003/2004 and 2004/2005 seasons, the four treatments could be arranged in a descending order according to mean numbers of aphid recorded per sample as follows; zero level of potassium fertilization (38.567 and 46.146) ; 25 Kg. potassium fertilization/feddan (30.664 and 34.572) ; 50 Kg. potassium fertilization/ feddan (24.259 and 26.421) and 75 Kg. potassium fertilization/feddan (20.357 and 20.669) insects/sample in the first and second seasons, respectively.

ii) ***Rhopalosiphum maidis*** (F.).

Data given in Table (16) show that the highest mean numbers of *R. maidis* (29.791 and 34.246) occurred with zero level of potassium fertilization during 2003/2004 and 2004/2005

Table (15): Effect of different varieties on the infestation of wheat plants by aphids and leafhopper insects at Diarb- Nigm district in Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

Varieties	Mean of aphids/ sample						Mean of leafhoppers/ sample				Mean of grain yield kg/plot	
	R. padi		*R. maidis*		*S. graminum*		*E. decipiens*		*E. decedens*			
	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005
V1	27.5	30.839	20.720	25.387	11.081	12.104	3.697	4.21 7	2.684	2.915	16.89	16.25
V2	34.79	37.545	28.363	31.180	12.498	14.373	4.57	4.983	3.368	3.842	15.88	14.79
V3	23.095	27.472	17.599	21.177	9.157	10.268	3.402	3.605	2.301	2.756	19.02	18.17
F	525..8**	836.2**	463.8**	176.4**	65.9**	178.1**	51.1**	382.5**	96.9**	120.6**	10.3**	12.2**

V1 = Gimaza 7 V2 = Giza 168 V3 = Sakha 61 seasons respectively. Whereas the lowest population density of this pest was recorded with 75 Kg. potassium fertilization/Feddan (16.127 and 19.397) insects/sample in the first and second seasons, respectively. In the two seasons highly significant differences could be obtained between zero level of potassium fertilization and all other tested fertilizers.

iii) ***Schizaphis graminum*** (R.)

Data given in Table (16) show that the highest mean numbers of *S. graminum* (14.407 and 16.124) insects/sample occurred with zero level of potassium fertilization during 2003/2004 and 2004/2005 seasons, respectively. Whereas the lowest population density of this pest was recorded with 75 Kg. potassium fertilization/Feddan (7.972 and 9.022) in the first and second seasons respectively. In the two seasons highly significant differences could be obtained between zero level of potassium fertilization and all other tested fertilizers.

Leafhoppers.

i) *Empoasca decipiens* (Paoli).

The degree of infestation of wheat plants by *E. decipiens* measured as mean numbers/sample as influenced by four treatments of fertilization during two successive seasons of 2003/2004 and 2004/2005 are given in Table (16). Statistical analysis showed that the differences between the insect population densities recorded with four fertilizers treatment were significant.

The highest levels of insects abundance were recorded with zero level of potassium fertilization (4.951 and 5.268) insects/sample during the first and second season respectively while the lowest insect abundance were observed by application of 75 Kg. potassium fertilization/feddan (2.954 and 3.325) insects/sample in the first and second seasons, respectively.

ii) ***Empoasca decedens*** (Paoli).

Data given in Table (16) show that the highest mean numbers of *E. decedens* (3.501 and 3.886) insects/sample occurred with zero level of potassium fertilization during 2003/2004 and 2004/2005 seasons respectively. Whereas the lowest population density of this pest was recorded with 75 Kg. potassium fertilization/Feddan (2.188 and 2.527) in the first and second seasons respectively. In the two seasons highly significant differences could be obtained between zero level of potassium fertilization and all other tested fertilizers.

Generally from the obtained results it could concluded that the maize and wheat cultivars that fertilized by potassium showed considerable reduction in the mean numbers of insects, (Aphids, leafhoppers and planthoppers).

Mean of grain yield (kg/ plot)

As clearly shown from the result in Table (16) the yield of wheat plants treated with the different tested treatments was highly significant influenced by changing the fertilization program in the two seasons. the highest yield (21 and 20.97) kg/ plot was recorded with F1 (75 Kg. / feddan) in 2003/2004 and 2004/2005 seasons whereas , the lowest yield of (13.72 and 12.03) kg/plot was obtained in case of F4 (control without potassium fertilization/feddan) treatments during the first and second seasons, respectively. the other tested treatments gave a moderate yield

In general, it could be concluded that the potassium fertilization levels influenced pronouncedly the insects infestation and yield quantity. As the results show the highest number of insects recorded with the least level of potassium fertilization treatment (zero kg potassium sulphate/feddan) and lowest quantity of yield, while increasing this level to 75 kg potassium fertilization/feddan reduced the insect infestation and markedly increased the yield quantity. Therefore it could be recommended that fertilization with 75 kg potassium fertilization/feddan is very suitable to decrease insect infestation and increasing the resulted yield.

These results are in agreement with the findings of **Hegab-Ola (2001) and Youssef (2006)** stating that the aphids *R. padi* showed a higher preference for plants growing in K deficient soil or treated with fertilizers devoid of K, while plants cultivated in soil rich in k or treated with NPK showed low attractively.

Also these results agreed with **Salem (1999)** who showed that Potassium fertilization decreased the mean number of cereal aphids in wheat plants.

Table (16) : Effect of different potassium fertilization rates on the infestation of wheat plants by aphids and leafhopper insects at Diarb- Nigm district in Sharkia Governorate during 2003/2004 and 2004/2005 seasons.

Fertilization rates	Mean of aphids/ sample						Mean of leafhoppers/ sample				Mean of grain yield kg/plot	
	R. padi		*R. maidis*		*S. graminum*		*E. decipiens*		*E. decedens*			
	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005	2003/ 2004	2004/ 2005
F1	20.357	20.669	16.127	19.397	7.972	9.022	2.954	3.325	2.188	2.527	21.0	20.97
F2	24.259	26.421	18.902	22.05	9.306	10.586	3.456	3.820	2.482	2.889	18.33	17.89
F3	30.664	34.572	24.09	27.966	11.963	13.262	4.197	4.647	2.966	3.382	16.0	14.72
F4	38.567	46.146	29.791	34.246	14.407	16.124	4.951	5.268	3.501	3.886	13.72	12.03
F	525.8**	836.2**	463.8**	176.4**	65.9**	178.1**	51.1**	382.5**	96.9**	120.6**	10.3**	12.2**

F1=75 Kg. potassium fertilization / feddan **F2=50 Kg. potassium fertilization / feddan**
F3= 25 Kg. potassium fertilization / feddan **F4= control (without potassium fertilization)**

4.3. Relationship between certain chemical contents of maize and wheat plant varieties and and its relationship with certain homopterous insect infestations.

Samples (3 leaves) of different maize and wheat plant varieties were chemically analyzed and the obtained results are recorded in Tables (17 and 18)

Data given in Table (17 and 18) showed significant effects of different chemical constituents of the three tested maize and wheat varieties on certain homopterous insect during 2004 season.

The results obtained can be discussed as follow:

a) Maize plants

Statistical analysis Table (17) show that the Total protein in wheat varieties was significant between Single cross 18, Single cross 123 and Single cross 129.

1) Total protein

i) ***Rhopalosiphum maidis*** (F)

The results revealed positive relationship between protein content and insects infestation.

In case of Single cross 18 variety the mean numbers of *Rhopalosiphum maidis* was 434.40 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *Rhopalosiphum maidis* was 455.40 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *Rhopalosiphum maidis* was 676.40 insects/sample with 15.6% total protein during 2004 season.

ii) ***Rhopalosiphum padi*** (L)

The results showed also positive relationship between protein content and *R. padi* infestation.

In case of Single cross 18 variety the mean numbers of *R. padi* was 263.91 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *R. padi* was 281.70 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *R. padi* was 473.70 insects/sample with 15.6% total protein during 2004 season.

iii) ***Aphis gossypii*** (Glov.)

The results showed also positive relationship between protein content and *A gossypii* infestation.

In case of Single cross 18 variety the mean numbers of *A gossypii* was 47.95 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *A gossypii* was 50.28 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *A gossypii* was 71.90 insects/sample with 15.6% total protein during 2004 season.

iv) ***Empoasca decipiens*** (Paoli)

The obtained results showed positive relationship between protein content and *E. decipiens* infestation for all maize varieties.

In case of Single cross 18 variety the mean numbers of *E. decipiens* was 15.43 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *E. decipiens* was 17.93 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *E. decipiens* was 19.33 insects/sample with 15.6% total protein during 2004 season.

v) ***Empoasca decedens*** (Paoli)

The results showed also positive relationship between protein content and *E. decedens* infestation.

In case of Single cross 18 variety the mean numbers of *E. decedens* was 12.3 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *E. decedens* was 12.5 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *E. decedens* was 16.76 insects/sample with 15.6% total protein during 2004 season.

vi) ***Cicadulina chinai*** (Ghauri)

The results revealed positive relationship between protein content and insects infestation.

In case of Single cross 18 variety the mean numbers of *C. chinai* was 7.2 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *C. chinai* was 9.9 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *C. chinai* was 10.7 insects/sample with 15.6% total protein during 2004 season.

vii)***Balclutha hortensis***

The results showed also positive relationship between protein content and *B. hortensis* infestation.

In case of Single cross 18 variety the mean numbers of *B. hortensis* was 6.11 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *B. hortensis* was 6.7 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *B. hortensis* was 7.92 insects/sample with 15.6% total protein during 2004 season.

viii)*Sogatella vibix* (Haupt)

The results showed positive relationship between protein content and *S. vibix* infestation.

In case of Single cross 18 variety the mean numbers of *S. vibix* was 9.66 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *S. vibix* was 10.29 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *S. vibix* was 12.96 insects/sample with 15.6% total protein during 2004 season.

ix) ***Sogatella furcifera*** (Horv.)

The results showed also positive relationship between protein content and *S. furcifera* infestation.

In case of Single cross 18 variety the mean numbers of *S. furcifera* was 9.92 insects/sample with 12.64% total protein. In case of Single cross 123 variety the mean number of *S. furcifera* was 10.29 insects/sample with 14.85% total protein while Single cross 129 variety infested with the mean number of *S. furcifera* was 11.66 insects/sample with 15.6% total protein during 2004 season.

2) Carbohydrate contents "C.C."

As shown from Table (17), carbohydrate content in the three tested maize varieties were significant

The effect of carbohydrate content on insect infestation can be discussed as follows:

i) ***Rhopalosiphum maidis*** (F)

The results revealed positive relationship between Carbohydrate content and insects infestation.

In case of Single cross 18 variety the mean numbers of *R. maidis* was 434.40 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *R. maidis* was 455.40 insects/sample with 41.74 %C.C., while Single cross 129 variety infested with the mean number of *R. maidis* insects was 676.40 insects/sample with 46.59 %C.C. during 2004 season.

ii) ***Rhopalosiphum padi*** (L)

The results showed also positive relationship between Carbohydrate content and *R. padi* infestation.

In case of Single cross 18 variety the mean numbers of *R. padi* was 263.91 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *R. padi* was 281.70 insects/sample, respectively with 41.74%C.C., while Single cross 129 variety infested with the mean number of *R. padi* was 473.70 insects/sample with 46.59 %C.C. during 2004 season.

iii) ***Aphis gossypii*** (Glov.)

The results showed also positive relationship between Carbohydrate content and *A gossypii* infestation.

In case of Single cross 18 variety the mean numbers of *A gossypii* was 47.95 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *A gossypii* was 50.28 insects/sample, respectively with 41.74%C.C., while Single cross 129 variety infested with the mean number of *A gossypii* was 71.90 insects/sample with 46.59 %C.C. during 2004 season.

iv) *Empoasca decipiens* (Paoli)

The obtained results showed positive relationship between Carbohydrate content and *E. decipiens* infestation for all maize varieties.

In case of Single cross 18 variety the mean numbers of *E. decipiens* was 15.43 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *E. decipiens* was 17.93 insects/sample with 41.74%C.C., while Single cross 129 variety infested with the mean number of *E. decipiens* was 19.33 insects/sample with 46.59 %C.C. during 2004 season.

v) ***Empoasca decedens*** (Paoli)

The results showed also positive relationship between Carbohydrate content and *E. decedens* infestation.

In case of Single cross 18 variety the mean numbers of *E. decedens* was 12.3 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *E. decedens* was 12.5 insects/sample with 41.74%C.C., while Single cross 129 variety infested with the mean number of *E. decedens* was 16.76 insects/sample with 46.59 %C.C. during 2004 season.

vi) *Cicadulina chinai* (Ghauri)

The results revealed positive relationship between Carbohydrate content and insects infestation.

In case of Single cross 18 variety the mean numbers of *C. chinai* was 7.2 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *C. chinai* was 9.9 insects/sample with 41.74%C.C., while Single cross 129 variety infested with the mean number of *C. chinai* was 10.7 insects/sample with 46.59 %C.C. during 2004 season.

vii)***Balclutha hortensis***

The obtained results showed positive relationship between Carbohydrate content and *B. hortensis* infestation for all maize varieties.

In case of Single cross 18 variety the mean numbers of *B. hortensis* was 6.11 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *B. hortensis* was 6.70 insects/sample with 41.74%C.C., while Single cross 129 variety infested with the mean number of *B. hortensis* was 7.92 insects/sample with 46.59 %C.C. during 2004 season.

viii) ***Sogatella vibix*** (Haupt)

The results showed positive relationship between Carbohydrate content and *S. vibix* infestation.

In case of Single cross 18 variety the mean numbers of *S. vibix* was 9.66 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *S. vibix* was 10.29 insects/sample, respectively with 41.74%C.C., while Single cross 129 variety infested with the mean number of *S. vibix* was 12.96 insects/sample with 46.59 %C.C. during 2004 season.

ix) ***Sogatella furcifera*** (Horv.)

The results showed also positive relationship between Carbohydrate content and *S. furcifera* infestation.

In case of Single cross 18 variety the mean numbers of *S. furcifera* was 9.92 insects/sample with 35.42% C.C.. In case of Single cross 123 variety the mean number of *S. furcifera* was 10.29 insects/sample with 41.74 %C.C., while Single cross 129 variety infested with the mean number of *S. furcifera* was 11.66 insects/sample with 46.59 %C.C. during 2004 season.

3) PH value

Data given in Table (17) showed that the effect of pH value in the three testes maize varieties were significant. The results obtained showed the following effects.

i) ***Rhopalosiphum maidis*** (F)

Table (17) showed negative relationship between pH value and insects infestation.

In case of Single cross 18 variety the mean numbers of *R. maidis* was 434.40 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *R. maidis* was 455.40 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *R. maidis* was 676.40 insects/sample with 4.57 pH during 2004 season.

ii) ***Rhopalosiphum padi*** (L)

Table (17) showed negative relationship between pH value and insects infestation.

In case of Single cross 18 variety the mean numbers of *R. padi* was 263.91 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *R. padi* was 281.70 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *R. padi* was 473.70 insects/sample with 4.57 pH during 2004 season.

iii) ***Aphis gossypii*** (Glov.)

In case of Single cross 18 variety the mean numbers of *A. gossypii* was 47.95 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *A. gossypii* was 50.28 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *A. gossypii* was 71.90 insects/sample with 4.57 pH during 2004 season.

iv) ***Empoasca decipiens*** (Paoli)

In case of Single cross 18 variety the mean numbers of *E. decipiens* was 15.43 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *E. decipiens* was 17.93 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *E. decipiens* was 19.33 insects/sample with 4.57 pH during 2004 season.

v) ***Empoasca decedens*** (Paoli)

In case of Single cross 18 variety the mean numbers of *E. decedens* was 12.3 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *E. decedens* was 12.5 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *E. decedens* was 16.76 insects/sample with 4.57 pH during 2004 season.

vi) ***Cicadulina chinai*** (Ghauri)

The obtained results revealed negative relationship between pH value and insects infestation in Single cross 18, Single cross 123 and Single cross 129.

In case of Single cross 18 variety the mean numbers of *C. chinai* was 7.2 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *C. chinai* was 9.9 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *C. chinai* was 10.7 insects/sample with 4.57 pH during 2004 season.

vii) ***Balaclutha hortensis***

In case of Single cross 18 variety the mean numbers of *B. hortensis* was 6.11 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *B. hortensis* was 6.70 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *B. hortensis* was 7.92 insects/sample with 4.57 pH during 2004 season.

viii) ***Sogatella vibix*** (Haupt)

In case of Single cross 18 variety the mean numbers of *S. vibix* was 9.66 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *S. vibix* was 10.29 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *S. vibix* was 12.96 insects/sample with 4.57 pH during 2004 season.

ix) ***Sogatella furcifera*** (Horv.)

In case of Single cross 18 variety the mean numbers of *S. furcifera* was 9.92 insects/sample with 5.48 pH. In case of Single cross 123 variety the mean number of *S. furcifera* was 10.29 insects/sample with 5.19 pH, while Single cross 129 variety infested with the mean number of *S. furcifera* was 11.66 insects/sample with 4.57 pH during 2004 season.

4) Phosphorous (P)

The results given in Table (17) the effects of Phosphorous percentages in the test maize plant varieties and aphids, leafhoppers and planthopper insects infestation were statistically not significant.

5) Potassium (K)

Data given in Table (17) the effects of Phosphorous percentages in the test maize plant varieties and aphids, leafhoppers and planthopper insects infestation were statistically not significant.

From the obtained results Single cross 18 variety, proved to be the least total protein and carbohydrate contents and the highest pH value, the least susceptible to insect infestation and the highest yield.

Generally it is worth to notice that the aphids, leafhoppers and planthopper insects infestation was correlated with the chemical constituents of the used maize varieties and also with quantity of yield.

Table (17): Effect of chemical constituents of different maize varieties on certain Homopterous insects infesting maize plants during 2004 season .

Maize varieties	Total Protein %	Carbohydrate % C. C	PH	K	P	Mean of aphids/sample			Mean of leafhoppers/ sample				Mean of planthoppers/ sample		Yield/ plot (kg.)
						R. maidis	*R. padi*	*A. gossypii*	*E. decipiens*	*E. decedens*	*C. chinai*	*B. hortensis*	*S. vibix*	*S. furcifera*	
Single cross 129	15.6	46.59	4.57	2.37	0.89	676.40	473.70	71.90	19.33	16.76	10.7	7.92	12.96	11.66	21.0
Single cross 123	14.85	41.74	5.19	2.93	0.91	455.40	281.70	50.28	17.93	12.5	9.9	6.70	10.29	10.29	23.25
Single Cross 18	12.64	35.42	5.48	3.1	0.71	434.40	263.91	47.95	15.43	12.3	7.2	6.11	9.66	9.92	25.25
F	*	*	*			*	*	*	*	*	*	*	*	*	*

b) Wheat plants

1) Total Protein

Statistical analysis Table (18) show that the total protein in wheat varieties was significant between Sakha 61, Gomaza 7 and Giza 168.

i) ***Rhopalosiphum padi*** (L)

The results showed positive relationship between protein content and *R. padi* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *R. padi* was 38.66 insects/sample with 8.84 % total protein . In case of Gimaza 7 variety the mean number of *R. padi* was 44.61 insects/sample with 9.3% total protein, while Giza 168 variety infested with the mean number of *R. padi* was 55.16 insects/sample with 11.8% total protein during 2004/2005 season.

ii) ***Rhopalosiphum maidis*** (F)

The results revealed also positive relationship between protein content and *R. maidis* infestations in all wheat varieties.

In case of variety Sakha 61 the mean number of *R. maidis* was 27.69 insects/sample with 8.84 % total protein . In case of Gimaza 7 variety the mean number of *R. maidis* was 32.72 insects/sample with 9.3% total protein, while Giza 168 variety infested with the mean number of *R. maidis* was 42.31 insects/sample with 11.8% total protein during 2004/2005 season.

iii) ***Schizaphis graminum*** (R.)

The obtained results revealed positive relationship between protein content and *S. graminum* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *S. graminum* was 13.54 insects/sample with 8.84 % total protein . In case of Gimaza 7 variety the mean number of *S. graminum* was 15.55 insects/sample with 9.3% total protein, while Giza 168 variety infested with the mean number of *S. graminum* was 19.26 insects/sample with 11.8% total protein during 2004/2005 season.

iv) ***Empoasca decipiens*** (Paoli)

The obtained results showed positive relationship between protein content and *E. decipiens* infestation.

In case of variety Sakha 61 the mean number of *E. decipiens* was 4.37 insects/sample with 8.84 % total protein . In case of Gimaza 7 variety the mean number of *E. decipiens* was 4.97 insects/sample with 9.3% total protein, while Giza 168 variety infested with the mean number of *E. decipiens* was 6.45 insects/sample with 11.8% total protein during 2004/2005 season.

v) ***Empoasca decedens*** (Paoli)

The obtained results showed also positive relationship between protein content and *E. decedens* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *E. decedens* was 3.35 insects/sample with 8.84 % total protein . In case of Gimaza 7 variety the mean number of *E. decedens* was 354 insects/sample with 9.3% total protein, while Giza 168 variety infested with the mean number of *E. decedens* was 4.75 insects/sample with 11.8% total protein during 2004/2005 season.

2) Carbohydrate contents "C.C."

Statistical analysis Table (18) show that the carbohydrate content in wheat varieties was significant.

i) ***Rhopalosiphum padi*** (L)

The results revealed also positive relationship between carbohydrate content and *R. padi* infestation.

In case of variety Sakha 61 the mean number of *R. padi* was 38.66 insects/sample with 24.97%C.C. In case of Gimaza 7 variety the mean number of the *R. padi* was 44.61 insects/sample with 25.72%C.C. while Giza 168 variety infested with the mean number of *R. padi* was 55.16 insects/sample with 26.84 %C.C. during 2004/2005 season.

ii) ***Rhopalosiphum maidis*** (F)

The obtained results showed positive relationship between carbohydrate content (C.C.) and *R. maidis* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *R. maidis* was 27.69 insects/sample with 24.97%C.C. In case of Gimaza 7 variety the mean number of the *R. maidis* was 32.72 insects/sample with 25.72%C.C. while Giza 168 variety infested with the mean number of *R. maidis* was 42.31 insects/sample with 26.84 %C.C. during 2004/2005 season.

iii) ***Schizaphis graminum*** (R.)

The obtained results revealed positive relationship between carbohydrate content and *S. graminum* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *S. graminum* was 13.54 insects/sample with 24.97%C.C. In case of Gimaza 7 variety the mean number of the *S. graminum* was

15.55 insects/sample with 25.72%C.C. while Giza 168 variety infested with the mean number of *S. graminum* was 19.26 insects/sample with 26.84 %C.C. during 2004/2005 season.

iv) ***Empoasca decipiens*** (Paoli)

The obtained results showed positive relationship between carbohydrate content and *E. decipiens* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *E. decipiens* was 4.37 insects/sample with 24.97%C.C. In case of Gimaza 7 variety the mean number of the *E. decipiens* was 4.97 insects/sample with 25.72%C.C. while Giza 168 variety infested with the mean number of *E. decipiens* was 6.45 insects/sample with 26.84 %C.C. during 2004/2005 season.

v) ***Empoasca decedens*** (Paoli)

The results revealed positive relationship between carbohydrate content (C.C.) and *E. decedens* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *E. decedens* was 3.35 insects/sample with 24.97%C.C. In case of Gimaza 7 variety the mean number of the *E. decedens* was 3.54 insects/sample with 25.72%C.C. while Giza 168 variety infested with the mean number of *E. decedens* was 4.75 insects/sample, respectively with 26.84 %C.C. during 2004/2005 season.

3) PH value

Statistical analysis Table (18) show that pH value in wheat varieties was significant.

i) ***Rhopalosiphum padi*** (L)

The obtained results showed negative relationship between pH value and *R. padi* infestation.

In case of variety Sakha 61 the mean number of *R. padi* was 38.66 insects/sample with 5.37 pH. In case of Gimaza 7 variety the mean number of the *R. padi* was 44.61 insects/sample with 4.81 pH, while Giza 168 variety infested with the mean number of *R. padi* was 55.16 insects/sample with 4.25 pH during 2004/2005 season.

ii) ***Rhopalosiphum maidis*** (F)

The obtained results revealed negative relationship between pH value and *R. maidis* infestation.

In case of variety Sakha 61 the mean number of *R. maidis* was 27.69 insects/sample with 5.37 pH. In case of Gimaza 7 variety the mean number of the *R. maidis* was 32.72 insects/sample with 4.81 pH, while Giza 168 variety infested with the mean number of *R. maidis* was 42.31 insects/sample with 4.25 pH during 2004/2005 season.

iii) ***Schizaphis graminum*** (R.)

The obtained results revealed negative relationship between *S. graminum* infestation pH value.

In case of variety Sakha 61 the mean number of *S. graminum* was 13.54 insects/sample with 5.37 pH. In case of Gimaza 7 variety the mean number of the *S. graminum* was 15.55 insects/sample with 4.81 pH, while Giza 168 variety infested with the mean number of *S. graminum* was 19.26 insects/sample with 4.25 pH during 2004/2005 season.

iv) ***Empoasca decipiens*** (Paoli)

The obtained results showed negative relationship between pH value and *E. decipiens* infestation in all wheat varieties.

In case of variety Sakha 61 the mean number of *E. decipiens* was 4.37 insects/sample with 5.37 pH. In case of Gimaza 7 variety the mean number of the *E. decipiens* was 4.97 insects/sample with 4.81 pH, while Giza 168 variety infested with the mean number of *E. decipiens* was 6.45 insects/sample with 4.25 pH during 2004/2005 season.

v) ***Empoasca decedens*** (Paoli)

The obtained results showed negative relationship between *E. decedens* infestation and pH value in all wheat varieties.

In case of variety Sakha 61 the mean number of aphids insects was 3.35 insects/sample with 5.37 pH. In case of Gimaza 7 variety the mean number of the aphids insects was 354 insects/sample with 4.81 pH, while Giza 168 variety infested with the mean number of *E. decipiens* was 4.75 insects/sample with 4.25 pH during 2004/2005 season.

4) Phosphorous (P)

Data given in Table 1(18) the effects of Phosphorous percentages in the test wheat plant varieties and aphids and leafhopper insects infestation were not significant.

5) Potassium (K)

As clear in Table (18) the effects of Potassium and Phosphorous percentages in the test wheat plant varieties and aphids and leafhopper insects infestation were not significant.

From the obtained results Sakha 61 variety, proved to be the least total protein and carbohydrate contents and the highest pH value, the least susceptible to insect infestation and the highest yield.

Generally it is worth to notice that the aphids and leafhopper insects infestation was correlated with the chemical constituents of the used wheat varieties and also with quantity of yield.

This may be due to the role of potassium in the host plant which used it as co-enzyme for incorporating the free amino acids into protein and soluble sugar to carbohydrate **(Hegab-Ola (2001))**. These changes decreased the hostability as a food source for aforementioned insects.

These results are in agreement with the finding of **Havlickova (1997)** who found that the sparta wheat variety highest dry matter content, free amino acids and sugars in leaves was the best host for *R. padi*.

Also, these results are in agreement with the finding of **Hegab-Ola (2001)** found that some correlation was found for carbohydrates content and acidity. Aphids feeding on resistant wheat cultivars showed greater amylase and carboxylesterase activities compared to those feeding on susceptible cultivars, **Narang *et al.*, (1997)** found that total free amino acids and soluble proteins were responsible for susceptibility of the plants. **El-Komy (1999)** showed that the concentration of total carbohydrate in Balady maize variety (more susceptible variety) was lower than in Len maize variety(least susceptible variety). **Youssef (2006)** showed that Positive correlation was found between total protein %, carbohydrate % and potassium fertilization levels while there was negative correlation between potassium fertilization levels, chemical content and insect populations.

Table (18): Effect of chemical constituents of different wheat varieties on certain Homopterous insects infesting wheat plants during 2004/2005 season .

Wheat variety	Total Protein %	Carbohydrate % C. C	PH	K	P	Mean of aphids/sample			Mean of leafhoppers/ sample		Yield/ plot (kg.)
						R. padi	*R. maidis*	*S.graminun*	*E.decipien*	*E.decedens*	
Giza 168	11.8	26.84	4.25	2.2	0.48	55.16	42.31	19.26	6.45	4.75	12.92
Gomaza 7	9.3	25.72	4.81	2.63	0.54	44.61	32.72	15.55	4.97	3.54	15.08
SaKha 61	8.84	24.97	5.37	2.77	0.54	38.66	27.69	13.54	4.37	3.35	23.25
F	*	*	*			*	*	*	*	*	*

4-4 Effect of potassium fertilization on the thickness of plant epidermal cells and its relation with certain homopterous insects infesting maize and wheat crop .

a) Maize plants

Result given in Table (19) indicated that in case of variety Single cross 18 the epidermal cell thickness was 4.38 micron with control , increased to 4.88, 5.6 and 6.08 micron by increasing the dose of fertilizer to 25, 50 and 75 Kg. potassium fertilization/feddan, reducing the aphid number from 249.536 in control to 216.848, 173.421 and 132.993 individuals, leafhopper and planthopper from 10.168 in control to 8.416, 7.136 and 6.343 individuals during 2004 season, respectively.

In case of Single cross 123 variety, the epidermal cell thickness was 3.98 micron with control, it increased to 4.58, 4.79 and 5.25 micron by increasing the dose of fertilizer to 25, 50 and 75 Kg. potassium fertilization/feddan and causing pronounced reduction in aphid number from 309.067 in control to 261.689, 218.587 and 165.353 individuals; leafhopper and planthopper from 11.21 with control to 9.565, 8.01 and 7.019 individuals during 2004 season, respectively.

In case of Single cross 129 variety the epidermal cell thickness was 3.55 micron with control and it increased to 3.82, 4.14 and 4.71 micron by increasing the dose of fertilizer to 25, 50 and 75 Kg. potassium fertilization/feddan resulting in considerable reduction in aphid number from 407.34 individuals for control to 364.298, 315.013 and 232.398 while in leafhopper and planthopper from 13.226 individuals to 11.256, 9.694 and 8.388 individuals, respectively in season 2004

b) Wheat plants

Result given in Table (19) indicated that in case of wheat, variety Sakha 61.The thickness of leaves epidermal cells was 4.25 micron in control (without potassium fertilization) and it increased to 4.48, 4.85 and 5.35 micron by increasing the dose of potassium fertilization to 25, 50 and 75 Kg. potassium fertilization/feddan. This treatment resulted in considerable drop in aphids number from 26.635 in control to 21.176, 16.561 and 14.185 and in leafhopper number from 3.868 in control to 3.449, 2.821 and 2.586 individuals during the season 2004/2005, respectively.

In case of Gimaza 7 epidermal cell thickness was 3.63 micron with control .It increased to 3.8, 4.15 and 4.6 micron by increasing the dose of fertilizer to 25, 50 and 75 Kg. potassium fertilization/feddan, resulting in the reduction of aphid number from 30.963 in control to 24.19, 19.7 and 16.253 the leafhopper number from 4.261 in control to 3.859, 3.299 and 2.825 individuals, respectively for the season 2004/2005.

Epidermal cell thickness of Giza 168 variety was 3.55 micron with control, it icreased to 3.6, 3.98 and 4.41 micron by increasing the dose of fertilizer to 25, 50 and 75 Kg. potassium fertilization/feddan causing considerable reduction in aphid number from 38.918 in control to 30.434, 22.796 and 18.65 and the number of leafhopper from 5.603 in control to 4.735, 3.944 and 3.368 individuals respectively, in 2004/2005 season

From the previous results it could be concluded that using of potassium fertilizer caused considerable increase in the thickness of plant epidermal cells and suppressed the ability of piercing and sucking mouth part insects to feed and reproduce causing great reduction in the population density of these insect pests.

Therefore, the potassium fertilization with the applied doses could be recommended for controlling the insect pests such as aphids and leafhoppers

From the previous results it could be concluded that using

potassium fertilization

caused considerable increase in the thickness of plants epidermal cells and suppressed the ability of piercing and sucking mouth part insects to feed and reproduce causing great reduction in the population densities of these insect pests. Therefore the potassium fertilization could be recommended for controlling the insect pests such as aphids and leafhoppers. These results are in agreement with the finding of **Hegab-Ola (2001), EL-Gindy (2002) and Youssef (2006).**

Table(19):Mean numbers of certain homopterous insects as influenced by potassium sulfate fertilization and the thickness of plant epidermal cells in case of maize varieties in 2004 and wheat varieties in 2004/2005 season.

Crops	Variety	Potassium fertilization unit/feddan	Epidermal cell thickness/ micron	Aphids mean number	Leafhoppers and planthoppers mean number
Maize plants	Single cross 18	F1	6.08	132.993	6.343
		F2	5.6	173.421	7.136
		F3	4.88	216.848	8.416
		F4	4.38	249.536	10.168
	Single cross 123	F1	5.25	165.353	7.019
		F2	4.79	218.587	8.010
		F3	4.58	261.689	90565
		F4	3.98	309.067	11.21
	Single cross 129	F1	4.71	232.398	8.388
		F2	4.14	315.013	9.694
		F3	3.82	364.298	11.256
		F4	3.55	407.34	13.226
Wheat plants	Sakha 61	F1	5.35	14.185	2.586
		F2	4.85	16.561	2.821
		F3	4.48	21.176	3.449
		F4	4.25	26.635	3.868
	Giza 168	F1	4.41	18.65	3.368
		F2	3.98	22.796	3.944
		F3	3.6	30.434	4.735
		F4	3.55	38.918	5.603
	Gimaza 7	F1	4.6	16.253	2.825
		F2	4.15	19.700	3.299
		F3	3.8	24.19	3.859
		F4	3.63	30.963	4.261

F1=75 Kg. feddan F2=50 Kg./ feddan

F3= 25 Kg./ feddan F4= control (without potassium fertilization)

4.5. Transmission of plant pathogenic virus associated with barley yellow dwarf disease by aphid vectors

The experiments of barley yellow dwarf virus transmission were carried out in the laboratory of plant protection Dept., Faculty of Agric., Zagazig Univ.

According to the results of the survey study on the aphid species on wheat plants, the following species were found: *Rhopalosiphum maidis, Rhopalosiphum padi, Sitobion avenae and Schizaphis graminum*. All the aforementioned aphid species were used in the transmission experiments.

The primary experiments results showed that the aphid *R. maidis* was the only species which proved to transmit barley yellow dwarf virus from infected maize plants to healthy celery plants (as indicator plants) in Tables (20)

The results of barley yellow dwarf virus transmission from infected maize plants to healthy celery plants by *R. maidis* are shown in Table (20). These results clearly indicated that the individuals of the aphid under consideration which fed on the infected maize plants only for 30 min failed to transmit the virus of the mentioned disease.

The shortest acquisition feeding period for *R. maidis* on infected maize plants was 1 hr, after which they became infectious and capable to transmit the pathogen. The transmission ability of *R. maidis* increased by prolonging the acquisition feeding period to 5 days Tables (20 and 21) after which efficiency of transmission was constant with increasing, the acquisition feeding period to 5 days.

The results also indicated that, the infectious *R. maidis* were not capable to induce infection except after a latent period of 48-96 hrs.

Well expressed symptoms of barley yellow dwarf virus on indicator plants started to appear after incubation period of about 18- 25 days from pathogen inoculation in celery plants Table (20)

Subsequent transmission of barley yellow dwarf virus by *R. maidis* was also obtained from infected celery plants to healthy ones Table (21). Data confirmed that the shortest acquisition feeding period for *R. maidis* on infected celery plants was 1 hr. and the transmission ability increased by prolonging the acquisition feeding period to 2 days after which the ability of barley yellow dwarf virus transmission was constant with increasing the acquisition feeding period to 5 days. The results also indicated that the latent period of pathogen in the tested vector ranged from 48 - 96 hrs. and also confirmed that the length of latent period decreased gradually by prolonging the acquisition feeding period Table (21)

In general, it can be concluded that the *R. maidis* was able to transmit barley yellow dwarf virus from infected maize plants to healthy celery, from infected celery plants to healthy ones and from infected celery to healthy maize plants.

The results showed also that this insect acquired and transmitted the BYDV. The acquisition threshold feeding period ranged between 1 hr. to 2 days after, which of *R. maidis* was able to transmit (BYDV). The transmission efficiency increased by prolonging the acquisition feeding period to 2 days, after which ability of transmission was constant.

R. maidis were able to transmit the BYDV after a latent period of Lp50 = (48- 96 hr.). It is worth to mention that the length of latent period decreased gradually by prolonging the acquisition feeding period Table (20).

Symptoms appeared on celery plants within 18-25 days and maize plants within 17 – 26 days after inoculation of the agent. In comparison with their control, the leaves of diseased celery plants were smaller in size, their number per plant mush higher. The petiole were shorter and horizontally positioned. In addition infected plants were not able to flower.

Sadeghi *et al.*, (1997), reported that the vector efficiency of twenty *R. padi* clones, originating from Europe, North America and North Africa and exhibiting different type of life cycle, was evaluated by transmitting a French barley yellow dwarf virus (BYDV-PAV) isolate to barley plants. Differences between clones in transmission efficiency were found only when a short acquisition access period AAP was followed by a long inoculation access period IAP (6 hr. / 120 hr.) respectively and to some extent when long AAP (48 hr.) was followed by long IAP (48 hr/120 hr).

The mean vectors was *R. padi, Sitobion avenae and Schizaphis graminum* **Carver *et* al., (1999)** reported that *R. padi and S. avenae* were the main vector of BYDV in the United Kingdom.

Other workers inch as **Haack *et* al., (1999)** showed that *R. padi* and *S. avenae* were the main vector to PAV and MAV strain respectively and for both virus strains 100% infection was obtained in maize plants inoculated at the 2, 4 and 6 leaf stages, the percentage of infection decreased drastically for PAV and more slowly for MAV in plant inoculated at an older stage. **Moon *et al.*, (2000)** mentioned that *R. padi* was the main vector of BYDV in Illinois. **Hegab, Ola (2001)** mentioned that *R. padi* is a vector transmitting barley yellow dwarf virus she summarized the results of insect transmission experiments as follows : The acquisition threshold feeding periods ranged between 1 hr and 3 days. Incubation periods in insects ranged between 34 - 96 hr. Inoculation threshold feeding periods ranged between 1 - 6 hr. Incubation periods in the host plants were 24 to 32 days in celery plants and 28 - 42 days in wheat plants. Retention periods of the virus in the infective aphid vector *Rhopalosiphum padi* ranged between 56 - 112 hr.

Table(20): Transmission of barley yellow dwarf virus from infected maize plants to healthy celery plants by aphids *Rhopalosiphum maidis*.

Acquisition access period A.A.P.	% efficiency of virus transmission from infected maize plants to celery plants	Range of latent period in	
		an insect vectors (hr)	an indicator plant (day)
00mn	00	00	00
30mn	00	00	00
60mn	33%	96a (48-96)b1	25a(18-25)b
120mn	33%	80	25
4hr.	33%	80	24
8hr.	33%	72	24
12hr.	33%	60	19
16hr.	33%	60	19
1day	33%	48	18
2day	66%	56	18
3day	66%	80	18
4day	66%	104	17
5day	66%	128	17

N.B. a - Latent period for the treatment
b - Latent period 50%

Table(21): Transmission of barley yellow dwarf virus from infected celery plants to healthy ones by aphids *Rhopalosiphum maidis.*

Acquisition access period A.A.P.	% efficiency of virus transmission from infected celery plants to healthy ones	Range of latent period in	
		an insect vectors (hr)	an indicator plant (day)
00mn	00	00	00
30mn	00	00	00
60mn	33%	96a (48-96)b	25a (18-25)b
120mn	33%	80	25
4hr.	33%	80	20
8hr.	33%	72	20
12hr.	33%	60	18
16hr.	33%	48	18
1day	33%	48	18
2day	66%	56	18
3day	66%	80	16
4day	66%	104	16
5day	66%	128	15

N.B. a - Latent period for the treatment

b - Latent period 50%

5. SUMMARY

The present work was conduct during 2003/2004 and 2004/2005 seasons to survey certain of homopterous insects (aphids, leafhoppers and planthoppers) infesting some graminaceous field crops (maize and wheat) in Diarb-Nigm, district Sharkia Governorate, Egypt. The seasonal abundance of the aforementioned dominant species and the ability of *Rhopalosiphum padi* to transmit Barley yellow dwarf virus were studied.

These insect pests were collected by different methods from graminaceous plants under field conditions. For this purpose, the sweeping net, plant samples and yellow sticky board were used.

Results showed that the sweeping net proved to be the best method to collect the leafhoppers and planthopper species. Yellow sticky board traps have a remarkable selectivity for attracting certain leafhopper species.

5.1. Survey of certain homopterous insects infesting some graminaceous crops.

Survey studies could be summarized as follows:

i) Aphids (Fam: Aphididae)

Rhopalosiphum maidis (F.), *Rhopalosiphum padi* (L.), *Schisaphis graminum* (R.) and *Sitobion avenae* (F.) were collected from maize and wheat plants, while *Aphis gossypii* (Glov.) was collected from maize plants.

ii) Leafhoppers (Fam: Cicadellidae)

a)- Maize plants

The following leafhopper species were collected from maize fields *Empoasca decipiens* (Paoli), *Empoasca decedens* (Paoli), *Cicadulina chinai* (Ghauri), *Balclutha hortensis* (Lindb), and *Cicadulina bipunctella* zea (Chinai).

b)-Wheat plants, *E. decipiens* (Paoli) and *E. decedens* (Paoli).

iii) Planthoppers (Fam: Delphacidae)

The following species of planthopper fields *S. vibix* (Haupt) and *S. furcifera* (Horv) were collected from maize.

5.2. Seasonal abundance of dominant homopterous insect species infesting the aforementioned graminaceous plants can be summarized as follows:

i) Aphids

Rhopalosiphum maidis (F.) was represented by one peak at the third week of August for the 2004 and 2005 seasons on maize and also one peak on wheat the peak at end of February for 2003/2004 2004/2005 season and mid of March for 2004/2005 season.

Rhopalosiphum padi (L.) was represented by one peak at the third week of August for the 2004 and 2005 seasons on maize and also one peak on wheat the peak at end of March in 2003/2004 and 2004/2005 seasons.

Schizaphis graminum (R) was represented by one peak at mid of March on wheat plants in the two seasons.

Aphis gossypii (Glov.) One peak were recorded on maize plants at the end week of August in 2004 and 2005 seasons.

ii) Leafhoppers

Empoasca decipiens (Paoli): Two peaks were recorded on maize plants at the third week of July and the mid of August respectively. On wheat plants, it had one peak at the end of February in the two seasons.

Empoasca decedens (Paoli) :Tow peaks was recorded on maize plants at the end week of July and the third week of August. On wheat plants, it had one peak at the end of February in the two seasons.

Cicadulina chinai (Ghauri): one peaks were recorded on maize plants at the third week of August in the two seasons.

Balclutha hortensis (Lindb):It has one peak recorded at the third week of August on maize plants in the two seasons.

iii) Planthopper

Sogatella vibix (Haupt): This planthopper showed one peak at third week of August on maize in the two seasons.

Sogatella furcifera (Horv.) :The highest population abundance of *S. furcifera* was recorded on maize at the third week of August in the two seasons.

5.3. Effect of certain climatic factors (Maximum temperature, minimum temperature and relative humidity) on the population density of dominant homopterous insects infesting some cereal field crops.

Effects of the maximum temperature, minimum temperature and relative humidity on the population density and the abundant of aphids, leafhoppers and planthopper species infesting certain graminaceous plants (maize and wheat) were studied under field conditions. The results clearly indicated significant correlation coefficient and partial regression were obtained between numbers of different insect species and maximum, minimum temperatures and relative humidity during the two investigation seasons on maize and wheat, respectively.

5.4. Effect of certain agricultural practices on population density of certain insects (Aphids, leafhoppers and planthoppers).

a) Maize plants:

1) Sowing dates

The second sowing date (end of May) showed the lowest mean numbers of insects (Aphids, leafhoppers and planthoppers) followed by the third sowing date (mid of June) while the first sowing date showed the highest mean numbers of aforementioned insects.

2) Varieties

Single cross 18 variety proved to be the least susceptible host for insects (Aphids, leafhoppers and planthoppers) infestation, followed by Single cross 123 variety while the Single cross 129 variety appeared to be the most susceptible maize variety.

3) Fertilization

The highest mean numbers of aforementioned insects / sample occurred on the control (without potassium fertilization) whereas the lowest population density of these insects recorded with (75 Kg. potassium fertilization/ feddan).

b)- wheat plants.

1) Sowing dates

The second sowing date (The mid of November) showed the lowest mean number of insects per sample followed by the third sowing date (end of November) while the first sowing date (first of November) showed the highest mean numbers of insects per sample

2) Varieties

Sakha 61 variety proved to be the least susceptible host plant for insects (aphids and leafhoppers) infestation followed by Gimaza 7 variety whereas Giza 168 variety appeared to be the most susceptible wheat variety.

3) Fertilization

The highest mean numbers of insects per sample occurred with control (without potassium fertilization)whereas the lowest population density of these insects recorded with 75 Kg. potassium fertilization/ feddan.

5.5. Relationship between certain chemical contents of certain graminaceous plant varieties and aphids, leafhoppers and planthoppers insects infestation.

1- Protein

The results indicated positive correlation between insects infestation and protein content of maize and wheat.

2- Carbohydrate

Positive correlation was found between insects infestation and carbohydrate.

3- Ph value

There was negative correlation was found between pH value and insects infestation.

4- phosphorous and potassium

There were non significant changes in calcium, phosphorous.

5.6. Effect of potassium fertilization on epidermal plant cell thickness.

Positive correlation was found between potassium fertilization levels and thickness of epidermal plant leaves cell , while negative correlation was recorded between thickness of epidermal leaves cell and insects infestation.

5.7. Transmission of Barley yellow dwarf virus by Aphid *Rhopalosiphum maidis*

In the course of the transmission experiments, it is demonstrated that *R. maidis* is a vector transmitting barley yellow dwarf virus.

The results of insect transmission experiment could be summarized as follows :

i) The acquisition threshold feeding periods ranged between 1 hrs and 1 days.

ii) Incubation periods in insects ranged between 48-96 hrs.

iii) Incubation periods in the host plants were to 18-25 days in celery plants.

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الملخص العربي

دراسات على الآفات الحشرية التى تصيب بعض المحاصيل النجيلية

أجريت الدراسة في مركز ديرب نجم – محافظة الشرقية خلال موسمي ٢٠٠٣ / ٢٠٠٤ ، ٢٠٠٤/ ٢٠٠٥ على بعض الحشرات التابعة لرتبة متشابهة الأجنحة وهى المن، نطاطات الأوراق و نطاطات النباتات التي تصيب الذرة والقمح.

و قد تضمنت الدراسة حصر وتقدير الكثافة العددية للحشرات الحشرات التابعة متشابهة الأجنحة (المن ،نطاطات الأوراق و نطاطات النباتات) و كذلك تم دراسة تغير التعداد للأنواع السائدة لهذه الحشرات على نباتات الذرة والقمح و دراسة تأثير العوامل الجوية (الحرارة العظمى و الحرارة الصغرى و الرطوبة النسبية)على نشاط و تعداد الحشرات موضع الدراسة و كذلك اختبار مقدرة حشرتي من الذرة *Rhopalosiphum maidis* (F.) على نقل الفيروس المسبب للمرض التقزم االأصفر فى الشعير والذي يصيب نباتات الذرة.

و قد تم أخذ عينات أسبوعية و جمعت تلك الحشرات سالفة الذكر بطرق مختلفة من نباتات الذرة والقمح وهذه الطرق هي:

أ- العينات النباتية Plant samples

ب- المصائد اللاصقة الصفراء Yellow sticky board Traps

جـ المصيدة الشبكية لجمع الحشرات Sweeping net

و قد أوضحت الدراسة أن المصيدة الشبكية تعتبر من أفضل الطرق لجمع أنواع نطاطات الأوراق ونطاطات النباتات وأن المصيدة اللاصقة الصفراء أكثر تخصصا في جمع أنواع معينة من نطاطات الأوراق.

ويمكن تلخيص النتائج المتحصل عليها كما يلى:

أولاً: الدراسة البيئية على بعض الحشرات متشابهة الأجنحة التى تصيب الذرة والقمح.

١-إجراء الحصر Survey للأنواع المختلفة للحشرات المتشابهة الأجنحة التي تصيب الذرة والقمح.

بين الحصر تواجد أنواع المن الآتية على كل من نباتات الذرة والقمح

أ- المن Aphids (Fam : Aphididae)

انواع المن التى سجلت على الذرة والقمح

- من الذرة *Rhopalosiphum maidis* (F.)
- من الشوفان *Rhopalosiphum padi* (L.)
- من القمح *Schizaphis graminum* (R.)
- من الغلال *Sitobion avenae* (F.)
- من القطن *Aphis gossypii* (Glov.)

وقد أوضحت الدراسة أن النوع الأول والثاني هى الانواع السائدة على نباتات الذرة الشامية و القمح.

ب- نطاطات الأوراق Leafhoppers (Fam: Cicadellidae)

اظهر الحصر تواجد الأنواع الآتية من نطاطات الأوراق علـى كـل مـن نباتات الذرة والقمح .

١- نباتات الذرة: تم تسجيل الأنواع الآتية:-

Empoasca decedens (Paoli), *Empoasca decipiens* (Paoli) , *Cicadulina chinai* (Ghauri), *Balclutha hortensis* (Lindb) and *Cicadulina bipunctella zea* (Chinai).

٢- نباتات القمح: تم تسجيل الأنواع الآتية:-

Empoasca decipiens (Paoli) and *Empoasca decedens* (Paoli)

جـ- نطاطات النباتات Planthoppers (Fam: Delphacidae)

سجلت الأنواع التالية على الذرة:-

Sogatella vibix (Haupt) and *Sogatella furcifera* (Horv.)

٢- دراسة الوفرة الموسمية للأنواع السائدة لهذه الحشرات.

وقد أوضحت نتائج الدراسة ما يلي:

أ- المن Aphid

١- من الذرة (.F) *Rhopalosiphum maidis*

سجل تغير تعداد حشرة من الذرة على نباتات الذرة قمة نشاط واحدة فى **الأسبوع الثالث من أغسطس خلال موسمي الدراسة** و بين التعداد على نباتات القمح قمة نشاط واحدة فى نهاية فبراير فى موسم ٢٠٠٣ / ٢٠٠٤ وفى خلال الأسبوع الأول من مارس خلال موسم الدراسة ٢٠٠٤/ ٢٠٠٥.

٢- من الشوفان (.L) *Rhopalosiphum padi*

سجل تعداد حشرة من الشوفان قمة نشاط واحدة على الذرة فى **الأسبوع الثالث من أغسطس خلال موسمي الدراسة** وفى حين سجلت قمة نشاط واحدة فى نهاية مارس خلال موسمى الدراسة ٢٠٠٣ / ٢٠٠٤ - ٢٠٠٤/ ٢٠٠٥على نباتات القمح.

٣- من الغلال(.F) *Schizaphis graminum*

سجل تعداد حشرة من الغلال قمة نشاط واحدة على نباتات القمح فى منتصف شهر مارس.

٤- من القطن (.Glov) *Aphis gossypii*

فقد سجل تعداد حشرة من القطن قمة نشاط واحدة على نباتات الذرة خلال الأسبوع **الثالث من أغسطس خلال موسمي الدراسة.**

ب- نطاطات الأوراق Leafhoppers

١- *Empoasca decipiens* (Paoli)

سجل تعداد هذه الحشرة على نباتات الذرة قمتين نشاط فكانت القمة الأولى في الأسبوع الثالث من يوليو، القمة الثانية في الأسبوع الثاني

من أغسطس. وقد سجلت قمة نشاط واحدة على نباتات القمح في الأسبوع الأخير من فبراير.

٢- *Empoasca decedens* **(Paoli)**

لقد سجل تعداد هذه الحشرة على نباتات الذرة قمتين نشاط فكانت القمة الأولى في الأسبوع **الرابع** من يوليو، القمة الثانية في الأسبوع **الثالث** من أغسطس على الذرة على حين أن تعداد تلك الحشرة سجل قمة واحدة على نباتات القمح في نهاية فبراير.

٣ - *Cicadulina chinai* **(Ghauri)**

سجل تعداد هذه الحشرة قمة نشاط واحدة على نباتات الذرة في الأسبوع الثالث من أغسطس خلال موسمي الدراسة ٢٠٠٤-٢٠٠٥

٤- *Balclutha hortensis* **(Lindb)**

سجل تعداد هذه الحشرة قمة نشاط واحدة فى الأسبوع الثالث من أغسطس على نباتات الذرة خلال مواسم الدراسة.

جـ - نطاطات النباتات Planthoppers (Delphacidae)

١- *Sogatella vibix* **(Haupt)**

سجل تعداد هذه الحشرة قمة نشاط واحدة على نباتات الذرة في الأسبوع الثالث من أغسطس.

٢- *Sogatella furcifera* **(Horv)**

سجل تعداد هذه الحشرة قمة نشاط واحدة على نباتات الذرة في الأسبوع الثالث من أغسطس خلال مواسم الدراسة.

٣- تأثير بعض عوامل المناخ على كثافة المجموع للحشرات المتشابهة الأجنحة السائدة والتي تصيب بعض محاصيل الحبوب النجيلية.

لقد تم دراسة تأثير كلا من الحرارة العظمى والحرارة الصغرى ومتوسط الرطوبة النسبية على كثافة المجموع للأنواع السائدة من حشرات

المن- نطاطات الأوراق - نطاطات النباتات والتي تصيب بعض المحاصيل (الذرة والقمح). خلال موسمي٢٠٠٣ / ٢٠٠٤ - ٢٠٠٤/ ٢٠٠٥ وقد أوضحت النتائج أن كل من درجة الحرارة العظمى ودرجة الحرارة الصغرى ونسبة الرطوبة النسبية لها تأثير معنوي على تعداد هذه الحشرات المتشابهة الأجنحة السالفة الذكر.

٤- تأثير بعض العمليات الزراعية (مواعيد الزراعة-الأصناف - التسميد) على تعداد حشرات المن- نطاطات النباتات - نطاطات الأوراق

أ- مواعيد الزراعة:

١-الذرة Maize plants

وجد أن ميعاد الزراعة الثاني (نهاية مايو) قد أظهر أقل تعداد لحشرات المن، نطاطات الأوراق ، نطاطات النباتات يلية ميعاد الزراعة الثالث (منتصف يونيو) بينما أظهر ميعاد الزراعة الأول (منتصف مايو) أعلى تعداد للحشرات

٢- القمح Wheat plants

وجد أن ميعاد الزراعة الثاني (منتصف نوفمبر) قد أظهر أقل تعداد لحشرات المن، نطاطات الأوراق ، نطاطات النباتات يلية ميعاد الزراعة الثالث (نهاية نوفمبر) بينما أظهر ميعاد الزراعة الأول (أول نوفمبر) أعلى تعداد للحشرات.

ب-حساسية الأصناف للإصابة:

١-الذرة Maize plants

يعتبر الصنف هجين فردى ١٨ أقل الأصناف حساسية للإصابة بالحشرات المتشابهة الأجنحة يليه الصنف هجين فردى ١٢٣ بينما

الصنف هجين فردى ١٢٩ هو أعلى الأصناف حساسية للإصابة بالحشرات المتشابهة الأجنحة.

٢- القمـــح Wheat plants

كان الصنف سخا ٦١ أقل الأصناف حساسية للإصابة بالحشرات يليه الصنف جميزه ٧ يليه الصنف جيزة ١٦٨ حيث يعتبر أكثر الأصناف حساسية للإصابة بالحشرات المتشابهة الأجنحة.

ب- تأثير معدلات التسميد البوتا سى على كثافة المجموع.

وجد أن معدل التسميد البوتاسى الأول (٧٥كحم سلفات بوتاسيوم/ فدان) قد أعطى أقل تعداد للإصابة بالحشرات المتشابهة الأجنحة التي تصيب كلا من نباتات الذرة ,القمح ويلية معدل التسميد الثانى (٥٠ كحم سلفات بوتاسيوم/ فدان) ويلية معدل التسميد الثالث (٢٥ كحم سلفات بوتاسيوم/ فدان) بينما اظهر معدل التسميد الرابع (صفر/فدان) اكبر تعداد للحشرات المتشابهة الأجنحة خلال موسمي الدراسة .

٥- العلا قة بين بعض المكونات الكيميائية للعصارة النباتية(البروتين الكربوهيدرات و K , P , pH) والأصناف المختلف للنباتات النجيلية و علاقة ذلك بكثافة المجموع للحشرات موضع الدراسة.

أوضحت نتائج التحليل الكيميائي لأوراق الأصناف المختلف للنباتات النجيلية (الذرة – القمح) الاتى:

ا- **البروتين** : أظهرت النتائج وجود علاقة موجبة بين المحتوى البروتينى لأوراق النباتات ودرجة إصابتها بالحشـرات وقـد تبـين زيـادة تعـداد الحشرات مع زيادة المحتوى البروتينى لأوراق.

ب- **الكربوهيدرات** : أظهرت النتائج وجود علاقة موجبة بين نسبة الكربوهيدرات في العصارة النباتية لأوراق الأصناف المختلفة ومستوى

الإصابة بالحشرات حيث زاد تعداد الحشرات مع زيادة المحتوى الكربوهيدرات لأوراق.

جـ- pH : أظهرت النتائج وجود ارتباط سالب بين قيم ال PH و متوسط كثافة التعداد للحشرات تحت الدراسة.

د- الفوسفور، البوتاسيوم:

كان التغير في هذه العناصر تغير غير معنوي باختلاف الأصناف.

٦ - تأثير التسميد البوتاسى بمعدلاته المختلفة على سمك خلايا البشرة للأوراق (نباتات القمح والذرة).

أثبتت النتائج أن زيادة معدل التسميد البوتاسى للأصناف المحاصيل تحت الدراسة المحاصيل أدى إلى زيادة سمك جدار خلايا البشرة مما قلل من قابلية الحشرات المتشابهة الأجنحة السابقة الذكر للتغذية على هذه النباتات كما أدى كذلك إلى انخفاض تعداد هذه الحشرات على الأصناف المختلفة لكل من الذرة و القمح.

ثانيا":- اختبار مقدرة بعض أنواع حشرات المن في نقل المسببات المرضية الفيروسية التي تصيب نباتات الذرة (فيروس التقزم الأصفر فى الشعير).

قد أوضحت نتائج تجربة نقل المسبب المرضى الفيروسي للمسبب لمرض التقزم الأصفر في الشعير و الذي يصيب نباتات الذرة مقدرة حشرة من الذرة ***Rhopalosiphum maidis*** على نقل هذا الفيروس من نباتات الذرة المصابة إلى نباتات الكرفس السليم (نباتات مختبرة) و من نباتات كرفس مصابه إلى نباتات كرفس السليمة.

وقد تبين كذلك ما يلي:-

١- قدرة الحشرة على نقل المسبب المرضى الفيروسي من نبات الذرة المصاب إلى نبات كرفس سليم (نباتات مختبره) وكذلك قدرة الحشرة على نقل هذا المسبب المرض من نباتات كرفس مصاب إلى أخر سليم.

٢- حساب أقل فترة تغذية لازمة لاكتساب المسبب المرضى تتـراوح مـن ساعة إلى ٢٤ ساعة.

٣-اقل فترة لازمة لحقن المسبب المرضى داخل النبات المختبر ٨ ساعات

٤- فترة الحضانة داخل الحشرة المختبر٤٨-٩٦ ساعة

٥-فترة الحضانة داخل النبات المختبر.١٨- ٢٥ يوم.

دراسات على الآفات الحشرية التي تصيب بعض محاصيل الحقل النجيلية

رسالة مقدمة من

أمل زكريا نور الدين الحبشي

بكالوريوس العلوم الزراعية (الحشرات الاقتصادية) كلية الزراعة- جامعة الزقازيق١٩٩٢

ماجستير العلوم الزراعية (الحشرات الاقتصادية) كلية الزراعة - جامعة الزقازيق٢٠٠١

للحصول على درجة
دكتور الفلسفة في العلوم الزراعية
(الحشرات الاقتصادية)

لجنة الإشراف العلمي:

(١) أ.د / متولي مصطفى خطاب
أستاذ مساعد الحشرات الاقتصادية المتفرغ - كلية الزراعة بمشتهر - جامعة بنها

(٢) د / رضا السيد محمد عمر
أستاذ مساعد الحشرات الاقتصادية - كلية الزراعة بمشتهر - جامعة بنها

(٣) أ.د / على مرسى سليمان حجاب
أستاذ الحشرات الاقتصادية المتفرغ - كلية الزراعة - جامعة الزقازيق

(٤) أ.د / على محمود سليمان
رئيس بحوث بمعهد بحوث وقاية النباتات - الدقى - جيزة

قسم وقاية النبات

كلية الزراعة بمشتهر - جامعة بنها

٢٠٠٨

دراسات على الآفات الحشرية التى تصيب بعض محاصيل الحقل النجيلية

رسالة مقدمة من

امل زكريا نور الدين الحبشى

بكالوريوس العلوم الزراعية (الحشرات الاقتصادية) كلية الزراعة- جامعة الزقازيق١٩٩٢

ماجستير العلوم الزراعية (الحشرات الاقتصادية) كلية الزراعة - جامعة الزقازيق ٢٠٠١

للحصول على درجة

دكتورالفلسفة فى العلوم الزراعية

(الحشرات الاقتصادية)

وقد تمت مناقشة الرسالة والموافقة عليها

اللجنـــة

(١)أ.د / إبراهيم إبراهيم مصباح ....

أستاذ الحشرات الاقتصادية - كلية الزراعة - جامعة طنطا

(٢) أ.د/ فارس أمين محمد أللقوة ....

أستاذ الحشرات الاقتصادية المتفرغ - كلية الزراعة بمشتهر - جامعة بنها

(٣)أ.د /على مرسى سليمان حجاب ....

أستاذ الحشرات الاقتصادية المتفرغ - كلية الزراعة - جامعة الزقازيق

(٤) أ.د / متولي مصطفى خطاب ....

أستاذ مساعد الحشرات الاقتصادية المتفرغ - كلية الزراعة بمشتهر - جامعة بنها

(٥) د / رضا السيد محمد عمر ....

أستاذ مساعد الحشرات الاقتصادية - كلية الزراعة بمشتهر - جامعة بنها

تاريخ الموافقة ٢٨ / ٧ / ٢٠٠٨

دراسات على الآفات الحشرية التي تصيب بعض محاصيل الحقل النجيلية

رسالة مقدمة من

أمل زكريا نور الدين الحبشي

بكالوريوس العلوم الزراعية (الحشرات الاقتصادية) كلية الزراعة- جامعة الزقازيق١٩٩٢

ماجستير العلوم الزراعية (الحشرات الاقتصادية) كلية الزراعة - جامعة الزقازيق ٢٠٠١

للحصول على درجة

دكتور الفلسفة في العلوم الزراعية

(الحشرات الاقتصادية)

قسم وقاية النبات

كلية الزراعة بمشتهر – جامعة بنها

٢٠٠٨