

# Population Dynamics of Insect and Mite Pests Attacking Pear Trees During the Blooming and Fruiting Seasons at Ismailia Governorate

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**Abstract:** The insect and mite pests attacking pear trees at Ismailia Governorate, Egypt, were surveyed throughout two successive years 2005 – 2006 in two pear orchards of Suez Canal University. The survey covered the existing insect species causing damage, frequency of occurrence, period of occurrence and attacked plant parts during two successive blooming and fruiting seasons. Thirteen insect and mite pests belonging to twelve families from orders Homoptera, Thysanoptera, Diptera, Coleoptera, Isoptera and Parasitiformes were recorded. The most dominant and economically important pests were a mealybug, *Planococcus ficus*, a scale insect, *Aonidiella aurantii*, an aphid, *Aphis gossypii*, and a psyllid, *Cacopsylla pyricola*. A stem borer, *Scolytus aegyptiacus*, and a mite, *Cenopalpus pulcher*, were present in high density. The less economically important pests were a mite, *Tetranychus urticae*, a scale insect, *Chrysomphalus ficus*, a thrips, *Thrips tabaci*, a leaf hopper, *Empoasca lybica*, a wax scale, *Ceroplastes floridensis*, a fruit fly *Ceratitis capitata*, and the termite *Anacanthotermes ochraceus*. Mealybugs were the most important and major insect pests that attack pear trees in the first season, whereas in the second season *Cacopsylla pyricola* was the major pest. Temperatures and relative humidity showed a significant effect on the population of such pests.

**Keywords:** Population dynamics, insects, mites, pear trees

## INTRODUCTION

Pear is a deciduous fruit tree of economic importance that is widely grown successfully in many countries, including Egypt. However, its cultivated area in Egypt is very small compared to other fruit crops as mango, citrus, grapevine and peach. Moreover, this area has decreased, especially in recent years. The reduction in production has resulted in importation of fruit. The cost of imported pears increased from \$29,000 in 1993 to \$498,000 in 2000 (FAO, 2000). In addition, a wide range of insect species attack pear trees, causing a significant and serious loss in the yield production; a 25–30% loss was reported (Boldrev, 1985).

Although there have been many studies of the pests that attack different fruit crops, the pear crop has not been well studied. The present study was done to contribute to understanding the population dynamics of insects and mites attacking the pear trees during the critical period of the yield production; i.e., the vegetation and fruiting period from March to June. The seasonal distribution of these pests attacking pear trees may open the possibility for using integrated pest programs against those pests causing the most economic injury.

In France, Rieux *et al.*, (1999) conducted a survey of arthropods to determine the role of hedgerows and ground cover management on their populations in pear orchards. In Saudi Arabia, a general survey of agricultural pests on fruit trees was performed by Abu-Thuraya, in (1982). In Egypt, survey of mites was reported by Zaher *et al.* (1973) and El-Halawany *et al.* (1986) on deciduous fruit trees.

## MATERIAL AND METHODS

Surveys of the insect and mite pests attacking pear trees at Ismailia Governorate, Egypt, were carried out throughout two successive vegetating and fruiting seasons, from March 2005 until June 2006. Two pear

orchards at Suez Canal University were selected. The first was located in the new farm, Faculty of Agriculture of an area of 1600 m<sup>2</sup> included 72 pear trees (Le-Conte) on the origin *Pyrus communis*. The second was located in the old farm, Faculty of Agriculture, 4.5 Km from the first site. Twelve trees of pear trees (Calyriana) were situated in the old farm.

Five trees were selected randomly from every location, one from every corner and the fifth from the middle. Samples were taken from the selected trees three times monthly. Four branches one-two years old, 20 cm in length were severed from four sites of the tree and transferred in suitable paper bags to the laboratory for proper identification of pests (Osman, 2004). Laboratory identification of the specimens was made either under the binocular microscope or after mounting on microscopic slides.

All parts of the samples were inspected and recorded; i.e., the branches length, number of leaves and number of buds. Any existing major or minor insect and mite pests were recorded and identified directly as much as possible in the laboratory. Also, plant parts attacked (leaves – wood – buds – fruits) were recorded (Tadros *et al.*, (1997). The numbers of the different pests attacking pear trees during the blooming period were recorded at the selected areas throughout the inspecting samples.

Records of the average temperature and relative humidity, throughout the inspected periods were obtained from the meteorological station belonging to the Department of the Ministry of Agriculture at Ismailia Governorate.

## RESULTS AND DISCUSSION

### The survey of insect and mite pests:

The survey revealed that the most important pests attacking pear trees (from initiation sap flowing, swelling buds and developing leaves until fruiting) belonged to five insect orders and one order

(Parasitiformes) belonging to class Acari. The main insect orders included six families of Homoptera (Aphididae, Pseudococcidae, Diaspididae, Coccidae, Cicadellidae and Psyllidae), Thysanoptera, Diptera, Coleoptera and Isoptera.

Survey of the insect and mite pests in pear trees and the plant parts attacked by them are shown in Table 1. Recorded pests could be divided into 10 groups; Mealybugs, Aphids, Psyllids, Scale insects, Leaf hoppers, Thrips, Stem borers, Fruit flies, Termites and Mites.

One species of mealybug; the vine mealybug *Planococcus ficus* (Signoret) (Pseudococcidae) was found to cause serious damage to pear trees almost during the whole period of the experiment. It mainly attacks leaves followed by woody parts and was slightly observed on fruits. This pseudococcid is distributed throughout southern Europe, South and North of America, the Middle East and parts of Africa Jocelyn *et al.*, (2002). It is a polyphagous insect with a wide range of host plants Walton and Pringle (2004) such as grapes, figs, apples, and citrus, as well as more tropical crops such as yams, mangos, and avocados Diane *et al.*, (2001). It causes direct crop loss of grapes due to desiccation of bunches and unsightly honeydew excretion. In Egypt Awadallah *et al.*, (2004) found that it becomes an economic pest, especially in the newly-reclaimed areas.

The aphid, *Aphis gossypii* (Aphididae), was also an important pest in pear orchards; sucking sap from leaves and young shoots and found on flowers.

The European pear sucker plant louse, *Cacopsylla pyricola* Foerster (Psyllidae), is one of the most menacing insect pests of pear in many countries. As far as the present authors are aware, no information was previously reported for the presence of this pest in Egypt. Psyllid insects were significantly recorded mainly on leaves, flowers and buds. It feeds primarily on phloem tissues and it is a host specific to certain *Pyrus* spp. Bell and Stuart (1990) and Butt *et al.* (1988) reported that successful initiation of nymphal feeding and honeydew production were strong indicators of host suitability. Large numbers of winter forms leave pear orchard in autumn to overwinter in nonpear habitats, and return to pear orchards the following spring Horton *et al.*, (1994). The pear psylla secretes honeydew, which serves as a substratum for the growth of a black fungus that gives the tree a smoky, sooty appearance. Foliage may wilt and drop to the ground. Trees that are heavily infested for a long time produce little growth and set fewer fruit buds. Fruit remains undersized, fails to mature and may fall off the tree when only partly grown. The tree shows symptoms from "psylla shock" caused by the toxin the psylla have injected into it. Prolonged infestations may kill the tree outright Angus, (1999). Rieux *et al.*, (1999) and Milaire (1988) stated that the mainly phytophagous species on pear trees were psylla and aphids.

Two species of scale insects, *Aonidiella aurantii* and *Chrysomphalus ficus* (Diaspididae) existed all the season; mainly on wood and rarely on leaves.

Few numbers of the Florida wax scale insect, *Ceroplastes floridensis* (Coccidae) were observed on the wood and leaves. Hamad and Abd El\_salam (1985) stated that the scale insects such as *Ch. ficus* and *C. floridensis* attack pear trees.

Adults and nymphs of the leaf hopper, *Empoasca lybica* (Cicadellidae), were collected from leaves and flowers of pear trees.

The thrips, *Thrips tabaci* (Thripidae), was also recorded, especially on leaves, fruits and insignificantly on flowers. Pear trees were also subjected to infestation by the stem borer, *Scolytus aegyptiacus* (Scolytidae). Hamad and Abd El\_salam (1985) mentioned that this pest causes a serious damage to pear trees.

Pear fruits were infested with the fruit fly *Ceratitis capitata* (Trypetidae). It is a common polyphagous pest attacking more than 250 species of commercial fruits growing in the Mediterranean area Fimiani, 1983; Mahmoud, (1997). Papadopoulos *et al.* (2001) mentioned that the important hosts for the summer generations of *C. capitata* are peach, fig, and in autumn, pear and apple.

The termite species *Anacanthotermes ochraceus* (Hodotermitidae) was infrequently observed on the wood, in some samples. Tadros *et al.* (1997) mentioned that the workers of this termite attack vineyard trees, especially at the newly reclaimed lands.

The flat scarlet mite, *Cenopalpus pulcher* (Tenuipalpidae), was a common pest on pear trees during all period of study. The mature, immature stages and eggs were observed on the wood, buds and leaves and modestly on fruits. Another mite species, *Tetranychus urticae* (Tetranychidae), was also recorded on leaves. Shoukry *et al.* (1999) recorded the mites *C. pulcher* (C. and F.) on apple and *T. urticae* on pear at Ismailia, while Zaher *et al.* (1973) recorded the species *C. lanceolatisetae* Attiah on pear trees at Giza.

Some pest species were recorded infrequently, i.e., the scale insect *Lepidosaphes ulmi* (Diaspididae), the thrips *Retithrips syriacus* (Thripidae), the soft scale insect *Coccus hesperidum* L. (Coccidae), in addition to mite species as *Tydeus californicus* (Tydeidae) and pear mite *Eriophes pyri* Pgst. (Eriophyidae). It is noteworthy to mention that various natural enemies were also recorded during investigation. For instance, larvae and eggs of *Chrysoperla carnae*, coccinellid larvae, syrphid larvae and nymphs of predacious thrips.

Moreover, some species of predacious mites were found such as *Cunaxa* sp. (Cunaxidae), *Cheyletogenus ornatus* (Cheyletidae) and *Amblyssus* sp. (Phytoseidae).

### Population dynamics

The population dynamic of different pests attacking pear trees during the blooming period at new and old experimental orchards in season 2005 are shown in Fig. 1. The moderately changes in temperature and relative humidity (%) were favorable to increasing of pest populations. The pests reached their maximum populations in the second decade of May when the average of temperature and relative humidity were 25°C and 50.5 % R.H, respectively. The results showed that the most abundant and dominant pest species were the scale insects, followed by mites then aphid, mealybugs,

**Table (1):** List of insect and mite pests attacking different plant parts of pear trees during the blooming seasons, 2005 and 2006 in two pear orchards at Ismailia governorate.

No.	Pest	Family	Order	Damage plant parts			
				W.	L.	Fl.	Fr.
1	<b>Mealybugs</b> <i>Planococcus ficus</i>	Pseudococcidae		++	+++	--	+
2	<b>Aphid</b> <i>Aphis gossypii</i>	Aphididae		--	++	+	--
3	<b>Plant lice</b> <i>Cacopsylla pyricola</i>	Psyllidae		+	++	+	--
	<b>Scale insects</b>		Homoptera				
4	<i>Aonidiella aurantii</i>	Diaspididae		+++	+	--	--
	<i>Chrysomphalus ficus</i>			++	--	--	--
	<i>Ceroplastes floridensis</i>	Coccidae		+	+	--	--
5	<b>Leaf hoppers</b> <i>Empoasca lybica</i>	Cicadellidae		--	+	+	--
6	<b>Thrips</b> <i>Thrips tabaci</i>	Thripidae	Thysanoptera	--	++	+	--
7	<b>Stem borers</b> <i>Scolytus aegyptiacus</i>	Scolytidae	Coleoptera	+++	--	--	--
8	<b>Flies</b> <i>Ceratitis capitata</i>	Tephritidae	Diptera	--	--	--	+
9	<b>Termites</b> <i>Anacanthotermes ochraceus</i>	Hodotermitidae	Isoptera	+	--	--	--
	<b>Mites</b>		Class: Acari				
10	<i>Tetranychus urticae</i>	Tetranychidae	Order:	+	++	--	--
	<i>Cenopalpus pulcher</i>	Tenuipalpidae	Parasitiformes	+++	++	--	+

+ low populated pest, ++ mid populated pest, +++ a high populated pest and unrecorded pest in the collected samples. W. wood, L. leaf, F. flowers and Fr. fruits.

leaf hopper, thrips and psylla in the new orchard. However, in the old orchards the most dominant species were mites followed by the mealybugs after that, thrips, scale insects, leaf hopper and aphid, whereas the psyllid was not recorded in this location.

In the new orchard, scale insects were observed in low numbers with an average of (0.24 individual) on pear trees from the beginning of the survey (March 1, 2005) and increased gradually to reach its peak (7.37 individuals) during the second decade of May. The mite populations showed two peaks; the first (1.57 individuals) during the second decade of April at 23.5°C and 50% R.H. and the second (3.78 individuals) in the second decade of May at 25°C and 50.5 % R.H. The dynamic of aphid population was initiated with an average of (0.28 individuals) during the first decade of April at 18.5°C and 54.5 % R.H. to reach its peak (2.56 individuals) in the second decade of May. Mealybugs were recorded with an average of (0.29 individuals) in the second decade of March at 14.8.5°C and 55.5 % R.H. which decreased gradually to zero in the first of April, then back to occur to attain the maximum of 1.08 individuals in the second decade of May, 2005. The dynamics of leaf hopper, thrips and psylla were slight and not constant. Leaf hoppers occurred in three periods: first of April with an average of (0.03

individuals), third decade of April (0.15 individuals) at 22.5°C and 53 % R.H. and third decade of May (0.26 individuals) at 25.5°C and 54.5 % R.H. Thrips occurred at two times in the First of March, 2005 with an average of 0.09 individuals at 19°C and 52 % R.H. and the first of April (0.18 individuals), whereas the incidence of psylla initiated in the first of May with an average of 0.12 individuals to the end of season (June 1, 2005) with an average of 0.49 individuals at 26.5°C and 55.5 % R.H.

In the old orchard, the most dominant pest species were mites followed by mealybugs. The mites were present in high populations from the beginning of the season (March 3, 2005) with an average of 19.71 individuals and increased gradually to attain their peak (54.84 individuals) in the first decade of May, then the population strongly decreased to the end of season to 9.63 individuals (June 5, 2005). Conversely, the mealybugs were observed from the beginning of season 0.59 (9.63 individuals) and increase regularly to reach the maximum at the end of the season with an average of 39.91 (9.63 individuals). The population dynamics of other pest species were insignificant.

The population dynamics of different pests attacking pear trees during the blooming period at new and old experimental orchards in 2006 season are shown

in Fig. 2. The population dynamics of various pests especially mites were developed very quickly due to the indistinct but regular changes in temperature and relative humidity to reach their highest populations in the second decade of April and the first of June when the average of temperature and relative humidity were 21.2°C, 26.5°C and 53 %, 52.5 % R.H., respectively.

The obtained data showed that mites were the most abundant pest species in both two orchards. Population were highly abundant in the old orchard compared to the new one and so were all other pest species except aphids, psylla and thrips which were more abundant in the new orchard.

In the new orchard, infestation of mites started from the beginning of the season (March 1, 2006) at 16°C and 55.5 % R.H. with an average of 0.94 individuals and increased gradually to reach its maximum of 9.75 individuals in the second decade of April at 17.5°C and 53 % R.H. After that the population began to decrease (4.98 individuals) to the second decade of May at 22°C and 53 % R.H., then increased again to 6.37 individuals by the end of the season (June 9, 2006) at 26.5°C and 52.5 % R.H. The psyllid population was initiated with an average of 0.26 individuals at 22.5°C and 53 % R.H. in the third decade of April and increased rapidly to reach its peak (3.89 individuals) at 26.5°C and 51 % R.H. in the end of May, then decreased slightly to the end of the season (2.72 individuals).

The aphids started to occur with an average of 0.09 individuals in the third decade of March at 19°C and 54.5 % R.H. and increased to reach its peak of 3.71 individuals by the end of May, then decreased sharply in the end of the season (0.74 individuals). Thrips started to appear in the second decade of March at 17.5°C and 53 % R.H. with an average of 0.05 individuals and raised slightly to the end of May (1.64 individuals) and decreased again by the end of the season (0.51 individuals). The mealybug population was observed in the first of April at 18°C and 57 % R.H. with an average of 0.16 individuals and gradually increased to the second decade of May (0.68 individuals) and decreased to the end of season (0.33 individuals). Leaf hopper occurred with the beginning of April, with an average of 0.04 individuals and up to 0.19 individuals by the end of season. Scale insects were recorded relatively from the beginning to the end of season, with a range from 0.34 to 0.17 individuals.

In the old orchard, the most dominant pest species were mites, followed by mealybugs. The high population of mites was initiated from the beginning of the season (March 2, 2006), with an average of 31.5 individuals and increased to show two peaks; the first (49.21 individuals) during the second decade of April and the second (63.12 individuals) by the first of June. Afterwards, it decreased to the end of the season (June 12, 2006), with an average of 12.32 individuals at 25.5°C and 54 % R.H. The population of mealybugs increased slowly to reach its peak with an average of 1.09 individuals in the first of June and then decreased. Leaf hoppers were the next most important pest in the density which occurred in the third decade of April,

with an average of 0.11 individuals, and 0.12 individuals by the end of the season.

The population of thrips increased from the beginning of the season, with an average of 0.07 individuals to reach its peak of 0.89 individuals in the first of June and decreased to 0.63 individuals by the end of the season.

Scale insects occurred rarely during the study. Psylla was recorded in the second decade of April, with an average of 1.08 individuals and slightly decreased to the end of season (0.32 individuals). Aphids did not occur regularly and were present in fewer numbers than in the new orchard.

## CONCLUSIONS

1) Survey of insect and mite pests attacking pear trees at Ismailia Governorate, Egypt showed the presence of thirteen insect and mite pests belonging to twelve families from orders Homoptera, Thysanoptera, Diptera, Coleoptera, Isoptera and Parasitiformes.

2) The insect and mite pests attacking pear trees at Ismailia could be divided into two divisions according to their economic importance, degree of damage and population density throughout the experimental period of survey as a major and minor pests. The major and most economically important pests were the mite, *C. pulcher*, the scale insect, *A. aurantii*, the mealybug, *P. ficus*, aphid, *A. gossypii*, psyllid, *C. pyricola* and stem borer, *S. aegyptiacus*. Whereas, the less economically important arthropods, rated as minor pests were the mite, *T. urticae*, scale insect, *Ch. ficus*, thrips, *T. tabaci*, leaf hopper, *E. lybica*, wax scale insect, *C. floridensis*, fruit fly, *C. capitata* and termite, *A. ochraceus*.

3) The population dynamics and the degree of infestation by various pests were related to weather conditions. The moderate increase in temperature and relative humidity in 2005 were favorable to cause increases in pest populations. The recorded pests reached their maximum populations in the second decade of May when the average of temperature and relative humidity were 25°C and 50.5 % R.H., respectively. However, the population dynamics of various pests, especially mites, developed very quickly due to the indistinct but regular increase in temperature and relative humidity to reach their highest populations in the second decade of April and the first of June wherever the average of temperature and relative humidity were 21.2°C, 26.5°C and 53 %, 51 % R.H., respectively.

## REFERENCES

- Abu-Thuraya, N. H. (1982). A general survey of agricultural pests in Saudi Arabia. Minist. Agric. and Water, Agric. Res. Dept., Kingdom of Saudi Arabia (in Arabic).
- Angus H. Howitt (1999). Fruit IPM Fact Sheet, Pear Psylla. From NCR-63:Common Tree Fruit Pests. Michigan State University.  
<http://web1.msue.msu.edu/vanburen/index.htm>

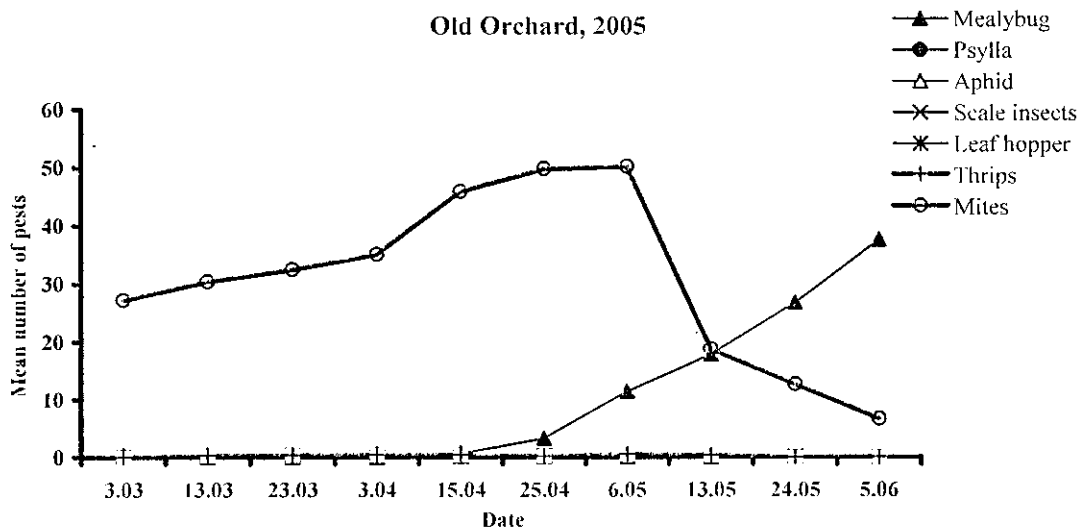
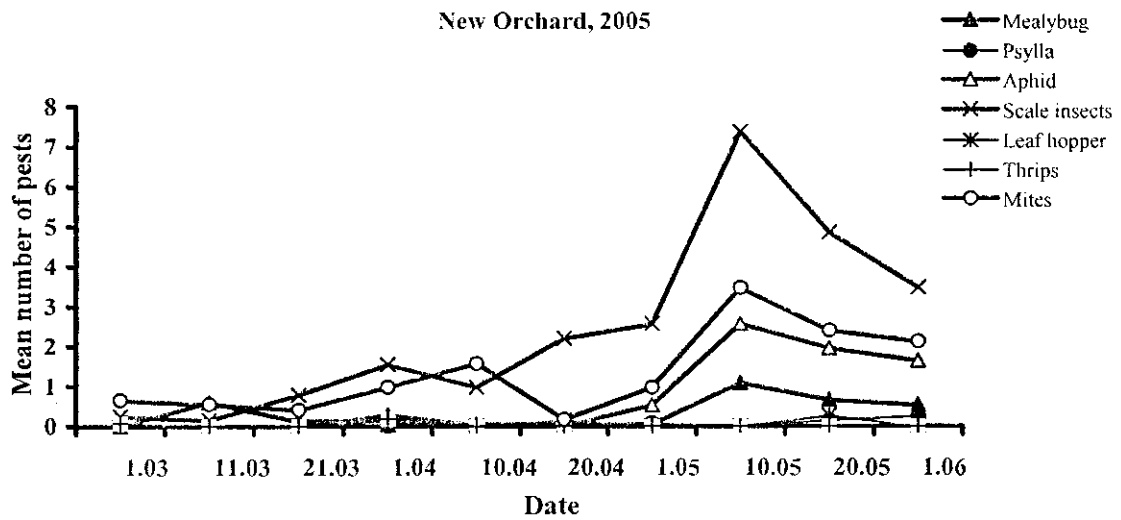
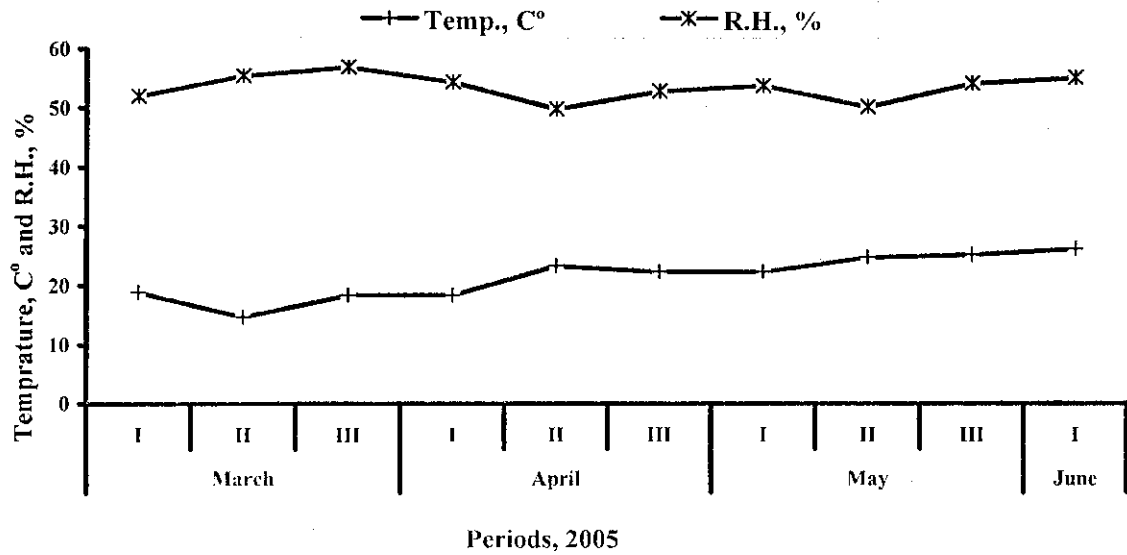


Fig.(1): The phenology of different pests attacking pear trees during the blooming period at the Faculty of Agriculture; new and old orchards in 2005.

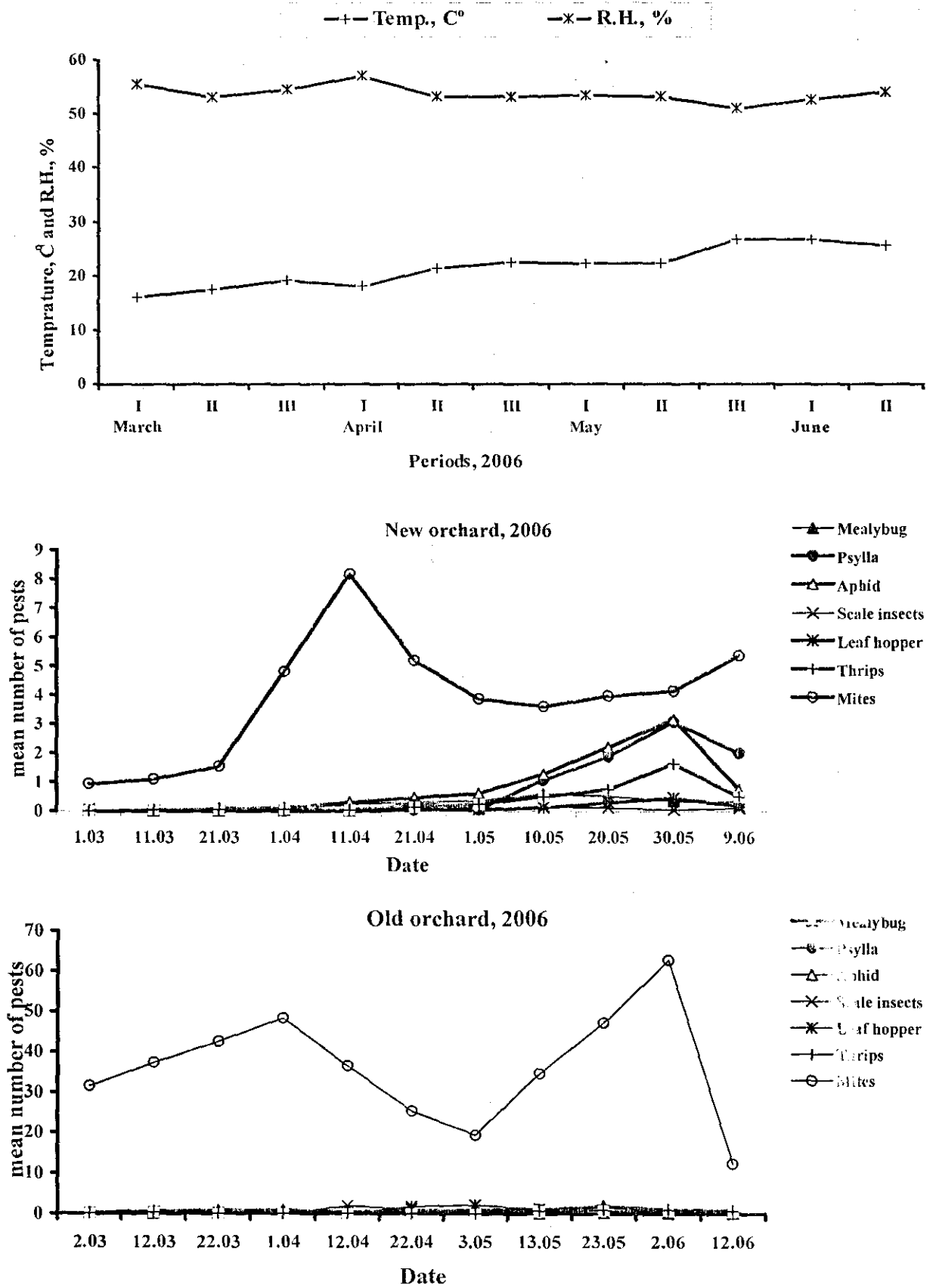


Fig. (2): The phenology of different pests attacking pear trees during the blooming period at the Faculty of Agriculture; new and old orchards in 2006.

- Awadallah, K. T., Ibrahim A. M. A., Mona H. Tawfik and Angel R. Attia. (2004). On the biology of the Vine Mealybug *Planococcus ficus* (Signoret) (Pseudococcidae: Homoptera). Agric. Res. J., Suez Canal University, VI, 4, No. 2. pp. 105-112.
- Bell, R. L. and Stuart L. C. (1990). Resistance in eastern European *Pyrus* germplasm to pear psylla nymphal feeding. HortScience 25: 789-791.
- Boldrev, M. I. (1985): Integrated control system on apple orchards. Russia, Plodovoshnoe khoz-vo. No. 2 pp. 42-47.
- Butt, B. A., Stuart, L. C. and Bell, R. L. (1988). Feeding behavior of pear psylla (Homoptera: Psyllidae) nymphs on susceptible and resistance *Pyrus* germplasm. J. Econ. Entomol., 81: 1394-1397.
- Diane M. Hinkens, J. Steven McElfresh and Jocelyn G. Millar (2001). Identification and synthesis of the sex pheromone of the vine mealybug, *Planococcus ficus*. Tetrahedron Letters V. 42, Issue 9, 26 pp.1619-1621.
- El-Halawany, M. E., Kandeel, M. H. H. and Rakha, M. A. (1986). Mites inhabiting deciduous fruit trees in Egypt. Egypt, J. Agric. Res., 64 (1): 115-122.
- FAO, Food Agriculture Organization, (2000).
- Fimiani, P., (1983). Chapter 2.I. Mediterranean region in: fruit flies, their biology, natural enemies and control. Vol. 3A (edited by Robinson, A.S. and Hooper, G.) Elsevier, Amsterdam, The Netherlands. 372 pp.
- Jocelyn G. Millar, Kent M. Daane, J. Steven McElfresh, Jardel A. Moreira, Raksha Malakar-Kuennen, Marta Guillen, and Walt J. Bentley (2002): Development and optimization of methods for using sex pheromone for monitoring the mealybug *Planococcus ficus* (Homoptera: Pseudococcidae) in California Vineyards. J. Econ. Entomol., 59 (4): 706-714.
- Hamad S. M. and Abd El\_salam A. I. (1985). Economic insect of Egypt and Arab countries, Dar El-Marrikh, Riadah, Saudi Arabia. (in Arabic).
- Horton-D. R., Higbee-B. S. and Krysan-J. L. (1994). Postdiapause development and mating status of pear psylla (Homoptera: Psyllidae) affected by pear and nonhost species. Ann. Entomol. Soc. Am. 87: 2, 241-249.
- Mahmoud M. F. (1997). Behavioral and ecological studies on Medfly *Ceratitis capitata* (Wied.) and control methods. M.Sc. Thesis, Faculty of Agriculture, Suez Canal University.
- Milaire-H. G. (1988). Integrated protection of apple and pear trees. EUR-Report, EUR 9386, 84-94.
- Osman, M. A. M. (2004). Biological and ecological principles of using pheromones, other biological active agents and microbiological preparations in apple integrated protection from pests. Ph.D. Thesis, Moscow Timiryazev Agricultural Academy.
- Papadopoulos, N. T., Katsoyannos, B. I., Carey, J. R. and Kouloussis, N. A. (2001). Seasonal and annual occurrence of the Mediterranean fruit fly (Diptera: Tephritidae) in Northern Greece. Ann. Entomol. Soc. Am., V.94, No.1. pp. 41-50.
- Rieux, R., Simon, S. and Defrance, H. (1999): Role of hedgerows and ground cover management on arthropod populations in pear orchards. Agriculture, Ecosystem and Environment 73 pp. 119-127.
- Shoukry, A., El\_kady, G., Sharabasy, H. M. and Mohamed Tawfik Ahmed (1999). Incidence of mites inhabiting plants and soil at newly reclaimed lands in Ismailia Governorate. 8th Nat. Conf. of Pests & Dis. of Veg. & Fruits in Ismailia, Egypt. V. I; pp. 175- 187.
- Tadros A. W., Semeada A. M., El-Sherif S. I. and Fattouh, A. A. (1997). Survey of the insect pests in vineyards in Egypt. 7th Nat. Conf. of Pest. & Dis. of Vegetables & Fruits in Egypt Vol. II; pp. 242- 249.
- Walton. V. M. and Pringle K. L. (2004). Vine mealybug, *Planococcus ficus* (Signoret) (Homoptera: Pseudococcidae), a key pest in South Africa vineyards. A review. S. Afr. J. Entol. Vltle., V. 25, No. 2. pp 54-62.
- Zaher, M. A., Soliman Z. R. and El-Safi G. S. (1973). Survey and Population studies on mites associated with deciduous fruit trees in Giza, Egypt. Bull Soc. Ent. Egypte, LVII. Pp. 425- 433.