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DEVELOPMENT OF A PROTOTYPE COMPUTER PROGRAM FOR PREDICTING *Rhopalosiphum maidis* (FITCH) ABUNDANCE ON BARLEY IN EGYPT

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ABSTRACT

The obtained data of seasonal abundance of the corn leaf aphid, *Rhopalosiphum maidis* (Fitch) (Homoptera: Aphididae) in relation to climatic factors, sowing dates, plant growth stage and fertilization rates were used to develop a prototype computer program to predict aphids' abundance on barley at different planting dates in relation to plant growth stages. This prototype program is a first step towards developing an expert system for prediction of aphids on barley in Egypt.

INTRODUCTION

Aphids attack barley at critical stages of plant growth; they cause serious damage to their hosts by sucking plant sap and transmitting barley yellow dwarf virus. Barley fields are considered harboured much more aphid populations than the adjacent wheat fields in Shandawil (Upper Egypt). Two yearly cycle of aphids' outbreak on wheat and barley were reported by Bishara (1987). The dominant cereal aphid species are *Rhopalosiphum padi* and *Rhopalosiphum maidis* and to a lesser extent *Schizaphis graminum* and *Sitobion avenae* (El-Hariry, 1979 and Tantawi, 1985). In the Barley Belt located on the north western coast *R. maidis* was the most dominant species of aphids infested 30 to 40% of the plants (Noaman *et al.*, 1992).

Also, Slman and Ahmed (2005) found that *R. maidis* was the most serious cereal aphid species on barley plants in south Egypt during February and March and was usually the most abundant species in the Autumn (Mepherson and Brann, 1983). Youssef *et al.* (1998) attributed the low infestation with aphid during 1995/1996 season at Shandawil in Egypt, to the fluctuation in humidity and temperature. They argued that, during this particular season, the Winter was mild and dry resulting in a less infestation. in Egypt, Mohamed (1992) stated that the weather conditions greatly affected the peak activity of aphids and plant maturity seemed to be the most important factor causing drastic reduction in aphid colonization.

Balakrishnan (2013) mentioned that, An Expert System is a system that employs human knowledge captured in a computer to solve problems that ordinarily required human expertise. In agriculture, expert systems unite the accumulated expertise of individual disciplines, such as plant pathology, entomology, horticulture, agricultural meteorology and animal sciences; into a framework that best addresses the specific, on-site needs of farmers. Cereal aphids expert system (CAES) was designed by Gonzalez-Andujar *et al.* (1993). This program designed to provide identification and information to farmers and extension specialists as well as information for educational and research purposes, on the main cereal aphid species in Spain. As a result of using expert systems as a training tool in the agricultural sector in Egypt, this study presented preliminary computer program in the process of introducing expert system (Hitoshi *et al.*, 2012). Expert system is offered as the second choice after expert on consultation (Selvakumar *et al.*, 2011).

This study tries to present a prototype program as a first step towards developing an expert system for prediction of aphids on barley in Egypt.

MATERIALS AND METHODS

The treatments included different sowing dates and fertilization rates were replicated four times in stripes for three tested sowing dates experiment and in a complete randomized design for nitrogen fertilization experiment (24 plots). The area of each plot size was about 42m^2 (1/100 of feddan). The field studies were conducted throughout two successive growing seasons, 2001/2002 and 2002/2003 on barley, *Hordeum vulgare*.

Feekes scale represented by Large, 1954 for describing the different growth stages of barley plants (Plate 1) was employed. Sampling of barley plants began as soon as the plants appeared above ground and continued until the crop maturity.

The random sample per plot was twenty-five tillers at each of the four cardinal directions (*i.e.*, north, south, east and west in addition to the center). Direct count of the corn leaf aphid, *Rhopalosiphum maidis* was made according to Dewar *et al.* (1982). Meteorological data of temperature and relative humidity for Giza Governorate were obtained from the meteorological services provided by the Ministry of Agriculture.

Prediction program prototype (copy right ©):

The obtained data of seasonal abundance of aphids are used to develop a prototype program to predict *R. maidis* abundance on barley at different planting dates in relation to plant growth stages using net program (Visual Studio (VS), Version = "3:701").

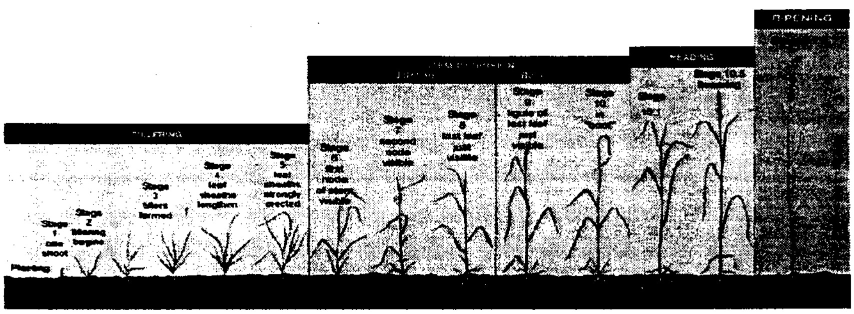

Plate (1): Growth stages of barley according to the Feekes scale (Large, 1954)

RESULTS

Seasonal abundance of *Rhopalosiphum maidis* on barley:

The investigation was focused on the seasonal abundance of *R. maidis* over three sowing dates in relation to plant growth stage, temperature and relative humidity. The recorded Data of *R. maidis* over the two seasons were presented in Tables, 1-6.

Seasonal abundance of *R. maidis* on barley at the different sowing dates:

- **First sowing date (22nd November)**

In the first season (2001/2002) as shown in Table (1) *R. maidis* appeared in few numbers on barley plants and increased gradually to reach a total average number of 7.14 individuals/tiller on the 4th Jan. during the tillering stage with a highest mean Number of 27.54 individuals/tiller (plant age of 43 day, Feekes 4) while the recorded maximum and minimum temperatures were 18.37 and 3.3°C and the recorded mean relative humidity (RH) was 55.33%, During the stem extension period, *R. maidis* reached mean Number of 33.8 individuals/tiller. The highest population Number was 66.13 individuals/tiller occurred on the 31st Jan. 2002 (plant age of 70 day, Feekes 8), where the ligules of last leaf just visible (maximum and minimum temperature of 18.93 and 6.43°C, respectively and the mean RH of 57%). Then this numbers were decreased gradually until disappearance during the heading stage (after 97 day, Feekes 10 of plant age).

In the second season (2002/2003) as shown in Table (2), the population of *R. maidis* was generally lower than in the first season similarity trend of *R. maidis* was occurred in both seasons.

The total mean Number of *R. maidis* was 6.7 individuals/tiller with a highest population (13.7 individuals/tiller) on the 13th Jan. 2003 (plant age of 52 d; Feekes, 5) when the leaf sheaths strongly erected during the tiller stage (maximum and minimum temperature of 26 and 6.5°C, respectively and mean RH of 57.5%), while it reached 27.1 individuals/tiller with a highest population (58.8 individuals/tiller) on the 3rd Feb. (plant age of 73 day, Feekes 9) when the ligule of last leaf just visible recorded during the stem extension stages (maximum and minimum temperature of 20.9 and 9.3°C, respectively and mean RH of 47.7%). Few numbers of aphids were observed at the heading stage then disappeared after the 5th Mar. (after 103 day, Feekes 10.1 of plant age) in boot period.

Table (1): Average numbers of *R. maidis* /tiller infesting barley plants at the first sowing date at Giza region, during the growing season, 2001/2002.

Growth stage		Plant Age	Sampling date	*R. maidis*			
				Adult		Nymph	Total
				Alate	Aptera		
Tillering stage	1	13	5-12-2001	0.10	0.00	0.10	0.20
		16	8	0.10	0.20	0.60	0.90
	2	19	11	0.00	0.20	0.80	1.00
		22	14	0.00	0.40	1.60	2.00
		25	17	0.00	0.20	2.40	2.60
		28	20	0.00	0.70	3.60	4.30
	3	31	23	0.01	1.47	11.43	12.91
		34	26	0.00	1.50	5.20	6.70
		37	29	0.00	2.20	5.40	7.60
	4	40	1-1-2002	0.00	2.90	6.60	9.50
		43	4-1	0.04	12.50	15.00	27.54
	5	46	7	0.00	5.48	4.20	9.68
		49	10	0.00	2.00	5.10	7.10
		52	13	0.00	2.10	5.20	7.30
		55	16	0.00	2.10	5.60	7.70
Mean				0.02	2.26	4.86	7.14
Stem extension	6	58	19	0.00	7.11	7.81	14.92
	7	61	22	0.00	5.30	11.60	16.90
		64	25	0.00	6.11	10.47	16.57
	8	67	28	0.00	7.64	15.73	23.37
		70	31	0.00	14.48	51.65	66.13
	9	73	3-2	0.00	16.00	40.20	56.20
		76	6	0.50	19.40	37.20	57.10
		79	9	0.67	19.51	36.85	57.03
		82	12	0.10	11.24	23.60	34.94
		85	15	0.10	20.50	9.50	30.10
		88	18	0.20	33.23	6.37	39.80
		91	21	0.90	16.80	9.70	27.40
		94	24	0.88	16.64	9.24	26.76
	10	97	27	0.04	0.11	0.00	0.15
Mean				0.24	13.86	19.28	33.38
Heading	10.1	100	2-3	0.00	0.00	0.00	0.00
		103	5	0.00	0.00	0.00	0.00
		106	8	0.00	0.00	0.00	0.00
Mean				0.00	0.00	0.00	0.00
Total				3.64	228.00	342.76	574.40
General Mean				0.11	7.13	10.71	17.95

1 = One shoot **5=Leaf sheath strongly erected** **9 = Ligule of last leaf just visible**
2= Tillering begins **6= First node of stem visible** **10= In boot**
3= Tillers formed **7= Second node visible** **10.1= Head visible**

Table (2): Average numbers of *R. maidis* /tiller infesting barley plants at the first sowing date at Giza region, during the growing season 2002/2003.

Growth stage		Plant Age	Sampling date	*R. maidis*			
				Adult		Nymph	Total
				Alate	Aptera		
Tillering stage	1	13	5-12-2002	0.2	0.0	0.6	0.8
		16	8	0.0	0.7	1.0	1.7
	2	19	11	0.3	1.4	0.8	2.5
		22	14	2.0	2.0	4.0	8.1
		25	17	0.1	2.0	3.0	5.1
		28	20	0.0	2.0	4.1	6.1
	3	31	23	0.0	2.0	3.3	5.4
		34	26	0.0	2.3	3.6	5.9
		37	29	0.0	1.5	6.0	7.5
	4	40	1-1-2003	0.0	1.7	4.1	5.8
		43	4-1	0.0	1.0	4.5	5.6
	5	46	7	0.0	3.0	7.0	10.1
		49	10	0.0	4.0	8.1	12.1
		52	13	0.0	6.2	7.5	13.7
		55	16	0.0	4.6	6.2	10.7
Mean				0.2	2.3	4.3	6.7
Stem extension	6	58	19	0.0	2.6	6.1	8.7
	7	61	22	0.0	7.5	10.3	17.8
		64	25	0.0	13.4	28.5	41.9
	8	67	28	0.0	16.7	22.9	39.6
		70	31	0.0	11.5	24.5	36.0
	9	73	3-2	0.2	3.0	55.6	58.8
		76	6	0.0	8.8	16.6	25.4
		79	9	0.0	10.8	16.6	27.4
		82	12	0.0	14.3	23.5	37.8
		85	15	0.0	11.0	28.1	39.1
		88	18	0.0	0.0	12.3	12.3
		91	21	0.0	0.0	12.3	12.3
		94	24	0.1	3.4	7.8	11.3
	10	97	27	0.0	4.2	6.8	11.1
Mean				0.24	13.86	19.28	0.0
Heading	10.1	100	2-3	0.1	3.6	0.8	4.5
		103	5	0.0	2.1	0.5	2.6
		106	8	0.0	0.0	0.0	0.0
Mean				0.00	0.00	0.00	0.0
Total				3.64	228.00	342.76	0.0
General Mean				0.11	7.13	10.71	3.1

1 = One shoot
2= Tillering begins
3= Tillers formed
4=Leaf sheath lengthen
5 = Leaf sheath strongly erected
6= First node of stem visible
7= Second node visible
8= Last leaf just visible
9 = Ligule of last leaf just visible
10= In boot
10.1= Head visible
10.5= Flowering

• **The second sowing date (5th December)**

In the first season (2001/2002) as represented in Table (3) shows that the barley plants at the tiller stage harboured low mean numbers of *R. maidis* with (6.13 individuals/tiller) with a highest population (13.5 individuals/tiller) on the 19th Jan. (plant age of 45 day,.Feekes 5) when the leaf sheaths strongly erected during the tillering stage (maximum and minimum temperature of 18.7 and 5°C, respectively and the mean RH of 65.67%), while the population of this aphid species was more abundant (37.4 individuals/tiller), during the stem extension stage, with a highest peak of 103.05 individuals/tiller recorded on the 24th Feb. 2002 (plant age of 81 day, Feekes 9), when the ligules of last leaf was just visible (maximum and minimum temperature were 22.7 and 9.57°C, respectively and mean RH of 45%). *R. maidis* completely disappeared from the beginning of Mar. (87 d of plant age, Feekes 10), *i. e.*, from boot period to the heading stage.

In the second season (2002/2003) as shown in Table (4) *R. maidis* recorded in low numbers during tillering stage (total mean Number of 4.45 individuals/tiller) with a highest population of 25.4 individuals/tiller on the 4th Jan. 2003 (plant age of 30 day, Feekes 3) when tillers formed (maximum and minimum temperatures of 20.1 and 6.7°C, respectively and mean RH of 69.5%), while the highest numbers of it was recorded during the stem extension stage, with a mean number of 33.9 individuals/tiller, with a peak number of 57.2 individuals/tiller occurred on the 27th Feb., 2003 (plant age of 84 day, Feekes, 9) while the ligules of last leaf was just visible (maximum and minimum temperature of 18.3 and 6.9°C, respectively and mean RH of 56.3%).

During the heading stage, few numbers of *R. maidis* were noticed while the head was visible with an average number of 0.6 individuals/tiller. The aphids disappeared when the plant age reached 99 d at the end period of head visible stage.

Table (3): Average numbers of *R. maidis*/tiller infesting barley plants at the second sowing date at Giza region, during the growing season, 2001/2002.

Growth stage		Plant Age	Sampling date	*R. maidis*			
				Adult		Nymph	Total
				Alate	Aptera		
Tillering stage	1	15	20-12-2001	0.4	0.4	2.7	3.5
	2	18	23	0.3	0.7	1.9	2.9
		21	26	0.0	0.3	1.8	2.0
		24	29	0.2	1.5	3.2	4.9
		27	1-1-2002	0.0	1.9	3.2	5.1
	3	30	4-1	0.0	0.7	4.3	4.9
		33	7	0.2	1.7	1.1	2.9
	4	36	10	0.2	2.0	2.5	4.7
		39	13	0.0	3.4	5.4	8.8
	5	42	16	0.0	2.9	5.0	7.9
		45	19	0.0	4.0	9.5	13.5
		48	22	0.0	5.1	7.2	12.3
Mean				0.1	2.0	4.0	6.1
Stem extension	6	51	25	0.0	0.7	1.9	2.6
		54	28	0.0	2.1	6.3	8.4
	7	57	31	0.0	3.8	10.8	14.6
		60	3-2	0.0	6.0	14.0	20.0
	8	63	6	0.0	8.4	16.5	24.9
	9	66	9	0.0	14.1	30.9	45.0
		69	12	0.0	9.7	31.4	41.1
		72	15	0.1	30.5	22.2	52.8
		75	18	0.2	21.0	32.1	53.3
		78	21	0.3	60.6	27.7	88.6
		81	24	0.6	60.9	41.5	103.1
		84	27	0.0	23.4	8.3	31.8
	10	87	2-3	0.0	0.0	0.0	0.0
Mean				0.1	18.6	18.7	37.4
Heading	10.1	90	5	0.0	0.0	0.0	0.0
		93	8	0.0	0.0	0.0	0.0
		96	11	0.0	0.0	0.0	0.0
Mean				0.0	0.0	0.0	0.0
Total				2.6	265.9	291.4	559.8
General Mean				0.1	9.5	10.4	20.0

1 = One shoot
2= Tillering begins
3= Tillers formed
4=Leaf sheath lengthen
5 = Leaf sheath strongly erected
6= First node of stem visible
7= Second node visible
8= Last leaf just visible
9 = Ligule of last leaf just visible
10= In boot
10.1= Head visible
10.5= Flowering

Table (4): Average numbers of *R. maidis* /tiller infesting barley plants at the second sowing date at Giza region, during the growing season 2002/2003.

Growth stage		Plant Age	Sampling date	*R. maidis*			
				Adult		Nymph	Total
				Alate	Aptera		
Tillering stage	1	15	20-12-2001	0.1	0.1	0.2	0.4
	2	18	23	0.1	0.3	1.4	1.7
		21	26	0.1	0.4	1.5	2.0
		24	29	0.0	0.5	1.4	1.9
		27	1-1-2002	0.0	0.4	1.2	1.6
	3	30	4-1	0.0	11.8	13.6	25.4
		33	7	0.7	2.6	0.0	3.3
	4	36	10	0.0	0.7	1.5	2.2
		39	13	0.0	0.4	1.2	1.6
	5	42	16	0.0	0.5	2.5	3.0
		45	19	0.0	1.2	3.5	4.7
		48	22	0.0	1.8	3.8	5.6
Mean				0.1	1.7	2.6	4.5
Stem extension	6	51	25	0.0	4.9	11.2	16.1
		54	28	0.0	6.8	16.6	23.4
	7	57	31	0.0	6.1	17.7	23.8
		60	3-2	0.0	5.2	13.3	18.5
	8	63	6	0.0	7.4	20.5	27.9
	9	66	9	0.0	6.6	22.1	28.7
		69	12	0.1	16.0	14.5	30.7
		72	15	0.3	13.3	23.7	37.3
		75	18	0.3	18.5	22.3	41.1
		78	21	0.1	31.8	16.9	48.8
		81	24	0.3	25.2	31.7	57.1
		84	27	0.3	20.7	36.3	57.2
	10	87	2-3	0.2	15.5	14.0	29.6
Mean				0.1	13.7	20.1	33.9
Heading	10.1	90	5	0.0	0.4	0.9	1.3
		93	8	0.0	0.4	0.3	0.7
		96	11	1.5	0.2	0.1	1.8
		99	14	0.0	0.0	0.0	0.0
	10.5	102	17	0.0	0.0	0.0	0.0
		105	20	0.0	0.0	0.0	0.0
Mean				0.3	0.2	0.2	0.6
Total				3.9	199.7	293.9	497.5
General Mean				0.1	6.4	9.5	16.0

1 = One shoot; 2= Tillering begins; 3= Tillers formed; 4=Leaf sheath lengthen; 5 = Leaf sheath strongly erected; 6= First node of stem visible; 7= Second node visible; 8= Last leaf just visible; 9 = Ligule of last leaf just visible; 10= In boot; 10.1= Head visible; 10.5= Flowering

- **The third sowing date (20th December)**

In the first season (2001/2002), Table (5) it was obvious that the mean number of *R. maidis* was recorded during the tillering stage reached 7.3 individuals/ tiller with a highest peak number of 13.24 individuals/tiller recorded on Jan., 28, 2002 (plant age of 37 day, Feekes 4) when the leaf sheath lengthen (maximum and minimum temperature of 18.20 and 8.33°C, respectively and mean RH of 62%). The population of *R. maidis* increased gradually to reach the total mean Number of 36.03 individuals/tiller with a highest peak (122.48 individuals/tiller) on the 2nd Mar., 2002 (plant age of 70 day, Feekes 9) while the ligule of last leaf was just visible during the stem extension stage (maximum and minimum temperature of 21.8 and 9.83°C, respectively and the mean RH of 59%).

The aphid numbers again decreased to disappear at the end of the stem extension stage (82 d of plant age, Feekes 9) when the ligule of last leaf just visible.

In the second season (2002/2003) as shown in Table (6) the tillering stage harboured the lowest numbers of *R. maidis* (total mean Number of 5.4 individuals/tiller) with a highest population of 13.5 individuals/tiller on the 3rd Feb. 2003 (plant age of 43 day, Feekes 5) when the leaf sheath strongly was erected (maximum and minimum temperature of 20.9 and 9.3°C, respectively and mean RH of 47.7%).

Table (5): Average numbers of *R. maidis* /tiller infesting barley plants at the third sowing date at Giza region, during the growing season, 2001/2002.

Growth stage		Plant Age	Sampling date	*R. maidis* Adult Alate	Adult Aptera	Nymph	Total
Tillering stage	2	13	4-1-2002	0.22	0.80	2.27	3.29
		16	7	0.04	0.10	1.56	1.70
		19	10	0.00	0.90	3.04	3.94
		22	13	0.10	3.20	4.05	7.35
	3	25	16	0.00	3.13	5.66	8.79
		28	19	0.00	1.93	5.50	7.43
		31	22	0.00	2.40	3.60	6.00
	4	34	25	0.00	3.50	4.23	7.73
		37	28	0.01	2.78	10.45	13.24
	5	40	31	0.00	3.52	9.28	12.80
		43	3-2	0.00	5.02	3.04	8.06
Mean				0.03	2.48	4.79	7.30
Stem extension	6	46	6	0.00	7.00	14.20	21.20
		49	9	0.01	8.43	22.37	30.82
	7	52	12	0.00	4.30	16.40	20.70
		55	15	0.00	7.49	23.05	30.54
	8	58	18	0.09	9.31	11.60	21.00
	9	61	21	0.20	17.09	23.92	41.21
		64	24	0.45	23.42	20.62	44.49
		67	27	0.13	26.32	60.41	86.86
		70	2-3	0.13	63.35	59.00	122.48
		73	5	0.45	10.14	11.13	21.72
		76	8	0.50	16.32	6.12	22.94
		79	11	0.04	3.65	0.73	4.43
	10	82	14	0.00	0.00	0.00	0.00
Mean				0.16	15.14	20.74	36.03
Total				2.4	224.1	322.2	548.7
General Mean				0.1	9.3	13.4	22.9

1 = One shoot | **5 = Leaf sheath strongly erected** | **9 = Ligule of last leaf just visible**
2= Tillering begins | **6= First node of stem visible** | **10= In boot**
3= Tillers formed | **7= Second node visible** | **10.1= Head visible**
4=Leaf sheath lengthen | **8= Last leaf just visible** | **10.5= Flowering**

The highest population of *R. maidis* was recorded during the stem extension stage (total mean Number of 20.1 individuals/tiller) with a highest peak of 47.6 individuals/tiller on Mar., 2, 2003 (plant age of 70 day, Feekes 9) when the ligule of last leaf was just visible (maximum and minimum temperature of 25.1 and 10.6°C, respectively and mean RH of 49%). Then its population gradually decreased until it disappeared on Mar., 23, 2003. While the head was visible during the heading stage which harboured few numbers of *R. maidis* (total mean Number of 0.8 individual/tiller).

It could be concluded that the highest aphid abundance was observed at barley plant age of 70 d (first season) and 73d (second season) for the first sowing date while it was recorded at plant age of 81 d (first season) and 81-84d (second season) for the second sowing date.

The highest recorded aphid population was at plant age of 70 d at both the first and second season for the third sowing date.

It is apparent in both seasons that the trend of population value of *R. maidis* was almost similar in all three sowing dates, however decreased slightly in the delayed sowing dates, and this was pronounced in the second season.

The total numbers of aphids were 574.4, 559.82 and 548.7 individuals/season for the first, second and third sowing dates, respectively (Tables 1, 3 and 5) during the first season and 487.7, 497.5 and 323.3 individuals/season), respectively (Tables 2, 4 and 6) for the second season.

Table (6): Average numbers of *R.maidis*/tiller infesting barley plants at the third sowing date at Giza region, during the growing season, 2002/2003.

Growth stage		Plant Age	Sampling date	R. maidis			
				Adult		Nymph	Total
				Alate	Aptera		
Tillering stage	2	13	4-1-2002	0.0	1.9	8.7	10.6
		16	7	0.0	1.0	5.0	6.0
		19	10	0.0	0.8	5.3	6.1
		22	13	0.0	0.8	3.2	4.0
	3	25	16	0.0	0.3	1.3	1.6
		28	19	0.0	0.3	1.0	1.3
		31	22	0.0	0.6	1.4	2.0
	4	34	25	0.0	0.8	1.4	2.2
		37	28	0.0	1.9	3.3	5.2
	5	40	31	0.0	1.6	5.1	6.6
		43	3-2	0.0	5.3	8.2	13.5
Mean				0.0	1.4	4.0	5.4
Stem extension	6	46	6	0.0	7.1	4.4	11.5
		49	9	0.0	4.5	2.9	7.4
	7	52	12	0.0	3.1	5.0	8.1
		55	15	0.0	2.1	4.8	6.8
	8	58	18	0.0	4.3	7.1	11.4
	9	61	21	0.0	7.6	12.9	20.5
		64	24	0.1	7.9	18.0	26.0
		67	27	1.0	10.3	29.1	40.4
		70	2-3	0.8	20.8	26.0	47.6
		73	5	0.0	18.5	23.4	41.9
		76	8	0.5	5.3	30.3	36.1
		79	11	0.3	1.4	1.0	2.7
	10	82	14	0.1	0.1	1.0	1.3
Mean				0.2	7.1	12.8	20.1
Heading	10.1	85	17	0.2	1.0	0.9	2.1
		88	20	0.3	0.0	0.0	0.3
		91	23	0.0	0.0	0.0	0.0
	10.5	102	17	0.0	0.0	0.0	0.0
		105	20	0.0	0.0	0.0	0.0
Mean				0.2	0.3	0.3	0.8
Total				3.4	109.2	210.7	323.3
General Mean				0.1	4.0	7.8	12.0

1 = One shoot | **5 = Leaf sheath strongly erected** | **9 = Ligule of last leaf just visible**
2= Tillering begins | **6= First node of stem visible** | **10= In boot**
3= Tillers formed | **7= Second node visible** | **10.1= Head visible**
4=Leaf sheath lengthen | **8= Last leaf just visible** | **10.5= Flowering**

Effect of rate of nitrogen fertilization during *R. maidis* population

The data presented in Table (7) demonstrate that the total mean numbers of *R. maidis* at the three tested nitrogen fertilization rates were 153.4, 252.1 and 280.5 individuals/season, respectively during the first growing season 2001/2002. While, they were 162.5, 211.3 and 244.8 individuals/tiller at the second season (2002/2003), respectively. The relationship between aphid infestation level and fertilization rates was fitted with R^2 = I for both seasons. The relation was polynomial for the second degree.

Table (7): Weekly average number of *R. maidis* per tiller on barley under three rates of nitrogen fertilizations (Giza region, 2001/2002 and 2002/2003).

First season				Second Season			
Sampling Date	Nitrogen fertilization rate (Kg/fed.)			Sampling Date	Nitrogen fertilization rate (Kg/fed.)		
	30	50	70		30	50	70
20 Dec. 2001	0.4	0.9	0.5	19-12-2002	2.9	2.9	1.1
27	0.9	2.1	2.6	26	2.0	2.0	2.9
3 Jan. 2002	3.5	15.4	1.7	2-Jan.2003	2.2	5.0	4.4
10	2.3	2.9	3.3	9	6.7	6.2	4.9
17	1.9	2.8	5.7	16	7.0	7.9	8.1
24	2.9	6.2	6.0	23	8.7	10.6	20.9
31	7.1	17.1	29.2	30	18.3	18.9	36.3
7 Feb.	27.3	24.7	37.1	6 Feb.	19.4	27.9	39.0
14	36.3	55.8	56.1	13	25.2	33.6	22.6
21	51.6	86.8	92.8	20	31.0	40.1	39.2
28	19.2	37.3	41.4	27	36.7	53.6	56.0
7 Mar.	0.2	0.2	4.0	06-Mar	2.4	1.4	6.7
14	0	0	0	13	0.0	1.1	1.0
21	0	0	0	20	0.0	0.0	1.7
Total	153.4	252.1	280.5	Total	162.5	211.3	244.8
Mean	11.0	18.0	20.0	Mean	11.6	15.1	17.5

Effect of temperature and relative humidity on the seasonal abundance of *R. maidis* on barley plants.

Statistical analysis was undertaken during the active period of the aphids (Jan. 10 to Feb. 27) in order to detect if any significant effect of temperature (maximum and minimum) and relative humidity (maximum and minimum) on aphids infestations. There were significant relations between the maximum temperature and the aphid population at the second and the third sowing dates in both of the first season (P=0.73062 t= 0.0009 and P=0.70489 t=0.0016) and the second season (P= 0.80462 t= 0.0001 and P=0.57763 t=0.0152). Also, their were a significant relation between the minimum temperature and the population at the second sowing date for both the first season (P= 0.46321 t= 0.0611) and the second season (P= 0.5777 t= 0.0152), respectively while there were no significant relationship between the maximum and minimum relative humidity and the population at both the first and the second studied seasons.

Prediction program prototype:

The obtained data of seasonal abundance of aphids illustrated in Tables (1-7) were used to develop a prototype program to predict *R. maidis* abundance on barley at different planting dates in relation to plant growth stages using.net program (Visual Studio (VS), Version = "3:701") (Appendix 1).

This prototype is a first step towards developing an expert system for prediction of aphids on barley.

Plate (2 a - e) presents the start up screen and the all steps of the proposed program prototype.

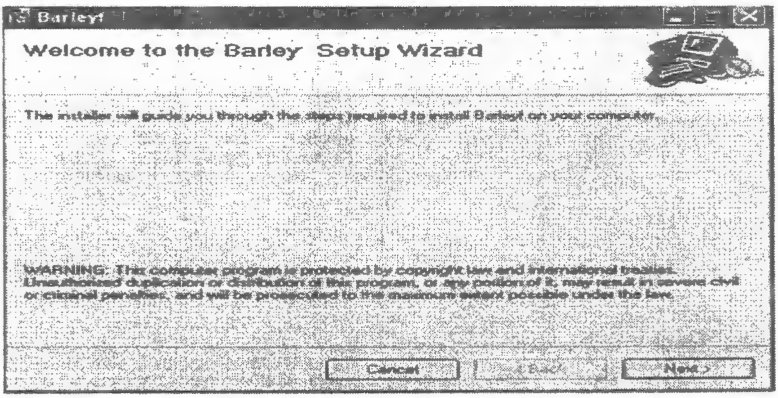

Plate (2 a): Start up screen of the proposed prediction program.

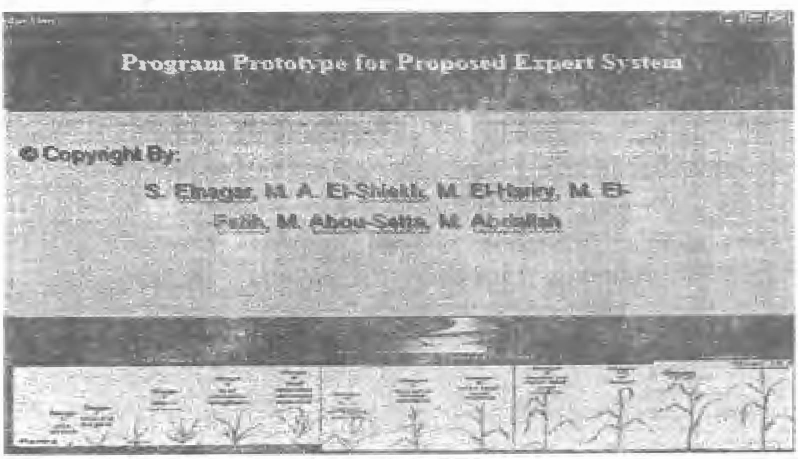

Plate (2 b): Second screen of the proposed prediction program.

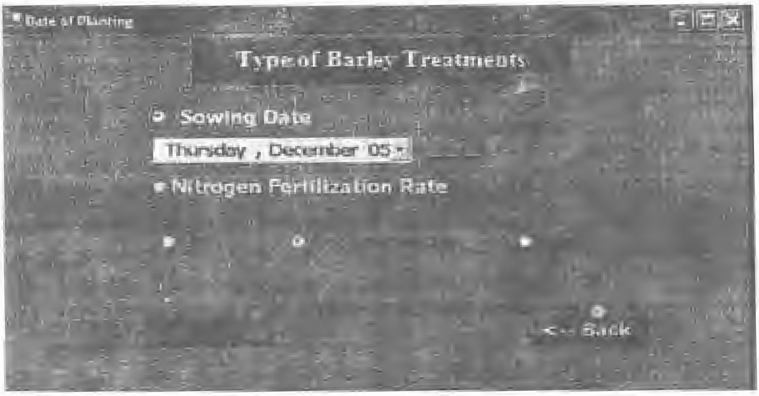

Plate (2 c): Third screen of the proposed prediction program.

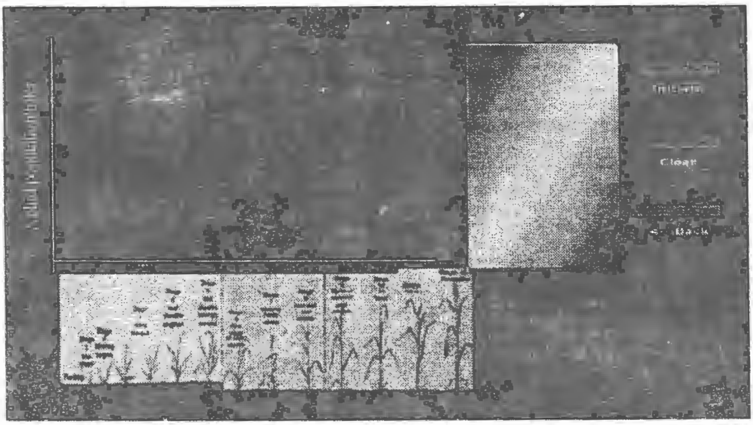

Plate (2 d): Fourth screen of the proposed prediction program.

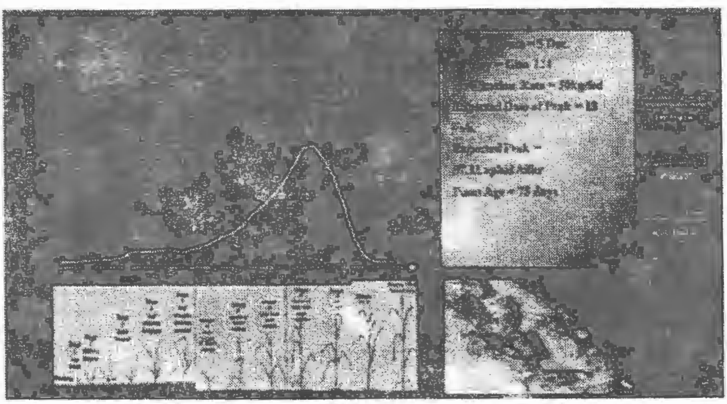

Plate (2 e): Fifth screen of the proposed prediction program.

DISCUSSION

It is apparent in both seasons that the trend of population value of *Rhopalosiphum maidis* was almost similar in all three sowing dates, however decreased slightly in the delayed sowing dates, and this was pronounced in the second season. Bishara *et al.*, (1997) found that the highest *R. maidis* populations existed on late sown barley, while the least existed on the early sown. Also, Vidya (1982), stated that *R. maidis* incidence was much lower when barley was sown early (Mid. Oct. to Mid. Nov.) than in late sowings. Basedow (1987) noticed that heavier infestation by *S. avenae* observed at the early sown spring wheat and referred it to the physiological state of the plant.

The relationship between *R. maidis* infestation level and fertilization rates (30, 50 and 70 Kg N/fed.) was fitted with R^2 = I for both seasons. The relation was polynomial for the second degree.

The present investigation introduces a preliminary attempt in the frame work of developing a complete expert system to predict *R. maidis* abundance. The resulted prototype is a model example to build on, for other species as well as other crops and host plants. Further studies are required to test the validity of the program over a number of years.

Balakrishnan (2013) mentioned that; An Expert System is a system that employs human knowledge captured in a computer to solve problems that ordinarily require human expertise. In agriculture, expert systems unite the accumulated expertise of individual disciplines, such as plant pathology, entomology, horticulture and agricultural meteorology and animal sciences; into a framework that best addresses the specific, on-site needs of farmers.

Cereal aphids expert system (CAES) was designed by Gonzalez-Andujar *et al.* (1993). This program designed to provide identification and information to farmers and extension specialists as well as information for educational and research purposes, on the main cereal aphid species in Spain.

As a result of using expert systems as a training tool in the agriculture sector in Egypt, this study present preliminary computer program in the process of introducing expert system (Hitoshi *et al.*, 2012). Selvakumar *et al.*, 2011 said mentioned that Expert system is offered as the second choice after expert on consultation.

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APPENDIX I

Program code:
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"     ARPHELPTELEPHONE" = "8":
"     ARPHELPLINK" = "8":
"     Title" = "8:Barleyf"
"     Subject" = "8":
"     ARPCONTACT" = "8:Default Company Name"
"     Keywords" = "8":
"     ARPCOMMENTS" = "8":
"     ARPURLINFOABOUT" = "8":
"     ARPPRODUCTICON" = "8":
"     ARPIconIndex" = "3:0"
"     SearchPath" = "8":
"     UseSystemSearchPath" = "11:TRUE"
{
"     Registry"
}
"        HKLM"
}
"           Keys"
}
6}"              A471EEF-D31B-40F8-BCF6-
C9E8EC783F36}:_D1FE3834871041D2BCF8FB50278FB1F5"
}
"                 Name" = "8:Software"
"                 Condition" = "8":
"                 AlwaysCreate" = "11:FALSE"
"                 DeleteAtUninstall" = "11:FALSE"
"                 Transitive" = "11:FALSE"
"                    Keys"
}
6}"                   A471EEF-D31B-40F8-BCF6-
C9E8EC783F36}:_6D8B7D1352A74B4E98364F8058CA2D1A"
}
"                       Name" = "8:{Manufacturer"[
"                       Condition" = "8":
"                       AlwaysCreate" = "11:FALSE"
"                       DeleteAtUninstall" = "11:FALSE"
"                       Transitive" = "11:FALSE"
"                          Keys"
}
{
"                          Values"
}
{
{
{
"                     Values"
}
{
{
{
{
"        HKCU"
}
"           Keys"
}
6}"              A471EEF-D31B-40F8-BCF6-
C9E8EC783F36}:_3FC64825C38A48C0A043E6BF438E778D"
}
"                 Name" = "8:Software"
"                 Condition" = "8":
"                 AlwaysCreate" = "11:FALSE"
"                 DeleteAtUninstall" = "11:FALSE"
"                 Transitive" = "11:FALSE"
"                    Keys"
}
6}"                   A471EEF-D31B-40F8-BCF6-
C9E8EC783F36}:_9453061D1E96433B8ACA0CC794C3FF4C"
}
"                       Name" = "8:{Manufacturer"[
"                       Condition" = "8":
"                       AlwaysCreate" = "11:FALSE"
"                       DeleteAtUninstall" = "11:FALSE"
"                       Transitive" = "11:FALSE"
"                          Keys"
}
{
"                          Values"
}
{
{
{
"                     Values"
}
{
{
{
{
"        HKCR"
}
"           Keys"
}
{
{
"        HKU"
}
"           Keys"
}
{
{
"        HKPU"
}
"           Keys"
}
{
{
{
"     Sequences"
}
{
"     Shortcut"
}
478}"        F747B-8505-45D1-9AAE-
8C3B645C26E3}:_3C015A1C9C604F12AFDFCF1C6061C679"
}
"        Name" = "8:Barley"
"        Arguments" = "8":
"        Description" = "8":
"        ShowCmd" = "3:1"
"        IconIndex" = "3:0"
"        Transitive" = "11:FALSE"
"        Target" =
"8:_2AA300B01BB949B8B57F7E27AEE56D9A"
"        Folder" = "8:_7E2ECC51164F4C3CB5BD391071F12075"
"        WorkingFolder" =
"8:_7E2ECC51164F4C3CB5BD391071F12075"
"        Icon" = "8:_8835C785CF834C4C908DEB5A544A2CC1"
"        Feature" = "8":
{
478}"        F747B-8505-45D1-9AAE-
8C3B645C26E3}:_C7E4E85FEE3D44298A77790F824A3302"
}
"        Name" = "8:barley"
"        Arguments" = "8":
"        Description" = "8":
"        ShowCmd" = "3:1"
"        IconIndex" = "3:0"
"        Transitive" = "11:FALSE"
"        Target" =
"8:_2AA300B01BB949B8B57F7E27AEE56D9A"
"        Folder" = "8:_002CEF42661F4BA192938B43954C8875"
"        WorkingFolder" =
"8:_7E2ECC51164F4C3CB5BD391071F12075"
"        Icon" = "8:_8835C785CF834C4C908DEB5A544A2CC1"
"        Feature" = "8":
{
{
"     UserInterface"
}
8}"       D9DEE8B-DD8B-4F48-9072-
C4364E4F4011}:_462AAADEBAA54A50BDF777268922160C"
}
"        Name" = "8:#1901"
"        Sequence" = "3:2"
"        Attributes" = "3:2"
"           Dialogs"
}
18}"            ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_3524E166A73D4E38B97599E0FFF9C9B4"
}
"              Sequence" = "3:100"
```

" DisplayName" = "8:Progress"
" UseDynamicProperties" = "11:TRUE"
" IsDependency" = "11:FALSE"
" SourcePath" =
"8:<VsdDialogDir>\\VsdAdminProgressDlg.wid"
" Properties"
}
" BannerBitmap"
}
" Name" = "8:BannerBitmap"
" DisplayName" = "8:#1001"
" Description" = "8:#1101"
" Type" = "3:8"
" ContextData" = "8:Bitmap"
" Attributes" = "3:4"
" Setting" = "3:1"
" UsePluginResources" = "11:TRUE"
{
" ShowProgress"
}
" Name" = "8:ShowProgress"
" DisplayName" = "8:#1009"
" Description" = "8:#1109"
" Type" = "3:5"
" ContextData" = "8:1;True=1;False=0"
" Attributes" = "3:0"
" Setting" = "3:0"
" Value" = "3:1"
" DefaultValue" = "3:1"
" UsePluginResources" = "11:TRUE"
{
{
{
{
{
8}" D9DEE8B-DD8B-4F48-9072-
C4364E4F4011}:_80C43806FAE04BC7970A4AECF3D86156"
}
" Name" = "8:#1901"
" Sequence" = "3:1"
" Attributes" = "3:2"
" Dialogs"
}
18}" ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_56E63459C3114788A630A3966ACB6C91"
}
" Sequence" = "3:100"
" DisplayName" = "8:Progress"
" UseDynamicProperties" = "11:TRUE"
" IsDependency" = "11:FALSE"
" SourcePath" =
"8:<VsdDialogDir>\\VsdProgressDlg.wid"
" Properties"
}
" BannerBitmap"
}
" Name" = "8:BannerBitmap"
" DisplayName" = "8:#1001"
" Description" = "8:#1101"
" Type" = "3:8"
" ContextData" = "8:Bitmap"
" Attributes" = "3:4"
" Setting" = "3:1"
" UsePluginResources" = "11:TRUE"
{
" ShowProgress"
}
" Name" = "8:ShowProgress"
" DisplayName" = "8:#1009"
" Description" = "8:#1109"
" Type" = "3:5"
" ContextData" = "8:1;True=1;False=0"
" Attributes" = "3:0"
" Setting" = "3:0"
" Value" = "3:1"
" DefaultValue" = "3:1"
" UsePluginResources" = "11:TRUE"
{
{
{
{
{
}" B654A020-6903-4E6A-A86C-
75DC463DB54B}:_9D6E3F948B4B4AD2B7C9B04735E3BE51"
}
" UseDynamicProperties" = "11:FALSE"
" IsDependency" = "11:FALSE"
" SourcePath" =
"8:<VsdDialogDir>\\VsdBasicDialogs.wim"
{
8}" D9DEE8B-DD8B-4F48-9072-
C4364E4F4011}:_A76094B3B51242DFA2F0074B7A892DEF"
}
" Name" = "8:#1902"
" Sequence" = "3:1"
" Attributes" = "3:3"
" Dialogs"
}
18}" ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_4B5CE821093A4C988F13BE5DF148C9D4"
}
" Sequence" = "3:100"
" DisplayName" = "8:Finished"
" UseDynamicProperties" = "11:TRUE"
" IsDependency" = "11:FALSE"
" SourcePath" =
"8:<VsdDialogDir>\\VsdFinishedDlg.wid"
" Properties"
}
" BannerBitmap"
}
" Name" = "8:BannerBitmap"
" DisplayName" = "8:#1001"
" Description" = "8:#1101"
" Type" = "3:8"
" ContextData" = "8:Bitmap"
" Attributes" = "3:4"
" Setting" = "3:1"
" UsePluginResources" = "11:TRUE"
{
" UpdateText"
}
" Name" = "8:UpdateText"
" DisplayName" = "8:#1058"
" Description" = "8:#1158"
" Type" = "3:15"
" ContextData" = "8":
" Attributes" = "3:0"
" Setting" = "3:1"
" Value" = "8:#1258"
" DefaultValue" = "8:#1258"
" UsePluginResources" = "11:TRUE"
{
{
{
{
{
8}" D9DEE8B-DD8B-4F48-9072-
C4364E4F4011}:_D2DD7DD026204807BFA1B289C765FB5B"
}
" Name" = "8:#1900"
" Sequence" = "3:2"
" Attributes" = "3:1"
" Dialogs"
}
18}" ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_9B6EBCD7F65449FFA818D3A0F9496667"
}
" Sequence" = "3:100"
" DisplayName" = "8:Welcome"
" UseDynamicProperties" = "11:TRUE"
" IsDependency" = "11:FALSE"
" SourcePath" =
"8:<VsdDialogDir>\\VsdAdminWelcomeDlg.wid"
" Properties"
}
" BannerBitmap"
}
" Name" = "8:BannerBitmap"
" DisplayName" = "8:#1001"
" Description" = "8:#1101"
" Type" = "3:8"
" ContextData" = "8:Bitmap"
" Attributes" = "3:4"
" Setting" = "3:1"
" UsePluginResources" = "11:TRUE"
{
" CopyrightWarning"
}

```
"                    Name" = "8:CopyrightWarning"
"                    DisplayName" = "8:#1002"
"                    Description" = "8:#1102"
"                    Type" = "3:3"
"                    ContextData" = "8":
"                    Attributes" = "3:0"
"                    Setting" = "3:1"
"                    Value" = "8:#1202"
"                    DefaultValue" = "8:#1202"
"                    UsePlugInResources" = "11:TRUE"
{
"                    Welcome"
}
"                    Name" = "8:Welcome"
"                    DisplayName" = "8:#1003"
"                    Description" = "8:#1103"
"                    Type" = "3:3"
"                    ContextData" = "8":
"                    Attributes" = "3:0"
"                    Setting" = "3:1"
"                    Value" = "8:#1203"
"                    DefaultValue" = "8:#1203"
"                    UsePlugInResources" = "11:TRUE"
{
{
{
18}"                 ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_D4EB9F5E444E4A09AFB32098405089EF"
}
"                Sequence" = "3:200"
"                DisplayName" = "8:Installation Folder"
"                UseDynamicProperties" = "11:TRUE"
"                IsDependency" = "11:FALSE"
"                SourcePath" =
"8:<VsdDialogDir>\\VsdAdminFolderDlg.wid"
"                  Properties"
}
"                    BannerBitmap"
}
"                    Name" = "8:BannerBitmap"
"                    DisplayName" = "8:#1001"
"                    Description" = "8:#1101"
"                    Type" = "3:8"
"                    ContextData" = "8:Bitmap"
"                    Attributes" = "3:4"
"                    Setting" = "3:1"
"                    UsePlugInResources" = "11:TRUE"
{
{
{
18}"                 ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_FFBF3555D3DE4C68872D7F60FF05566A"
}
"                Sequence" = "3:300"
"                DisplayName" = "8:Confirm Installation"
"                UseDynamicProperties" = "11:TRUE"
"                IsDependency" = "11:FALSE"
"                SourcePath" =
"8:<VsdDialogDir>\\VsdAdminConfirmDlg.wid"
"                  Properties"
}
"                    BannerBitmap"
}
"                    Name" = "8:BannerBitmap"
"                    DisplayName" = "8:#1001"
"                    Description" = "8:#1101"
"                    Type" = "3:8"
"                    ContextData" = "8:Bitmap"
"                    Attributes" = "3:4"
"                    Setting" = "3:1"
"                    UsePlugInResources" = "11:TRUE"
{
{
{
{
{
8}"          D9DEE8B-DD8B-4F48-9072-
C4364E4F4011}:_EB5633FE52D34CF89514CCDA0C2404E1"
}
"          Name" = "8:#1902"
"          Sequence" = "3:2"
"          Attributes" = "3:3"
"             Dialogs"
}
18}"                 ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_50AFEDA08A234014AE1E551FCC43DF8A"
}
"                Sequence" = "3:100"
"                DisplayName" = "8:Finished"
"                UseDynamicProperties" = "11:TRUE"
"                IsDependency" = "11:FALSE"
"                SourcePath" =
"8:<VsdDialogDir>\\VsdAdminFinishedDlg.wid"
"                  Properties"
}
"                    BannerBitmap"
}
"                    Name" = "8:BannerBitmap"
"                    DisplayName" = "8:#1001"
"                    Description" = "8:#1101"
"                    Type" = "3:8"
"                    ContextData" = "8:Bitmap"
"                    Attributes" = "3:4"
"                    Setting" = "3:1"
"                    UsePlugInResources" = "11:TRUE"
{
{
{
{
{
}"          B654A020-6903-4E6A-A86C-
75DC463DB54B}:_ED02EFFC2B5B4B36B7C48AAE110606EB"
}
"          UseDynamicProperties" = "11:FALSE"
"          IsDependency" = "11:FALSE"
"          SourcePath" =
"8:<VsdDialogDir>\\VsdUserInterface.wim"
{
8}"          D9DEE8B-DD8B-4F48-9072-
C4364E4F4011}:_F96A892A3FB545D9ADCDF43EA3C627FD"
}
"          Name" = "8:#1900"
"          Sequence" = "3:1"
"          Attributes" = "3:1"
"             Dialogs"
}
18}"                 ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_02E4FBFA99DC48948BDB0716576797DF"
}
"                Sequence" = "3:300"
"                DisplayName" = "8:Confirm Installation"
"                UseDynamicProperties" = "11:TRUE"
"                IsDependency" = "11:FALSE"
"                SourcePath" =
"8:<VsdDialogDir>\\VsdConfirmDlg.wid"
"                  Properties"
}
"                    BannerBitmap"
}
"                    Name" = "8:BannerBitmap"
"                    DisplayName" = "8:#1001"
"                    Description" = "8:#1101"
"                    Type" = "3:8"
"                    ContextData" = "8:Bitmap"
"                    Attributes" = "3:4"
"                    Setting" = "3:1"
"                    UsePlugInResources" = "11:TRUE"
{
{
{
18}"                 ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_56D9C8F534B640DC3CE9764E0A4327CC"
}
"                Sequence" = "3:100"
"                DisplayName" = "8:Welcome"
"                UseDynamicProperties" = "11:TRUE"
"                IsDependency" = "11:FALSE"
"                SourcePath" =
"8:<VsdDialogDir>\\VsdWelcomeDlg.wid"
"                  Properties"
}
}
"                    Name" = "8:BannerBitmap"
"                    DisplayName" = "8:#1001"
"                    Description" = "8:#1101"
"                    Type" = "3:8"
"                    ContextData" = "8:Bitmap"
"                    Attributes" = "3:4"
"                    Setting" = "3:1"
"                    UsePlugInResources" = "11:TRUE"
"                    BannerBitmap"
{
```

```
"               CopyrightWarning"
}
"               Name" = "8:CopyrightWarning"
"               DisplayName" = "8:#1002"
"               Description" = "8:#1102"
"               Type" = "3:3"
"               ContextData" = "8":
"               Attributes" = "3:0"
"               Setting" = "3:1"
"               Value" = "8:#1202"
"               DefaultValue" = "8:#1202"
"               UsePlugInResources" = "11:TRUE"
{
"               Welcome"
}
"               Name" = "8:Welcome"
"               DisplayName" = "8:#1003"
"               Description" = "8:#1103"
"               Type" = "3:3"
"               ContextData" = "8":
"               Attributes" = "3:0"
"               Setting" = "3:1"
"               Value" = "8:#1203"
"               DefaultValue" = "8:#1203"
"               UsePlugInResources" = "11:TRUE"
{
{
{
18}"            ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_9BEF347ED0F14341A6FE1238C0A38935"
}
"          Sequence" = "3:400"
"          DisplayName" = "8:License Agreement"
"          UseDynamicProperties" = "11:TRUE"
"          IsDependency" = "11:FALSE"
"          SourcePath" =
"8:<VsdDialogDir>\\VsdLicenseDlg.wid"
"             Properties"
}
"               BannerBitmap"
}
"               Name" = "8:BannerBitmap"
"               DisplayName" = "8:#1001"
"               Description" = "8:#1101"
"               Type" = "3:8"
"               ContextData" = "8:Bitmap"
"               Attributes" = "3:4"
"               Setting" = "3:1"
"               UsePlugInResources" = "11:TRUE"
{
"               EulaText"
}
"               Name" = "8:EulaText"
"               DisplayName" = "8:#1008"
"               Description" = "8:#1108"
"               Type" = "3:6"
"               ContextData" = "8":
"               Attributes" = "3:0"
"               Setting" = "3:2"
"               Value" =
"8:_0C1262AB858946D1801CB0E4450B1CD8"
"               UsePlugInResources" = "11:TRUE"
{
"               Sunken"
}
"               Name" = "8:Sunken"
"               DisplayName" = "8:#1007"
"               Description" = "8:#1107"
"               Type" = "3:5"
"               ContextData" = "8:4;True=4;False=0"
"               Attributes" = "3:0"
"               Setting" = "3:0"
"               Value" = "3:4"
"               DefaultValue" = "3:4"
"               UsePluginResources" = "11:TRUE"
{
{
{
18}"            ADD6EC-89FE-4ED7-AD3E-
211C40278470}:_D38C5E7780B94A8A88F373F2B79CF52F"
}
"          Sequence" = "3:200"
"          DisplayName" = "8:Installation Folder"
"          UseDynamicProperties" = "11:TRUE"
"          IsDependency" = "11:FALSE"
"          SourcePath" =
"8:<VsdDialogDir>\\VsdFolderDlg.wid"
"             Properties"
}
"               BannerBitmap"
}
"               Name" = "8:BannerBitmap"
"               DisplayName" = "8:#1001"
"               Description" = "8:#1101"
"               Type" = "3:8"
"               ContextData" = "8:Bitmap"
"               Attributes" = "3:4"
"               Setting" = "3:1"
"               UsePlugInResources" = "11:TRUE"
{
{
{
{
{
{
"     MergeModule"
}
35}"        A69C8E-5BA4-440D-803D-
762B59A45393}:_C7B0579CA47B44C881ADA1400C41F133"
}
"        UseDynamicProperties" = "11:TRUE"
"        IsDependency" = "11:TRUE"
"        SourcePath" = "8:dotnetfxredist_x86.msm"
"           Properties"
}
{
"        LanguageId" = "3:1033"
"        Exclude" = "11:TRUE"
"        Folder" = "8":
"        Feature" = "8":
"        isolateTo" = "8":
{
{
"     ProjectOutput"
}
8062640}"       A-2EEE-46E9-AB67-
688E9A886E9F}:_2AA300B01BB949B8B57F7E27AEE56D9A"
}
"        SourcePath" = "8:C:\\chart\\obj\\Debug\\Chart.exe"
"        TargetName" = "8":
"        Tag" = "8":
"        Folder" = "8:_7E2ECC51164F4C3CB5BD391071F12075"
"        Condition" = "8":
"        Transitive" = "11:FALSE"
"        Vital" = "11:TRUE"
"        ReadOnly" = "11:FALSE"
"        Hidden" = "11:FALSE"
"        System" = "11:FALSE"
"        Permanent" = "11:FALSE"
"        SharedLegacy" = "11:FALSE"
"        PackageAs" = "3:1"
"        Register" = "3:1"
"        Exclude" = "11:FALSE"
"        IsDependency" = "11:FALSE"
"        IsolateTo" = "8":
"        ProjectOutputGroupRegister" = "3:1"
"        OutputConfiguration" = "8":
"        OutputGroupCanonicalName" = "8:Built"
"        OutputProjectGuid" = "8:{1679EB6C-DD29-432C-8F6C-
EE87DA263D5C"{
"        ShowKeyOutput" = "11:TRUE"
"           ExcludeFilters"
}
{
{
8062640}"       A-2EEE-46E9-AB67-
688E9A886E9F}:_559F08B1EED24689A628F1EB584EFE56"
}
"        SourcePath" = "8":
"        TargetName" = "8":
"        Tag" = "8":
"        Folder" = "8:_7E2ECC51164F4C3CB5BD391071F12075"
"        Condition" = "8":
"        Transitive" = "11:FALSE"
"        Vital" = "11:TRUE"
"        ReadOnly" = "11:FALSE"
"        Hidden" = "11:FALSE"
"        System" = "11:FALSE"
"        Permanent" = "11:FALSE"
"        SharedLegacy" = "11:FALSE"
```

```
"        PackageAs" = "3:1"
"        Register" = "3:1"
"        Exclude" = "11:FALSE"
"        IsDependency" = "11:FALSE"
"        IsolateTo" = "8":
"        ProjectOutputGroupRegister" = "3:1"
"        OutputConfiguration" = "8":
"        OutputGroupCanonicalName" = "8:Documentation"
"        OutputProjectGuid" = "8:{1679EB6C-DD29-432C-8F6C-
EE87DA263D5C"{
"        ShowKeyOutput" = "11:TRUE"
"          ExcludeFilters"
}
{
{
8062640}"        A-2EEE-46E9-AB67-
688E9A886E9F}:_8B0D5D7B3A39404EBF71337B54C1A4CF"
}
"        SourcePath" = "8":
"        TargetName" = "8":
"        Tag" = "8":
"        Folder" = "8:_7E2ECC51164F4C3CB5BD391071F12075"
"        Condition" = "8":
"        Transitive" = "11:FALSE"
"        Vital" = "11:TRUE"
"        ReadOnly" = "11:FALSE"
"        Hidden" = "11:FALSE"
"        System" = "11:FALSE"
"        Permanent" = "11:FALSE"
"        SharedLegacy" = "11:FALSE"
"        PackageAs" = "3:1"
"        Register" = "3:1"
"        Exclude" = "11:FALSE"
"        IsDependency" = "11:FALSE"
"        IsolateTo" = "8":
"        ProjectOutputGroupRegister" = "3:1"
"        OutputConfiguration" = "8":
"        OutputGroupCanonicalName" = "8:ContentFiles"
"        OutputProjectGuid" = "8:{1679EB6C-DD29-432C-8F6C-
EE87DA263D5C"{
"        ShowKeyOutput" = "11:TRUE"
"          ExcludeFilters"
}
{
{
8062640}"        A-2EEE-46E9-AB67-
688E9A886E9F}:_DB714A88B9F04B83B8CC46509C3E836A"
}
"        SourcePath" = "8":
"        TargetName" = "8":
"        Tag" = "8":
"        Folder" = "8:_7E2ECC51164F4C3CB5BD391071F12075"
"        Condition" = "8":
"        Transitive" = "11:FALSE"
"        Vital" = "11:TRUE"
"        ReadOnly" = "11:FALSE"
"        Hidden" = "11:FALSE"
"        System" = "11:FALSE"
"        Permanent" = "11:FALSE"
"        SharedLegacy" = "11:FALSE"
"        PackageAs" = "3:1"
"        Register" = "3:1"
"        Exclude" = "11:FALSE"
"        IsDependency" = "11:FALSE"
"        IsolateTo" = "8":
"        ProjectOutputGroupRegister" = "3:1"
"        OutputConfiguration" = "8":
"        OutputGroupCanonicalName" =
"8:LocalizedResourceDlls"
"        OutputProjectGuid" = "8:{1679EB6C-DD29-432C-8F6C-
EE87DA263D5C"{
"        ShowKeyOutput" = "11:TRUE"
"          ExcludeFilters"
}
{
{
{
{
{
```

تصميم برنامج كومبيوتر كنموذج مبدئي للتنبؤ بالوفرة الموسمية لمن أوراق الذرة على الشعير في مصر

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استخدمت النتائج المتحصل عليها من دراسة الوفرة الموسمية لحشرة من أوراق الذرة فى تصميم نموذج برنامج مبدئى لمحصول الشعير لتوضيح علاقة معدل الإصابة بحشرة من اوراق الذرة على مدار مراحل النمو المختلفة لنباتات الشعير ببعض العمليات الزراعية تحت الدراسة كخطوة أولية تفيد فى تصميم برنامج خبير للاستفادة منه فى عمليات التنبؤ.