

**Seasonal Dynamic and life tables structure of the whitefly
(*Acaudaleyrodes rachipora*) (Hemiptera: Aleurodidae) on Nabok
(*Zizyphus spina*) in Baghdad**

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Abstract:

The population density of the whitefly, *Acaudaleyrodes rachipora*, was observed at the College of Basic Education/ Mustansiriyah University, Baghdad Governorate, on Nabok trees. The maximum number of immature stages in March 2025 was 493 eggs, 436 nymphs, and 395 pupae per leaf, respectively. The lowest population was in April 2025(383 eggs, 365 nymphs, and 380 pupae per leaf, respectively). The immature stage population on the plant varied according to the tree's orientation. The highest population was observed on trees facing east (524 eggs, 517 nymphs, and 328 pupae per leaf, respectively), followed about eggs by trees facing the North 447 eggs, south 408 eggs, About nymphs in the middle 505 nymphs, south 366 nymphs, South 338 nymphs. According the pupae in middle 268, south 246 and north 225 pupae. Natural enemies, as well as the abiotic factors of high temperature and low humidity, were the main factors regulating populations. Life-life tables revealed that the aforementioned factors were responsible for limiting insect populations, particularly photoperiod and adult mortality. The monthly trend index for the period from March to April 2025 was 2.94 and 1.05.

Keywords: photoperiods, population density, nymphs, immature stages, natural enemies, mortality.

Introduction

The fruit is identified by its carbohydrates, proteins, fats, and other minerals. Many parts of the plant, such as the leaves, roots, and bark of Nabok trees, are also a source of animal feed and medicinal uses, and are rich in alkaloids. Several species of jujube are found in Iraq, the most important of which include *Zizyphus spina* Christi (also known as Malasi, Bamboo, and Fosami) and (Olive and Apple) (Kamil and Heusseini,2024). These varieties are mainly cultivated in central and southern Iraq (Al-Nadawi, 2015) and are attacked by several insect pests (Vidal and Jaber, 2015) (Pan et al.,2021). Among these is the white fly, *A. rachipora* (Aleyrodidae: Hemiptera), which is a serious pest of Nabok trees. Adults of both sexes are active and have wings covered with a white powder (Wang et al.,2021). The immature (pupa) stages are dark brown to black with a white waxy coating around the outer edge (AL-NADAWI, 2017A). The genus *Acaudaleyrodes* comprises five species and affects a wide range of forest plants. Nymphs and adults feed on plant sap and excrete honeydew, which promotes the growth of black mold. This prevents the plant from reaching its physiological balance, resulting in yellowing and stunted growth (AL-

NADAWI and Al-Zubaidy, 2014) (yang et al ,2023) (Bai et al., 2021). Pesticides play a key role in whitefly control (AL-NADAWI, 2019). The current study was conducted to estimate population density and construct life tables (Liu and Li ,2023; Bai et al.,2022; Yin et al. ,2021).

Materials and Methods

Population Density: Random samples were collected following a general survey conducted according to the method of Morris and Miller (1954) at the College of Basic Education, Mustansiriyah University, Baghdad. Data were collected from 20 Nabok trees of equal size and growth, which were placed evenly. Sampling was conducted at 10-day intervals, with 20 leaves per tree sampled, oriented along the four cardinal directions (north, south, east, and west) as well as the center (Long et al.). The total sample size was 100 leaves, collected from March 1 to April 29, 2025. Data were recorded from both the upper and lower leaf surfaces.

Life Tables: A life table for the whitefly **A. rachipora** on Nabok trees was constructed based on random sampling results after a ten-day period in the gardens of the College of Basic Education/ Mustansiriyah University, Baghdad. The table calculated the total number of hatched and unhatched eggs, as well as the number of live and dead nymphs. Mortality factors (predation, parasitism, and fungal infection) were identified. Mortality in the dead insect stages due to unknown causes was also recorded, and the role of harsh weather conditions was assessed (Mills and Rahal, 2021). Data were tabulated according to various criteria (Harcourt 1969) and included the following columns:

X = Age group at which sampling took place.

L_x = Number of individuals alive at the beginning of the age group.

d_x = Factor responsible for mortality within the age group. d_x = Number of deaths within the age group q_x = Death-to-survival ratio

S_x = Survival rate

d_x = Number of deaths within the age group q_x = Death-to-survival ratio The life table uses the K factor (the principal factor), which represents the sum of the total mortality logarithms in each age group and is calculated using the equation (Aitken,2024): $K = \log(L_x) - \log(L_{x-1})$, as follows: K = relative contribution of each mortality factor; $\log(L_x)$ = number of living individuals logarithm of the age group; $\log(L_{x-1})$ = number of living individuals logarithm of the age group following the age group. The total mortality of the generations represented by the K value is calculated from the sum of the K values for all age groups as follows: $K = K_1 + K_2 + K_3 \dots + K_N$ (Longang,2023). The expected number of eggs, the population trend index (TI), and the generation survival rate (SG) are estimated as follows: Expected number of eggs = (normal females \times 2) / 2 \times maximum number of eggs / females. Expected number of eggs = expected number of eggs; normal female = normal female; maximum number of eggs / females = The highest number of eggs laid by a female.

The trend index (TI) population was calculated according to the following equation:

$$TI = N_2/N_1$$

N_1 = number of eggs laid by females of the current generation, N_2 = number of eggs laid by females of the next (new) generation.

The survival rate (SG) was calculated according to the following equation:

$$SG = N_3/N_1$$

N_1 = number of eggs laid by females of the first generation, N_3 = number of eggs laid by females of the current generation.

Results and Discussion

Whitefly Population Density and Seasonal Spread

Egg Count:

The highest number of eggs was recorded in March 2025 (403 eggs/leaf), when the maximum temperature was 22°C, the minimum 8.18°C, and the relative humidity was 42% (Figure 1). The lowest fertility was recorded in April (303 eggs/leaf), with maximum and minimum temperatures of 18°C and 6.9°C, and relative humidity of 52.11%. The highest egg-laying occurred in the eastern trend. (524 eggs/leaf), followed in North by (447 eggs/leaf). However, the lowest number of eggs was in the Middle direction (385 eggs/leaf).

Whitefly nymph density:

The highest number of nymphs on Nabok leaves in March 2025 was 436 nymphs/leaf, when the maximum and minimum temperatures were 33.7°C and 17.6°C, respectively, with a relative humidity of 41.45%. The lowest infestation was in April 2025, at 365 nymphs/leaf, when the maximum temperature was 18°C and the minimum was 6.9°C, with a relative humidity of 52.11%. The highest number of nymphs was in the Middle direction (534 number of nymphs/leaf), followed by the East 473 nymphs/leaf and North directions 465 nymphs/leaf. Nymph infestation in the western direction was the lowest (354 nymphs/leaf). AL-NADAWI (2018) also observed the same results for this direction.

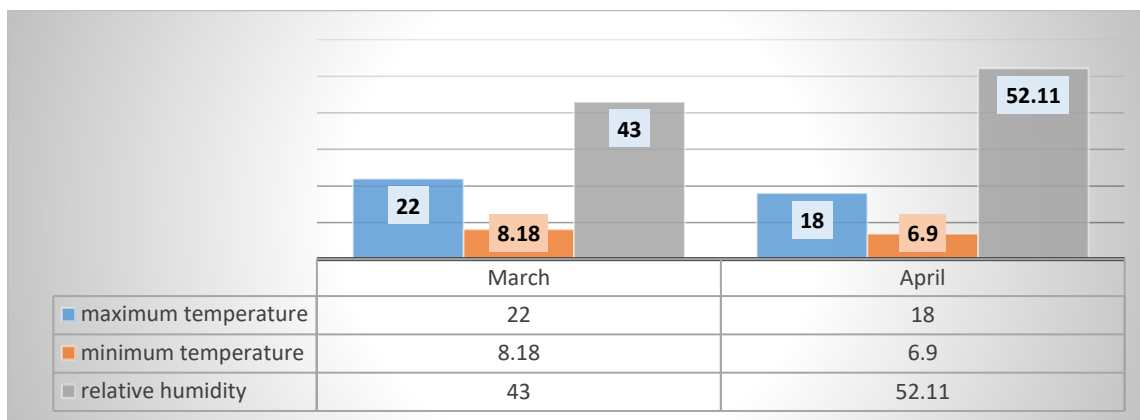


Figure 1. Maximum and minimum temperatures and relative humidity for March and April 2025

Table 1. Whitefly egg Population density on Nabok trees in Baghdad (2025)

Direction						Total	Mean
	East	Middle	South	North	West		
Months							
March	588	472	466	511	380	2417	483
April	459	298	350	382	426	1915	383
Sum of Mean	1047	770	816	893	806	4332	866
Mean	524	385	408	447	403	2166	433

Table 2. Whitefly nymphs Population density on Nabok trees in Baghdad (2025)

Direction Months						Total	Mean
	East	Middle	South	North	West		
March	473	534	355	465	354	2182	436
April	560	476	376	211	201	1824	365
Sum of Mean	1033	1010	731	676	555	4005	801
Mean	517	505	366	338	278	2004	401

Table 3. Population density of Pupae on Nabok trees in Baghdad (2025)

Direction Months						Total	Mean
	East	Middle	South	North	West		
March	432	321	467	376	377	1973	395
April	322	356	354	321	547	1900	380
Sum of Mean	655	535	492	449	398	3873	775
Mean	328	268	246	225	199	1937	388

Whitefly pupa population density:

The minimum and maximum pupa counts on March 8th were 230 and 276 pupas/leaf, respectively, when the maximum and minimum temperatures were 22°C and 8.18°C, respectively, and the relative humidity was 43%. With maximum and minimum temperatures of 18°C and 6.9°C, and relative humidity of 52.11% in April. The number of pupas on the leaves varied according to tree orientation. The highest number, 328 pupas/leaf, was found in the eastern direction, followed by the central pupas/leaf 268, southern, and North directions and Southern direction. AL-NADAWI and AL-Salihi (2015) also observed similar results for the same orientations.

Life tables:

The complete life tables for the lifespans of the blackfly *A. rachipora* on Nabok trees were constructed to determine the factors responsible for the population during March and April 2025 in the gardens of the College of Basic Education, Mustansiriyah University, Baghdad. The mortality rate in the egg stage was 10%, with unfertilized eggs playing the most significant role in reducing the hatching rate. Predation accounted for 1.6% of egg mortality, reducing the hatching rate (AL-NADAWI, 2017b). The mortality rate of some abiotic factors in egg mortality was 11.6%, while the total relative contribution to mortality due to these factors, indicated by the K value, was 0.329. The variance in mortality among abiotic factors (predation and parasitism) and abiotic and fungal factors in reducing nymph populations and mortality was 0.51%, 0.51%, and 0.51%, respectively. Fungi are important factors in determining population density (Akler et al.,2019). Table (4) shows that biological control has a very small role compared to

abiotic factors, despite the introduction of abiotic factors, as the additional mortality rate, with a total relative contribution to mortality, was 0.335. The sexual ratio, however, played the largest role in reducing insect populations, contributing 0.335, which exceeds the effect of the other factors mentioned above. Harcourt (1969) stated that optical synchrony (photoperiods), measured by its effect on the egg-laying rates (maximum and minimum) of the female insect, played a significant role in influencing insect population density, with a K value of 0.377.0. The potential energy for egg-laying in insects depends on photoperiods and is considered one of the most important functions. The effect of this factor on the female insect led to a 12.9% reduction in the number of eggs laid, ranking second only to factors responsible for adult mortality. The most important factors regulating nymph populations are natural enemies, with a K value of 0.334. The most important factors influencing pest population density are exposure to natural enemies, including predation by predatory insects or birds, death due to weather conditions or lack of mating, as well as population density or migration to other locations. Natural enemies are the most important factor in pupal mortality (K values of 0.335 and 0.291 during March and April). The current study indicates that the maximum temperature in April was 18°C and the relative humidity was 52.11%, which may be responsible for determining the population size compared to the previous month. The K value differed between March and April (0.335 and 0.291, respectively). The study suggests that maximum temperature and low relative humidity are responsible for determining population density, mortality rates, fertility, and adult survival.

Table (4): Life table of the white fly, *A. rachipora*, on Nabok trees in Baghdad Governorate for the month March 2025

X	Lx	Dxf	dx	100qx	Sx	K-value
Eggs (N ₁)	1086	Infertility	98	10	0.90	0.329
		Predators	17	1.6	0.98	
			115	11.6	0.94	
Nymphs (1-3)	971	Predators	—	—	—	0.334
		Fungus	5	0.51	0.99	
			5	0.51	0.99	
Pupae	966	Parasitism	1	0.10	0.99	0.335
		Predators	1	0.10	0.99	
		abiotic extermination agents	4	0.41	0.99	
			6	0.61	0.99	
Adult	960	(% (47.2♀♀ Sex ratio ♀	509	52.8	5.6	0.335
Females x2(N ₃)	451	Photoperiodism	58	12.9	0.87	0.377
Normal females x2	393	Adult mortality	389	99.73	0.27	0.385
Generation totals	4		1082			2.095

Expt. Eggs = 11987 , , Actual eggs (N₂) = 3192 , (T.I.) = 2.94 , (S.G.) = 0.42

Table (5): Life table of the whitefly *A. rachipora* on Nabok trees in Baghdad Governorate for the month of April 2025

Expt. Eggs = 35380 , Actual eggs (N_2) = 1638 , (T.I.) = 1.051 , (S.G.) = 0.42

X	Lx	Dxf	dx	100qx	Sx	K-value
Eggs (N_1)	3192	Infertility	287	10	0.90	0.285
		Predators	45	1.41	0.99	
			332	11.41	0.95	
Nymphs (1-3)	2860	Parasitism	2	0.07	0.99	0.289
		Predators	6	0.21	0.99	
		Fungus	3	0.12	0.99	
		Honey dew	1	0.04	0.99	
			12	0.44	0.99	
Pupae	2848	Parasitism	4	0.14	0.99	0.291
		Predators	6	0.21	0.98	
		Fungus	3	0.10	0.99	
		Unknown causes	1	0.04	0.99	
			14	0.49	0.99	
Adult	2834	(% (47.2♀♀ Sex ratio ♀	1502	52.8	5.6	0.291
Females x2(N_3)	1332	Photoperiodism	172	12.9	0.87	0.320
Normal females x2	1160	Adult mortality	1148	99.95	0.05	0.326
Generation totals	12		3021			1.802

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