American Journal of Entomology
2017; 1(1): 19-26
http://www.sciencepublishinggroup.com/j/aje
doi: 10.11648/j.aje.20170101.15

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Effect of Host Plant on Biology and Life Table Parameters of *Sipha maydis* (Pass.) (Hemiptera: Aphididae)

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To cite this article:

Francisco La Rossa, Albano Giudici, Araceli Vasicek, María Carolina López, Carlos Bainotti. Effect of Host Plant on Biology and Life Table Parameters of *Sipha Maydis* (Pass.) (Hemiptera: Aphididae). *American Journal of Entomology*. Vol. 1, No. 1, 2017, pp. 19-26.
doi: 10.11648/j.aje.20170101.15

Received: May 22, 2017; **Accepted**: June 13, 2017; **Published**: July 26, 2017

Abstract: *Sipha (Rugsia) maydis* (Pass.) is an important pest of wheat and it has been reported throughout the Mediterranean region, into Central and South Asia, South Africa, South America and North America The development, survivorship, and life table parameters of *R. padi* were evaluated in a growth chamber on seven wheat cultivars as follows: ACA 315, Baguette 12 P, BioINTA 1002, BioINTA 2004, Buck Meteoro, Klein Yarará and LE 2330 at controlled conditions (20±1°C; about 70% RH; 14 h photophase). The development time of immature stage was ca. 8-9 d on cv. ACA 315, BioINTA 1002, Buck Meteoro, Klein Yarará and LE 2330, while those on cvs BioINTA 2004 and Baguette 12 P was ca. 11-12 d. The immature survival ranged from 90 to 100%. The intrinsic rate of increase (r_m) for ACA 315 and BioINTA 2004 were the highest. Jackknife estimates of r_m on all cultivars ranged from 0.199 to 0.093 females/female/day on ACA 315 and LE 2330, respectively. The mean generation times (T) ranged from 22.82 d on Baguette 12 P to 15.09 d on Klein Yarará. The highest net reproductive rate (R_0) were on ACA 315 and Baguette 12 P (59.80 and 53.25 females/female/generation, respectively). Because of the high coefficient of determination (pseudo-R^2) values in Gompertz and Weibull models, survival data from different cultivars had a good fit to both models. The results pointed LE 2330, Klein Yarará and partially BioINTA 1002 as the least suitable host plants, indicating that they were the most resistant to *S. maydis* among the cultivars tested.

Keywords: Host Suitability, Life History, Intrinsic Rate of Increase

1. Introduction

Wheat (*Triticum aestivum* L.) is the most important crop in Argentina after soybeans and maize [1]. Production of wheat is limited by various pests, e.g. aphids, such as *Diuraphis noxia* (Mordvilko*), Rhopalosiphum padi* (L.), *Schizaphis graminum* (Rondani), *Sitobion avenae* (F.) and *Sipha (Rugsia) maydis* (Passerini) are some of the most important ones [2]. *S. maydis* has been reported throughout the Mediterranean region, into Central and South Asia, South Africa, South America [2, 3] and in North America [4, 5]. This aphid feeds broadly on numerous species over 30 genera of Poaceae (Gramineae) [2] and it is reported to be a vector of the BYD virus complex [6]. This species was found mainly on cultivated barley, wheat, wild *Bromus spp*. and *Sorghum halepense* (L.) and most of the damage to winter cereal crops occurs at the seedling stage in early autumn and on adult plants in late spring [3]. On the other hand, the wide range of regions, hosts and climatic conditions are likely to make the control of this pest very difficult in Argentina [3]. The use of insect-resistant plants is a successful control tactic in the Integrated Pest Management (IPM) context because it is sustainable and does not increase pollution and production costs. It is known that pests cause more damage on susceptible host plants by having a higher population growth rate than on resistant ones [7]. For this reason, knowledge about the population of a pest on different host plants gives an idea about the resistance or susceptibility of hosts [8, 9, 10]. Despite the studies carried out on barley [11] and wheat [12] there are no sufficient information on the population development of *S. maydis* on new argentine wheat cultivars. In the present study, several biological and demographic parameters that provide valuable information on population growth rate of *S. maydis* (development rate, survival and fecundity), were examined on different wheat cultivars under laboratory conditions

2. Material and Methods

2.1. Aphid Colony

The aphid colony of *S. maydis* was obtained from a greenhouse of the Instituto de Microbiología y Zoología Agrícola (CICvA – INTA, Castelar, Buenos Aires, Argentina) reared from some viviparous apterous females collected on wild Poaceae in the campus of CICVyA INTA, near Castelar, Buenos Aires, Argentina (34°36'21, 6"S, 58°40'48"W). Aphids were maintained on unknown barley cultivar in the greenhouse (about 23°C; 12 h photophase).

2.2. Host Plants

Seven commercial wheat (*Triticum aestivum*) cultivars which are new in Argentina, including ACA 315, Baguette 11 Pr., BioINTA 1002, BioINTA 2004, Buck Meteoro, Klein Yarará and LE 2330 were used. These cultivars were chosen and tested based on their intermediate-large cycle and exposure at aphid attack due to its planting time (late May to middle June, according to region). All tested plants were obtained from 20-30 seeds and maintained in a growth chamber in cylindrical plastic pots (7.5 cm in diameter and 10.5 cm in height) containing a sterile mixture of 2/3 soil and 1/3 organic compost. Sterilization was carried out in an autoclave at 120°C, 1 kg/cm^2, for 1 h, twice at a 48 h interval, following [13]. When plants reached about 15 cm in height they were infested with aphids and watered as required.

2.3. Biological and Life Table Parameters Determination

For each cultivar, nearly 45 apterous females from the stock colonies maintained on each host plant for at least three generations were placed into individual leaf clip-cages (3 cm in diameter) clipped to leaves [14]. After 24 h, the adult and all but one first-instar were removed and all single first instars were the cohorts on each cultivar (n = 40). The whole assay was carried out in a growth chamber at 20 ± 1°C, about 75% RH and 12h photophase. Individual aphids were checked daily for ecdysis and survivorship. The exuviae were used to determine instar changes. After the immature became an adult, mortality and fecundity were checked daily and offspring were counted and removed from each clip-cage until the death of the adult. When necessary, the adults were transferred to another leaf or seedling of the same cultivar. The study was completed when the last female died. The mean and standard error of mean (SEM) of nymph developmental, pre-reproductive, reproductive, post-reproductive duration time and longevity, as well as life table construction and calculation of demographic parameters were developed by using the specifics computer programs PERIOD and TABLAVI [15]. TABLAVI's outputs also include the SEM estimate of all life table statistics by using the Jackknife procedure [16, 17]. The age-specific survival rate (l_x) and life expectancy (e_x) of *S. maydis* on different wheat cultivars were obtained from outputs of TABLAVI program. The equations to obtain the life table parameters followed [18, 19, 20] and are shown in Table 1.

Table 1. *Demographic and mortality parameters used with its respective units and equations.*

Parameter	Units	Equation
Intrinsic rate of natural increase (r_m)	♀♀/♀./day	$\sum_{x=0}^{\infty} l_x m_x e^{-r_m t} = 1$
Net Reproductive rate (R_0)	♀♀/♀/. gene-ration	$R_0 = \sum l_x m_x$
Mean generation time (T)	days	$T = \frac{\sum x l_x m_x}{\sum l_x m_x}$
Finite rate of increase (λ)	1/day	$\lambda = e^{r_m}$
Doubling time (DT)	days	$D = \frac{\ln 2}{r_m}$
Entropy (H)	days	$H = \frac{\sum_{x=0}^{\varpi} d_x e_x}{e_0}$
Average daily mortality ($\bar{\mu}$)	days	$\bar{\mu} = \frac{1}{e_0}$

References: x = age, l_x = age-specific survival, m_x = daily fecundity, d_x = frequency of deaths, e_x= life expectancy, e_0= total life expectancy or life expectancy at day 0.

2.4. Data Analysis

Data were prior tested for normality using the Shapiro-Wilk test in PROC UNIVARIATE and tested for homogeneity of variances using the Levene test in PROC GLM [21]. Data were not normally distributed and the SAS macro MC-KW (Multiple Comparison Kruskal-Wallis non-parametric ANOVA based) [22] was used to compare all biological attributes and life table parameters. The percentages of pre-adult mortality were compared using a SAS macro called "comp prop" [23]. Variations in fecundity over time for a specific cultivar were analyzed as a four-order polynomial regression with fecundity as the dependent variable, and cultivar and age as discrete, independent variables. Cultivar effects were analyzed by using least-square means to adjust for the polynomial age effects.

These means of fecundity were then compared among cultivars and means were separated with option of Tukey Kramer test in the GLM procedure [21]. The survival data recorded on the various cultivars was analyzed in two ways: non-parametric comparison of survival curves in PROC LIFETEST and estimation of Gompertz (1) and Weibull (2) models parameters with non-linear regression in PROC NLIN [21]. The probability that an individual lives at least to age x was calculated by the equations:

$$S_x = e^{\left[\left(\frac{a}{b}\right)\left(1-e^{bx}\right)\right]} \quad (1)$$

where a is the initial mortality rate and b is the exponential rate of increase in the death rate.

$$S_x = e^{-\left(\frac{x}{b}\right)^c} \quad (2)$$

for x > 0, where b is a scale parameter that is inversely related to the mortality rate and c is a shape parameter that allows the model to produce survival distributions of different forms [24, 25]. Values of the shape parameter c > 1, = 1, or < 1 correspond to Deevey ' s type I, II, or III survivorship curves, respectively.

3. Results

3.1. Development of Immature Stages

Differences in the duration of each instar were always significant among cultivars ($P < 0.05$) (Table 2). There were significant differences in the time of the immatures development among the cohorts on different cultivars (Table 2). Individuals fed on cv. ACA 315, BioINTA 1002, Buck Meteoro, Klein Yarará and LE 2330 developed significantly faster (ca. 8-10 d) than those on any other cultivars, while those on cvs BioINTA 2004 and Baguette 12 Pr. had the longest development time (ca. 11-12 d). Mortality at the nymphal stage were from 0 to 10% and was not different on the tested cultivars (χ^2 =9.519; df: 6; P = 0.146).

3.2. Reproductive Periods and Longevity

The pre-reproductive period was different on the tested cultivars (Table 2). It was shorter on cvs Baguette 11 Pr., Klein Yarará and Buck Meteoro, Intermediate on BioINTA 1002, BioINTA 2004 and LE 2330 and longer on ACA 315. The wheat cultivars used in this study had a noticeable effect on the reproductive period of *S. maydis* (Table 2). The reproductive period was longer for adults reared on cvs. ACA 315, Baguette 11 Pr., BioINTA 2004. The post-reproductive period was shorter on BioINTA 1002, Buck Meteoro, Klein Yarará and LE 2330 (Table 2). Longevity varied significantly among cultivars and two groups can be clearly distinguished: the first, with short-lived aphids reared on BioINTA 1002, Buck Meteoro, Klein Yarará and LE 2330, and the second with the long-lived aphids reared on the remaining cultivars (Table 2)

Table 2. *Development time (days) (Mean (SEM)) of immatures, reproductive periods and longevity of Sipha maydis on seven wheat (Triticum aestivum) cultivars.*

		Instars			
Cultivar	**N**	**1st**	**2nd**	**3rd**	**4th**
ACA 315	40	1.44 c* (0.08)	2.46 b (0.07)	2.36 bc (0.07)	2.48 ab (0.16)
Baguette 11 Pr	40	2.55 a (0.13)	3.10 a (0.09)	2.67 ab (0.10)	2.84 a (0.10)
BioINTA 1002	40	2.14 ab (0.11)	2.61 b (0.13)	2.22 c (0.11)	2.60 ab (0.16)
BioINTA 2004	40	1.60 b (0.09)	2.78 ab (0.09)	2.80 a (0.10)	3.00 a (0.17)
Buck Meteoro	40	2.40 a (0.10)	2.87 ab (0.17)	2.57 bc (0.12)	2.36 ab (0.13)
Klein Yarará	40	2.67 a (0.25)	3.13 a (0..26)	2.47 bc (0.23)	1.93 b (0.22)
LE 2330	40	2.00 a (0.14)	3.28 a (0.15)	2.26 bc (0.09)	2.46 ab (0.14)
H		68.544	35.202	26.840	28.256
Df		6	6	6	6
P		<.0001	<.0001	.0002	<.0001

Table 2. *Continue.*

		Instars				
Cultivar	**N**	**Total Nymph**	**Pre -reprod.**	**Reprod.**	**Post- reprod**	**Longevity**
ACA 315	40	9.06 c (0.24)	1.79 a (0.10)	38.72 a (2.06)	6.13 a (0.57)	52.90 a (2.58)
Baguette 11 Pr	40	12.12 a	0.53 c (0.10)	34.82 a (1.91)	4.76 a (0.47)	52.22 a (2.04)
BioINTA 1002	40	7.89 c (0.20)	0.82 b (0.10)	9.54 b (1.00)	0.33 b (0.13)	14.11 b (1.04)
BioINTA 2004	40	11.18 b (0.18)	1.25 b (0.09)	32.55 a (1.58)	5.45 a (0.63)	50.43 a (1.84)
Buck Meteoro	40	9.63 c (0.12)	0.47 c (0.09)	6.73 b (1.13)	0.07 b (0.05)	16.90 b (1.30)
Klein Yarará	40	10.20 bc (0.27)	0.31 c (0.09)	7.93 b (0.89)	0.32 b (0.09)	7.92 b (1.79)
LE 2330	40	8.23 c (0.11)	1.00 b (0.00)	8.00 b (2.10)	0.13 b (0.13)	11.03 b (1.04)
H		95.172	100.16	141.53	136.42	208.54
Df		6	6	6	6	8
P		<.0001	<.0001	.0001	.0001	.0001

*Values within a column followed by the same letters are not significantly different (P >.05) in KW-MC test.

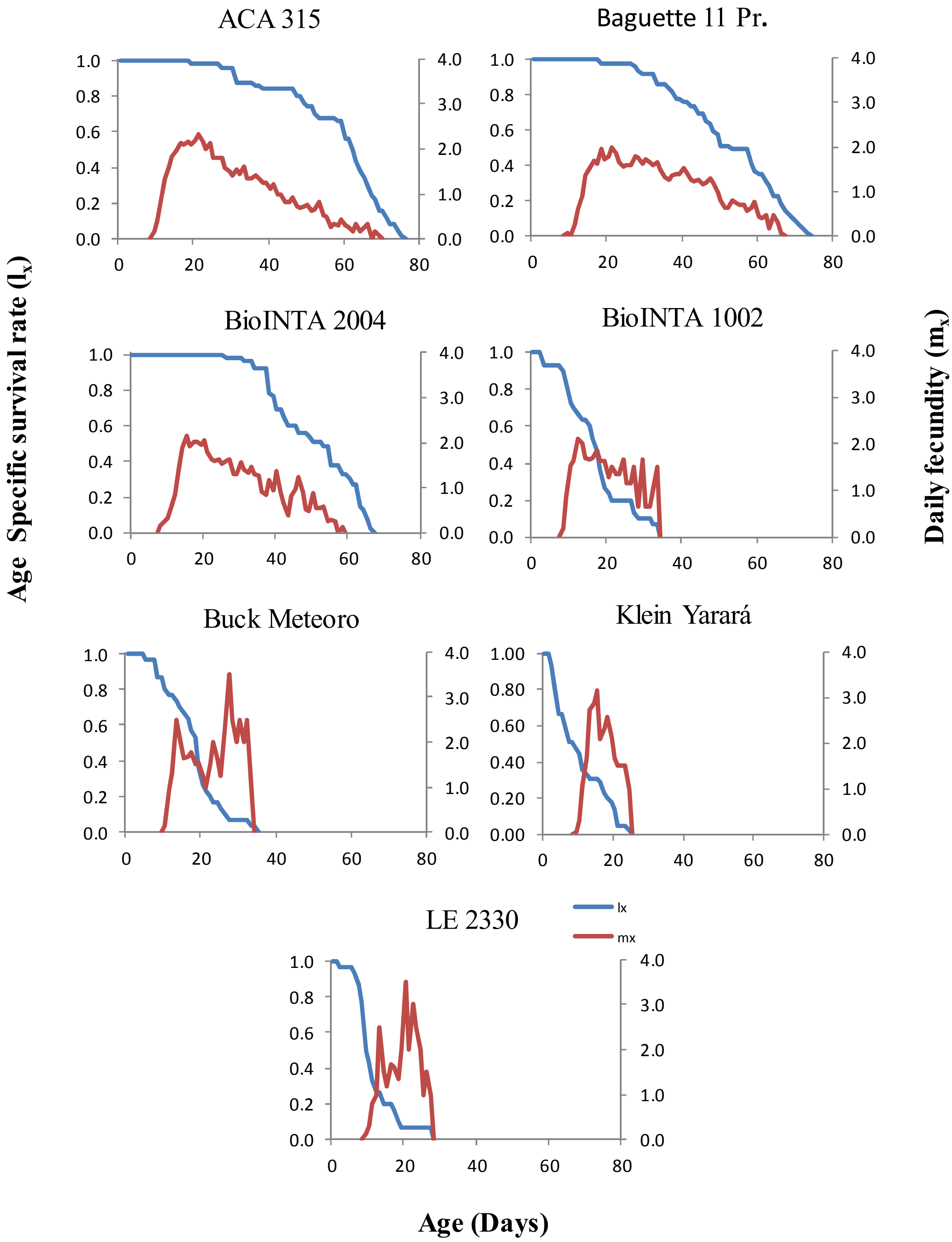

Figure 1. *Age-specific survival rate (l_x) and fecundity (m_x) on age (in days) of Sipha maydis reared on seven wheat (Triticum aestivum) cultivars.*

3.3. Survival Rate, Fecundity and Life Expectancy

The log–rank test used to compare age-specific survival curves has shown significant differences among cohorts reared on different cultivars (log-rank test: χ^2 = 399.96; *df* = 6; P <.0001). Three survival curves groups can be clearly distinguished: the first including the aphids reared on cv BioINTA 1002 only, the second including those on Buck Meteoro and LE 2330 and the third, those on ACA 315, Baguette 11 Pr., BioINTA 2004 and Klein Yarará (Table 3, Figure 1). The daily fecundity patterns observed over life span of the aphids were best described by polynomial regression and were not a linear function of age, forming a more or less skewed-left on ACA 315, Baguette 11 Pr., BioINTA 2004 and Klein Yarará and more or less right pattern on BioINTA 1002, Buck Meteoro and LE 2330 (Figure 1). The regression analysis (Table 4) showed a very strong effect of host plants on the aphid daily fecundity, even after variation due to age was removed (F = 14.97; df = 6, 249; P < 0.0001). The highest numbers were recorded from four to 13 d after adulthood, with values of 2.33, 1.99, 2.10, 2.15, 2.50, 3.14 and 3.50 nymphs per day on cultivars ACA

315, Baguette 11 Pr., BioINTA 1002, BioINTA 2004, Buck Meteoro, Klein Yarará and LE 2330, respectively. Overall, the number of nymphs per female per day on LE 2330 was higher than that of nymphs on the other six cultivars. The life expectancy at birth (e_0) of *S. maydis* was shorter on Klein Yarará and LE 2330, 10.1 and 11.2 d, respectively. The longest e0 was observed on cv. ACA 315 (57.3 d). On the other cultivars, e_0 varied from 16.6 to 51.8 d.

Table 3. *Multiple comparison log-rank test of survival rate curves of S. maydis reared on different wheat cultivars.*

Cultivar	Log-rank Statistic
ACA 315	-38.512 c*
Baguette 11 Pr.	-28.285 c
BioINTA 1002	46.986 a
BioINTA 2004	-11.311 c
Buck Meteoro	20.304 b
Klein Yarará	-12.804 c
LE 2330	23.622 b

*Values followed by the same letter are not significantly different. P <.05

Table 4. *Polynomial regression analysis of daily fecundity on age of S. maydis and cultivar.*

Regression Source	df	Mean Square	F	P	R^2
Model	16	6.27	40.42	<.0001	0.72
Mean (Age)	1	16.71	107.66	<.0001	
$Mean^2$	1	23.96	154.37	<.0001	
$Mean^3$	1	21.23	136.79	<.0001	
$Mean^4$	1	9.43	60.81	<.0001	
Cultivar	6	2.32	14.97	<.0001	
Age x Cult.	6	2.51	16.22	<.0001	
Error	249	0.15			

Least square for daily fecundity	
Cultivar	**Least-square mean ± SE**
ACA 315	1.27828 ± 0.0546 a *
Baguette 11 Pr.	1.18474 ± 0.0547 a
BioINTA 1002	0.42226 ± 0.1389 b
BioINTA 2004	1.11394 ± 0.0555 a
Buck Meteoro	1.26761 ± 0.1305 a
Klein Yarará	0.56158 ± 0.3212 b
LE 2330	1.08479 ± 0.2349 a

*Least-square means followed by the same letter are not significantly different (Tukey-Kramer, P> 0.05)

3.4. Entropy and Average Daily Mortality

The entropy (H) and the average daily mortality parameter ($\bar{\mu}$) on cvs ACA 315, Baguette 11 Premium, BioINTA 1002, BioINTA 2004, Buck Meteoro, Klein Yarará and LE 2330 were 0.187 and 0.0174, 0.234 and 0.0193, 0.450 and 0.0602, 0.198 and 0.0200, 0.400 and 0.0575, 0.701 and 0.1010, 0.534 and 0.0892, respectively. The results suggested that the survival schedule of *S. maydis* was convex on the most cultivars (H < 0.5) except on Klein Yarará and LE 2330 that it was concave (H > 0.5).

3.5. Life Table Parameters

The intrinsic rate of increase (r_m), net reproductive rate (R_0), mean generation time (T), finite rate of increase and population doubling time (D) were calculated for aphids developing on seven wheat cultivars (Table 5). There were significant differences in r_m values among the populations on seven cultivars (Kruskal-Wallis H= 71.513, df= 6, P<0.0001). *S. maydis* reared on cvs. ACA 315 and BioINTA 2004 had higher r_m values (0.199 and 0.195 ♀♀/♀./day) although the last it is not significantly different from Baguette 11 Pr., Buck Meteoro and BioINTA 1002. The lowest r_m value was observed on LE 2330 (0.093 ♀♀/♀./day), although not different from those on Klein Yarará (0.123 ♀♀/♀./day). The R_0 values of *S. maydis* estimated on wheat cultivars ranged from 4.19 to 59.80 females. $female^{-1}$. $generation^{-1}$ with significant differences among cultivars (Kruskal-Wallis H = 212.9644, df = 6, P < 0.0001). Three groups of R_0 values can be distinguished: the first including cvs. ACA 315, Baguette 11 Pr. and BioINTA 2004 with higher values ranged from 49.38 to 59.80 females. $female^{-1}$. $generation^{-1}$, the second with intermediate values ranged from 6.23 to 12.80 including Buck Meteoro, BioINTA 1002 and Kein Yarará and the third with lower values including the aphids reared on LE 2330 although the last it is not significantly different from Klein Yarará. There were significant differences in T values among the populations reared on the seven cultivars (Kruskal-Wallis H = 166.9058, df = 6, P < 0.0001) and ranged from 15.09 to 22.82 d. Significant differences were found in the finite rate of increase (λ) (Kruskal-Wallis H = 73.4999, df = 6, P < 0.0001) and doubling times (D) (Kruskal-Wallis H = 60.603, df = 6, P < 0.0001) for *S. maydis* populations reared on the tested wheat cultivars. The last mentioned life table parameter (D) varied from 3.48 d on cv ACA 315 to 6.39 d on LE 2330.

Table 5. *Life table parameters of S. maydis on different wheat cultivars (Means and (SEM)).*

Cultivar	r_m	R_0	T	λ	D
ACA 315	0.199 a* (0.0028)	59.80 a (2.589)	20.59 a (0.351)	1.220 a (0.0035)	3.49 c (0.050)
Baguette 11 P	0.174 b (0.0022)	53.25 a (3.236)	22.82 a (0.365)	1.190 b (0.0026)	3.99 c (0.049)
BioINTA 1002	0.152 bc (0.0100)	10.56 b (1.491)	15.67 b (0.388)	1.165 c (0.0115)	4.66 b (0.391)
BioINTA 2004	0.195 a (0.0054)	49.38 a (2.443)	19.99 a (0.499)	1.215 a (0.0065)	3.55 c (0.100)
Buck Meteoro	0.159 b (0.0089)	12.79 b (2.191)	16.13 b (0.709)	1.172 b (0.0104)	4.34 c (0.244)
Klein Yarará	0.123 c (0.0169)	6.23 bc (1.525)	15.09 b (0.328)	1.131 c (0.0191)	5.52 ab (0.820)
LE 2330	0.093 d (0.0267)	4.19 c (1.619)	16.58 b (0.291)	1.097 d (0.0289)	6.39 a (0.052)

*Means followed by the same letter are not significantly different (MC. KW. P > 0.05).

3.6. Mortality Models

Parameters of non-linear regression analysis between survival rate and age of *S. maydis* reared on different wheat cultivars using the Gompertz and Weibull models are showed in Table 5. A significant fit was obtained between the survival rate and age of *S. maidis* reared on wheat cultivars using these models (P < 0.01). Survival curves for aphids reared on any cultivar followed the Deevey's type I survival curve as c values of the Weibull model were higher than one.

Table 6. *Estimated parameters (SE) of nonlinear regression between survival rate and age Sipha maydis reared on seven wheat (Triticum aestivum) cultivars fitted to Gompertz and Weibull models.*

	Gompertz			Weibull		
Cultivar	a	B	R^2	b	c	R^2
ACA 315	2.52E-04 (3.80E-05)	9.09E-02 (2.92E-03)	0.983	64.4912 (0.3963)	5.3659 (0.2349)	0.970
Baguette Pr. 11	9.30E-04 (7.20E-05)	7.43E-02 (1.74E-03)	0.982	58.491 (0.2482)	3.891 (0.0882)	0.992
BioINTA 1002	2.21E-02 (2.16E-03)	9.02E-02 (8.42E-03)	0.977	19.256 (0.2578)	2.201 (0.0932)	0.986
BioINTA 2004	6.45E-04 (1.11E-04)	8.73E-02 (4.00E-03	0.97	55.818 (0.3789)	4.306 (0.172)	0.977
Buck Meteoro	6.50E-03 (8.44E-04)	1.60E-01 (9.01E-03)	0.989	20.001 (0.2048)	2.908 (0.1185)	0.991
Klein Yarará	4.66E-02 (3.13E-03)	4.33E-02 (6.50E-03)	0.981	11.700 (0.3097)	1.278 (0.0707)	0.976
LE 2330	1.51E-02 (4.28E-03)	2.18E-01 (3.26E-02)	0.955	12.359 (0.3026)	2.581 (0.226)	0.971

4. Discussion

It has been shown here that the biological attributes and life table parameters of *S. maydis* were significantly influenced by the wheat cultivars tested. Although developmental rates and reproduction have been suggested to reflect the suitability of a host plant [26] and these parameters are recognized to provide important clues concerning the ability of the host to sustain a complete insect life cycle, these data should be linked to other parameters, such as life table parameters and mortality before definitive conclusions can be drawn concerning host suitability; host plant and naturally occurring resistance (different among cultivars) are known to influence reproductive performance of insects [27]. The intrinsic rate of population increase is a basic parameter that an ecologist may wish to establish for an insect population [18]. The r_m value determines whether a population increases exponentially ($r_m > 0$), remains constant in size ($r_m = 0$), or declines to extinction ($r_m < 0$) [28]. Thus, the intrinsic rate of population increase indicated that *S. maydis* reared on the seven cultivars exhibited exponential population growth. The adult aphids were able to reproduce on all cultivars but began the larviposition at different times. In the present study the pre-reproductive period was considered as the time from the fourth ecdysis to the first larviposition while for other authors it is the time elapsed from the birth to the first larviposition [29]. Therefore, if the pre-reproductive period was ca. 1 day in all cultivars, the nymphal stage duration may be related to the level of resistance or susceptibility because high levels of resistance increased the time from birth to first reproduction compared with a susceptible cultivar. In this study, aphids reared on cultivar Baguette 11 Pr had significantly longer nymphal period compared to other cultivars tested, indicating some level of resistance and host plant unsuitability to *S. maydis*. There may be some constituent compounds or physiological barriers inherent in this cultivar that significantly reduced feeding and consequent reduction in development and reproductive performance of aphids. Therefore, aphids grew faster on susceptible cultivars probably because of high nutrition in those cultivars when compared to the less suitable cultivar Baguette 11 Pr. The survival rate of *S. maydis* had different trends on the seven wheat cultivars. Since the total number of days to be lived by the average individual within a cohort from age x to the last day of possible life were lower on Klein Yarará and LE 2330, at the beginning of life, the life expectancy of the aphid on these cultivars was less in comparison with the others. The entropy parameter provides a useful summary measure for characterizing differences in shapes of survival curves among cohorts [19]. Survival curves for aphids reared on any cultivar followed the Deevey's type I survival curve, as c values of the Weibull model were higher than one. However, Deevey's type I survival curve is convex, but it was slightly concave or straight for the aphids reared on BioINTA 1002 and LE 2330 and concave on Klein Yarará as shown by the entropy (H). While the parameter c of Weibull model for these cultivars was closest to one than the remaining values, it is not clearly detected by the model. On the other hand, the parameter b of Weibul model is inversely related to the mortality rate and this values were lower on Klein Yarará and LE 2330, it is congruent with the higher average daily mortality ($\bar{\mu}$) on these cultivars. In the Gompertz model, the initial rate of mortality (a) was higher on Klein Yarará, in contrast, the exponential rate of increase in the death rate (b) were higher on LE 2330. Because of the observed significant fit, both models are valid to explain the survival curves of aphids reared on all tested cultivars. *S. maydis*, at least for the population used in the current study, performed significantly better on ACA 315. It was expressed as a high population build up and decreased nymphal duration. The r_m has been used to measure aphid performance on different host plant [30, 31] and crop cultivar [32]. The higher r_m values indicated that *S. maydis* had relatively greater potential to reproduce on cultivars ACA 315 and BioINTA 2004. The low r_m value on the other cultivars, especially LE 2330 and Klein Yarará, suggests that these cultivars have comparatively higher antibiosis or antixenosis causing reduced survival. In the present study, r_m ranged from 0.093 to 0.199 females/female/day on the wheat cultivars tested. Other authors [12], working with 47 wheat cultivars, including ACA 315, Buck Meteoro and Klein Yarará, have found r_m values between 0.21 and 0.29 but no significant differences among them. Possibly the difference with results here obtained was due to the use of another rearing or analytical methodology. In an investigation carried out in Iran to investigate the effect of temperature on the biology of *S. maydis*, it has been observed that at 20°C, on wheat Pishtaz, the developmental time, T, R_0 and r_m were 12.15 d, 21.95 d, 35.04 females/female/generation and 0.173 females/female/day, respectively [33]. In another Iranian study employing the wheat cultivars Pishtaz, Ghuds and Falat, but at 25°C, the r_m was 0.187, 0.179 and 0.170, respectively [34]. On barley the r_m 0.198 [11] and on oat ranged from 0.154 to 0.192 females/female/day [35]. Despite the difference in temperature and host plant, all of these values are close to or within the range of those estimated in the present study. LE 2330, Klein Yarará, Buck Meteoro, BionInta 1002 and Baguette 11 P are promising cultivars to use in IPM programs. They could also be used as genetic resources for wheat breeding programs aimed at developing resistant cultivars against *Sipha maydis*.

Acknowledgements

Financial assistance was provided by Instituto Nacional de Tecnología Agropecuaria (NTA) Project PNPV 1135032. We thank INTA for granting a research fellowship to Albano Giudici.

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