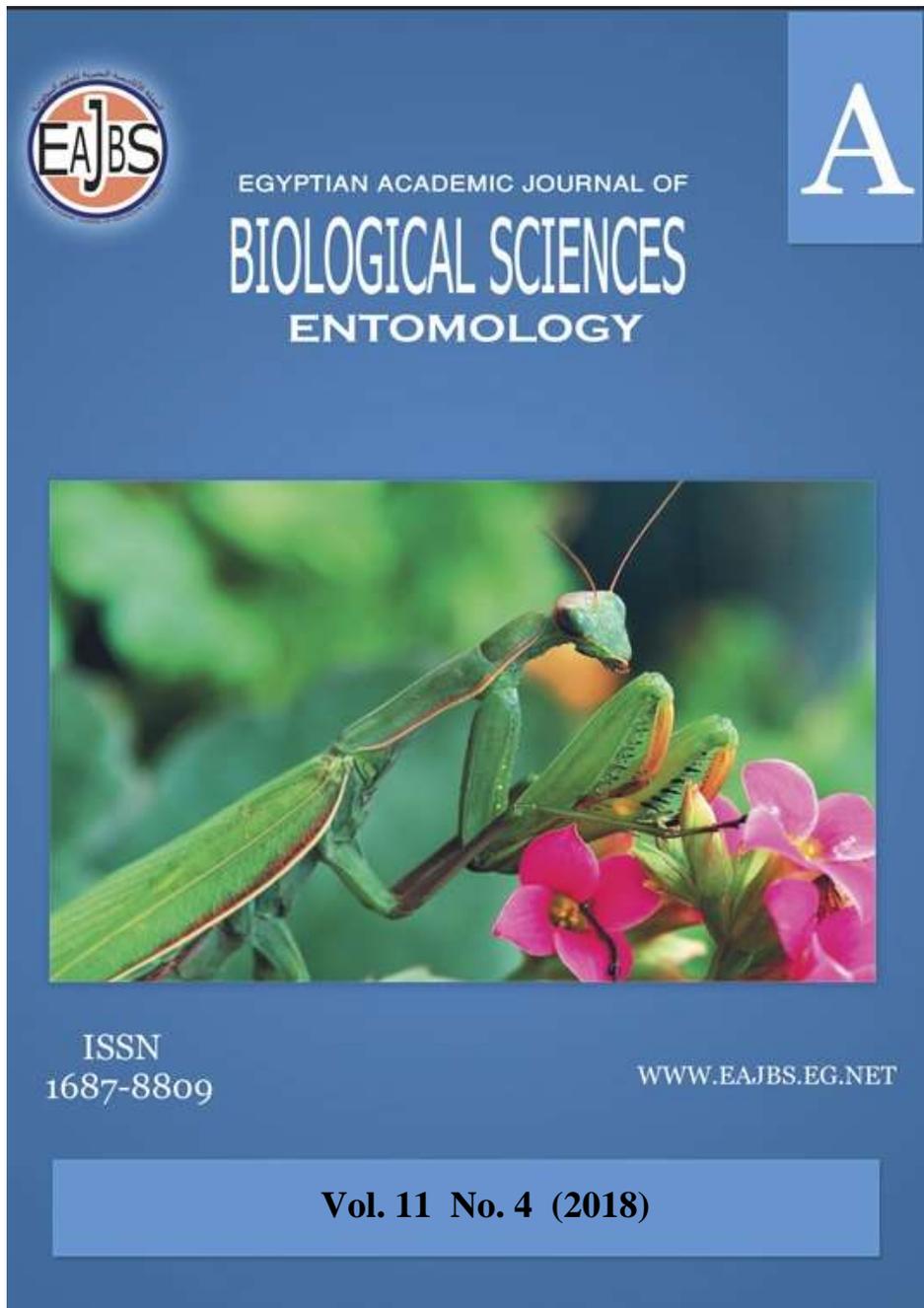


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**Age Distribution Patterns of Mite ,Some Predator and Piercing Sucking Insects Inhabiting Faba Bean as A Method for Prediction of Reproductive Capabilities and Their Relationships to Phenols Leaf Content**

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**ABSTRACT**

Faba bean (*Vicia faba* L.) is the main source of plant proteins in Egypt. This crop is attacked by numerous of pests as mites , Aphids ,white fly and leaf hoppers. Unfortunately these pests contribute to transmit viral diseases . The experiment was carried out Sakha Agricultural Research Station , Kafr El-Sheikh Governorate and conducted in 2013/2014 season to determine the age distribution patterns of pests and predators as a method for predicting the reproductive capabilities and probability of the continuation of arthropods species in the future .In addition to the relationships between phenols leaf content and occurrence of arthropods was studied. Populations of sucking pests and their natural enemies on leaflets of different cultivars of faba bean; Giza 716, Sakha 3 and Giza 40 were recorded.

The age distribution patterns of the above mentioned arthropods were represented by three patterns are expanding population, decline population and stationary population. Decline age distribution was found for phytophagous mite; *Tetranychus urticae* Koch on Giza 716 cultivar which means that the mite population is decreasing . The population of age distribution of *Aphis* Giza 716 spp. stages appeared as expanding population on the three faba bean cultivars. The population of age distribution of *Empoasca* sp. was expanding on Giza 716 and Giza 40 cultivars of faba bean ,but it declining on Sakha 3 cultivar. However the three age patterns were found for *Chrysoperla carnea* Steph., expanding for *Aphidoletes aphidimyza* (Rond.). Data revealed that the correlation between total phenols in faba bean leaflets were significantly positive only in Sakha 3 cultivar .

**INTRODUCTION**

Faba bean (*Vicia Faba*) is a very important economic crop, and ranks first as a source of plant proteins in Egypt. This crop is attacked by numerous of pests as phytophagous mite ; *Tetranychus urticae* and sucking insects as two species of aphids such as *Aphis craccivora* and *Myzus persicae* , white fly; *Bemisia tabaci*, and leaf hopper ; *Empoasca* sp . that cause serious damage to plants,

(Sherif et al., 1994 ; Mohamoud et al. ; 1996 and El-Komi(2006) and transmit viral diseases. Also faba bean is a main source to feed . The above mentioned pests are associated with predatory insects ; *Aphidoletes aphidimyza* ; *Orius* sp.; *Coccinella undecimpunctata* ,and *Chrysoperla carnea* (Steph.) were found on faba bean (Yasarakinci and Hincal ,1999)and (Abou-Elhagag and salman ,2001 and Hashem et al .,2009).

The population age distribution predicts the future changes in arthropod populations. The population age distribution is evaluated using age pyramid and graphically illustrated to shows the distribution of various age stages for different species of mites and sucking insects (Gadau et al .,2009; Elsadany 2012). The population age distribution has three patterns, the first pattern is expanding age distribution this means that the total percentages of immature stages for certain species of pests or predators is larger than percentage of adult stage and this pattern maybe expect that in the future will increasing in population . Also this pattern has high fertility rates and express it with expanding population pyramid, where the pyramid form is very wide at the base.

The second pattern is decline age distribution which means that the total percentages of immature stages and egg stage is less than percentage of adult stage for certain species of pests or predators .

The third pattern of age distribution is stable or stationary pattern because the total percentage of immature stages and egg stage is equal or relatively equal to percentage of adult stage for certain species of pests or predators and this pattern maybe expect that stable in the future (Elsadany ,2012) . Phenols are present in all plants ,and act as defensive system against pests (Sharma et al.,2009 and War, et al. ,2012 ). Plant phenols are consider secondary metabolites which play important role in plant defense against insects by increasing the leaf toughness which reduces the feeding by herbivores hence the quantities of phenols in infested leaves by mite are less than un infested leaves and these compounds reduce fecundity of mite female (Sharma et al .,2009;Waretal2012 and Ellaithy et al 2017). Relationships between phenols , predator insects and sucking pests were found in faba bean (Elsadany and El-Shamy,2016) at Kafr Elsheikh Governorate .

This study aims to the following points:

- 1-Determination age distribution pattern of some pests and predatory insects to predict their reproductive capabilities and probability of the continuation in the future on faba bean cultivars.
- 2- Study effect of total phenols in leaflets of faba bean on occurrence of mite , some piercing sucking insects and some predatory insects .

## MATERIALS AND METHODS

An experiment was carried out at sakha Agricultural Research Station farm , Kafr Elsheik Governorate , Egypt during 2013/2014 season. The experimental area divided into four plots for each cultivar of faba bean each plot area was 1/200 of feddan . Every cultivar was replicated three times in a completely randomized block design. Three cultivars of faba bean (*vicia faba*); Giza716, Giza40 and Sakha3 were sown on 14 November during study season .The normal agricultural practices were applied without pesticide treatments .

To estimate total population of eggs and developmental stages of *Tetranychus urticae* Koch, while nymphs and adults for leafhoppers (*Empoasca* sp.) .About fifteen leaflets representing three levels (upper, middle , lower) of plant of each

plot for each cultivar of faba bean were taken randomly every two weeks. The number of immature stages and adults of leafhoppers was directly counted in early morning in the field by lens while immature stages of the other insects and mite were inspected in the laboratory by stereomicroscope. For investigation immature stages (nymphs and adults) of aphids; *Aphis craccivora* Koch and *Myzus persicae*, while (eggs, larvae, adults) for the predator insect as *Aphidoletes aphidimyza*, (eggs, larvae, pupae adults) for the other predator insect *Chrysoperla carnea* Steph. Five branches were selected randomly from each plot for each cultivars of faba bean. Each branch in paper bag and it was transferred to laboratory to counting individuals of aphids and the predator insects by suitable lens. The samples were taken after 42 days of sowing and continued until end of the season. Some development stages of pests species, predatory insects were put it in alcohol 70% till identification by Taxonomy Department, plant protection research Institute. Mite species was identified by Acarology of Fruit Research Department.

#### **Account Age Distribution for Pests and Predator Insect in Each Age Distribution Pattern:**

- 1- Account population age structure this means number of individuals of each stage of development stages for each pest species or predator insect species where both adults and post reproductive forms of males and females are grouped together.
  - 2- Account percentage for each stage of development stages for each pest species or predator insect species.
  - 3- The data are represented in form age pyramid which shows the distribution of various age stages of population pest or predator insect.
- Age pyramid expresses the relative widths of successive horizontal bars which expresses population growth based on population age data to be used in predicting the future distribution arthropods.

#### **Estimation of Total Phenols in Faba Bean Cultivars :**

Total phenols were estimated in faba bean leaflets according to William (2005) but the phenol reagent was folin ciocalteu (Elsadany and El-shamy, 2016) instead of folin reagent.

#### **Data Analysis:**

The obtained data were statistically analyzed by using Duncan's Multiple Rang Test (1955). Also simple correlation according to Snedecor and Cochran (1988) were calculated by Minitab program (2007).

## **RESULTS AND DISCUSSIONS**

#### **Age Distribution Patterns of Arthropods:**

Data in Fig. (1) reveal that the age distribution pattern of *T. urticae* is a declining pattern on G.716 faba bean cultivar where the adult stage was represented by 100%. This means that phytophagous mite maybe decrease in the future on this cultivar of faba bean. Both of Sakha3 and G.40 were free from mite infestation during 2013/2014 season at Kafr Elsheikh region. These results are in disagreement with Elsadany (2012) who found that age distribution of *T. urticae* on cotton and clover plants affected by motors was expanding population this means that pest may increase in the future.

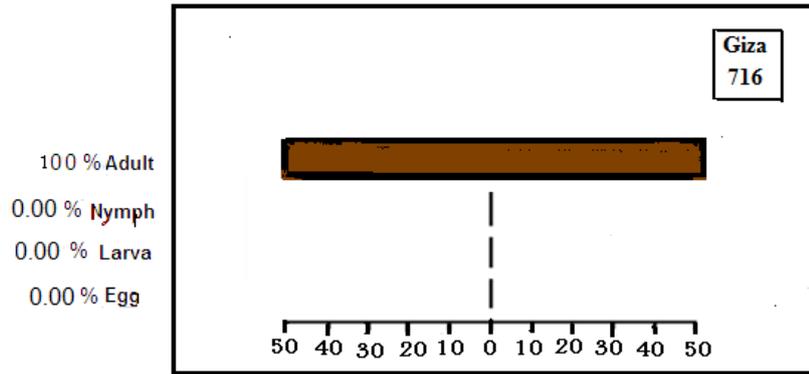


Fig. 1. Population age distribution of different stages of *Tetranychus urticae* on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

The results in Fig. (2) demonstrated that the age distribution of the predatory insect ; *Chrysoperla carnea* on G.716 cultivar was expanding where the percentage of adult stage was 36.36% less than egg stage which was 63.64% egg .

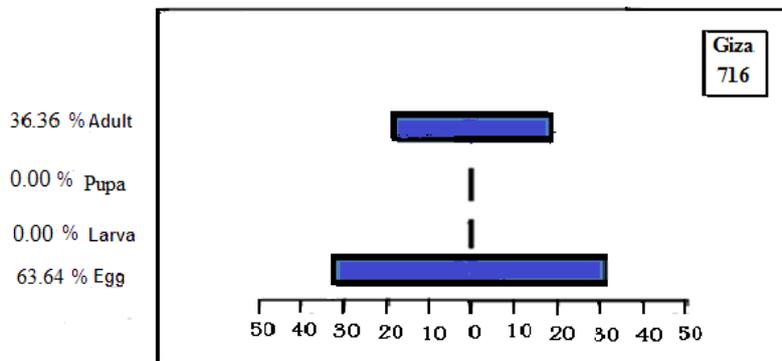


Fig. 2. Population age distribution of different stages of *Chrysoperla carnea* on faba bean plants during 2013/2014 season at Kafr El-Sheikh region .

*Chrysoperla carnea* is represented by a stationary pattern on sakha3 cultivar as in Fig .(3) hence percentage of eggs represent 50%and percentage of adult stage about 50% of total abundance of predator insect this means that this pattern in the future will stable where fertility rate equal to mortality rate ,and the larval stage was not detected .

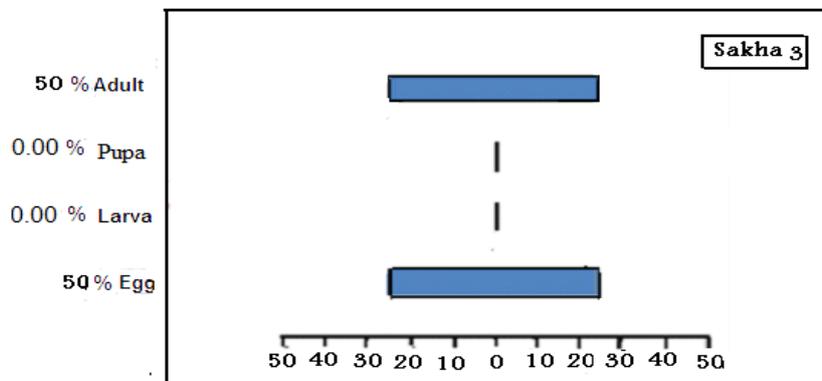


Fig. 3 . Population age distribution of different stages of *Chrysoperla carnea* on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

Results in fig. (4) indicated that age distribution of *Chrysoperla carnea* on G.40 cultivar is decline pattern . The adult stage occurred as 90% , while egg stage occurred as 10% of total abundance of this predator. Thus, the population of the predator is going to decrease. The larval stage did not found.

These results are in disagreement to Elsadany (2012)who found that the age distribution of *C. carnea* was expanding on clover at low traffic density location .

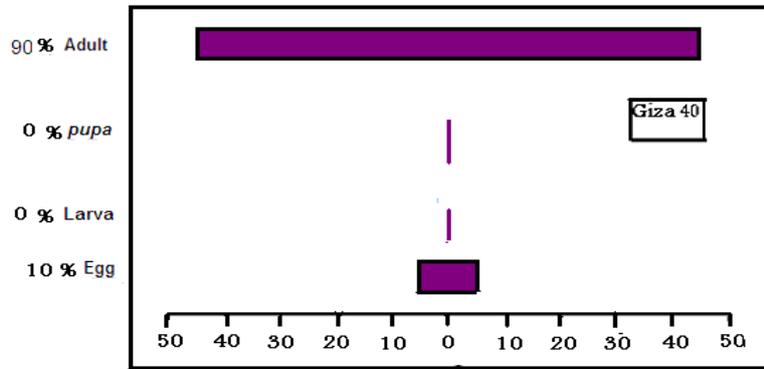


Fig. 4 . Population age distribution of different stages of *Chrysoperla carnea* on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

Figures (5&6) illustrated that the age distribution of predator insect ; *Aphidoletes aphidimyza* on two cultivars (Giza 716 and Sakha3) was expanding . This means that this predator may increase in the future where the larval stage represents 100% . However adult and egg stages were not recorded on two cultivars (G.716 and sakha3) of faba bean at Kafr Elsheikh region.G.40 cultivar of faba bean was free from the predator.

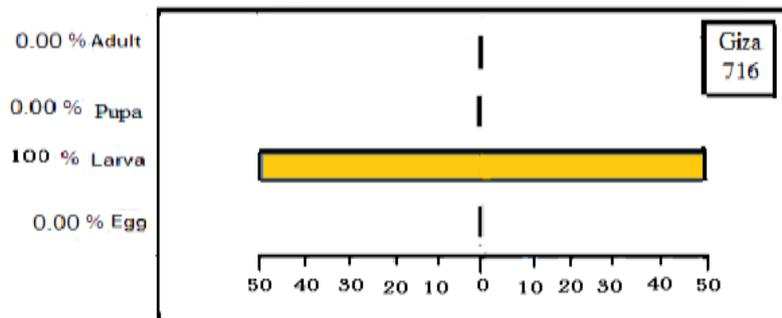


Fig.5. Population age distribution of different stages of *Aphidoletes aphidimyza* on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

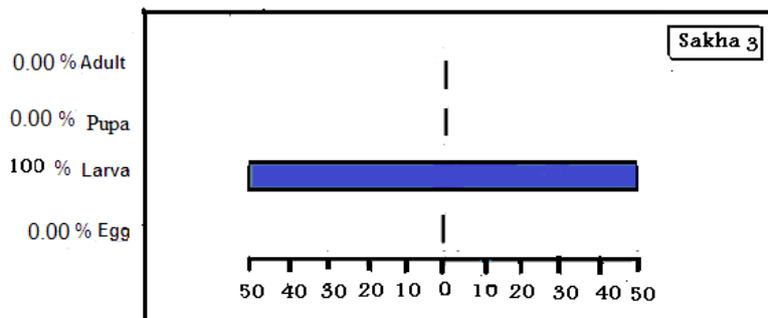


Fig.6. Population age distribution of different stages of *Aphidoletes aphidimyza* on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

The figures 7,8 and 9 are illustrated that the age distribution of *Aphis* spp. which include ; *Aphis craccivora* Koch and *Myzus persicae* Sulz was expanding population on three faba bean cultivars .The nymph stage more than percentage of adult stage and it was represented by 60%, 62.93% and 74.51% on the three cultivars, respectively.

This means that population of these pests may increase in the future at Kafr Elsheik region during 2013/2014 season these results are in agreement with Elsadany (2012) who mentioned that the age distributions of *Aphis* spp. which include *Aphis craccivora* and *Aphis gossypii* are expanding patterns during 2005/2006 season on clover leaves at high traffic density location .

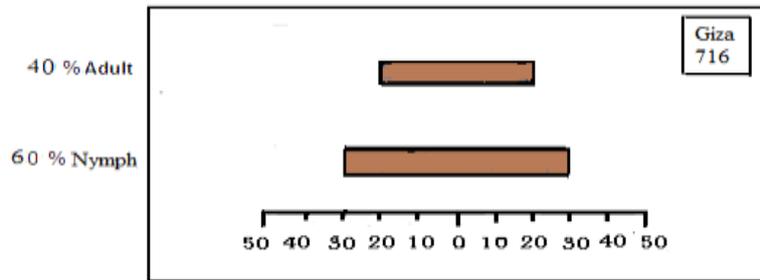


Fig.7. Population age distribution of different stages of *Aphis* spp. on faba bean plants during 2013/2014 season at Kafr El- Sheikh region.

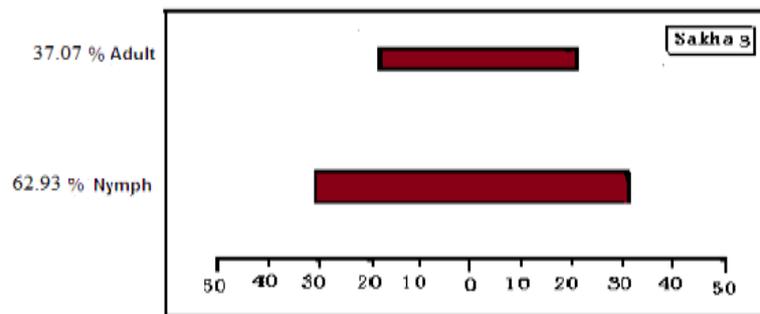


Fig.8. Population age distribution of different stages of *Aphis* spp. on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

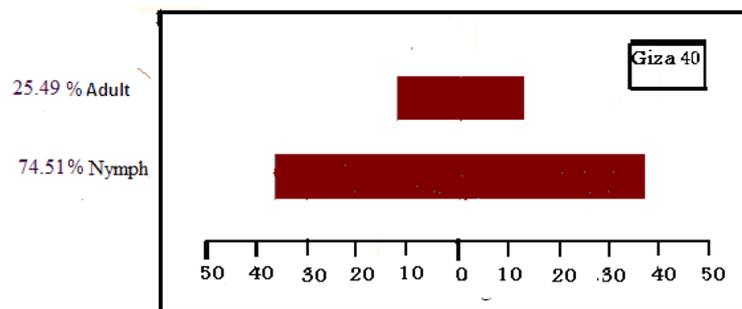


Fig.9. Population age distribution of different stages of *Aphis* spp. on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

Data in figure 10 indicated that age distribution pattern *Empoasca* sp . is expanding , as the nymph stage represents 58.62% but the adult stage represents 41.38, while eggs were not record on G.716 cultivar .

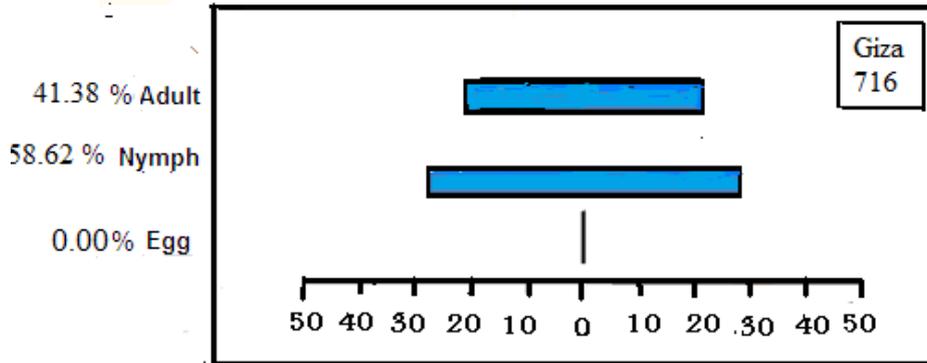


Fig. 10. Population age distribution of different stages of *Empoasca* sp. on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

Data in fig (11) revealed that the age distribution of pest which is called *Empoasca* sp. was decline population pattern on Shakha3 cultivars. This means that this pest may decrease in the future . The adult stage is represented by 57.26%, while the nymph stage represents 42.74%, and egg stage was not recorded

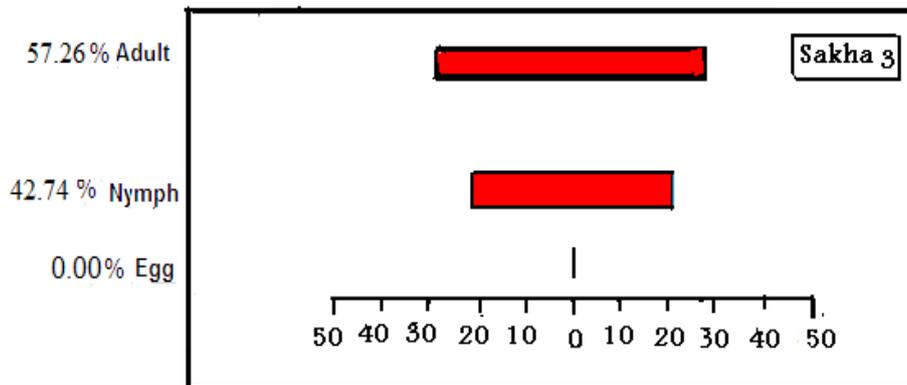


Fig. 11. Population age distribution of different stages of *Empoasca* sp. on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

The result in figure 12 demonstrated that the age distribution pattern of *Empoasca* sp. is expanding population where age pyramid form is wide at the base ,which indicates that there is an increase in fertility rate, where nymph stage is represented by 74.50% ,but the adult stage is represented by 25.50% on leaflets G.40 cultivar of faba bean.

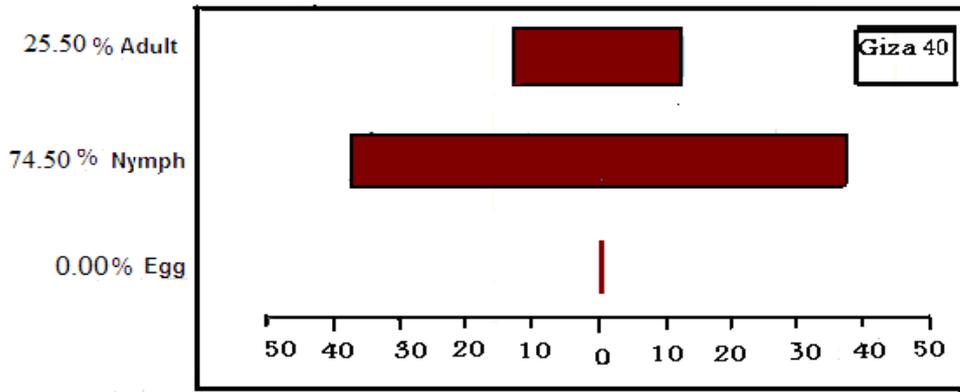


Fig. 12. Population age distribution of different stages of *Empoasca* sp. on faba bean plants during 2013/2014 season at Kafr El-Sheikh region.

### Relationship Between Phenols Leaflets Content of Faba Bean Cultivars and Arthropods Occurrence:

The correlation ( $r$ ) between concentration total phenols in leaflets of G.716 cultivars of faba bean and mean population mite species ; *Tetranychus urticae* was insignificant negative . The phytophagous mite was not recorded on leaflets of two cultivars (Sakha3 and G.40) of faba bean during 2013/2014 season as in Table (1).

These results are in agreement with Magouz et al .(2006) they found that correlation between concentration of total phenols and mean population of *T. cucurbitacearum* on soybean cultivars was negative but not significant .

Also, these results are similar to Elsadany and El-Shamy(2016) who mentioned that correlation between total phenols in G.843 cultivars of faba bean and mean population of mites species was negative and not significant .Also Table (1) showed that the correlation between predator insects and total phenols in G.716 cultivar of faba bean was positive but insignificant.

Data in table (1) revealed that relationships between mean populations aphids species , jassids ,and total phenols were negative or positive insignificant on three cultivar of faba bean.

These results are in contrast with Awadalla et al .(2013) who mentioned that population density of *Aphis craccivora* correlated with total phenols but the correlation was negative significant on different varieties of faba bean . Also these results partially agree with those Elsadany and El-Shamy (2016) who found that the correlation between population of moving stages of piercing sucking pests and total phenols was not significant positive on faba bean G.843 cultivar. Also these results are similar with El-Srand (2013) who found that population of piercing sucking insect ; white fly. correlated with total phenols but it was negatively insignificant on variety of faba bean. Also these results are in agreement with (Awadalla et al .,2013; Elsadany and El-Shamy,2016) they mentioned that the correlation between *Empoasca* spp . and total phenols was positive but not significant on different varieties of faba bean .

Table (1) Correlation (r) between total phenols leaflets content in different cultivars of faba bean and mite species, predator insects and some piercing sucking insects during 2013/2014 season Kafr Elsheikh region.

Cultivar	Total Phenols	Mite species	Predator insects	Aphids species	Jassid species
Giza716		-0.866 N.S	0.491 N. S	-0.458 N. S	-0.761 N. S
Sakha 3		-	0.999 *	0.991 N. S	0.600 N. S
Giza40		-	0.491 N. S	0.725 N. S	-0.446 N. S

\* = Significant at level ( 5% ) , N. S =not significant

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### ARABIC SUMMERY

نماذج التوزيع العمري لنوع من الأكاروس النباتي وبعض المفترسات الحشرية والحشرات الثاقبة الماصة المتواجدة علي الفول البلدي كطريقه للتنبؤ بالقدرات التكاثرية لهذه الأنواع وعلاقتهم بمحتوي الفينولات للورقة

ملكه فراج إبراهيم السعدني ١ ، محمد عزت عبد السلام ٢

- ١- قسم أكاروس القطن والمحاصيل - معهد بحوث وقاية النباتات - محطة البحوث الزراعية بسخا- كفر الشيخ - مركز البحوث الزراعية - الجيزة - مصر
- ٢- قسم المحافظه علي القطن - معهد بحوث القطن - مركز البحوث الزراعية - الجيزة - مصر

أجريت التجربة في محطة البحوث الزراعية بسخا محافظة كفر الشيخ خلال موسم ٢٠١٣ / ٢٠١٤ م يعتبر الفول البلدي محصولاً اقتصادياً هاماً ، لأنه يحتوي علي أعلى نسبة من البروتينات النباتية المنزرعة في مصر . يُهاجم هذا المحصول بعدد من الآفات كالأكاروس النباتي *Tetranychus urticae* والحشرات الثاقبة الماصة وهما نوعان من المن ( من البسلة الأسود ، ومن الخوخ الأخضر) والذبابة البيضاء والجاسيد وهذه الآفات تسبب خساره في محصول الفول البلدي علاوة علي نقلها لأمراض الفيروسية. سُجلت أعداد الآفات وأعدادها الحيوية علي وريقات الأصناف المختلفة للفول البلدي وهي جيزة ٧١٦ ، سخا ٣ وجيزة ٤٠ . تم حساب النسب المئوية للأطوار المختلفة للآفات المختلفة والمفترسات الحشرية للأصناف الثلاثة من الفول البلدي . كما درست نماذج التوزيع العمري للأكاروس وبعض الحشرات الثاقبة الماصة والمفترسات الحشرية كطريقه للتنبؤ بالقدرات التكاثرية واحتمالية استمرارية الأنواع في المستقبل عن طريق دراسته التوزيع العمري الذي يوضح في صورته الهرم العمري لكل نوع من الآفات والمفترسات الحشرية والذي يمثل توزيع النسب المئوية للمراحل المختلفة لكل أفة أو مفترس حشري.

ونماذج التوزيع العمري ثلاثة وهي :  
 أولاً: التوزيع العمري المتزايد ، ثانياً: التوزيع العمري المتناقص وثالثاً: التوزيع العمري الثابت.  
 أوضحت النتائج أن التوزيع العمري للمراحل المختلفة للأكاروس النباتي *Tetranychus urticae* كان متناقصاً علي صنف جيزة ٧١٦ وهذا يعني أن هذه الآفة يتوقع لها أن تنقص في المستقبل علي هذا الصنف . أوضحت النتائج أيضاً أن الأنواع الثلاثة لنماذج التوزيع العمري ظهرت في التوزيع العمري للمراحل المختلفة للمفترس الحشري أسد المن *Chrysoperla carnea* حيث وُجد هذا النوع من المفترسات الحشرية علي الأصناف الثلاثة للفول البلدي خلال موسم ٢٠١٣/٢٠١٤ . لكن التوزيع العمري للمراحل المختلفة للذبابة المقترسة *Aphidoletes aphidimyza* وللمن كان متزايداً وهذا يعني أن الذبابة المقترسة يتوقع لها أن تزداد في المستقبل علي هذين الصنفين من الفول البلدي وهما صنف سخا ٣ وجيزة ٧١٦ . وأيضاً التوزيع العمري للمن *Aphis* spp. كان يسمى التوزيع العمري المتزايد علي الأصناف الثلاثة للفول البلدي جيزة ٧١٦ ، سخا ٣ ، جيزة ٤٠ وهذا يعني أن هذه الآفة يتوقع لها أن تزداد في المستقبل علي الأصناف الثلاثة لكن كان التوزيع العمري لتعداد المراحل المختلفة من الجاسيد *Empoasca* sp. علي صنف جيزة ٧١٦ وجيزة ٤٠ توزيعاً متزايداً وهذا يعني أن هذه الآفة يتوقع لها أن تزداد في المستقبل علي هذين الصنفين ، بينما التوزيع العمري لهذه الآفة علي صنف سخا ٣ كان توزيعاً متناقصاً وهذا يعني أن هذه الآفة يتوقع لها أن تنقص في المستقبل علي هذا الصنف .  
 أوضحت النتائج أن ارتباط محتوى الفينولات الموجودة في وريقات الفول البلدي صنف سخا ٣ بالمفترسات الحشرية كان معنوياً موجباً .