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AN IMPACT OF PHOTOPERIOD ON THE GENERATION OF THE WINGED INDIVIDUALS IN THE POPULATION OF BLACK BEAN APHID (*Aphis fabae* Scopoli, 1763)

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ФОТОПЕРИОДИЧЕСКАЯ РЕГУЛЯЦИЯ ОБРАЗОВАНИЯ КРЫЛАТЫХ ФОРМ У СВЕКЛОВИЧНОЙ ТЛИ (*Aphis fabae* Scopoli, 1763)

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Abstract. The study of the process of migration in aphids has great practical importance. Thus, the aphids pass from one plant to another by these morphs and feed there and maintain their population by growing. The literature information on the research of the photoperiodic reactions in aphids is sufficient. However, the seasonal adaptation characteristics of sugar beet aphids have not been studied up to date in Azerbaijan. For this reason, the study of an impact of photoperiod on the emergence of winged ones in the population of black bean aphid is one of the important issues. During the study of reaction of individuals fed in the same routine against the photoperiod in the next generations, it has been defined that short photoperiod is more observed in the following generations. It seems that the information collected from the former generations is directly passed to the next generations. The results show that the continuous breeding of these species by means of parthenogenesis is only available in the long day (14, 16, 18, 24 hours) routine. However, the winged individuals prevail in the short photoperiods. The preference of winged individuals in 24 hours of photoperiod rather than others (14–18 hours) is probably related to the physiological changes occurs in them.

Аннотация. Вопрос о миграциях тлей имеет большое практическое значение, т. к. миграция, обеспечивая переход на растение более благоприятное для питания и размножения, служит основным средством, поддерживающим высокую численность тлей. Литературных данных по изучению фотопериодических реакций у тлей достаточно. Однако до сих пор изучению сезонной адаптации свекловичной тли в Азербайджане не уделялось внимание. Исходя из этого в данной работе особое внимание было уделено выяснению роли фотопериодических условий в регуляции образования крылатых форм этой тли. Результаты опытов показывают что, беспрерывное партеногенетические размножения у этой тли при 17 °С наблюдается только при длиннодневных фотопериодах (14; 16; 18; 24 час. св.). при короткодневных фотопериодах (10; 12 час. св.) процент образования крылатых форм варьирует от 43,4 до 70,5%. Важно отметить, что тенденция к формированию мигрирующих самок (в основном полоносок) в короткодневных условиях нарастает в ряду последовательных поколений.

Keywords: Aphis fabae, photoperiod, migration, gynoparae.

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Ключевые слова: свекловичная тля, фотопериод, миграции, полоноски.

The study of ecological characteristics in the insects requires revealing the methods between the behaviors of the individuals related to the environment. Such type of information is really essential for the detection of the activity indicators and mainly their migration.

The study of the process of migration in aphids has great practical importance. Thus, the aphids pass from one plant to another by these morphs and feed there and maintain their population by growing. The literature information on the research of the photoperiodic reactions in aphids is sufficient. Beginning from Markovich, the studies on various species have been carried out about this topic and important results have been gained. According to his studies on *Aphis forbesi* and other migrated species, Markovich defined that in these species the substitution of parthenogenesis reproduction with sexual reproduction and formation of migrants are related to the seasonal change of the day length [1, 2]. These results were confirmed by various authors as a result of studies on different species: *Macrosiphum solanifolii; M. euphorbiae* [3], *Aphis rumicis* [4], *Aphis chloris* [5], *Brevicoryne brassicae* and *Myzus persicae* [6], *Aphis gossypii*, *A. craccivora* [7], *Acyrthosiphon pisum* [8], *Megoura viciae* [9].

The breeding, oviposition, seasonal alternation of generation and migration are the important biological characteristics of the aphids. Some species differs for high specialization in food plants. All of the aphids develop almost in several types. These types vary for their morphology along with carrying out different functions in their life.

According to V. P. Nevskiy (1942), the main reason for migration is related to the decrease of quality of food plant [10].

Also, A. A. Popova (1950) explains that the main reason for migration is related to the decrease of quality of food plant in the aphids [11].

For V. V. Yakhontov (1956), the formation of migrants is related to the inconvenient condition [12].

Lees (1966) noted that temperature and photoperiod have a special role in the growth of aphids. At the same time, it shows that high temperature is involved in parallel with long photoperiod in the suppression of oviparous individuals of *Brevicoryne brassicae* aphids. According to him, polymorphism is regulated by photoperiod in the adults [13].

Bonnemaison (1958) indicates that *Sappaphis plantagineus* aphids are very sensitive to both temperature and photoperiod. The long photoperiod and high temperature affect same in the formation of the parthenogenesis individuals. However, the short photoperiod has an important role in the formation of Gynoparae [14].

As it is observed, there are various thoughts about the polymorphism in the aphids.

Material and method

The experiments have been carried out in the laboratory of Insect Ecology and Physiology (in 2013–2015) of the Institute of Zoology of the Azerbaijan National Academy of Sciences and in the Center (in 2017–2019) of Applied Zoology.

During the studies, the larvae took from individuals, fed in a stable mode in the laboratory (19-20 °C, 24 hours at light) and collected from nature were used.

The role of winged ones in the generation of photoperiod was followed in stable temperature (17 °C) and in seven photoperiods (8, 10, 12, 14, 16, 18, 24 hours at light).

The various sprouts of the peas planted in separate pots were used for the implementation of the experiments and the nutrition of the aphids. The plants on which the aphids are moved are

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covered with a glass cylinder that is closed at the top. The experiments were carried out in different variants, at least in 3 repeats. All of the experiments were carried out in photo thermostats which control temperature and photoperiod automatically [15]. The experiments and notes were carried out daily.

The mathematical results of the research were carried out according to Y. K. Merkuryeva [16].

Results and the analysis

According to our studies, it has been defined that photoperiod affects seriously to the formation of winged individuals in the colonies of black bean aphid.

Thus, 18,9% of the individuals in the first generation, 24,7% in the second generation, 28,6% in the third generation turn into winged individuals during 8 hours of photoperiod. It should be mentioned that the highest percent for the wing formation was recorded during 12 hours of photoperiod. In this photoperiod, 61,1% of the winged individuals was recorded in the first generation, 70,4% in the second generation, 80% in the third generation (Table).

Table

A ROLE OF PHOTOPERIOD IN THE FORMATION OF WINGED INDIVIDUALS IN THE POPULATION OF *Aphis fabae*

Generations	*Photoperiods (in hour) t=17 °C*													
	8		*10*		*12*		*14*		*16*		*18*		*24*	
	A	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*	*a*	*b*
I	90	18,9	88	37,5	90	61,1	90	8,9	90	4,4	87	3,4	90	6,7
II	89	24,7	91	43,9	88	70,4	90	6,7	88	3,4	90	2,2	86	9,3
III	91	28,6	90	48,9	90	80,0	90	7,8	90	4,4	88	2,3	88	12,5
Total	270	24,1%	269	43,3%	268	70,5%	270	7,8%	268	4,1%	265	2,6%	264	3,0%

a) the number of individuals used in the experiments (with numbers); b) the number of winged individuals (%)

It is interesting that at least few winged individuals are observed in the periods longer than (14, 16, 18, 24 hours) 12 hours of photoperiod. However, all of these individuals consist of winged migrants and breed by means of parthenogenesis. The most of individuals got from larvae developed in the short-day condition consist of sexuparae - gynoparae. The highest % is also recorded in 12 hours of photoperiod (55–60%).

During the study of reaction of individuals fed in the same routine against the photoperiod in the next generations, it has been defined that short photoperiod is more observed in the following generations. It seems that the information collected from the former generations is directly passed to the next generations (Figure).

The results show that the continuous breeding of these species by means of parthenogenesis is only available in the long day (14, 16, 18, 24 hours) routine. However, the winged individuals prevail in the short photoperiods. The preference of winged individuals in 24 hours of photoperiod rather than others (14–18 hours) is probably related to the physiological changes occurs in them.

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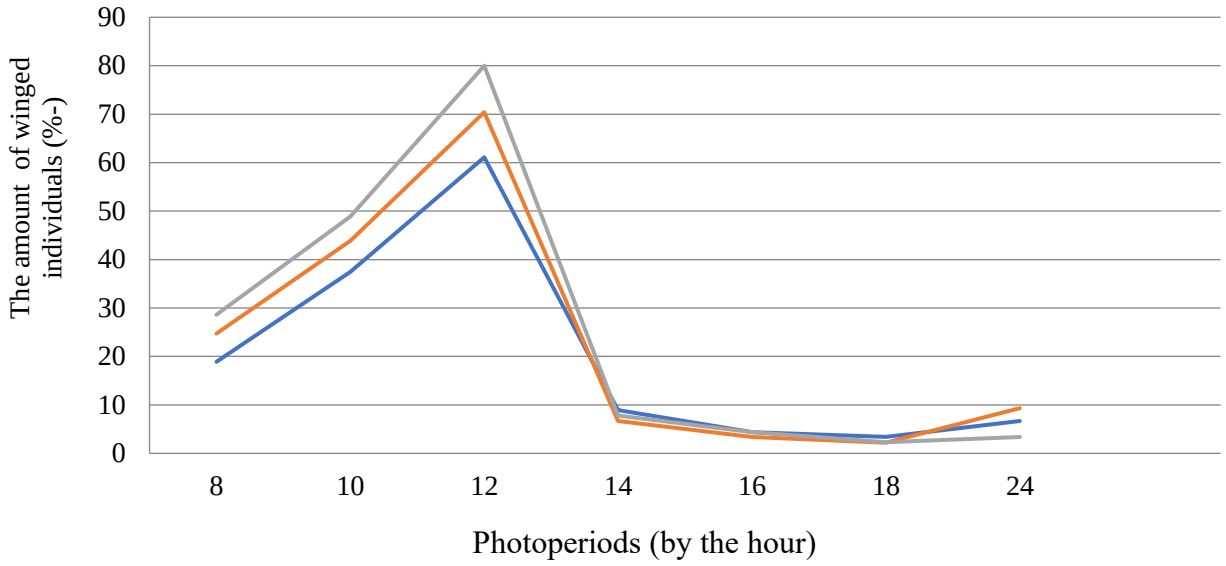

Figure. An impact of photoperiodic information on the next generations

The results obtained from the experiments coincide with the results obtained from the study of phenology of sugar leaf aphids. Thus, the longest day in Azerbaijan is observed in spring-summer (14–15 light h), in May - August, but the shortest day is observed in February - March and at the end of September, in October (12–10 light h). During the phenology observations, the observation of winged migrants in March, few migrants in July - August and sexuparae in September - October proves the importance of this pest in the seasonal adaptation.

Therefore, during the preparation of preventive measures for this pest its polymorphism characteristics should be considered.

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