

CHANGES OF CUTICULAR PROPERTIES IN ADULT *EPHESTIA CAUTELLA* (WALKER) LEPIDOPTERA: PYRALIDAE, DEVELOPED AFTER CESSATION OF EGGS GROWTH

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ABSTRACT

Both normally developed insects and insects developed after cessation of eggs growth were used in this work. Cessation of eggs growth occurred following abnormal conditions, which lasted for 3.5 months before developing into adults, due to the war led by the U.S. and her alliances against Iraq. These insects showed low rates of water contents and an active response to water loss. Therefore their tolerance of desiccation was weak. In addition, they had an active ability to restore their water loss quickly, after return them to a culture, this indicates that some changes occurred in their integumentary properties were not permanent and took their turn within one population only, but may or may not serve this population. That depends on the climatic factors.

INTRODUCTION

The first physiological study concerning water-relations of *Ephestia cautella* (Walker), was carried out by Al-Rubbaiee (1989). In his work, the effects of temperature and humidity on water loss were observed. Moreover, the active means of water loss and the role of endocrine control were investigated. In 1992, Al-Windawi studied the role of cephaloendocrine control on water content, loss of water at relative humidity stress. In their studies, they have used insects reared in a good-condition culture (food was available as well as optimal temperature and humidity). Females laying eggs after 3-5 days of mating. Eggs took 2-3 days for hatching. In the present study, eggs growth delay occurred and lasted from 17th, Jan, 1991 to the end of April 1991. The influence of growth delay on the insects water balance properties has not been studied yet, thus this work is an attempt toward the study of the effects of this delay.

MATERIALS AND METHODS

As a result of the Gulf war in 1991, eggs of *Ephestia cautella* (Walker) remained in a continuous darkness and a temperature below 15 °C, inside an incubator, for three and a half months before hatching. After electricity repair works, eggs were reared in incubator of 25 °C and 75-76% relative humidity.

Adults developed after cessation of eggs growth delay mentioned above, were used in this work to study the following parameters: (A) Water content: Water content of males and females (10 specimens of each) was measured by drying them at 60 °C until a steady weight was obtained. (B) Amount of water loss: Two sets of males and females (10 specimens of each) were used. Insects were kept individually in a closed perforated polythene polypots, which were weighed, both empty and with the specimen inside, reweighed after 24 hours of desiccation in a large glass desiccator over silica gel. This was to find out the amount of water

Cuticular properties of *Ephesia cutela*

loss of each individual. Perforated polytops lost insignificant weight and could be reduced to 0.00003-0.00005gm.(C) To lerance period of insects: Groups of insects, similar to those used above, were used. These individuals were kept at a very low relative humidity (5-8%) until reaching death. The prolonged time (days) was recorded. (D) The ability of recovering water content: Three groups of males (10 individuals of each) and three groups of females (10 individuals of each) were used. A group of males and another of females were used to find out their water content, immediately. The second group of males (10 specimens) and females (10 specimens) were subjected to a very low relative humidity (5-8%) over silica gel for 3 days. Then, water content of each group was measured following the procedure applied and described in A.

The last group of males and females (10 specimens of each) were kept in a very low relative humidity (5-8%) for three days and then, they were returned to normal-condition culture for 3 days before their water content was measured. All data obtained were compared with analogous data obtained at normal conditions, and considered as a control.

RESULTS

A) Water content	males	Females
1- Water content of insects developed from normally hatched eggs	69.07%	72.82%
2- Water content of insects developed from growth-delayed eggs	50.80%	60.99%
B) Amount of water loss		
1- Amount of w. l. of insects developed from normally-hatched eggs	13.27%	7.34%
2-Amount of w. l. of insects developed from growth delayed eggs	15.10%	9.21%
C) Tolerance period of insects		
1-Tolerance of insects developed from normally-hatched eggs	5	6
2- Tolerance of insects developed from growth – delayed eggs	4	4
D) The ability of recovering water content		
1- Water content of insects developed from normally-hatched eggs	62.10%	71.0%
2- Water content of insects developed from normally-hatched eggs, after(3) days of desiccation	54.18%	62.22%
3- Water content of insects developed from normally-hatched eggs, and predesiccated for (3) days, then fed for(3) days	51.90%	61.74%
4-Water content of insects developed from growth-delayed eggs	51.01%	61.17%
5- Water content of insects developed from growth delayed eggs after(3) days of desiccation	40.75%	50.26%
6- Water content of insects developed from growth-delayed eggs after 3 days of feeding following (3) days of desiccation	71.34%	70.0%

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DISCUSSION

In a first physiological study on *Ephestia cautella* (Walker), Al-Rubaiee (1989) found that the water content of the adult males was 72.2%, and that of the adult females was 76.1%. Moreover, he found that water loss from male adult insects was 21.5%, within 48 hours of desiccation. Adult females lost 9.32% of their body water within the same period of desiccation. Following this work, Al-Windawi (1992) studied the relation between water content, water loss and the cephalic neuroendocrine secretions. She found that the water content of the adult males was 63.1% and that of the females was 71.8%. Both workers have used normally-developed individuals, which have already been used in this work as a control. These insects showed that amounts of water content were close to those found by Al-Rubaiee. These amounts were 69.07% for males and 72.8% for females. In addition, the data showed an obvious decrease in the water content of both males and females, developed from growth-delayed eggs, compared with the amounts of normally-developed eggs. The water content of the males was lowered to 50.8% and that of the females was lowered to 60.9%. All differences between the values of normally-developed eggs and those developed from normally-delayed eggs were significant at $P < 0.001$.

On the other hand, the decline in the water content mentioned above was accompanied with increase of water loss (13.27% in normally-developed males and 15.1% in insects developed from growth delayed eggs, and 7.34% and 9.21% in females) respectively. The differences were found significant at $P < 0.001$.

In *Ephestia cautella*, the most effective route of water loss was through the cuticle (Al-Rubaiee, 1989). The cuticular water loss was a principle factor affecting the water content (Al-Windawi, 1992). She found that brain hormones plays (play) a role in the regulation of water content. Therefore, the decrease in water content and the increase in water loss are both an indication of a weak building-up of the cuticle, which became more permeable to water. This may have resulted due to an alteration of the role of the cephalic endocrine regulation on integumentary water loss. The tolerance of insects developed from growth delayed eggs confirmed the above result. Both males and females lasted for 4 days, whereas, males and females of normally-developed insects lasted for 5-6 days respectively. This is an indication of the fast loss of water and then the depletion of water content.

Investigation of the ability of the insects to recover their water content revealed an interesting result. Although insects developed from normally-hatched eggs had higher amounts of water content and lost lesser amount of water (which is coincident with the data previously explained), but they failed to restore their water content within (3) days of feeding. This is in insects developed from growth-delayed eggs in which they had restored it. This could be interpreted that these change shad occurred after growth-cessation of eggs (diapause-like) and may take their role in one population which suffered abnormal conditions.

Finally, these alterations in the properties of the integument may or may not serve the population, this being dependent on the nature of the climatic conditions.

LITERATURE CITED

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تغير الخواص الكيوتكلية (الجليدية) في بالغات حشرة عثة التين *Ephestia*
cautella (Walker) Lepidoptera: Pyralidae والمتطورة
من بيوض عانت توقفاً في النمو

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الخلاصة

جرت بعض الفحوصات المتعلقة بفقدان الماء من حشرة عثة التين *Ephestia cautella* ضمن حقل العلاقات المائية في الحشرات. وقد استخدمت في هذا البحث حشرات نمت وتطورت بشكل اعتيادي وحشرات أخرى تأخر فقس بيوضها لمدة ثلاثة أشهر ونصف بسبب تأثيرات الحرب التي قادتها الولايات المتحدة وحلفائها ضد العراق في سنة ١٩٩١ قبل أن تنمو وصولاً للبالغات.

أبدت هذه الحشرات معدلات محتوى مائي واطيء واستجابة فعالة لفقدان الماء قياساً بالحشرات النامية اعتيادياً. لهذا كان تحملها للجفاف ضعيفاً. اضافة الى ذلك فانها أبدت قدرة فعالة في استعادة ماء جسمها بسرعة بعد اعادتها الى وسط جيد وهذا يشير الى أن هذه التغيرات في الخواص المشار لها أعلاه ليست دائمية، وتأخذ دورها خلال جيل واحد، ولكنها ربما تستخدم أو لا تستخدم هذا الجيل، وهذا يعتمد على إلى العوامل المناخية.