



Otros

## Trabajo Original

### *Carpoglyphus lactis* (Carpoglyphidae) infestation in the stored medicinal *Fructus Jujubae*

#### *Infestación por el ácaro Carpoglyphus lactis (Carpoglyphidae) en frutas desecadas (Fructus Jujubae) para usos médicos*

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### Abstract

**Objective:** To investigate the breeding rate and breeding density of *Carpoglyphus lactis* in stored *Fructus Jujubae* in Anhui, China in order to provide a scientific basis for prevention of *Carpoglyphus lactis* (*C. lactis*) from spoiling the dried fruit of such category.

**Methods:** By the breeding nature of *C. lactis*, we collected samples of *Fructus Jujubae*, which were kept over 6 months in general, from the dried fruit shop and (or) Chinese herbal medicine warehouse, and isolated *C. lactis* from those samples. The mite specimens were prepared, and microscopically and morphologically identified.

**Results:** *C. lactis* was identified in 19 of the 300 samples, with breeding density and breeding rate of 6.52 heads/g and 6.33%. Constitute ratio at distinct developmental phase was associated with adult (including nymph, 85.71%), larva (12.27%), hypopus (0.56%) and egg (1.45%), respectively. The richness index, diversity index and evenness index was 1.644, 1.644 and 0.923, respectively.

**Conclusion:** *Carpoglyphus lactis* appears infesting in large quantity in the *Fructus Jujubae* stored in the above places in Anhui province, and the density is higher. Therefore, it is urgent to take effective measures to prevent *C. lactis* from spreading over other dried products stored in the same room and potential human intestinal acariasis as a result of the biological contamination.

#### Key words:

Carpoglyphidae.  
Storage. *Fructus Jujubae*.  
*Carpoglyphus lactis*.

### Resumen

**Objetivo:** investigar la tasa de reproducción y densidad de cría de *Carpoglyphus lactis* en productos almacenados de *Fructus jujubae* en Anhui, China, con el fin de proporcionar una base científica para prevenir el deterioro de la fruta desecada de dicha categoría.

**Métodos:** para la cría de *C. lactis* hemos recogido muestras de *Fructus jujubae*, que se mantuvieron a temperatura ambiente durante 6 meses, en la tienda de frutas secas o en el almacén de hierbas medicinales y se aislaron *C. lactis* de esas muestras. Se prepararon los especímenes del ácaro y se identificaron microscópicamente y morfológicamente.

**Resultados:** *C. lactis* fue identificado en 19 de las 300 muestras, con densidad de cría y reproducción índice de 6,52 cabezas/g y 6,33%. La proporción de ácaros en las distintas fases de desarrollo fue: adultos (incluida la ninfa, 85,71%), larva (12,27%), *hypopus* (0,56%) y huevo (1,45%). El índice de riqueza, el índice de diversidad y el índice de uniformidad fue de 1,644, 1,644 y 0,923, respectivamente.

**Conclusión:** el ácaro *Carpoglyphus lactis* infesta en gran cantidad los almacenes de *Fructus jujubae* de la provincia de Anhui (China). Por lo tanto, es urgente tomar medidas eficaces para prevenir la propagación del ácaro sobre productos secos almacenados en la misma habitación y la posible acariasis intestinal humana como consecuencia de la contaminación biológica.

#### Palabras clave:

Carpoglyphidae.  
Almacén.  
*Fructus Jujubae*.  
*Carpoglyphus lactis*.

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## INTRODUCTION

*Carpoglyphus lactis* (*C. lactis*), also known as *Acarus dysenteriae*, belongs to *Carpoglyphus* under *Carpoglyphidae* of *Astigmata*. It is not only a stored product mite infesting saccharide-rich stored commodities including dried fruits, candied fruits, sweet drinks and sugars of variety (1), but also capable of causing intestinal acariasis (2-4) or other conditions. *Fructus Jujubae*, apart from its culinary use, is also an important Chinese traditional medicine that functions to replenish spleen and stomach, nourish the blood and soothe the mind and moderate the action of herbs. However, few studies are available on the infestation of *C. lactis* with such dried fruit. Between November of 2009 and 2011, we conducted a survey on the infestation status of such mite with *Fructus Jujubae* in stored *Fructus Jujubae* that were collected in 30 groceries and/or warehouses for traditional Chinese medicinal herbs throughout 17 cities in Anhui province of China.

## MATERIALS AND METHODS

### SAMPLE COLLECTION

The intended *Fructus Jujubae* samples were collected from the dried fruit shops and/or warehouses for traditional Chinese medicinal herbs in compliance with the inhabiting nature of acaroid mites. All samples were kept more than 6 months, and taken by 10 aliquots weighing 10 g for each. Each sample was sealed in a sampling bag on spot and taken back to laboratory, where weighing was checked. The ecological data were collected with the ecological instrument.

### ISOLATION OF THE ACAROID MITE SPECIMENS

Mites in the samples were isolated by using both directcopy and redricopy, and then were made of slides, either for temporary or permanent use, according to previous descriptions (5-7). Classification of the mites, together with its identification and count, was performed under light microscope in compliance with the taxonomic system described by Hughes (1976) (8,9).

### DATA PROCESSING

Data on isolated *C. lactis* were determined as the following formula:

- B (Breeding rate) =  $(p/t) \times 100\%$  (p stands for the copies of *C. lactis* found in the samples, t for the total number of samples collected in different storages).
- C (Constituent ratio) =  $(A/N) \times 100\%$  (A stands for the total number of *C. lactis* at a certain development stage, N for complete breeding individual count).
- D (Breeding density) =  $N/T$  (N represents total number of breeding individuals, and T, sample weight).

- Richness index were denoted by Margalef index,  $R_{\text{margalef}} = (S-1)/\ln N$  (S stands for the number of species, and N the number of individuals).
- Diversity index were represented by Shannon-Wiener index as  $H'$  (species diversity index) =  $-\sum P_i \ln P_i$ , ( $P_i$  = proportion of total sample represented by species  $i$ ).
- Evenness index were denoted by Pielou index as  $J = H'/H'_{\text{max}}$ , where  $H'$  is the number derived from the Shanon diversity index and  $H'_{\text{max}}$  is the maximum value of  $H'$ .

## RESULTS

### CARPOGLYPHUS LACTIS BREEDING STATUS IN FRUCTUS JUJUBAE

*C. lactis* was found in 19 of 300 samples of *Fructus Jujubae* collected in the dried groceries and/or warehouses for traditional Chinese medicinal materials from in 17 cities in Anhui province. The breeding rate was 6.33% (19/300), and the breeding density in 19 samples varied from minimal 3 heads/g to maximal 11 heads/g, with 6.52 heads/g on average (1,239/190 g). Mixed statistics of the *C. lactis* in the 19 samples showed that different development stage of this mite included adults (including nymphs ) of 1,062 heads, larvae of 152 heads, *hypopus* of 7 heads and eggs of 18, and its constituent ratio at different development stage was 85.72% (adult, including nymphs), 12.27% (larva), 0.56% (*hypopus*) and 1.45% (eggs).

### MITE SPECIES IDENTIFICATION

#### Adult mites

The idiosoma of male is ovoid and slightly flattened, and measures 380~400  $\mu\text{m}$  in length. The feet and chelicerae are light red. The gnathosoma is conical and flexible activities, and the chelicerae presents with a scissor-shape. The shoulder region is well-defined and the rear edge is truncated shape or slightly concave. It has no dorsal propodosomal shield. Ventrally, the apodemes are well-sclerotized, and the apodemes of leg I join in midline to form a sternum that is shaped "X" to articulate with the apodemes of leg II. Genital aperture is located between the coxae III and IV. The penis is bent tube with the top being straight, and the genital sensory looks very long. There are two pairs of almost isometric genital setae. With the exception of the *sae* and *pa*, all setae in the dorsal idiosoma appears short, with rounded ends, yet longer *ve* was long.

The idiosoma of female, very similar to the male, varies from 380 to 420  $\mu\text{m}$ . On the ventral side of the idiosoma, the sternum and apodemes II are fused to a genital plates covering the anterior end of the genital opening. The genital folds are not well sclerotized and located between the coxal II and III. Anal pore extends almost to body trailing edge, and has a pair of anal setae. The bursa copulatrix looks lik a round hole, which is located at the dorsal end of the body back.

## The larva

Idiosoma of a larva measures approximately 180 µm in length, with 3 pairs of legs. *Pa*<sub>1</sub> is the longest seta. All setae in idiosoma back are short, with rounded ends as the adults. There is no *Sai* and *Sae*, and there are no coxal rods in ventral surface and no traces of reproductive organs. Genital setae and former anal setae are absent.

## Protonymph

Body length of typical protonymph is about 210 µm, with 4 pairs of legs. *Sae* and *Pa*<sub>1</sub> are the longest setae on idiosoma. There is one pair of genital organ (GS) on ventral side, and a pair of genital setae (h) and former anal setae (Pra). Characteristic lull protonymph has 4 pairs legs contracted to the body and body back uplifting as hemisphere shape, shiny and glass like. The second pair of genital organ GS can be seen through the transparent shell. The protonymph was molted into the tritonymph in later stage.

## Tritonymph

Its body length is some 250 µm. Apart from the *sae* and *pa*<sub>1</sub>, all setae in idiosoma back are short, with rounded ends, and the number and location are similar to adult mite. Two pairs of genital organ GS occur on ventral side. There is individual pair of genital seta (f, h, i) and preanal seta.

## Hypopus

The hypopus is mobile, which makes hard to detect. It measures approximately 270 µm in length, and presents with oval shape and yellow. Darker color stripes are seen on the back. The gnathosoma is small and partly covered by idiosoma.

## The eggs

The shape of the eggs is oval and milky white. Egg shell is translucent. Embryonic form of larval can be seen in the late stage of embryonic development.

## ECOLOGICAL PARAMETERS FOR *C. LACTIS* FOUND IN THE *FRUCTUS JUJUBAE*

The average breeding density of *C. lactis* in the *Fructus Jujubae* was 6.52 heads/g, the richness index, 1.64, the diversity index, 1.91 and evenness index, 0.92. These findings suggested that *Fructus Jujubae* stored in our sampling places were seriously infested by *C. lactis*. Although this species are rich in diversity, yet category remained relatively stable.

## DISCUSSION

*C. lactis* is one sort of storage mites with small individual, and widely distributed throughout the world. It likes living in a surrounding of moistness with low temperature, and particularly tends to breed in large quantity in the summer and autumn seasons (10-13). *C. lactis* can be found in sugary foods, such as white sugar, brown sugar, fruit sugar, biscuits, Shaqima, pastries, yogurt, candied fruit, prunes, dried plum, red dates, black dates, dried persimmons and the like (14, 15). It can also grow and reproduce even if its whole body is soaked into the sugar solution (16). It was reported that, when *C. lactis* was reared in a tank using Cuban sugar as feeds, it was capable of surviving in a life cycle of some 13 to 18 days in temperature of 25 °C ± 1 °C with relative humidity of 75% (17). The life cycle of *C. lactis* can generally experience five stages, namely the egg, larva, protonymph, tritonymph and adult mites. However, another 24-hour quiescent stage will occur following the larva, protonymph and tritonymph, which is termed as larva, protonymph and tritonymph quiescent stage. In addition, a second nymph known as hypopus will occur between the protonymph and the tritonymph (18). The hypopus is mobile and hard to be detected, for its formation may be resistance purpose to the adverse environment and ensuring spread of the species.

Blossoming of *C. lactis* not only cause deterioration, contamination and reduced function of *Fructus Jujubae*, but also leads to human acarriasis, including skin mite disease, pulmonary acarriasis, duodenal ulcers and other intestinal conditions (19-21). Intestinal acarriasis is a digestive disease caused by the mites that parasitize in the enteric cavity or bowel walls. Although the mild symptoms may reverse without any intervention in clinic, yet severe case can be complicated with abdominal pain, diarrhea, abdominal discomfort, weight loss, fatigue, lacking of energy, etc. (22). Once the *C. lactis* or other mites gets into the intestine, its chelicerae and claws can cause mechanical irritation to the intestinal wall, or even invade the intestinal mucosa layer or deeper bowel tissues, finally leading to intestinal necrosis and inflammation as well as duodenum ulcers (23). Discharges, the shell, metabolites and lysates of dead body of *C. lactis* can cause allergic reactions, which potentially result in gastrointestinal symptoms such as diarrhea, abdominal pain and anal burning sensation of the anus 24. Since the body of *C. lactis* is as small as dust, it can easily carry the infection through a variety of ways, and be serious damage to food products, sugar industry as well as serious threat to human health (25-28). Additionally, *C. lactis* is often associated with *Tyrophagus putrescentiae* and *Suidasia nesbitti*, which further increase hazards to food products (29,30). Therefore, understanding of the morphology and breeding conditions of *C. lactis* in the stored commodities with high sugar content has great importance.

In current study, we collected the *Jujubae* samples (over 6 months in storage) from the dried fruit shops and/or warehouses for Chinese medicinal herbs according to the breeding habits of *C. lactis*, which was found in large quantity. This indicates that this species universally occur in the stored medicinal *Fructus Jujubae*, and requires our great attention, because infesting of *C. lactis* with

*Fructus Jujubae* can lead to deterioration, mildew and decreased quality of this stored fruit.

We only prepared slides for parts of the mite specimen isolated from the *Fructus Jujubae* for identification, and other mite species were not included. And it is impossible to make a thorough isolation of the *C. lactis* from the samples. This means that the actual mite density in the samples should exceed our final count. Again, the breeding density of mites in full samples was indirectly estimated on individual sample basis, that merely makes a reckoning of the breeding density of *C. lactis* by and large in each sample. Current research data have shown that *C. lactis* may migrate and spread over ambient materials when their density was increased to a certain extent, and the migration process is prone to spreading of bacteria, fungi and other microbes. This implies that *C. lactis*, once occurred in storage environment, should be properly limited to prevent its spreading.

In summary, we preliminarily investigated the prevalence of *C. lactis*, with regard to its species, breeding density and diversity, in the stored *Fructus Jujubae* in Anhui Province. Our findings may supply a scientific evidence for planning appropriate strategies in prevention and control of this stored product mite.

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