

# House Dust Mites in Erzincan Province

## Erzincan İl'inde Görülen Ev Tozu Akarları

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### ABSTRACT

**Objective:** We aimed to determine the species of the house dust mites seen in Erzincan, the number of mites per gram of dust in the houses, and the relationship between temperature and the number of mite specimens.

**Methods:** For this purpose, 54 dust samples collected from 18 houses located in different districts of Erzincan province between November 2013 and January 2014. These samples were examined by a lactic acid precipitation method.

**Results:** Of the houses in which the dust samples were collected, 94.44% were found to be positive in terms of mites. A total of 844 mite specimens were isolated from the dust samples, and the mean number of mites per gram of dust was found to be 18.34. The most common species was found to be *Acarus siro* (55.55%) and was followed by *Dermatophagoides pteronyssinus* (50.00%), *Tyrophagus putrescentiae* (22.22%), *Histiostoma* sp. (22.22%), *Lepidoglyphus destructor* (16.66%), *T. perniciosus* (11.11%), *Euroglyphus maynei* (11.11%), *Glycyphagus privatus* (11.11%), *Cheyletus* sp. (11.11%), *Tarsonemus* sp. (11.11%), and *Tetranychus* sp. (11.11%).

**Conclusion:** Mite-holding rate of the houses in Erzincan province was found to be 94.44%. The mean number of mites per gram of dust was found to be 18.34. The most common mite species was *A. siro*, which was followed by *D. pteronyssinus*.

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**Keywords:** House dust mite, allergy, temperature, Erzincan

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### ÖZET

**Amaç:** Bu çalışma Erzincan'da görülen ev tozu akar türlerini belirlemek, 1 g tozda bulunan akar sayısını tespit etmek ve ortam sıcaklığı ile akar sayısı arasındaki ilişkiyi araştırmak amacı ile yapılmıştır.

**Yöntemler:** Bu amaçla Erzincan ilinin farklı mahallelerinde bulunan 18 evden Kasım 2013 ile Ocak 2014 tarihleri arasında 3 ay süresince 54 toz örneği toplanmış ve laktik asitte çöktürme yöntemi ile incelenmiştir.

**Bulgular:** Toz örneği alınan evlerin %94,44'ü akar bakımından pozitif bulunmuştur. Toz örneklerinden toplamda 844 akar örneği izole edilmiş, gram toz başına düşen ortalama akar sayısı 18,34 olarak belirlenmiştir. Evlerde en sık rastlanan tür *Acarus siro* (%55,55) olmuş, bunu sıra-

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si ile *Dermatophagoides pteronyssinus* (%50,00), *Tyrophagus putrescentiae* (%22,22), *Histioglyphus* sp. (%22,22), *Lepidoglyphus destructor* (%16,66), *T. perniciosus* (%11,11), *Euroglyphus maynei* (%11,11), *Glycyphagus privatus* (%11,11), *Cheyletus* sp. (%11,11), *Tarsonemus* sp. (%11,11) ve *Tetranychus* sp. (%11,11) izlenmiştir.

**Sonuç:** Erzincan'da evlerin akar bulundurma oranı %94,44 olarak belirlenmiştir. Gram toz başın düşen ortalama akar sayısı 18,34 olarak bulunmuştur. Evlerde en sık rastlanan türün *Acarus siro* olduğu ve bunu *Dermatophagoides pteronyssinus*'un takip ettiği görülmüştür. (*Türkiye Parazitoloji Dergisi* 2015; 39: 124-30)

**Anahtar Sözcükler:** Ev tozu akarı, alerji, sıcaklık, Erzincan

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## INTRODUCTION

House dust mites belonging to the subclass Acari are members of arachnid organisms. They difficult to see with the naked eye as their body size is approximately 100–400 µm. In houses, they are found in carpets and fabric-covered furniture, in particular, in living rooms and in beds, pillows, sheets, comforters, and carpets close to the bed in bedrooms. Their basic food sources are protein- and lipid-rich human skin rashes. In general, the term "house dust mites" is used to describe the mite species of *Dermatophagoides pteronyssinus*, *D. farinae*, and *Euroglyphus maynei*, which belong to the family Pyroglyphidae and continuously live in house dust. These mites transform from the egg stage to the adult stage within 3 to 4 weeks under humid conditions at temperature of 25–30°C. The average lifetime of adult mites is 4–6 weeks, and every female mite produces approximately 40–80 eggs during this time, which helps maintain this population (1).

Today, many commonly seen allergic diseases, including allergic asthma, allergic rhinitis, allergic conjunctivitis, and eczema, are caused by allergens. The most common allergens are house dust mites, which are too small to be visible. The impact of these mites as allergens results from their stools of 20–50 µm, which are digestive tract residues. Colloff (1) cited from a study by Tovey et al. (2) that mites defecate a mean of 20 times a day. These stools containing various chemicals belonging to mites remain suspended in air for a while depending on several activities in houses and are then taken into the body by inhalation. As a result, these stools stimulate the immune system in atopic (prone to allergy) individuals, initiating allergic reactions (1).

Approximately, 1–2% (65–130 million people) of the world population have house dust allergens (1). According to data from the World Health Organization, 235 million people in total are asthmatics, with children being the most commonly affected, followed by adults. More than 80% of deaths from asthma occur in low-and middle-income countries (3). These diseases may affect physical and psychosocial as well as school life and workforce of the patients. Similar to all over the world, house dust mites are a crucial problem in our country because of their impact both on the health and economy (4).

The determination of mite species in a residential area is very important for the elimination of allergic reactions seen in the area. On the contrary, although some studies have been conducted in our country on house dust mites, these are not sufficient. No previous study has been conducted in Erzincan province, which was selected as our study center, supporting this opinion. The objective of this study was to define the house dust mites seen in Erzincan province.

## METHODS

The study was conducted in Erzincan province between November 2013 and January 2014. The study protocol was approved by the Chairman Ethics Committee of Erzincan University. Written informed consent was obtained from all participants whose homes included in the study. Within the scope of the study, a total of 54 dust samples was collected from 18 houses located at different sites in the city, once a month for three months. Indoor and outdoor temperatures of the houses and temperature of the surface from which the dust samples were collected were measured using an infrared thermometer (Trotec; Grebbener Strasse, Germany). The dust samples were collected from carpets and fabric-covered furniture in living rooms and from beds, pillows, sheets, comforters, and carpets close to the bed in bedrooms using a 1200 W vacuum cleaner (Bosch; München, Germany) applied on an area of 1 m<sup>2</sup> for 2 min. To prevent mixing of house dusts with each other, disposable dust bags were used. In addition, subtracting hoses and mouthpieces of the vacuum cleaners were removed and cleaned in each house to prevent any possible contamination. The dust samples collected from the houses were put into locked plastic bags with the dust bags, labeled, and brought to the laboratory as soon as possible (maximum in 12 h). The samples were then taken from the bags and were sifted through dry sieves having 1 and 0.5 cm pores, which were inserted under each other with a distance of 5 cm between them for separating coarse particles. After the dry sieving process, the samples were weighed using an assay balance to define the number of mites per gram and were studied through Spiekma-Bozeman's modified lactic acid precipitation method (5).

In the lactic acid precipitation method, 1 g of dust sample was put into a Petri dish; 90% lactic acid was poured on it, and the Petri dish was mixed with manual rotating movements to obtain a homogeneous mixture. The petri dishes were put on a hot plate heated up to 70–80°C. After waiting for 1 h to separate small dust particles in it and to make it clearer, the dishes were removed from the plates and were left for cooling (1).

The complete area of the Petri dishes was examined under a stereo microscope (Leica Microsystems; Heerbrugg, Switzerland), and the visible mites were collected with the help of a fine-tipped needle. Mites obtained from the dust samples were collected and put into small Petri dishes containing 90% lactic acid and were kept for a day to be cleansed and cleared. After ensuring that the mites in the dishes were cleansed and whitened, indissoluble preparations were prepared in Hoyer's medium (20 mL glycerine, 30 g crystalline Arabic gum, 50 mL pure water, and 200 g chloral hydrate) (6). The mites were identified under a phase-contrast light microscope (Leica Microsystems; Heerbrugg, Switzerland) in accordance to relevant literature (1, 6-12).

The dust samples and the houses from which the dust sample were collected were considered to be positive in terms of mites in case of the existence of larva, nymphs, or adult individuals. The mean number of mites per gram of dust was calculated by dividing the total mites collected from the mite (+) samples to the number of mite (+) samples.

Statistical analysis of the data obtained was performed using the Statistical Package for Social Sciences for Windows version 19.0 (SPSS, Chicago, IL, USA) software.

**RESULTS**

During the study period, 46 of the 54 (85.18%) dust samples collected from 17 of the 18 (94.44%) houses from which the samples were obtained were found to be mite-positive. Of the 46 mite-positive samples, a total of 844 mites were isolated. A minimum of 2 and maximum of 250 mites were found in the dust samples that weighed 1 g, and the mean number of mites was found to be 18.34 per gram (Table 1).

In this study, a total 844 mite specimens were isolated with 692 from the order Astigmata, 78 from Prostigmata, 70 from Mesostigmata, and 4 from Cryptostigmata. The identification of the isolated mites belonging to Astigmata was performed at the species level, and a total of seven species belonging to the family were detected. *Acarus siro* from the family Acaridae was the most commonly seen mite in the houses (55.55%) followed by *D. pteronyssinus* (50.00%), *Tyrophagus putrescentiae* (22.22%), *Histiostoma* sp. (22.22%), *Lepidoglyphus destructor* (16.66%), *T. perniciosus* (11.11%), *Euroglyphus maynei* (11.11%), and *Glycyphagus privatus* (11.11%) (Figures 1-7). Mites belonging to the order Prostigmata were identified at the genus level, and in total, three genera from three families (*Cheyletus* sp., *Tarsonemus* sp., and *Tetranychus* sp.) were detected, while the identification of the mites belonging to Mesostigmata and Cryptostigmata remained at the order level (Table 2).

During the course of dust collection from the houses, the surface temperature was found to be a minimum of 16°C, a maximum of 23.5°C, and an average of 18°C as recorded by the infrared thermometer. The minimum indoor temperature was found to be 19°C; the maximum was 24.9°C and the average was 21.2°C. In addition, the outdoor temperature was found to be a minimum of -13.6°C, a maximum of 20.7°C, and an average 3.9°C (Table 3).

These temperatures and the number of mite specimens isolated from the house dust samples were analyzed by Spearman's cor-

relation test. A significant positive correlation was found in our study among the indoor temperature of the house, temperature of the surface, and number of mite specimens. No significant

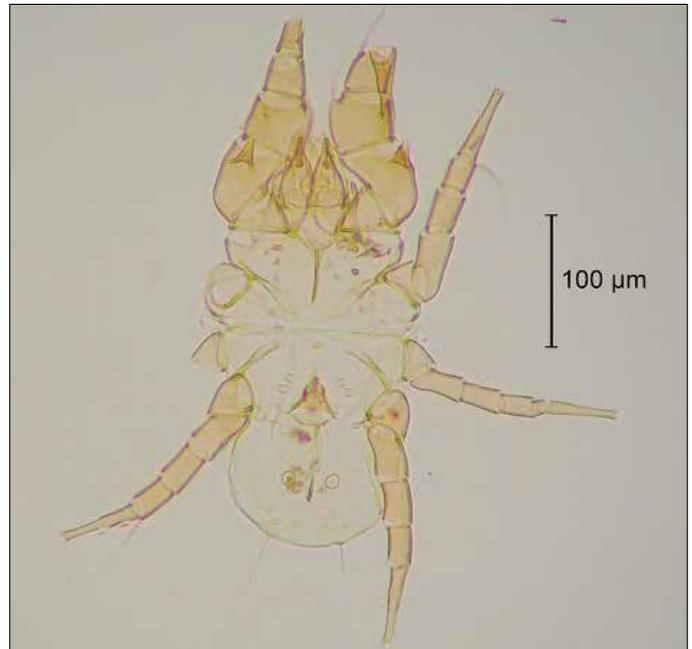


Figure 1. *Acarus siro* (male)

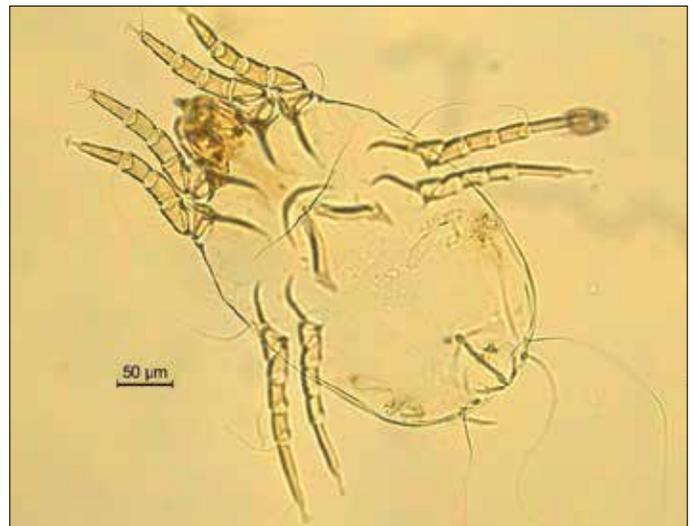


Figure 2. *Dermatophagoides pteronyssinus* (female)

**Table 1.** The incidence of house dust mites in Erzincan province and number of mites in 1 g of dust

	Number of houses		Number of collected dust samples		Number of isolated mites	Number of mites in the dust samples that weighed 1 g		
	n	%	n	%		Minimum	Maximum	Average
Mite (+)	17	94.44	46	85.18	844	2	250	18.34
Mite (-)	1	5.56	8	14.82	-	-	-	-
Total	18	100	54	100	844	2	250	18.34

(+) present  
(-) absent

**Table 2.** Incidence of house dust mites in Erzincan

Mites	Number of houses (n:18)	Incidence in houses (%)	Number of isolated mites
Astigmata	15	83.33	692
<i>Acarus siro</i>	10	55.55	516
<i>Dermatophagoides pteronyssinus</i>	9	50.00	44
<i>Tyrophagus putrescentiae</i>	4	22.22	38
<i>Histioglyphus</i> sp.	4	22.22	24
<i>Lepidoglyphus destructor</i>	3	16.66	10
<i>Tyrophagus perniciosus</i>	2	11.11	36
<i>Euroglyphus maynei</i>	2	11.11	20
<i>Glycyphagus privatus</i>	2	11.11	4
Prostigmata	6	33.33	78
<i>Cheyletus</i> sp.	2	11.11	30
<i>Tarsonemus</i> sp.	2	11.11	20
<i>Tetranychus</i> sp.	2	11.11	28
Mesostigmata	4	22.22	70
Cryptostigmata	1	5.55	4
Total			844

**Table 3.** Temperature values measured during the research

	Temperature of the surface from which the samples were collected (°C)	Indoor temperature (°C)	Outdoor temperature (°C)
Minimum	16	19	-13.6
Maximum	23.5	24.9	20.7
Average	18	21.2	3.9

**Table 4.** The relationship between temperature parameters and the number of mite specimens

Temperature parameters	$r_s$	$p^*$
Surface temperature (°C)	0.662	<0.001
Indoor temperature (°C)	0.521	<0.001
Outdoor temperature (°C)	0.252	0.091

\*Spearman's correlation test,  $r_s$ : correlation coefficient

relationship was found between the outdoor temperature and the number of mite specimens (Table 4).

## DISCUSSION

During the study period, 46 of the 54 (85.18%) dust samples collected from 17 of the 18 (94.44%) houses were found to be mite-positive, and a total of 844 mite specimens were isolated from the dust samples of 1 g. Studies conducted in our country have reported the mite-holding rates of houses to be 18.6% across Turkey, 48.4% in the Mediterranean, and 46% in the Black Sea region (13); 86.8% in the Eastern Mediterranean (14); 24.06% in Anatolian cities (15); 28.65% in Ankara (16); 18% in Sivas (17); 20% in another study from Sivas in the houses of asthmatic patients (18); 30% in Afyonkarahisar (19); 53.8% in İzmir (20); 57.66% in Konya (21); 18.05% in Kütahya (22); 29.3% in another study from Kütahya (23); 34.38% in Bursa (24); 23.1% in Malatya



**Figure 3.** *Tyrophagus putrescentiae* (male)

(25); 22.72% in Aydın (26); 23.6% in Isparta, 24.2% in Afyonkarahisar, 22.7% in Kütahya, 19.6% in Uşak, and 24% in Denizli (27); 16.67% in Eskişehir (28); 48% in Hasköy county of Muş (29); 39.47% in Kayseri (30); 20% in another study from Kayseri (31); and 72.21%



Figure 4. *Lepidoglyphus destructor* (female)

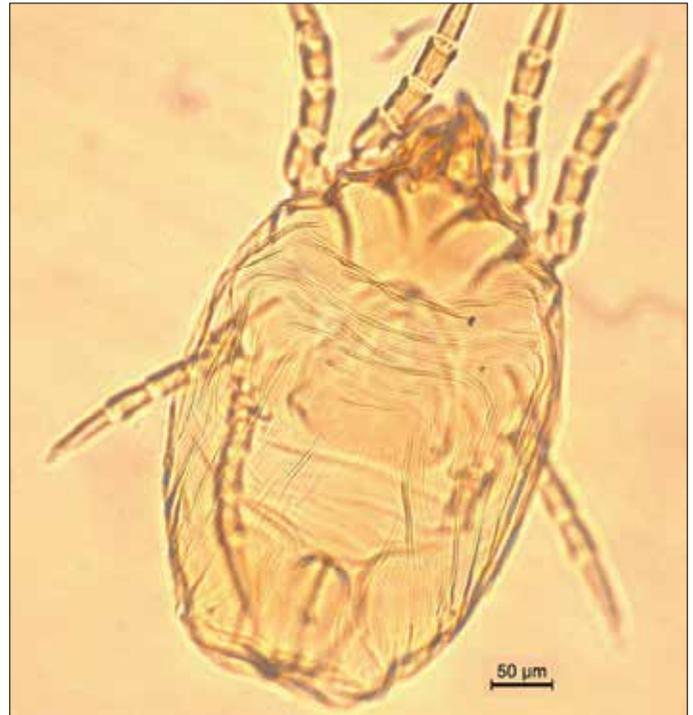


Figure 6. *Euroglyphus maynei* (female)

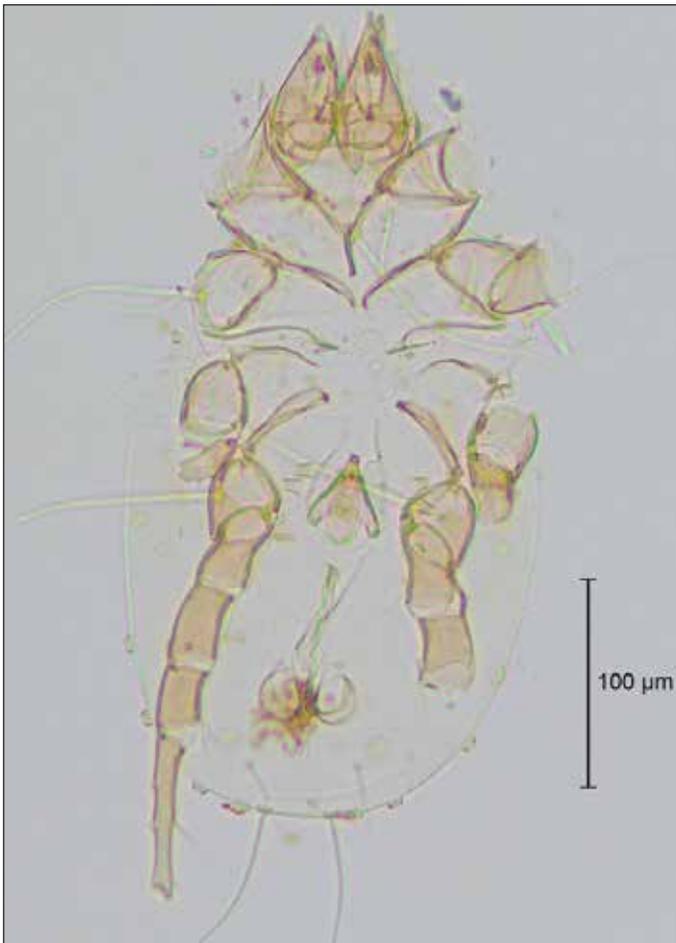


Figure 5. *Tyrophagus perniciosus* (male)

in Bitlis and Muş provinces (32). Studies conducted abroad have reported the mite-holding rate to be 85% during the autumn and 50% during the winter in Switzerland (33); 81.7% in eight different regions (Ohio, New Orleans, Memphis, Texas, Greenville, San Diego, Los Angeles, and California) in the USA where asthmatic patients lived (34); 51.3% in houses, 50% in



Figure 7. *Glycyphagus privatus* (male)

libraries, and 21.3% in hospitals located in Poland (35); 47.8% in south-west Poland (36); 87.8% in Rome (37); 73.7% in Puerto Rico (38); and 88% in Bandar Abbas province of Iran (39). In our study, the mite-holding rate of the houses (94.44%) was higher than those of the other studies conducted both in our country and abroad. This study showed that Erzincan province has suitable conditions for the growth and proliferation of house dust mites.

Of the mites identified in this study, *A. siro* (55.55%) was the most common species in the houses followed by *D. pteronyssinus* (50.00%), *T. putrescentiae* (22.22%), *Histioglyphus* sp. (22.22%), *L. destructor* (16.66%), *T. perniciosus* (11.11%), *E. maynei* (11.11%), *G. privatus* (11.11%), *Cheyletus* sp. (11.11%), *Tarsonemus* sp. (11.11%), and *Tetranychus* sp. (11.11%) (Table 2). Mite species have been found in varying rates in numerous studies from our country and abroad (15, 16, 22, 24, 25, 27-29, 31, 32, 37, 40-43). Majority of the studies conducted in our country and abroad have reported that the most common mite species is *D. pteronyssinus* (13-16, 19-21, 24, 25, 27-29, 32, 34, 41, 43-48). In our study, the most common species was found to be *A. siro* followed by *D. pteronyssinus*. This result suggested that *A. siro*, which is a storage mite, is transferred to the houses through stored foods and that the houses have suitable conditions for the proliferation of this mite species.

It has been reported in many studies conducted on house dust mites that temperature has an effect on the growth and proliferation of mites (1, 13, 15, 22, 25, 27-29, 32, 34, 39, 41, 48, 49). In our study, we concluded that temperature may differ between indoor and outdoor environments and that this might be resulted from structural status, age, floor coating, and ventilation frequency of the houses. Based on this information, indoor, outdoor, and surface temperatures were measured with an infrared thermometer. The number of mite specimens detected in the houses was compared with these temperatures and were statistically analyzed. A significant positive correlation was found in our study among the indoor temperature of the house, temperature of the surface, and the number of mite specimens. Accordingly, the number of mite specimens increased with an increase in the indoor or surface temperature. No significant relationship was found between the outdoor temperature and number of mites, but the number of mite specimens was found to decrease in case of decrease in outdoor temperatures.

## CONCLUSION

The mite-holding rate of the houses in Erzincan province included in this study was found to be 94.44%. The number of mites per gram of dust was found to be 18.34. The most common species was *A. siro*, which was followed by *D. pteronyssinus*. The number of mites was found to be statistically correlated with the indoor and surface temperatures.

It was thought that temperature and relative humidity, which are among the factors affecting the population dynamics of house dust mites, should be measured not only in the outdoor but also in the indoor environment. House dust mites were proposed to be associated with allergic diseases, but this must first be confirmed with skin tests, serological tests, and clinical examination. This study should be studied in the province across with more houses to be included.

**Ethics Committee Approval:** Ethics committee approval was received for this study from Erzincan University Chairman of the Ethics Committee (2014-02/6).

**Informed Consent:** The participants had read and signed the informed consent form.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept - E.Z., S.D.; F.Ö., M.A., E.Ü., A.Ö.; Design - E.Z., S.D.; F.Ö.; Supervision - S.D.; Funding - E.Z.; Materials - E.Z.; Data Collection and/or Processing - E.Z.; Analysis and/or Interpretation - E.Z., S.D., F.Ö., M.A.; Literature Review - E.Z.; Writing - E.Z., F.Ö.; Critical Review - S.D., M.A., F.Ö., A.Ö.; Other - E.Z., S.D., F.Ö., M.A., E.Ü., A.Ö.

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**Hakem Değerlendirmesi:** Dış Bağımsız.

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**Teşekkür:** Bize evlerini açan tüm ev sakinlerine teşekkür ederiz.

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