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RESEARCH ARTICLE

A Study on Karyotypes of Two Species of *Anoplius* (Hymenoptera: Pompilidae) in Kars Plateau, Turkey [1]

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Summary

In this study, karyotypes of two Pompilidae species [*Anoplius viaticus* (Linnaeus 1758) and *Anoplius concinnus* (Dahlbom 1845)] were studied. Based on metaphase studies, it was determined that *Anoplius viaticus* has 2n=28 chromosomes and that their karyotypes consisted of 3 metacentric, 2 submetacentric and 9 acrocentric chromosome pairs, and the fundamental number (NF) was 38. Metaphase studies of *Anoplius concinnus* gave the result that it had 2n=28 chromosomes, of which karyotype consisted of 2 metacentric, 4 submetacentric and 8 acrocentric chromosome pairs, and the NF was 40. No heteromorphic sex chromosomes for each species were found.

Keywords: *Hymenoptera, Pompilidae, Karyotype, Morphometrics, Kars Plateau*

Türkiye-Kars Platosunda İki *Anoplius* (Hymenoptera: Pompilidae) Türünün Karyotipi

Özet

Bu çalışmada, Kars Platosu'ndan toplanan iki Pompilidae türünün [*Anoplius viaticus* (Linnaeus 1758) ve *Anoplius concinnus* (Dahlbom 1845)] karyotipleri incelendi. Metafaz incelemeleri ile *Anoplius viaticus*'un 2n=28 kromozoma sahip olduğu belirlenmiş olup, bunların karyotiplerinin; 3 metasentrik, 2 submetasentrik, 9 akrosentrik kromozom çiftinden (NF:38) oluştuğu saptanmıştır. *Anoplius concinnus*'un metafaz incelemeleri sonucunda ise 2n=28 kromozoma sahip olduğu belirlenmiş ve karyotiplerinin; 2 metasentrik, 4 submetasentrik, 8 akrosentrik kromozom çiftinden (NF: 40) oluştuğu tespit edilmiştir. Her bir tür için eşey kromozomları bulunmamıştır.

Anahtar sözcükler: *Hymenoptera, Pompilidae, Karyotip, Morfometri, Kars Platosu*

INTRODUCTION

Evolutional proximity of species is highly essential in terms of determining the frequency of genetic drift (gene flow) among populations. In a study which examined genetic differences among Arabian horses in Turkey, genetic difference among populations was found as statistically significant (P<0.001) [1].

In addition, karyotypical researches allow obtaining necessary information for direction of the production of an efficient species, in particular, providing a foundation to the genetic crossbreeding between species. Kaya et al. determined that *O. angorae had* 2n=50 chromosomes [2] in their study performed on *Orthrias* species.

Karyotype analysis of various insect species is very important. This importance results from a number of reasons, such as the use of insects for biological control, insecticide agents, and development of fighting methods against harmful insects etc. In

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addition, in systematic studies, karyotype is also used together with other methods [3]. Studies on the karyotypes of various insect groups are very limited except Pompilidae [4].

Only morphological characteristics are used in the identification of Pompilidae family species [3,5-10]. Morphological characteristics were found insufficient in the identification at the level of some species of this family [11,12]. This case shows that karyological studies are needed so that Pompilidae species can be identified better.

The purpose of this study is to use karyotype in the identification of two Pompilidae species with almost identical morphological characteristics.

MATERIAL and METHODS

Totally 74 samples of *Anoplius viaticus* (Linnaeus 1758) and *Anoplius concinnus* (Dahlbom 1845) species were collected from Kars plateau and brought to the laboratory in special cages. The samples left in the cage were fed with 50% honey solution every other day [13]. Some samples for karyotype studies were immediately dissected, and the samples, which were not dissected, were put in special cages until the time of study. After a while, ovaries of the samples dissected were extracted with the aid of binocular microscope. Ovaries were put into colchicined hypotonic solution under room temperature for 2-3 h. Then, tissue samples were put in carnoy fixative and kept in refrigerator for 24 h [14]. In the freshly prepared carnoy fixative, ovary was divided into small pieces. By a mixer, some 7 ml carnoy fixative was added on the ovary in order to ensure fixation; it was then centrifuged and super-natant was omitted; this process was repeated twice. In the last procedure, supernatant on the surface was disposed and 2-3 ml sample, the rest of suspension, was dispersed on microscope slide. After the microscope slides were dried under room temperature, they were dyed for 15 min in Sorenson tampon prepared with 5-10% giemsa under room temperature [4,15,16]. Preparations were examined under microscope, and the photographs of proper metaphase distributions were taken.

RESULTS

It was found that leaving the ovary in colchicine-hypotonic solution for some 2-3 hours in order to make chromosome analysis easier gave desirable results. It was observed that if this period were shorter, metaphase areas would decrease or no metaphase could be witnessed; if this period wwere longer, metaphase areas would increase but chromosome branches were contracted since it was more difficult to conduct analysis.

In the karyogram of *Anoplius viaticus*, it was observed that it consisted of 3 metacentric, 2 sub-metacentric, and 9 acrocentric chromosome doubles, and the number of chromosome brachiums was detected as 38 *(Figure 1)*. On the other hand, it was determined that the karyogram of *Anoplius concinnus* consisted of 2 metacentric, 4 submetacentric, 8 acrocentric chromosome pairs, and the number of chromosome branches was detected as 40 *(Figure 2)*.

DISCUSSION

Species belonging to Hymenoptera order have haploid chromosome numbers in 4 different models. Haploid chromosome number models of these four models are 5-7, 8-11, 14-17 and 19-30 [4]. In this study, based on the examination of the karyograms of *Anoplius viaticus* and *Anoplius concinnus*, it was discovered that both had 2n=28 chromosomes and they were compatible with n=14-17 model. There is no standard method for karyotype analysis in insects, and some problems occur in the existing methods. Some factors, such as sampling methods, variety of species, variety of habitat, sampling period, climatic conditions, the dose of the solution used, have important effect on the results in practice. Therefore, modification is needed in the methods to be applied depending on the group which is subject of the study.

In this study, it was verified with karyological control that species identification depending on morphology was very fitting. Thus, in systematic and taxonomic studies in case these morphological characters were insufficient, ans this insufficiency can be overcome by karyotype studies.

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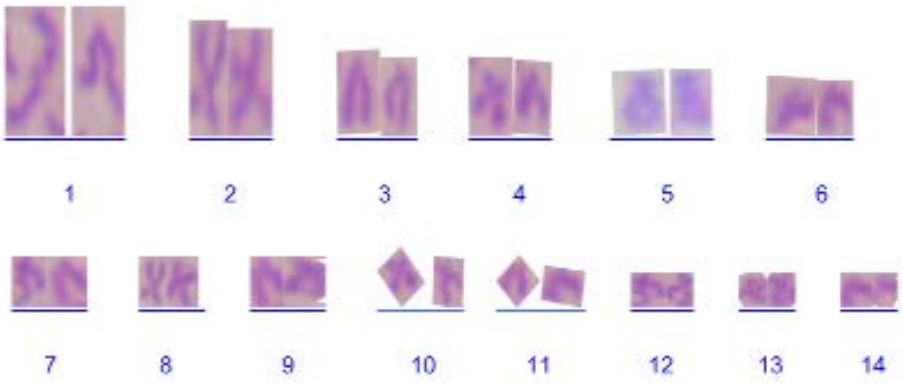

Fig 1. Karyogram of *Anoplius viaticus*

Şekil 1. *Anoplius viaticus*'un karyogramı

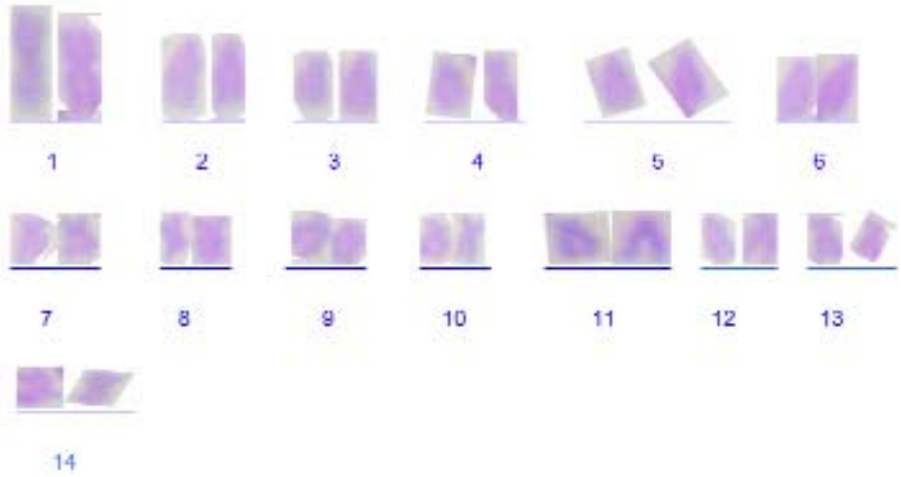

Fig 2. Karyogram of *Anoplius concinnus*

Şekil 2. *Anoplius concinnus*'un karyogramı