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# The Application of Ultraviolet Spectrophotometry (UV) on Some Water Mite Species (Acari, Hydrachnidia)

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## Abstract

In this study an ultra violet analysis, which is a spectrophotometric method, was applied for the first time as a structural analysis of the group. The following species were collected from Karamık Lake in Afyon Province, Turkey between April and August, 2015, *Hydryphantes flexiosus*, *Hydrodroma despiciens*, *Georgella helvatica*, *Eylais infundibulifera*, *Hygrobates nigromacutlatus and Torrenticola brevirostris.* These species were separately analyzed by Ultraviolet Spectrophotometer (US) and the results assessed using graphical readings. The affiliations between the species were read from the graphical curves of each species and then compared in terms of the curves.

## Keywords

Water Mites, Acari, Hydrachnidia, UV, Analysis

## 1. Introduction

Water mites occupy a significant position in the food chain and are also known as bioindicators of clean water sources. They belong to a branch of arthropoda commonly found in inland waters with more than 6000 species currently recognized [1]. Genetic, chemical and ecological studies have been carried out on this group in recent years in addition to classical-systematic studies [2]-[7]. The main reason for selecting water mites for this study is that these species represent the most fundamental level of life in lakes and flowing water systems [3].

As a result, they are a significant factor in many ecological studies. Other reasons are their role as biological indicator organisms of clean water ecosystems and the classical systematical problems encountered in the group. Morphologi-

cally, water mites have elliptical or egg shaped bodies with a flattened dorsum and abdomen. Larvae have three pairs of legs while nymphs and adults have four. Water mites have a complex life cycle and their eggs are found on many aquatic plants. During their larval phase they co-exist with different animal some of these species as ectoparasites. There is a particular importance in determining their habitats and communities in lakes and stagnant waters such as ponds as well as flowing waters [8].

The samples used in this study were collected from Karamık Lake in Afyon Province, Turkey between April and August, 2015 [9]. The collected species were analyzed using the UV (Ultraviolet Spectrophotometer) technique based on the absorption of UV rays by materials.

The basic logic of UV consists of transmitting light through a prepared dilution and determining the amount of light absorbed by that dilution. The higher the amount of agent contained in the dilution, the more light is absorbed by the dilution. The spectrophotometer is able to acquire quantitative information regarding the amount of the relevant ingredient in the dilution by determining the intensity of the light that passes through the dilution but is not absorbed. UV and spectrophotometric measurements in the visible area are the most widely used methods in qualitative and quantitative analyses. They are used to study whether functional groups are available for the determination of the structures of pure substances (C=O, C=C, conjugation, etc.) as well as determining the position of a functional group within a compound. They are also used to measure the quantitative concentration of a pure substance or the concentration of compounds in a mixture [10].

## 2. Materials and Methods

The water mites used in the study were collected from Karamık Lake in Afyon Province between May and August, 2015 using special gauze butterfly nets, Pasteur pipettes, steel sieves and other equipment. The samples were separated in the laboratory according to species with the help of a microscope. The species were washed with distilled water and dried in sterile dishes. Precision scales were used to weigh the dried remains and a few drops of (0.5 mL) concentrated $HNO_3$ (nitric acid) were added onto approximately 10 mg of water mite sample. Subsequently this was diluted with distilled water. The diluted solution was placed in micro tubs and weighed against diluted nitric acid with UV (Shimadzu UV-1700 pharma). The analysis results were assessed graphically at 200 - 400 nm.

## 3. Results and Discussion

UV (Ultraviolet spectrophotometer) is another of the spectrophotometric methods that is used primarily for the analysis of chemical substances [11] [12] [13] [14]. The essence of the method is diluting solid and liquid substances with appropriate solvents (water, alcohol, chloroform, etc.) and reading the wave lengths with a spectrophotometric device. The use of this method particularly on

invertebrates is quite recent and thus this study is pioneering in terms of the acaroid group. In some UV studies researchers used different doses of UV rays on different levels of invertebrates (especially small ones) in natural and laboratory environments and assessed the results [15] [16] [17] [18].

One of the main reasons for selecting water mites species in this study is to contribute to the solution of many systemic problems encountered in this group. Because most classical taxonomic methods are inadequate for detection and diagnosis in this group. Therefore, this method may be useful in solving these problems. Six different water mite species (Acari, Hydrachnidia) were used in the study. These species are *Hydryphantes flexiosus* (1), *Hydrodroma despiciens* (2), *Georgella helvatica* (3), *Eylais infundibulifera* (4), *Hygrobates nigromaculatus* (5) and *Torrenticola brevirostris* (6). The UV (ultraviolet spectrophotometer) method used in the study was applied separately to each of the species. The spectroscopic results were read as a wave length graphic versus absorbance. While the vertical axis in the graphics displayed absorbance percentage the horizontal axis displayed the wave length of the substance in nm. As a result of an examination of the wave length graphic versus absorbance of water mite species it is evident that the vertical axis or absorbance values of the first species, *Hydryphantes flexiosus*, varied between -0.920 and 2.00 while the horizontal axis wave length varied between 220 and 330 nm (**Figure 1**). The equivalent parameters for *Hydrodroma despiciens* varied between −0.97 and 1.70 on the vertical axis and between 215 and 340 nm on the horizontal axis (**Figure 2**). The values for *Georgella helvatica* varied between −0.800 and 4.00 on the vertical axis and between 210 and 320 on the horizontal axis (**Figure 3**). The values of the *Eylais infundibulifera* species varied between -0.840 and 4.00 on the vertical axis and

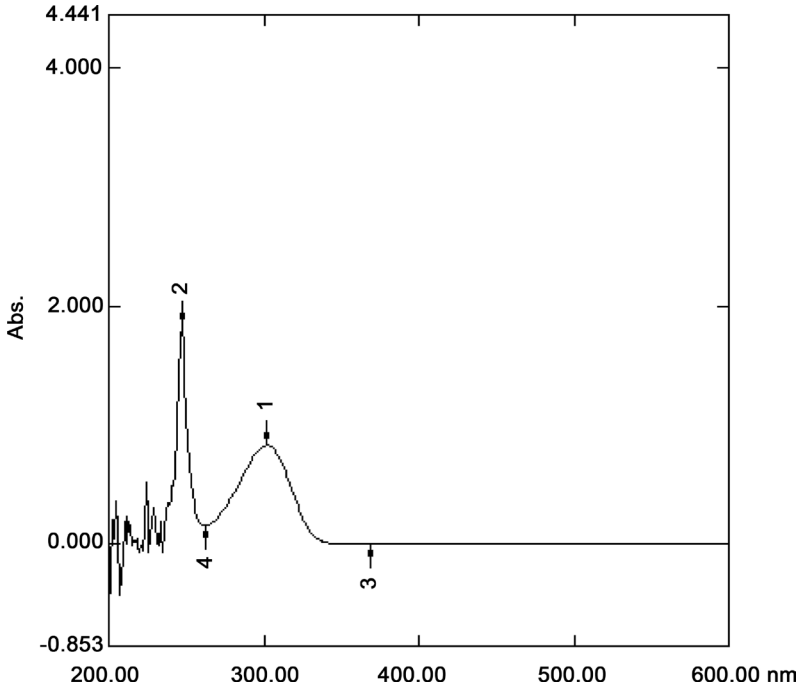


**Figure 1.** *Hydryphantes flexuosus.*

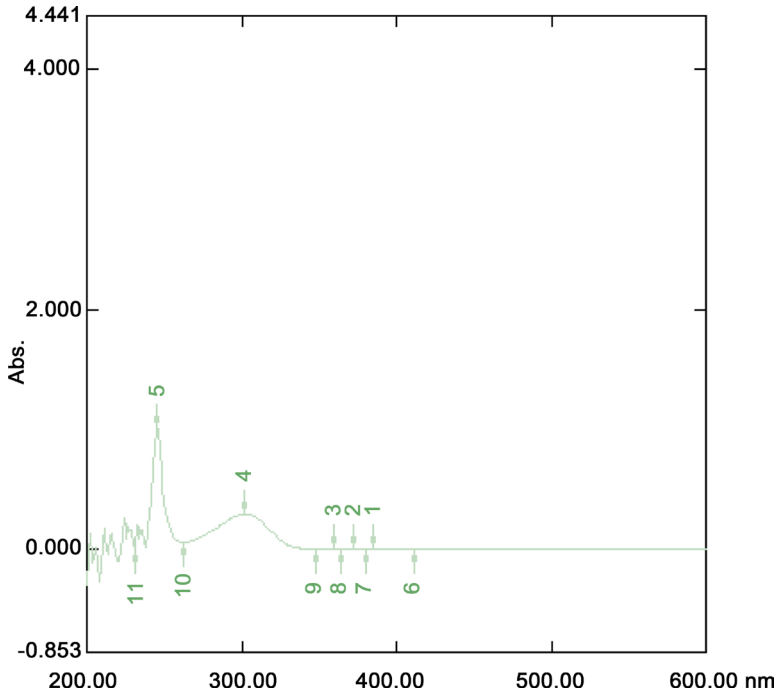


Figure 2. *Hydrodroma despiciens.*

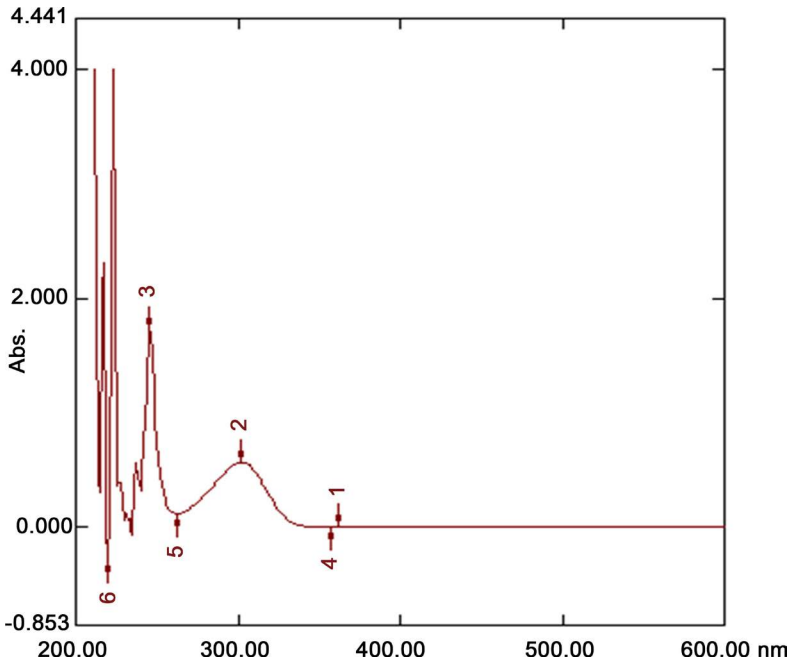


Figure 3. *Georgella Helvetica.*

between 205 and 330 nm on the horizontal axis (Figure 4). The figures for *Hygrobates nigromacutlatus* varied between 0.30 and 1.95 on the vertical axis and between 210 and 350 on the horizontal axis (Figure 5).

The last species of the study was *Torrenticola brevirostris* and the figures for the vertical axis were 0.20 - 2.20 and between 230 and 320 for the horizontal axis (Figure 6). The wave lengths of the horizontal axis specify the electronic transmission level in the molecules of the creature's structure. This in turn provides

information about the existence of the functional groups C=O, C=N etc. in the structure of the creature. The maximum wave length electronic transmissions observed in these groups are n – π*, π – π* transmissions. These structures are usually observed in amino acids that are the keystones of proteins and particularly in chitin structures. A study of the graphics of all these species shows that the numerical data are similar to one another. The reason for this is that these species are all systematically closely related groups. Therefore the acquired graphical values share a close similarity. However, a careful study of the values of

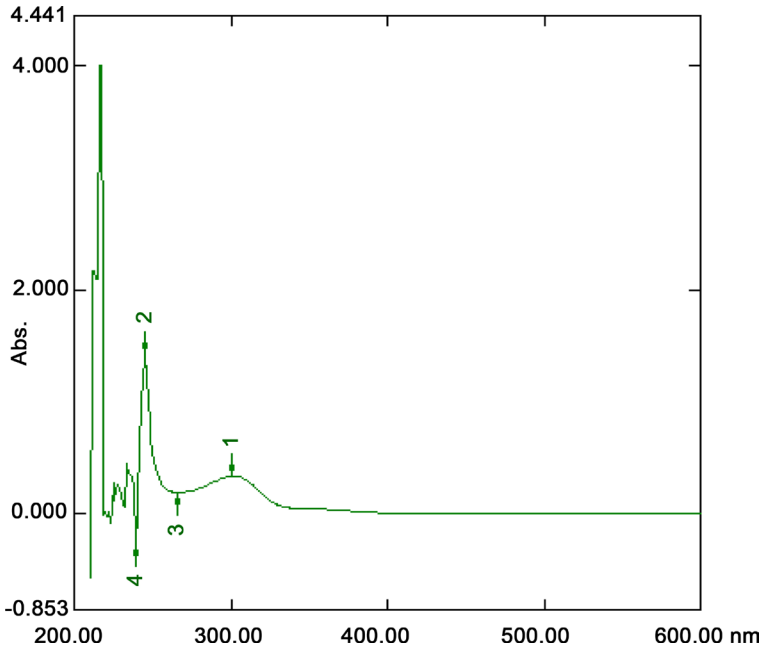


Figure 4. *Eylais infundibulifera.*

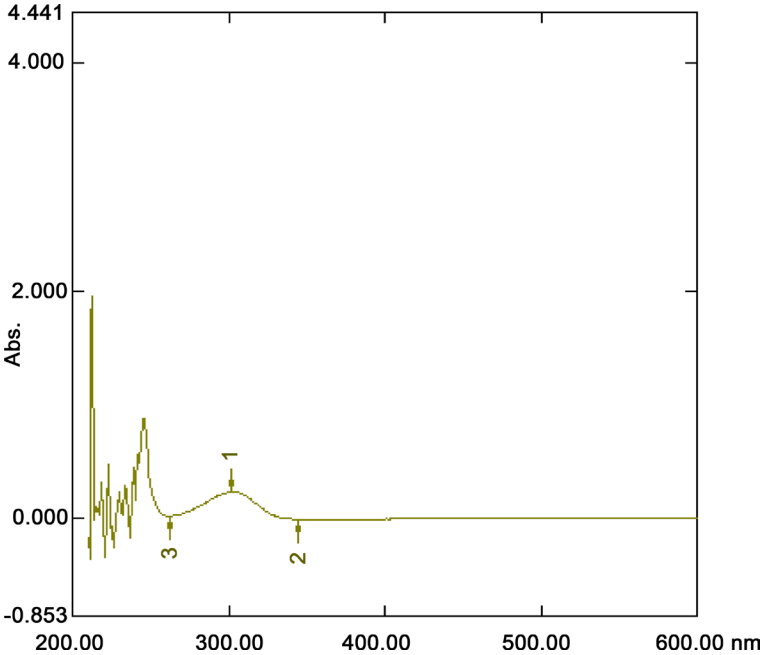


Figure 5. *Hygrobates nigromaculatus.*

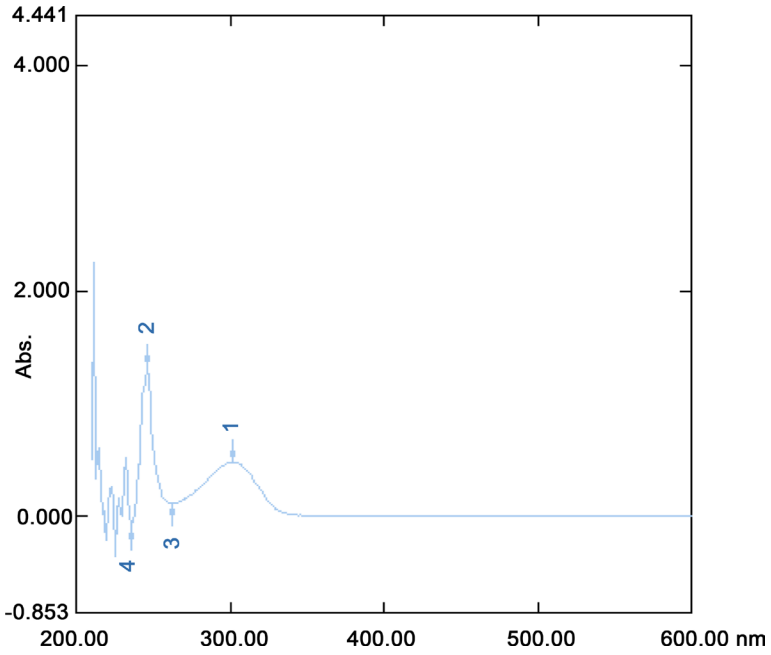


**Figure 6.** *Torrenticola brevirostris.*

absorbance and wave length graphics points to a systematic separation generated by the small amount of differences among the species. The expectation here is that the similarity is high while the differences are minor. This expectation coincides with the numerical values. The reason for this is that the similarity of data for groups that are systematically close to one another increases while the level of difference diminishes. The graphical values generated for each of the seven species used in this study indicate that those values are particular to the relevant species. Under the circumstances, using this method for the resolution of the controversial systematic problems surrounding this group as well as for studies regarding the phylogenetic affiliations between the species is worthy of consideration.

**Figures 1-6**, The UV spectrum of species at 200 - 400 nm.

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