# The ubiquity correction as an alternative method for the quantification of charcoal

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***Summary:*** *The absolute number of charcoal fragments and their relative frequency are the two parameters usually chosen for quantifying taxa in anthracological analysis. Besides, the criterion of ubiquity of taxa in different samples and archaeological features is commonly used (ubiquity analysis). Therefore, a new method that combines these two types of quantification procedures has been devised. This method, called the "ubiquity correction", considers both relative frequency and ubiquity of taxa. In this way, a correction for ubiquity of the relative frequencies of taxa found in different archaeological structures or diverse anthracological samples can be performed. This method also allows verifying if charcoals in various archaeological structures or anthracological samples are uniformly distributed.*

***Key words:*** *methodology, quantification of charcoal, ubiquity correction.*

## INTRODUCTION

In anthracological analysis, there are a few methods used to quantify the charcoals. Among these procedures, fragment numbers and weight measurements, together with ubiquity analysis predominate (Chabal, 1988; 1997; Lityńska-Zając, Wasylikowa, 2005). Besides, Chabal (1997) indicated that the results of the fragments' count and weight measurements are highly correlated. Another method was proposed by Kadrow and Lityńska-Zając (1994) and consisted of creating one measurement unit for all the fragments.

This paper presents a new method of quantification of taxa ("ubiquity correction") that combines both relative frequency of taxa based on the absolute number of charcoal fragments and their presence in all samples (*ubiquity analysis*). In this sense, not only the final frequency of taxa in the charcoal assemblage is taken into account but also the distribution of taxa across the samples is considered (Moskal, 2010).

## RESULTS AND DISCUSSION

Pits from the Neolithic sites of Polgár-Csőszhalom and Polgár 31 (Hungary) have been used as case studies to test the method (Moskal, 2010). In pit 13, the charcoal fragments come from 7 stratigraphic units/archaeological layers (Table 1). The basis is a usual count of charcoal fragments (N), but the results are presented as relative frequency (%). To obtain the final value of the frequency of a taxon (%U), all its relative frequencies obtained in different stratigraphic units are summed, and then this sum is divided into a total number of stratigraphic units. This can be summarized by the following equation:

$$\%U_t = (a + b + c + d...)/ n$$

In this equation, *t* is a taxon, while *a, b, c, d* express its relative frequencies in each stratigraphic unit and *n* indicates the total number of stratigraphic units. An example that uses the frequencies of hazel shown in Table 1 is presented below.

$$\%U_{hazel} = (3.1 + 2.0 + 1.0 + 5.1)/7 = 1.6$$

In this sense, a mean value of the relative frequency of each taxon is obtained. Also, this method may help to check if the distribution of taxa across diverse stratigraphic units is homogenous. In this case, little discrepancies are observed between relative frequencies obtained from sum of fragments (%) and after the "ubiquity correction" is applied (%U); this means that the same taxa appeared in similar quantities in different archaeological layers (Table 1).

The method can also be applied to different archaeological structures from the same site (Table 2). It is particularly useful when the charcoal assemblages from the entire site are very heterogeneous, as observed in the example from Polgár 31. The differences between relative frequencies based on sum of fragments (%) and after the "ubiquity correction" is used (%U) may confirm that the distribution of taxa at the site varies considerably. Also, it reduces the overrepresentation of some taxa. This may be observed in the case of *Frangula alnus*, which had a large number of fragments only in one of the archaeological pits (Table 2).

## CONCLUSIONS

The "ubiquity correction" method (%U) should be usually compared with the relative frequency of taxa (%). If both final values are correlated, the distribution of taxa is rather regular in different units of investigation (samples, archaeological layers, features, etc.). In the opposite case, the correction acts as a homogenization method providing mean values of percentages of taxa. Moreover, this method may serve for the charcoal assemblages characterized by overrepresentation of some taxa.

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| POLGÁR-CSŐSZHALOM | PIT 13 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRATIGRAPHIC UNIT | 388 | | 433 | | 434 | 463 | | 492 | | 497 | 681 | | TOTAL | | |
| TAXA | N | % | N | % | N/% | N | % | N | % | N/% | N | % | N | % | %U |
| *Acer* sp. | | 0 | | 0 | | | 0 | 1 | 1.0 | | | 0 | **1** | **0.1** | **0.1** |
| *Acer* sp. cf. *A. campestre* | 1 | 1.0 | | 0 | | | 0 | | 0 | | | 0 | **1** | **0.1** | **0.1** |
| *Cornus* sp. | 1 | 1.0 | 22 | 23.4 | 8 | 14 | 9.5 | 6 | 6.3 | 2 | 5 | 4.2 | **58** | **7.7** | **7.8** |
| *Corylus* sp. cf. *C. avellana* | 3 | 3.1 | | 0 | | 3 | 2.0 | | 0 | 1 | 6 | 5.1 | **13** | **1.7** | **1.6** |
| *Euonymus* sp. | | 0 | 1 | 1.1 | | | 0 | | 0 | | | 0 | **1** | **0.1** | **0.2** |
| *Fraxinus* sp. | | 0 | | 0 | | | 0 | | 0 | 13 | | 0 | **13** | **1.7** | **1.9** |
| *Quercus* sp. deciduous | 65 | 66.3 | 39 | 41.5 | 78 | 124 | 83.8 | 62 | 64.6 | 75 | 82 | 69.5 | **525** | **69.6** | **68.4** |
| *Populus* sp. | | 0 | | 0 | | | 0 | | 0 | | 2 | 1.7 | **2** | **0.3** | **0.2** |
| *Populus* sp./*Salix* sp. | | 0 | | 0 | | | 0 | 2 | 2.1 | | 4 | 3.4 | **6** | **0.8** | **0.8** |
| *Prunus* sp. | | 0 | 2 | 2.1 | | | 0 | 1 | 1.0 | | 1 | 0.8 | **4** | **0.5** | **0.6** |
| *Salix* sp. | 1 | 1.0 | | 0 | | | 0 | | 0 | 1 | 1 | 0.8 | **3** | **0.4** | **0.4** |
| *Ulmus* sp. | 25 | 25.5 | 20 | 21.3 | 11 | 2 | 1.4 | 19 | 19.8 | 7 | 8 | 6.8 | **92** | **12.2** | **13.2** |
| *Viburnum* sp. | | 0 | | 0 | | 1 | 0.7 | 3 | 3.1 | 1 | 1 | 0.8 | **6** | **0.8** | **0.8** |
| *Viburnum* sp./*Cornus* sp. | | 0 | 3 | 3.2 | 1 | 3 | 2.0 | 2 | 2.1 | | 1 | 0.8 | **10** | **1.3** | **1.3** |
| Maloideae | 2 | 2.0 | 7 | 7.4 | 2 | 1 | 0.7 | | 0 | | 7 | 5.9 | **19** | **2.5** | **2.6** |
| **SUM** | **98** | **100** | **94** | **100** | **100** | **148** | **100** | **96** | **100** | **100** | **118** | **100** | **754** | **100** | **100** |

*TABLE 1. Results of the absolute (N), relative frequency (%) and relative frequency corrected for ubiquity (%U) from pit 13 of the Polgár-Csőszhalom site.*

| POLGAR 31 | PITS | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N. OF STRUCTURE | 52 | | 733 | | 769 | | 860 | | 862 | | TOTAL | | |
| TAXA | N | % | N | % | N | % | N | % | N | % | N | % | %U |
| *Frangula alnus* | 25 | 22.3 | | 0 | | 0 | | 0 | | 0 | **25** | **8.4** | **4.5** |
| cf. *Frangula alnus* | 11 | 9.8 | | 0 | | 0 | | 0 | | 0 | **11** | **3.7** | **2.0** |
| *Pinus sylvestris* | | 0 | 1 | 3.7 | | 0 | | 0 | | 0 | **1** | **0.3** | **0.7** |
| *Cornus* sp. | 21 | 18.8 | | 0 | | 0 | | 0 | | 0 | **21** | **7.1** | **3.8** |
| *Corylus* sp. | 2 | 1.8 | | 0 | | 0 | | 0 | | 0 | **2** | **0.7** | **0.4** |
| *Fraxinus* sp. | 37 | 33.0 | 1 | 3.7 | 1 | 1.9 | 1 | 7.1 | | 0 | **40** | **13.5** | **9.2** |
| *Prunus* sp. | | 0 | | 0 | 5 | 9.6 | | 0 | 4 | 4.4 | **9** | **3.0** | **2.8** |
| *Quercus* sp. deciduous | 3 | 2.7 | 17 | 63.0 | 25 | 44.2 | 9 | 64.3 | 80 | 87.9 | **132** | **44.6** | **52.4** |
| cf. *Rubus* sp. | 5 | 4.5 | | 0 | 10 | 19.2 | | 0 | | 0 | **15** | **5.1** | **4.7** |
| Salix sp./*Populus* sp. | | 0 | | 0 | 2 | 3.8 | | 0 | | 0 | **2** | **0.7** | **0.8** |
| *Ulmus* sp. | 5 | 4.5 | 4 | 14.8 | 9 | 17.3 | 2 | 14.3 | 7 | 7.7 | **27** | **9.1** | **11.7** |
| Maloideae | | 0 | | 0 | 2 | 3.8 | | | | 0 | **2** | **0.7** | **0.8** |
| Monocotyledon | 3 | 2.7 | 4 | 14.8 | | | 2 | 14.3 | | 0 | **9** | **3.0** | **6.4** |
| **SUM** | **112** | **100** | **27** | **100** | **52** | **100** | **14** | **100** | **91** | **100** | **296** | **100** | **100** |

*TABLE 2. Results of the absolute (N), relative frequency (%) and relative frequency corrected for ubiquity (%U) from Polgár 31.*

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