SOME ASPECTS ON THE SOIL–PLANT RELATION IN *NEPETA NEPETELLA*

CRISTINA C. OANA[1], CRISTINEL V. ZANOAGA[2]*

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Abstract: The possible occurrence of a redox-mediation within the soil–plant relation, characterizing the soil from the vicinity of the (aproximately 20) plants as well the herbaceous mass, through a global biochemical parameter, the rH, has been checked. At the same time, the content of etheric oils has been estimated refractometrically. A certain dependence of soil's rH (characterized by a considerable variability) has been observed, for both the tissular rH and the content of etheric oils. As previously observed for other biochemical parameters, this depensence is of compensatory-type, that is, according to derivative I of the direct dependence, is manifested at the level of biomass accumulation.

INTRODUCTION

Nepeta nepetella var. *Amethystina* (fem. *Labiatae*) has been investigated as to its content of etheric oils – up to 1% (the composition of which is the following: geraniol 25%, nerol 23%, geraniol acetate and cytronelal 18%, limonen 10%, citral, terpineol) –, largely utilized in both alimentary and cosmetic industries. Involving here being biosynthesis of an active principle, the present research has been approached comparatively with the case of the poppy. In agreement with the observations of several others authors, an extremely large diversity of capsules' morphine content has been noticed, situated between 0 and about 1%, that could be correlated with soil's redox character [1]; on the same occasion, a large diversity of "offers" – from a redox point of view – from the part of the soil, was observed, expressed by rH values both favourable and unfavourable to the plant, at extremely low spatial differences. This is the reason that challenged the authors to investigate a possible ecological organism–environment relation, as evidenced in *Nepeta nepetella*.

MATERIALS AND METHODS

Within an experimental culture of *Nepeta nepetella*, a surface of 15 m^2 has been delimited, out of which 20 pairs of reference samples (from plant's aerian part and, respectively, from the soil neighbouring it) have been taken over. The moment of taking over selected has been the flowering time (with a view to possible future correlations among different species, a characteristic/defining/unique moment, once known that, durring its ontogenesis, the plant is characterized by a complex evolution of its redox characteristics [2]) – the same time as the one of other investigations [3, 4]. The obtained samples have been processed in a differentiated manner, according to their destination. Considering that, actually, an ecological plant–soil relation was actually looked for, the obtaining of some comparable data between the abiotic and the biotic environment has been followed, both segments being therefore to be described/characterized by an unique parameter, namely plant's tissular and, respectively, soil's rH. Implicitly, both the soil and the plant have been frozen up to the determination of their rH. Part of the plant has been immediately subjected to the extraction of the etheric oils with 45 v/v ethylic alcohol, in a 1 g plant to 10 mL solvent ratio, for one week. Further on, the hydroalcoholic extract containing etheric oils has been globally characterized, through refractometric measurements. Determination of the rH was made by a previously mentioned electrometric method, by means of a computerized system of data acquisition. The rezults obtained are listed in Table 1.

RESULTS AND DISCUSSION

The data of Table 1 may be interpreted in several ways.

Consequently, a first correlation may be established between the tissular and soil's rH (Fig. 1). More precisely, this is characterized by a slope in M – to be detailed in the following – being defined – at least in this point of the investigation – as a dependence of compensatory type of tissular rH on that of the soil.

Table 1

Sample	rH		n
	soil	Plant	
1	22.93	27.40	0.13611
2	30.82	18.73	0.13617
3	32.36	20.77	0.13616
4	29.20	27.795	0.13616
5	31.03	12.47	0.13621
6	30.49	16.975	0.13614
7	32.26	31.38	0.13612
8	32.615	7.005	0.13617
9	32.76	34.89	0.13616
10	32.205	13.86	0.13620
11	30.34	11.19	0.13640
12	30.95	23.595	0.13618
13	36.14	10.90	0.13640
14	26.715	23.62	0.13616
15	28.90	36.355	0.13616
16	33.80	28.745	0.13615
17	34.06	20.83	0.13613
18	34.33	24.86	0.13616
19	32.17	20.08	0.13627
20	32.98	23.75	0.13613

In a similar manner there may be defined, too, the dependence of the content in volatile oils (that may be correlated with the refraction index, n) of the plant, on the soil’s rH (Fig. 2).

In other words, both markers – of biochemical nature –, obey their own type of dependence, according to the sufficiently numerous previous data [1, 3, 4, 6].

As to the slope in M, some previously reported aspects [7] should be once again mentioned, namely:

“An organism’s reaction to the modification of the environmental rH differs from one level to another. More precisely, at the level at which the primary – such as, nuclear – impact takes place is of the Gaussian type while, at the immediately higher – in this case, cellular – one, it assumes the slope in M – that is, derivative I of a “module” function, rezulting from the response of the inferior hierarchical system, to which a continuously positive slope is attributed (Fig. 3: 1, 3 and 2, respectively). Consequently, reaction (1) is defined as a direct one, while (3) is a compensating reaction.

One should be therefore tempted to correlate the biochemical aspect with the biological one through derivation, such as the evolutive shifting from an inferior (integrated) to a superior (integrating) level, as might urge one to do the comparison between the rough biomass, generally, and the refinement of the reserve substance. The same aspect may be discussed between the individual and, respectively, populational level.”

If an attempt is made at evidencing the dependence of the content in volatile oils on the tissular rH, a slope similar to that plotted in figure 4 will result. As one may observe, the process of volatile oils’ accumulation is characterized by the existence of an optimum, that is, the highest amounts are biosynthesized in the plant in which, as a result of the interaction with the soil and with its own rH, acquire a tissular rH situated at reducing values, of about 13, namely the one representing the minimum of figure 1 – a characteristic parameter of the species, as shown elsewhere [6] –, which are plants grown on soils with a relatively oxidative rH – i.e., favourable to them [6] – of about 32.

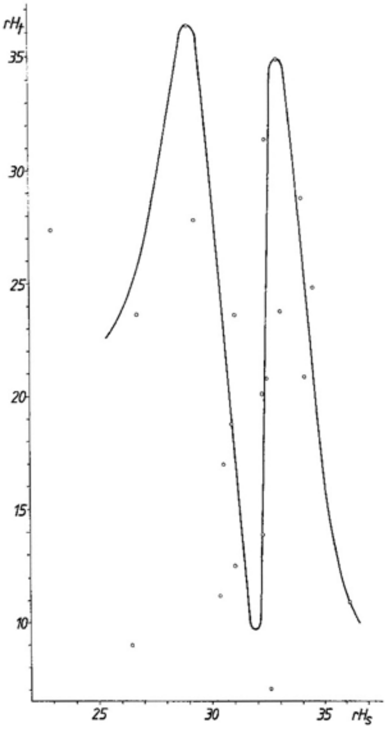

Fig. 1

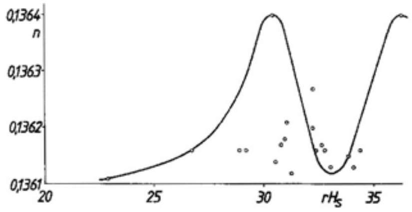

Fig. 2

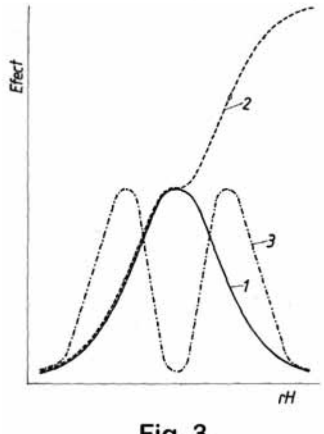

Fig. 3

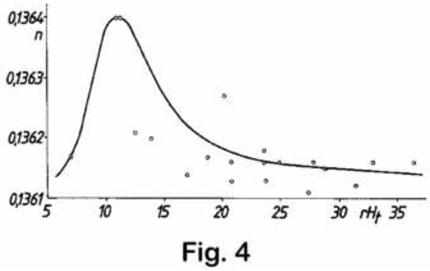

Fig. 4

CONCLUSIONS

The biosynthesis of etheric oils, in *Nepeta nepetella*, depends on the value of plant’s tissular rH, its maximum occurring at a rH value around 13. In its turn, it depends on soil’s rH, being characteristic to plants grown on soils with rH values of about 32.

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1) SC Coseli SA Jassy
2) Academy of Romania – Center for oenological researches of Jassy
*) cvzanoaga@hotmail.com