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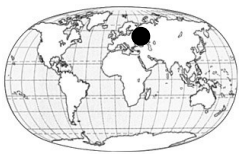

THE HISTORICAL MODEL OF THE DYNAMICS OF ALIEN FLORA OF SEVERAL REGIONS OF CENTRAL RUSSIA

The question of the dynamics of alien flora in the historical pattern of its formation is actively discussed in special literature (Jäger, 1988; Игнатов et al., 1990; Pyšek, 2003). The growth of interest towards this problem is explained by the willingness to model the course of the invasion process and clarify the possibilities of prognosticating its result. Alien flora also serves as a model object, which can be used as an example of detailed reconstruction of contemporary florogenetic processes.

In spite of the existence of the considerable amount of information on the regional alien floras, the main difficulty in the systematization of historical data lies in the lack of sufficient factual database. In the conditions of the uneven collection of material, the data from adjacent territories can help clarify the situation. However, it is not yet possible to eliminate the problem of the insufficiency of factual data completely. Some methods of mathematical processing could provide some additional possibilities.

We have created the databases of alien flora of two regions in Central Russia – the Tver and Tula Regions which covers the period from 1804 to 2004. They include a list of the species of alien flora as well as a time scale with a step in one year and a database. The database is a series of tables in the squares of which the invasion status for the definite year is indicated. So, every line of the table is a row of two hundred numerical meanings which shows the dynamics of the change of invasion status of every species.

Schroeder's qualification, which has become traditional of Eastern European florists, has been used for characterizing the invasion status (Schroeder, 1969): Ephemerophytes, Colonophytes, Epekophytes and Agriophytes. According to international standars the following correspondences apply: Casual alien plants, Naturalized plants, Invasive plants and Transformers (Pyšek et al., 2004). Each group is correlated with a definite numerical meaning (1, 2, 3 and 4). The absence of the species on the territory is indicated by «0». If the invasion status is unclear, it is indicated by «?»

In the Tver Region (S = 84,300 km²) 513 alien species were registered, and 389 alien species in the Tula Region (S = 26,500 km²).

The mathematical procession of database has been undertaken. In the course of processing, interpolation was undertaken, which has allowed to eliminate the gaps in meanings of invasion status, to exclude question marks to the maximum degree, eliminate subjectivism connected with the uneven rate of investigation of the territories in the different periods of time. The mathematical processing of data was undertaken in three stages. The first stage included data interpolation, which meant substitution of question marks with numerical meanings approximated to real meanings in accordance with the developed algorithms. The second stage included the calculation of integral indexes and drawing graphic models on the basis of interpolated meanings. The third stage consisted in the "smoothing out" of the acquired trends of invasion status of alien flora with the help of wavelet analysis. This mathematical method is

used in analyzing rows of observation in which data is supplied with breaks quite often. It is successfully used in astronomy and meteorology (Sokoloff et al., 1997). The purpose of wavelet analysis is the neutralization of breaks connected with the uneven investigation of flora, which modifies the exposed trends.
On the basis of the processed data, which shows dynamics of alien flora in the last 200 years the following conclusions, can be made:

1. Average rate of enrichment of alien flora in the regions is comparatively slow and stable (12,5-15 species in 10 years).
2. The number of species which modify their invasion status is comparatively stable (10 species in 10 years).
3. The rate of enrichment of alien flora by new species and the modifications of their invasion status are insignificantly connected with the level of industrial development of the territory in the exact period of time. The idea that the increase in the industrial development of the region significantly influences the number of newly introduces species reflects the uneven character of floristic investigations in the different periods of time.

keywords: alien flora, invasion status, invasion history, wavelet analysis