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The Review about the Kinetics of Monoterpenes Formation in Plants of Sort Artemisia

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ABSTRACT

The review about the reproductive kinetics at five etherional types of Crimean plants by the sort Artemisia and at the same unique type from Eastern Siberia, which correspond to the purpose of perfumery, pharmaceutical and the food-processing industry.

Keywords: Artemisia; Efficiency; Kinetic Model; Vegetation Phases

Introduction

Essential oils from plants of sort Artemisia are applicable in various branches of perfumery, pharmaceutical and the food-processing industry. Predominant components and their content define practical value of essential oil. Many explorers [1-3] studied the oils composition obtained from plants of sort Artemisia. The basic valuable components of essential oils are various representatives of monoterpenes. The huge actual data about the monoterpenic reproduction during the vegetative period of various ethereous-carrier plants is saved up. But numerous researches, as a rule, confine some selves by the only exposition of exact predominant components within the limits of any taxon-carrier for practical purposes [4-6]. In the present review the author's kinetic model affixed to the reproduction of monoterpenic hydrocarbons in life cycle of five Crimean plants of sort Artemisia [7-9] and to that from Eastern Siberia (A.glauca) [10] is used. Monoterpenes possess various biological effect: one with an open chain are used in perfumery (citral, geraniol, linalyl ester) and other are used in the food-processing industry as gustatory components. Between cyclical monoterpenes there are widely known medical products: menthol, terpin hydrate (monocyclic), camphor (bicyclic) [11-13]. Composition of monoterpenic components and their content in plants define as the quality and the industrial utility of received essential oil. By the method of hydro distilling from plants of type Artemisia abrotanum, A.annua, A.dracunculus, A.glauca, A.taurica, A.scoparia essential oils had been received, and then they are parted by the chromate-mass spectroscopy on components and are identified.

Then monoterpenic components of essential oils have been distributed according to their ring formation degree. For each degree of ring formation, as shown in the article [14], one calculated the normalized concentrations according to vegetation phases, namely: I – the vegetation beginning, II – budding, III – mass blooming, IV – maturing of seeds. Thus, one obtained the accumulation mass fractions of not exact compounds in studied plants, but the generalized carbocyclic structures, such as: acyclic (X2), monocyclic (Y2) and bicyclic (Z) (Figure 1), which can be extrapolated on all plants and to evolve the general regularities of their accumulation. The finding of

singularities in a connatural monoterpenes biosynthesis was made by own kinetic model reduced in the article [15,16]. Data about the qualitative composition and the quantitative maintenance of monoterpene's components in the essential oils obtained from plants of sort *Artemisia balchanorum Krasch* was given in the article [15]. Such experimental data about the essential oil's composition have been compared with the steps of calculated curves so that these curves must be maximum corresponded to the data (Figure 1) according to the known algorithm of the regressive analysis (Fisher's criterion), reduced in the articles [15,16]. The received graphic solutions of a differential equations system represent those selves a data bank of monoterpenes accumulative dynamics in the plants growing in the Crimean region. Thus, the quality and quantitative content of monoterpene's hydrocarbons in two sort plants samples Artemisia balchanorum is detected during all phases of vegetation with the distribution of the components according to the degree of cyclization and with the definition of their group quantity properties and it is placed on the (Figure 1).

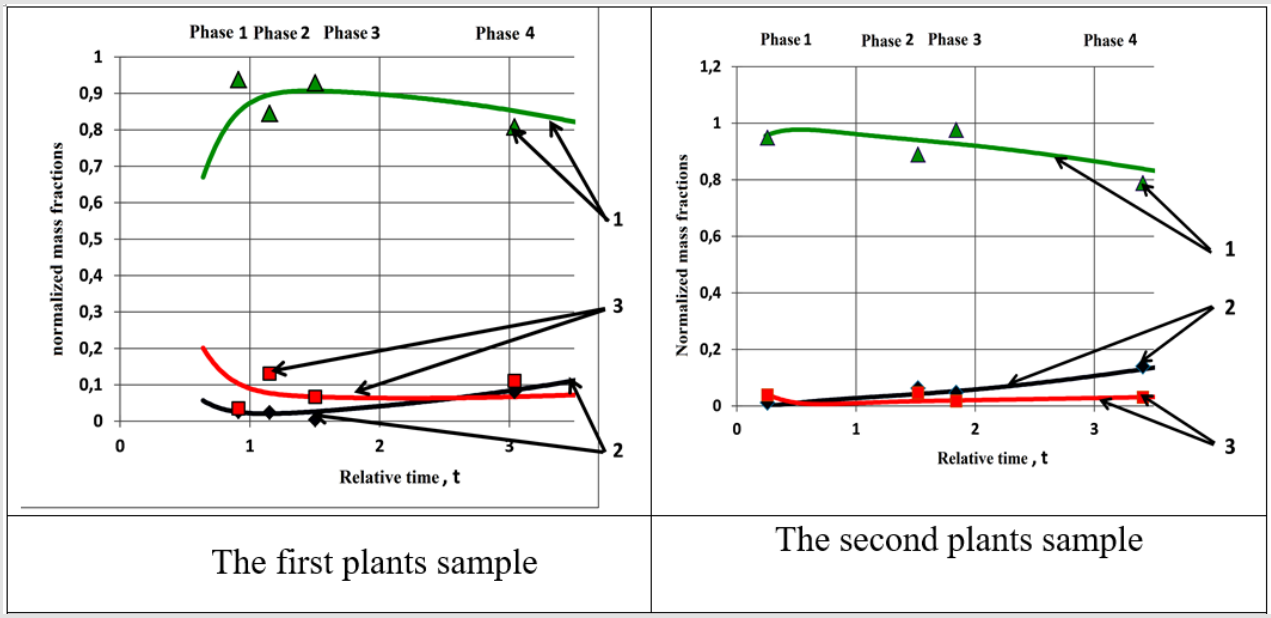

Figure 1: The calculated curves for the extract compositions from of vegetable species Artemisia balchanorum according to their ring formation degree during all phases vegetation (the phases I-IV): the points indicate the received experimental data about the normalized concentrations; the lines represent the solutions of the system of differential equations with three variables for the variable monoterpene's normalized concentration:

1. Acyclic;
2. Monocyclic;
3. Bicyclic.

Also, we constructed the similar calculated curves for the extract compositions from some other plants samples of vegetable species *Artemisia balchanorum* according to their ring formation degree during all phase's vegetation (the phases I-IV), as it is demonstrated on the (Figure 2). The steps of graphic curves (1) (Figures 1 & 2) indicate on the possibility to describe vegetative types by the kinetic methods according to the graphic maps, which demonstrate the efficiency of the investigated monoterpenes groups. There are accurate enough graphic differences between six types of the plants, despite the uniform mechanism of biosynthetic process (Figure 2). The constants of biosynthesis and the factor planes for each vegetative type are presented in the article [15]. For the medical industry it is more perspective to cultivate just the plant A. glauca Pall. ex Willd, which is rich monocyclic terpenes (β -fellandren, γ-terpinen, terpinolene) for use that as medical products [10-13]. There is a wide spectrum of benefit performance biological properties [17], which is corresponded to the components of essential oils from plants *A. annua L., such as A. abrotanum L., A. dracunculus L., A. scoparia Waldst. et Kit. Artemisia Taurica* Willd. Data of Figures 1 & 2 show a possibility to organize the harvesting of these plants such way that its results will lead to demanded composition of monoterpenes in the essential oils according to the corresponded vegetative phase.

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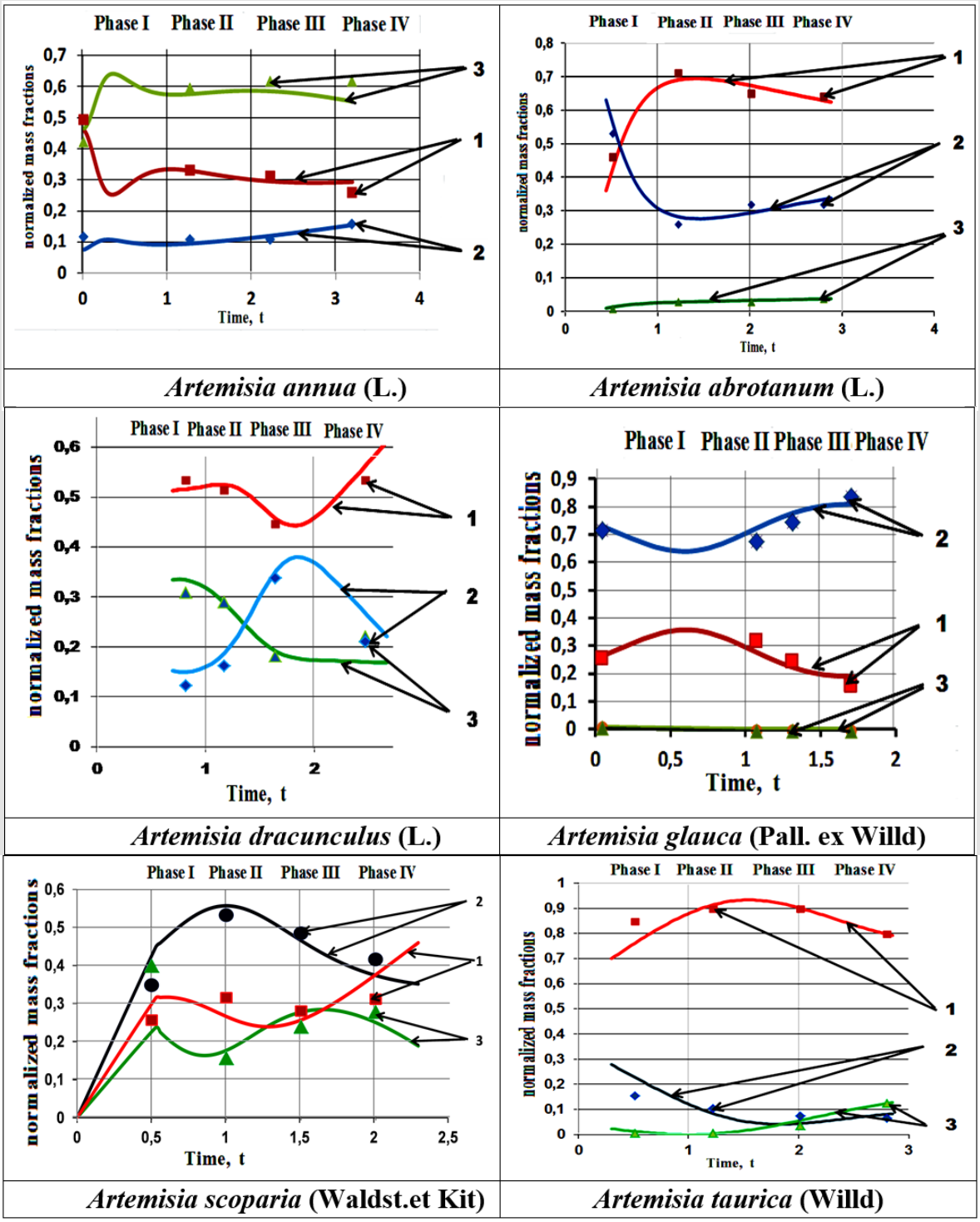

Figure 2: The calculated curves for the combined experimental data of monoterpenes accumulation in the plants of sort Artemisia, such as: acyclic, mono- and bicyclic monoterpenes and also the results of a numerical solution of the kinetic equations, placed in the article [14]:

1. Bicyclical monoterpenes;
2. Monocyclic monoterpenes;
3. Acyclic monoterpenes according to their ring formation degree during all phases vegetation of the plants (the phases I-IV).

One chooses some perspective sort-samples of these plants, which are used now as the agronomic culture for a pharmacology. For example: the sort Beginner in the type of *A.annua* L. is rich acyclic components, namely: 1,8-tsineol, Artemisia ketone, Artemisia alcohol having a high quantity of bicyclic camphor ketone; the sort Evksin in the type of *A.abrotanum* L. contains 1,8-tsineol and α -thujone as principal components of essential oil, is designed to be used not only in a medicine, but also in a perfumery, and also in the food-processing industry; one made two sorts named as WIM and the Crystal in the type of *A.dracunculus* L., which contain principal components, such as linalyl ester (at one) and neril-acetate (at another); the sort Branching in the type of *A.scoparia* Waldst.et Kit contains a high quantity of capillene in the essential oil; the sort Alupka in the type of *A.taurica* Willd contains bicyclic monoterpenes (thujones are the principal components and the camphor is presented also) [18]. The received outcomes about a monoterpenic hydrocarbons reproduction during the life cycle of ethereous-carrier plants will form a data bank of qualitative and quantitative composition of monoterpenic components in the essential oils from six Crimean plants types of sort *Artemisia* and one of that from Eastern Siberia. It is offered performances of vegetative types using the graphic maps of their efficiency according to degree of ring monoterpenes formation. It is offered to use the considered data bank at a choice of the plants sort-examples to cultivate them for exact industrial needs, to plane the terms of plants harvesting on purpose to extract from them the essential oil possessed by the known properties, to do a forecasting and to study the singularities of plants vegetation in agricultural region and to plane the compositions from the oils for industrial needs [19].

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