Reproductive biology studies - the way of understanding plant diversity

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There are two components of biodiversity – the diversity of taxa and diversity of coenoses. Doubtlessly both components need protection. The approach to their protection is distinct in kind, but in all cases it should include the reproductive biology studies. One of the two possible ways of protection of taxa (species, subspecies and variations) diversity is *ex situ* conservation and the leading role in it is played by different botanical gardens, nurseries, forest stations, etc. The protection of coenoses is possible only in-situ, so all necessary actions should be taken to restore it and bring to the original state at the site. It is very difficult to cultivate some plants at the botanical gardens, so the problem of such species propagation is genuine. Some species perfectly develop vegetatively but do not bloom and set fruits and seeds. It is necessary to remember that development of flowers, fruits and seeds occur under the influence of a number of exogenous factors, which stimulate the origin of endogenous ones. Joint action of these factors brings the plant to the reproductive stage of development (Chailakhyan, 1988).

The lack of some of the factors or influence of additional factors can cause the development of parthenocarpic fruits. There are many examples when a plant was collected in nature in vegetative stage and considered to be a well known species, and only later, at the botanical garden it developed flowers for the first time and turned out to be a new unknown species. Such story happened with *Aspidistra elatior* Blume – it was collected by Dr. Nikolaj Arnautov in Vietnam in 1986 and only in 15 years it gave first flowers morphologically different from Aspidistra elatior. Soon a new species *Aspidistra locii* Arnautov & Bogner (2004) was described basing on the plant cultivated in the Botanical Garden of the Russian Academy of Sciences in St. Petersburg. Similarly, the essential difference in flower and fruit characters in specimens of *Magnolia delavayi* Franch. cultivated at the dendrological park "Yushnye kul'turi" (Adler, Sochi, Russian SW Caucasus) brought us to conclusion that in spite of the great similarity of their vegetative features a new species – *Magnolia carpunii* M.S. Romanov & A.V. Bobrov (2003) should be described. A widely cultivated species *Cercidiphyllum japonicum* Siebold & Zucc. also turned out to be an interesting object for reproductive biology studies. At the Arboretum of the Main Botanical Garden of the RAS the species is represented by 20 trees (received from 5 sources), which are easily divided into two groups – with smooth bark and with rugged bark. Knowing that the vegetative features are more adaptive than reproductive we studied the latter in different groups of *Cercidiphyllum*. The size of mature female flowers differs in two times, fruit morphology and anatomy is also different. It is obvious that two different taxa are cultivated and both of them need protection. Thus lacking the information about reproductive structures we take the risk of missing a species from our attention. Strangely enough but sometimes we loose species as the result of a taxonomic treatment of a genus. For example, R. Pilger (1926) recognized seven species of *Phyllocladus* Rich. and the results of our original investigation of seed morphology and anatomy of all seven *Phyllocladus* species confirm their independence (Bobrov *et al*., 1999). On the other hand it was proposed to reduce the number of *Phyllocladus* species to five (Farjon, 1998). So, will all species of *Phyllocladus* be protected *ex situ* and *in situ*? Thus we can conclude an important activity of *ex situ* plant diversity conservation is detailed data on reproductive organs structure and function.

A very similar problem occurs when we protect biodiversity *in situ*. It is well known that biocoenoses are characterized by complex interconnections between all living organisms at different levels, some of which are obvious but other are unknown and require detailed studies. The bearing structure of any land

biocoenosis is the axis of interconnections between plants and animas. It is broadly recognized that connections between the pollinator and the flower, animal–disseminator and fruit (or seed) originated as the result of long co-evolution. Nevertheless, more detailed studies bring us to conclusion that the leading role in this tandem is played by plants. An excellent example of this is the parthenocarpy: plants attract disseminators (in case of zoochory) by fleshy fruits lacking seeds (which don't develop at the current year by some reasons). Thus, trying to reveal basic principles of functioning of ecosystems it is very important to study fruits and their role in the biocoenoses. Insufficient data will make saving numerous coenoses impossible from degradation. Not taking into account this aspect of plant life, we are risking failure in our measures for biodiversity protection *in situ*, focused both on plants and animals.

So, there are several very important reasons for studying structure and function of reproductive organs and especially fruits. First they allow us to reveal specific diagnostic features, both morphological and anatomical. Reproductive organs allow us to estimate the number of the species in every genus more correctly – it is very important to use data on reproductive biology when working on regional floras and taxonomic reviews of all kind. Not taking into consideration these data we are risking losing species, subspecies and varieties as the result of inadmissible mistakes. Different points of view are possible in systematic treatments, but aiming to reach the best results for biodiversity protection it is preferable to use the most detailed treatment of every genus (and species). Reproductive biology studies allow us to determine all interconnections between all inhabitants of the coenosis maximally precisely. Detailed *in situ* investigation of all reproductive processes in any plant species, including the flower development, blooming, pollination, fertilization, fruit and seed development, their dispersal and seed germination (including different kinds of natural stratification and scarification) will allow us to develop correct measures for protection in situ and propagation *ex situ*.

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