

GENETICS AND EMBRYOLOGY OF *ABIES KAWAKAMII*

**Kormuťák, A. & Yang, J.-C.: The Genetics and Embryology of Taiwan Fir (*Abies kawakamii* (Hayata) Ito). *Taiwan Journal of Forest Science, Monograph 1*, 78 pp, ISSN1026-4469. Taiwan Forestry Research Institute, Taipei, Taiwan, R. O. C. 78 pp., 182 figures, 22 tables and 145 references.**

One of rare endemic tree species, distributed in subalpine vegetation zone of the Taiwan Central Mountain Range between 2800 and 3600 m, has been studied genetically by Slovak scientist A. Kormuťák and his Taiwan colleague J.-C. Yang. The result of that study is a genetical monograph in which, from many points of view, the genetical and taxonomical relationships between endemic Taiwan fir and other firs were clarified. Since 1913, different authors have positioned Taiwan fir into different sections depending on criteria used by them. In their study, Kormuťák and Yang have shown that Taiwan fir exhibits high genetic affinity with the Japanese species *A. homolepis*. They have proven an existence of a compatible hybridological relationship between these two species and existence of a reproductive incompatibility between Taiwan fir and *A. lasiocarpa*, *A. concolor*, *A. alba*, *A. cephalonica* and *A. cilicica*.

The cytological and embryological evidence of crosses *A. kawakamii* with *A. alba* and *A. cephalonica* has proven that the normal course of fertilization between those species was prevented by a prezygotic hybridological block leading to abortion of their ovules at the mature archegonium stage.

Karyological studies based on examination of 69 cells from 21 root tip meristems have confirmed the classic karyological formula derived by Sax and Sax: 14 larger isobrachial and 10 shorter heterobrachial chromosomes.

Examining cells from the developing female gametophyte tissue, authors have observed 2 long isobrachial chromosomes with secondary constrictions.

After completing an isozyme study of 2 of Taiwan fir populations (Mt. Morrison and Hohuan mt.) authors have evidenced a high degree of genetic diversity. In terms of average values Taiwan fir is characterized by a 78 % of polymorphic loci among the total number of 16 alleles of 7 loci (2.2 alleles per locus); mean expected heterozygosity  $h_e = 0.325$  and  $0.242$  respectively; mean observed heterozygosity  $h_o = 0.021$  and  $0.046$  respectively, for two investigated populations. Compared to the two other endemic species of Taiwan (*Chamaecyparis formosensis* and *C. taiwanensis*) Taiwan fir shows an obvious higher genetic diversity. Two authors have speculated that the geomorphological heterogeneity of Taiwan, *i.e.* its numerous mountains function as efficient barriers preventing gene flow in the species, thus favoring genetic differentiation. Chloroplast and nuclear

DNA studies of 15 fir species have closely correlated taxonomical delineation of fir species suggested by Liu in 1971, as well as Taiwan fir crossability relationships with other firs studied.

Cluster analysis proved close genetic relationships between *A. homolepis* and *A. kawakamii* of the section Homolepides and between *A. nephrolepis* and *A. sachalinensis* of the section Elate, respectively. *A. koreana*, as an additional member of the section Elate occupied a relatively independent position. On the contrary, *A. veitchii* surprisingly exhibited a higher affinity towards the European species than to the Asian firs. Kormuťák and Yang concluded that the genetic uniformity of the European firs is the most contrasting feature of their cpDNAs in relation to both the Asian and North American species of firs. The differentiation ascertained within the North American species was found to comply even more precisely with the pattern of taxonomic pertinence of the species concerned than in the case of Asian firs.

Studies of pollen and ovule development from the period of differentiated pollen mother cells and megaspore mother cells until the stages corresponding to the shedding of mature pollen and seeds of Taiwan fir were thoroughly studied and well documented in number of microphotographs and scathes. The pollen of Taiwan fir was found to be at least comparable to pollen fertility typical for other fir species, which finding excluded low fertility of *A. kawakamii* pollen as a cause of the poor viability of its seeds. The high frequency of polyembryony has been shown to be the most remarkable feature of *A. kawakamii* embryogeny, but the entire process of embryogenesis was characterized by a high frequency of abortive embryos.

Concluding their work, authors have related that finding to the high degree of selfing as a prevailing type of pollination supposedly occurring under natural conditions. That conclusion could be proven by comparative studies on the efficiency of both selfing and outcrossing in the species, together with isozyme analysis of seed progenies from wind pollination. An interesting, informative and well illustrated genetical monograph!

Ž. Borzan (Zagreb, Croatia)