

MEGASPOROGENESIS OF *ABIES SIBIRICA* (PINACEAE) IN SOUTHERN SIBERIA

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Siberian fir (*Abies sibirica* Ledeb.) in the South Siberian mountains is characterized by poor seed quality. Studies of the development of female generative structures can reveal the features and critical stages of seed development, as well as to determine the causes of poor seed quality. The development of female generative buds and megasporogenesis in Siberian fir in the mountains of Southern Siberia was studied. The rate of the development is determined by air temperature and its timing varies somewhat depending on year and local weather and climatic conditions. Meiosis at megasporogenesis occurs in spring and completes before pollination. The peculiarity of the meiosis at megasporogenesis is asynchronous divisions not only in different trees, but also within the same megastrobiles. The normal structure and development of female generative structures determine a high reproductive potential of the species.

Keywords: *Abies sibirica* Ledeb., female generative buds, megasporogenesis, terms and rates of development

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REFERENCES

- Allen G.S. 1963. Origin and development of the ovule in Douglas fir. – *For. Sci.* 9: 386–393.
- Atlas ultrastructurey rastitelnykh tkaney [Atlas of plant tissue ultrastructure]. 1980. Petrozavodsk. 456 p. (In Russ.).
- Bazhina E.V. 1998. Seed production and quality in *Abies sibirica* Ledeb. in zone exposed to influence of the Baikal Pulpaner Factory. – *Russian Journal of Forest Science*. 2: 10–15 (In Russ.).
- Bazhina E.V. 2018. Siberian fir (*Abies sibirica*) state and chemical element allocation in tree crown in forest ecosystems of protected areas in south of Krasnoyarsk region (Russia). – *Nature Conservation Research*. 3 (2): 40–53 (In Russ.).
<https://doi.org/10.24189/ncr.2018.064>
- Bazhina E.V., Belova N.V. 2013. The loss of *Abies sibirica* seed stock from *Megastigmus specularis* Walley gamage in the middle mountains of East Sayan. – *Abstr. of World Biodiversity Congress-2013*, 26–30 November 2014. Chuang Mai, Thailand. P. 53.
- Bazhina E.V., Kvitko O.V., Muratova E.N. 2007. Meiosis at microsporogenesis and pollen viability in siberian fir (*Abies sibirica* Ledeb.) in the Middle Eastern Sayan Mountains. – *Russian Journal of Forest Science*. 1: 57–64 (In Russ.).
- Bazhina E.V., Tretyakova I.N. 2001. Towards a problem of Fir decline. – *Uspekhi Sovremennoy Biologii*. 121 (6): 626–631 (In Russ.).
- Chamberlain C.J. 1935. *Gymnosperms: structure and evolution*. Chicago, Illinois. 484 p.
- Ivanov V.B. 1982. *Active dyes in biology*. Moscow. 224 p. (In Russ.).
- Hutchinson A.H. 1915. Fertilization in *Abies balsamea*. – *Bot. gaz.* 69: 457–472.
- Jensen W.A., 1962. *Botanical histochemistry. Principles and practice*. San Francisco, London. 408 p.
- Khromova L.V. 1986. Embryologic processes at xenogamy and interspecific crossing in some *Pinus* species subgenus *Diploxylon* Koehne: *Abstr. ... Diss. Kand. Sci. Voronezh*. 23 p. (In Russ.).
- Kozubov G.M. 1974. *The biology of conifers fruiting on the north*. Leningrad. 136 p. (In Russ.).
- Martens P. 1966. Du megasporange cryptogamique a l'ovule gymnosperme. – In: *Trends in plant morphogenesis*. London. 329 p.
- Matveeva R.N., Milyutin L.I., Butorova O.F., Bratilova N.P. 2017. Selection of high reproductive siberian cedar trees in the geographic seed plantation. – *Lesnoy Zhurnal*. 2: 9–20 (In Russ.).
<https://doi.org/10.17238/issn0536-1036.2017.2.9>
- Minina E.G., Tretyakova I.N. 1983. *Geotropizm and sex in conifers*. Krasnoyarsk. 198 p. (In Russ.).
- Moitra A., Bhatnager S.P. 1982. Ultrastructural, cytochemical and histochemical studies on pollen and male gamete development in gymnosperms. – *Gamete Res.* 5 (1): 71–112.
- Moshkovitch A.M. 1992. *Embryology of conifers: Pinales, Cupressales, Taxales*. Kishinev. 249 p. (In Russ.).
- Nekrasova T.P. 1970. Morphogenesis of generative buds of *Abies sibirica*. – *Bull. Siberian Branch of Academy of Sciences of the USSR. Ser. Biol.* 10 (2): 35–41 (In Russ.).
- Nekrasova T.P., Ryabinkov A.P. 1978. *Fruit set of Abies sibirica*. Novosibirsk. 150 p. (In Russ.).
- Owens J.N., Molder M. 1985. *The reproductive cycles of true firs*. – Information Services Branch Ministry of Forests. Victoria, British Columbia. 35 p.
- Pausheva Z.P. 1980. *Praktikum po tzitologii rasteniy. [Practicum on plant cytology]*. Moscow. 304 p. (In Russ.).
- Polikarpov N.P., Chebakova N.M., Nazimova D.I. 1986. *Climate and mountain forests of Southern Siberia*. Novosibirsk. 226 p. (In Russ.).
- Prozina M.N. 1960. *Botanical microtechnology*. Moscow. 199 p. (In Russ.).
- Sarvas R. 1962. Investigations on the flowering and seed crop of *Pinus sylvestris*. – *Comm. Inst. Forestal. Fenniae*. 53 (4): 198.
- Singh H. 1978. *Embryology of gymnosperms*. Berlin. 302 p.
- Singh H., Owens J.N. 1981. Sexual reproduction in subalpine fir (*Abies lasiocarpa*). – *Can. J. Bot.* 59: 2650–2666.
- Singh H., Owens J.N. 1982. Sexual reproduction in grand fir (*Abies grandis* Lindl.). – *Can. J. Bot.* 60: 2197–2214.
- Spravochnik po klimatu SSSR. [USSR Climate Reference Book]. 1969. Is. 21. Part II. 1967. Leningrad. P. 87. Is. 21. Part IV. Leningrad. P. 189 (In Russ.).
- Stanlake E.A., Owens J.N. 1974. Female gametophyte and embryo development in western hemlock (*Tsuga heterophylla*). – *Can. J. Bot.* 52: 885–893.
- Trenin V.V. 1988. *Introduction to embryology of conifers*. Petrozavodsk. 151p. (In Russ.).
- Tretyakova I.N. 1990. *Embryology of conifers (physiological aspects)*. Novosibirsk. 157 p. (In Russ.).
- Voronin V.I. 1989. Effect of sulfur-containing emissions on siberian fir in the southern Baikal region: *Abstr. ... Diss. Kand. Sci. Krasnoyarsk*. 19 p. (In Russ.).