Ministry education and Science of Republic of Kazakhstan
Karaganda State University named after academician Ye.A. Buketov

Biological and geographical faculty

Botany Department

Course – Botany
Specialty - 5B011300 – «Biology»

Lecture № 20

Division Pinophyta, Gymnospermae

(1 hour)

Lecturer: candidate of biological science, associated professor
Ishmuratova Margarita Yulaevna

Plan of lecture:

1 General characteristic of Pinophyta.
2 Circle of development of Pinophyta.
3 Systematic of Pinophyta.

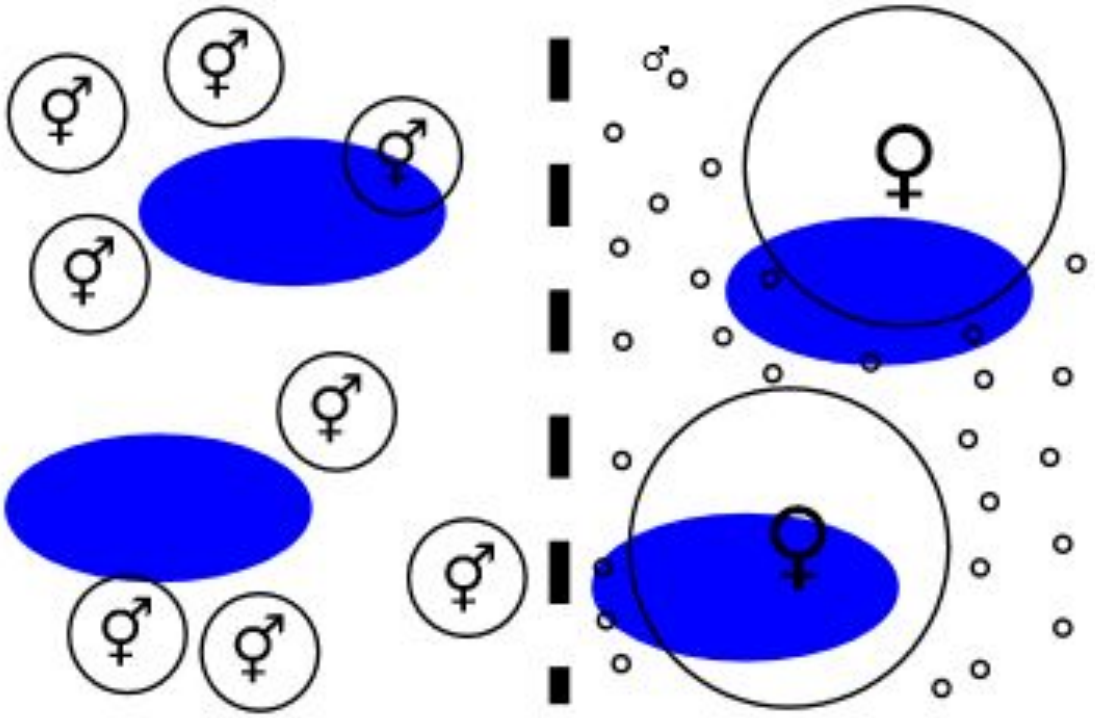
Main literatures:

1 Еленевский А.Г., Соловьев М.П., Тихомиров В.Н. Ботаника: систематика высших, или наземных, растений. 2 изд. - М.: Academia, 2001. - 429 с.
2 Нестерова С.Г. Лабораторный практикум по систематике растений. - Алматы: Қазақ ун-ті, 2011. - 220 с.
3 Родман А.С. Ботаника. – М.: Колос, 2001. - 328 с.

Additional literatures:

1 Билич Г.Л., Крыжановский В.А. Биология. Т. 2: Ботаника. - М.: Оникс 21 век, 2002. - 543 с.
2 Ишмуратова М.Ю. Систематика и интродукция растений (курс лекций). - Караганда: РИО Болашак-Баспа, 2015. - 100 с.
3 Тусупбекова Г.Т. Основы естествознания. Ч. 1. Ботаника. – Астана: Фолиант, 2013. – 321 с.
4 Ишмуратова М.Ю. Ботаника. Курс интерактивных презентаций. – Караганда: КарГУ, 2017. – 5,6 Гб.

Plants started to perform the similar “evolutionary efforts” even earlier, but while reptiles actively approach the sexual partner, plants cannot do the same because their tissues and organs evolved for completely different purposes. Instead of the active sex, plants use“carpet bombing”with spores; this was invented to increase the chance that two spores land nearby and the distance between sperm and egg cell will be minimal.
However,since simple increase in the number of spores is a great waste of resources, plants minimized spore size; this will also allow for the longer distance of dispersal. On the other hand, some spores must remain large because embryo (if fertilization occurs) will need the support from the feeding gametophyte. Consequently, plants ended up with division of labor: numerous, minuscule male spores which grow into male gametophytes with antheridia only, and few large female spores which make female gametophytes producing only archegonia. Altogether, this heterosporic cycle makes fertilization less dependent on water and more dependent on spore distribution and gametophyte features.



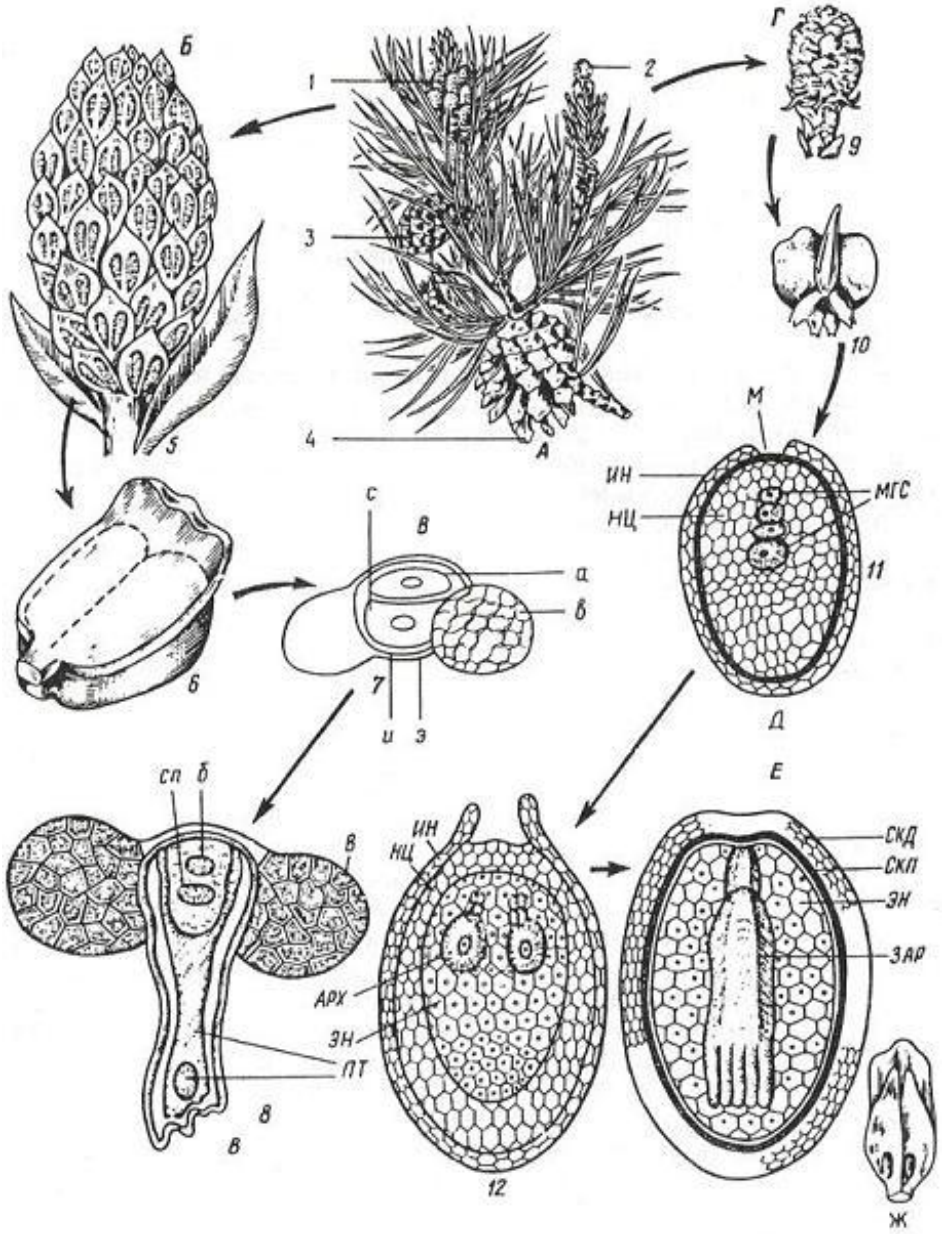
Simple scheme illustrating the heterosporic way of fertilization. Two drops of water (blue) do not provide the connection between two gametophytes of homosporous plant (left) but are enough for gametophytes of heterosporous plant (right) using the same amount of resources.

Seed plants appeared about 360 millions years ago in poleozoy period (the end of dewon). They are separated into 2 division - *Pinophyta, or Gymnospermae* and *Magnoliophyta, or Angiospermae*.

This division of labor allows resources to be used more efficiently and also restricts self-fertilization. In the plant evolution, there was a high need for heterospory because it independently arose in several groups of pteridophytes and even among mosses. In the extreme cases of heterospory, a female spore does not leave the mother plant and germinate there, “waiting” for the fertilization from the male gametophytedevelopednearby;infact,thisisincipientpollination,thesteptowards the seed.

Heterosporic life cycle starts with a male gametophyte and a female gametophyte, both of which produce gametes. Once fertilization occurs, a zygote develops into sporophyte. The sporophyte will then produce two different sporangia types: female megasporangia and male microsporgangia. Meiosis in megasporangium will frequently result in one female spore, megaspore (similar to the meiosis in the ovaries of vertebrate animals), whereas in the microsporangium, meiosis and subsequent mitoses will make numerous microspores; both the megaspore and microspores will develop into gametophytes and the cycle will repeat.

Circle of development of Pinus sylvestris



А – branch of pine with male (1) and female cones: 2 – first year; 3 – second year of life after pollination; 4 – mature cone with seeds; Б – male cone: 5 – general view; 6 – microsporophyll with 2 micro sporangium, В – pollen grain (male gametophyte): 7 – structure; 8 – germination (э - exine, и – intine, в – air bags, а – antheridia cell, с – cell of tube, б – nucleus of basal cell, СП – nucleus of sperm cell, ПТ – pollen tube); Г – female cone: 9 – general view; 10 – seed part of cone; Д – nucellus: 11 – after creation of mega spore (ИН – integument, М – micro pile, НЦ – nucellus, МГС – mega spore); 12 – after development of female gametophyte (ЭН – endosperm, АРХ – archegonium); Е – seed (СКД – seed woody coat, СКП – seed soft coat, ЗАР – embryo); Ж – seed leaf with seeds

Leaves of coniferous plants

Abies

Pinus

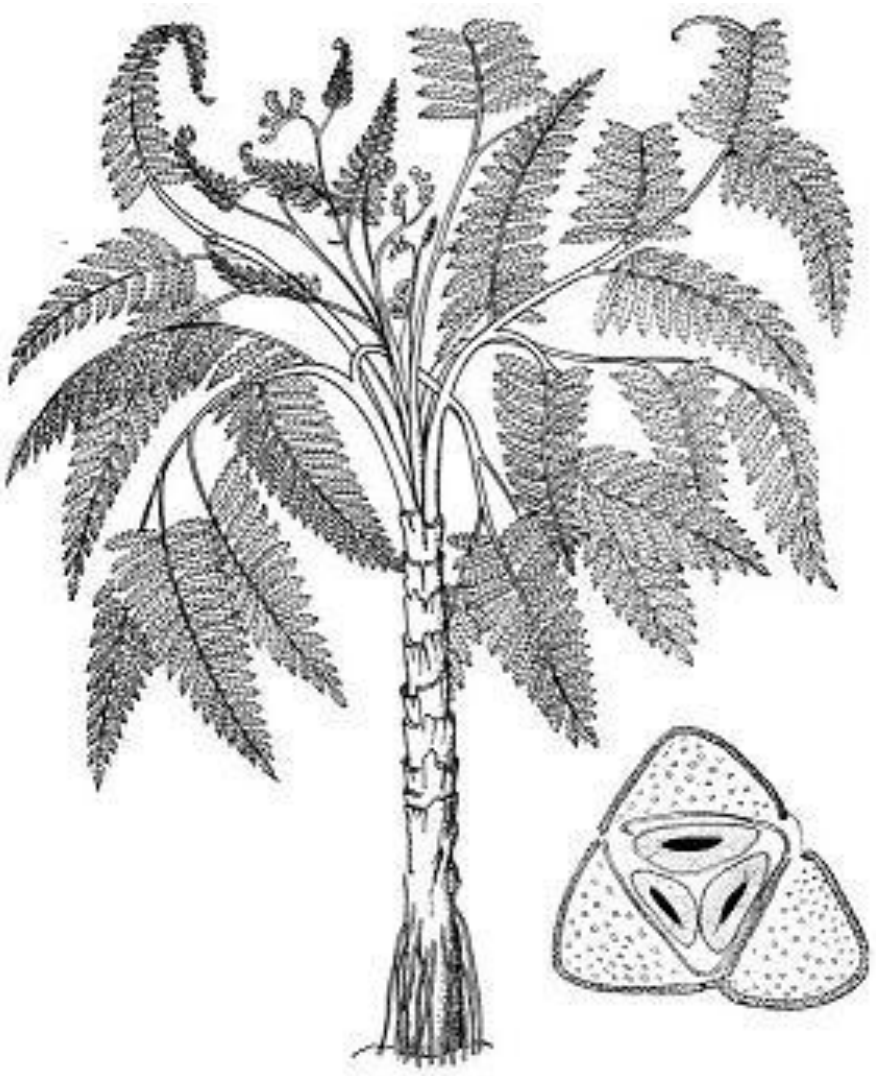
Larix sibirica

Gingko biloba

Division Pinophyta includes six classes:

-*Pteridospermatopsida*,
-*Cycadopsida*,
-*Bennettitopsida*,
-*Ginkgoopsida,*
-*Pinopsida*,
-*Gnetopsida*.

Seed ferns



Cycadopsida

Gingko biloba

Pinus sylvestris

Abies sibirica

Juniperus communis

Ephedra equisetina

Welvichia paradoxa

juvelur

cosmetics

medicine

practical use of coniferous plants

essential oils

green building

new year trees

building

Control questions:

1 Find the similar signs and differences between ferns and coniferous plants.
2 Modern seed plants dominate in vegetative cover on Earth. Why?
3 Describe circle of development of Pinus sylvestris.
4 Note the most spreading species of coniferous plants which have practical value for human activity.

Test questions:

Inside nucellus of coniferous plants is created:
A) spore
B) archegonium
C) Pollens
D) Micro spore
E) Cones
F) seeds
G) fruits
H) flower

Process of pollination of coniferous plants is going by using of:
A) water
B) wind
C) insects
D) animals
E) birds