Usefulness of the genetic field experiments for biological sciences

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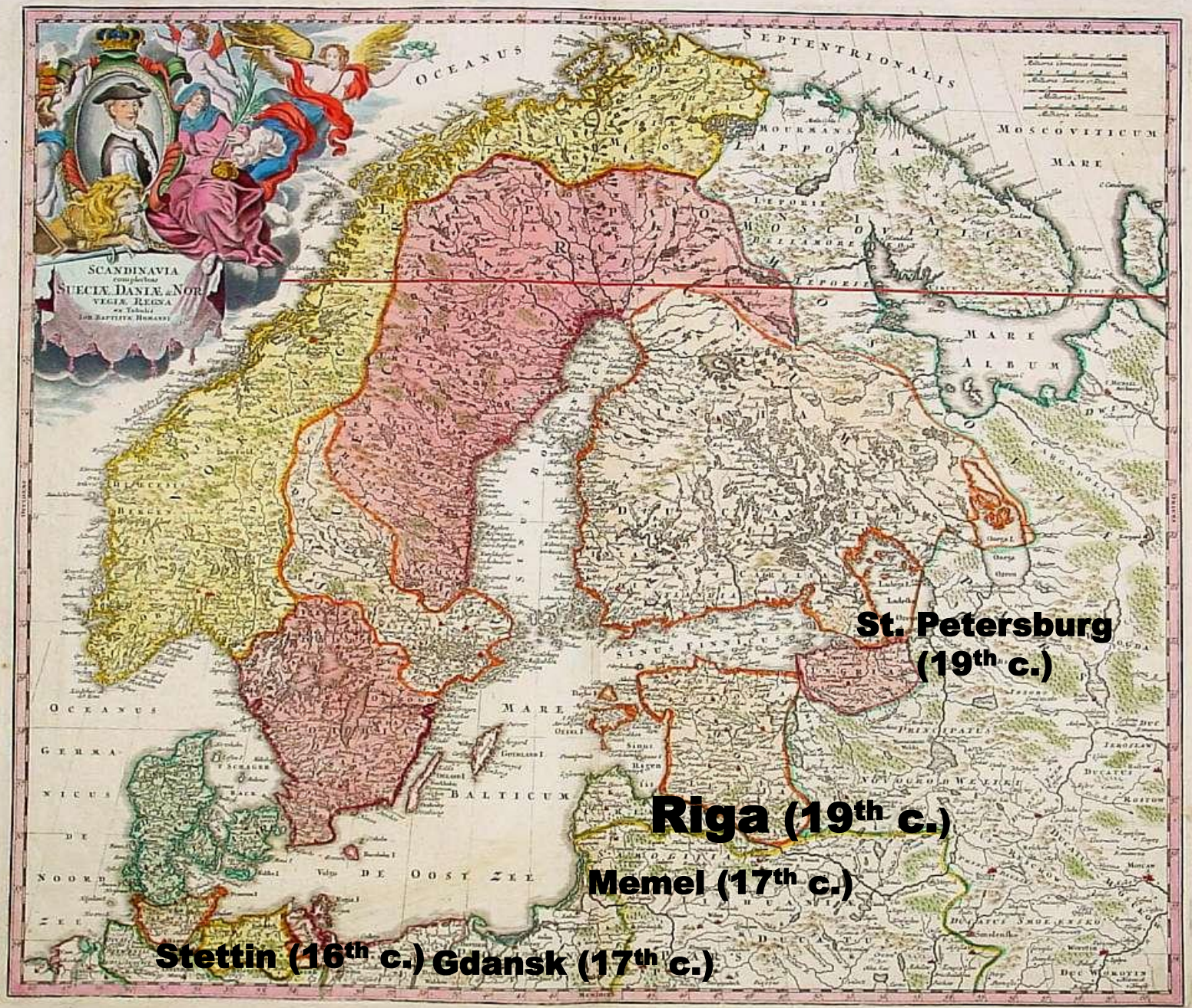
HMS Victory (104 guns)


SCANDINAVIA
SUECIÆ, DANIÆ, & NORVEGIÆ REGNA
OCEANUS SEPTENTRIONALIS
MOSCOVITICUM MARE
MARE ALBUM
OCEANUS GERMANICUS
MARE BALTICUM
DE OOSTZEE
St. Petersburg (19th c.)
Riga (19th c.)
Memel (17th c.)
Stettin (16th c.)
Gdansk (17th c.)

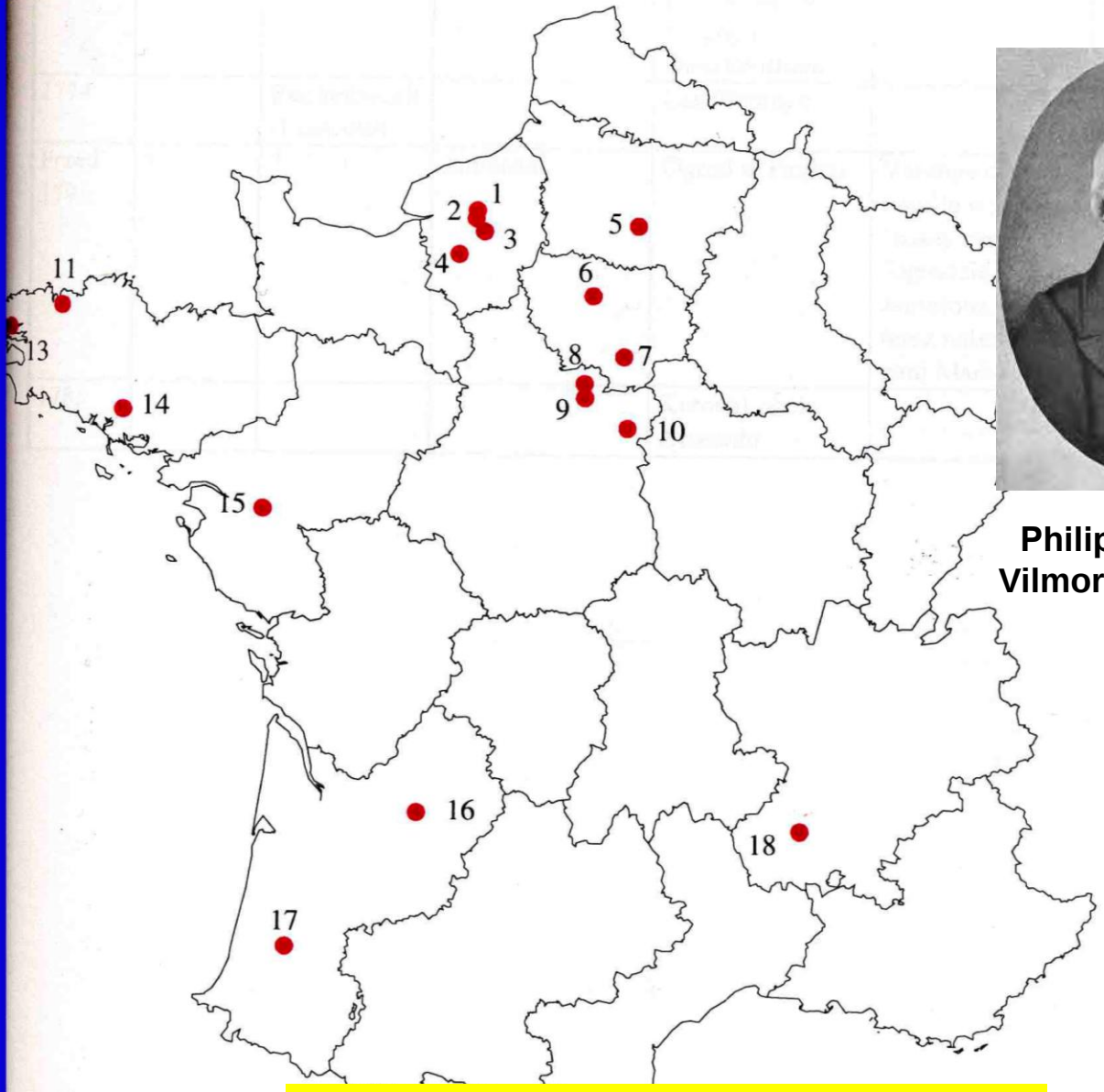
Dvina river, S.M. Prokudin-Gorskii (1912)

Mariinskii channel, S.M. Prokudin-Gorskii (1912)

Mariinskii channel, S.M. Prokudin-Gorskii (1912)

Volga near Kostroma, S.M. Prokudin-Gorskii (1912)

Piotr Daszkiewicz
Muséum national d'Histoire naturelle



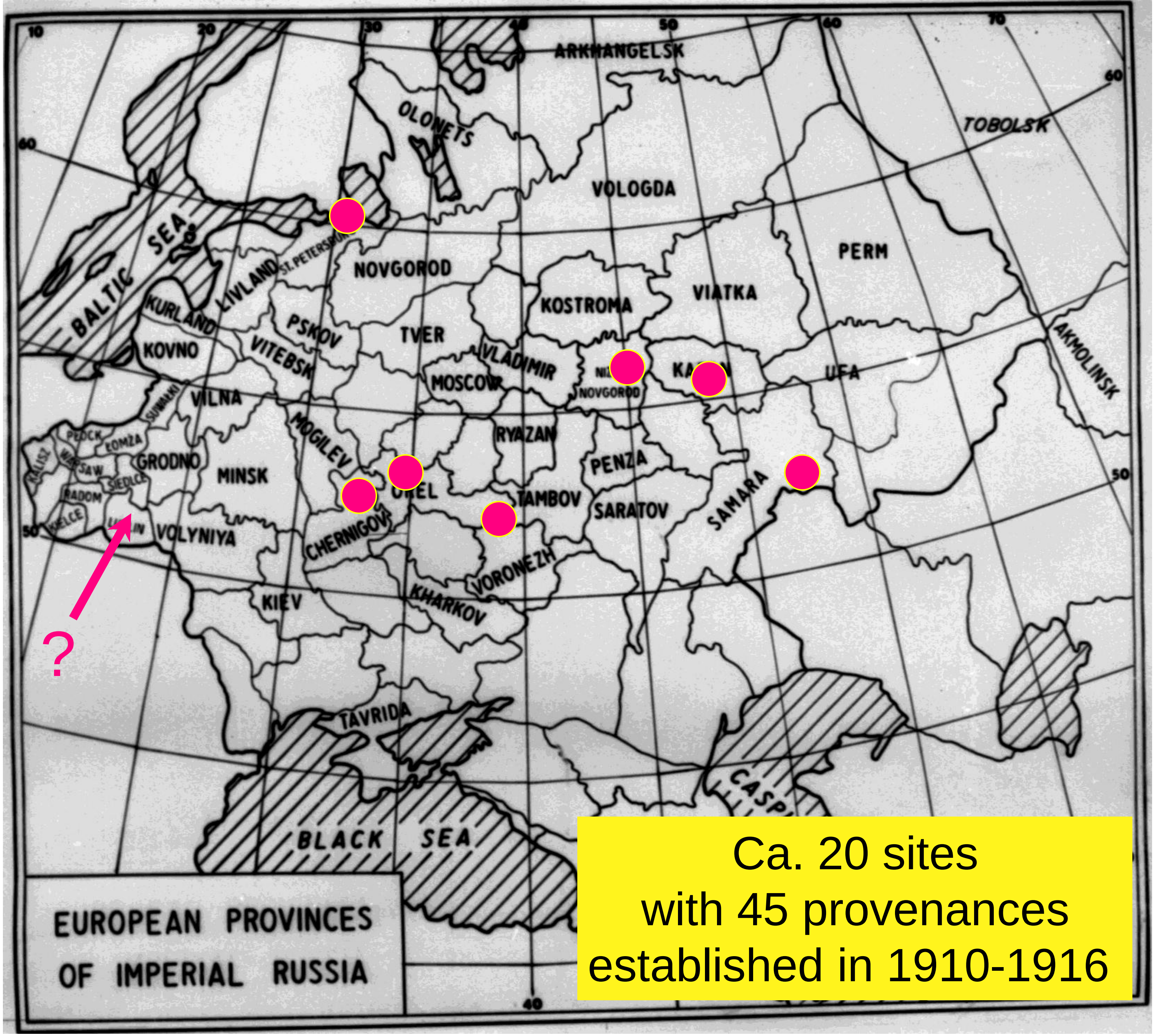
Philippe André de Vilmorin (1776-1862)

Known sites with ‘Riga pine’ plantations in 18th – 19th c. France

IUFRO Scots pine provenance experiments

- 1907
- 1938-1939
- 1982

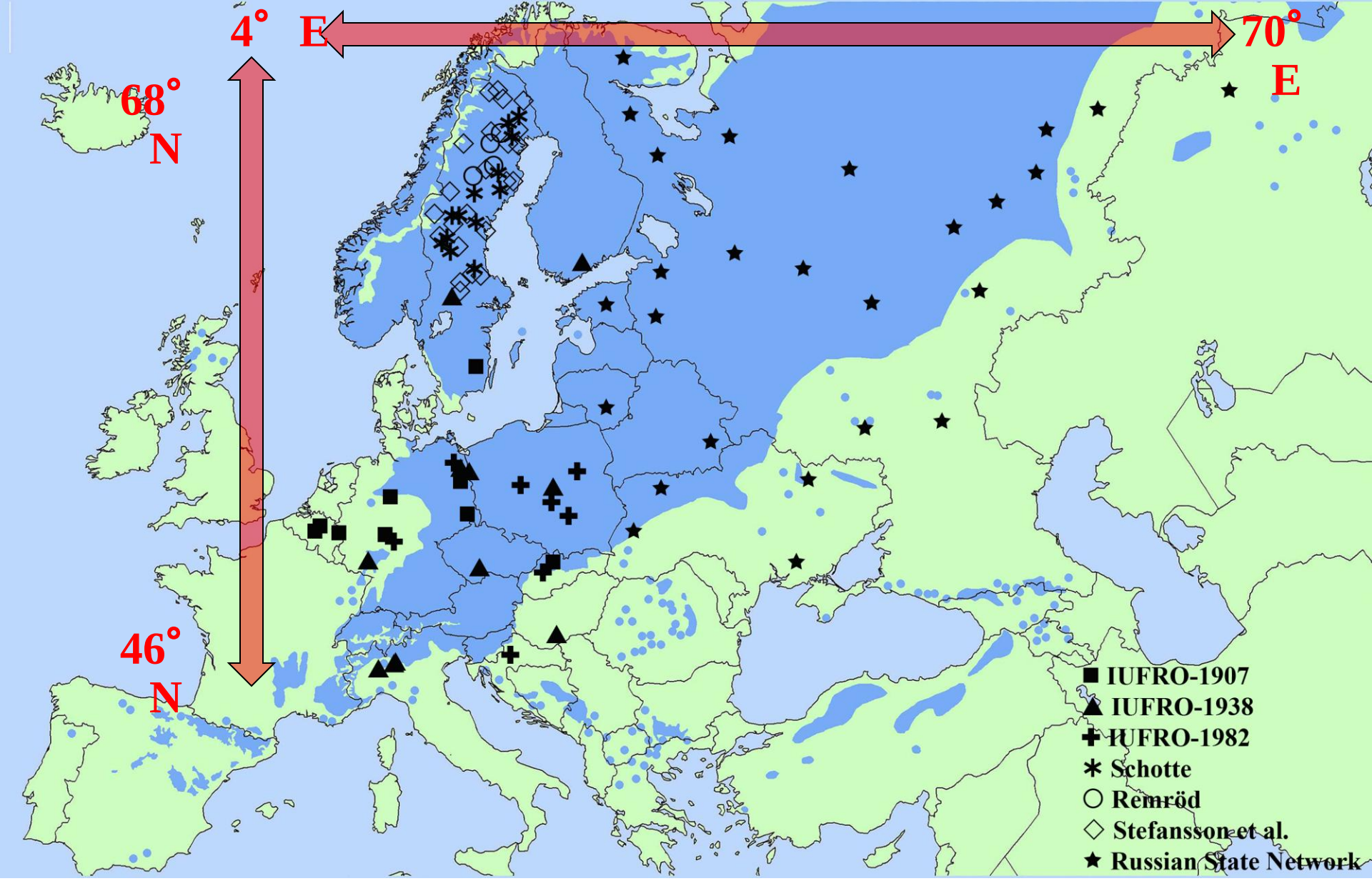
V.D. Ogievskii, 1909 r.



Ca. 20 sites
with 45 provenances
established in 1910-1916

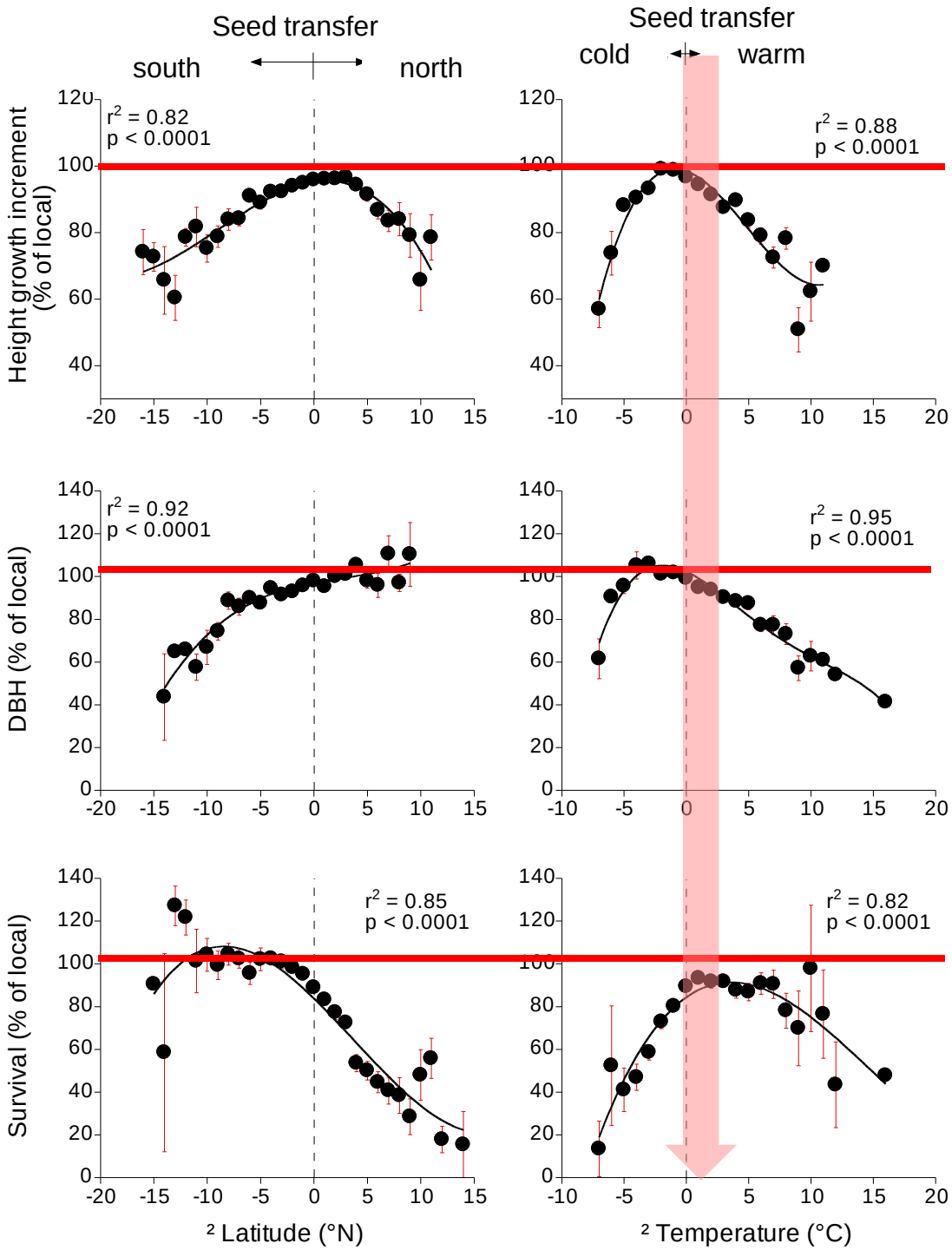
Salomon Z. Kurdiani, *ca*. 1930

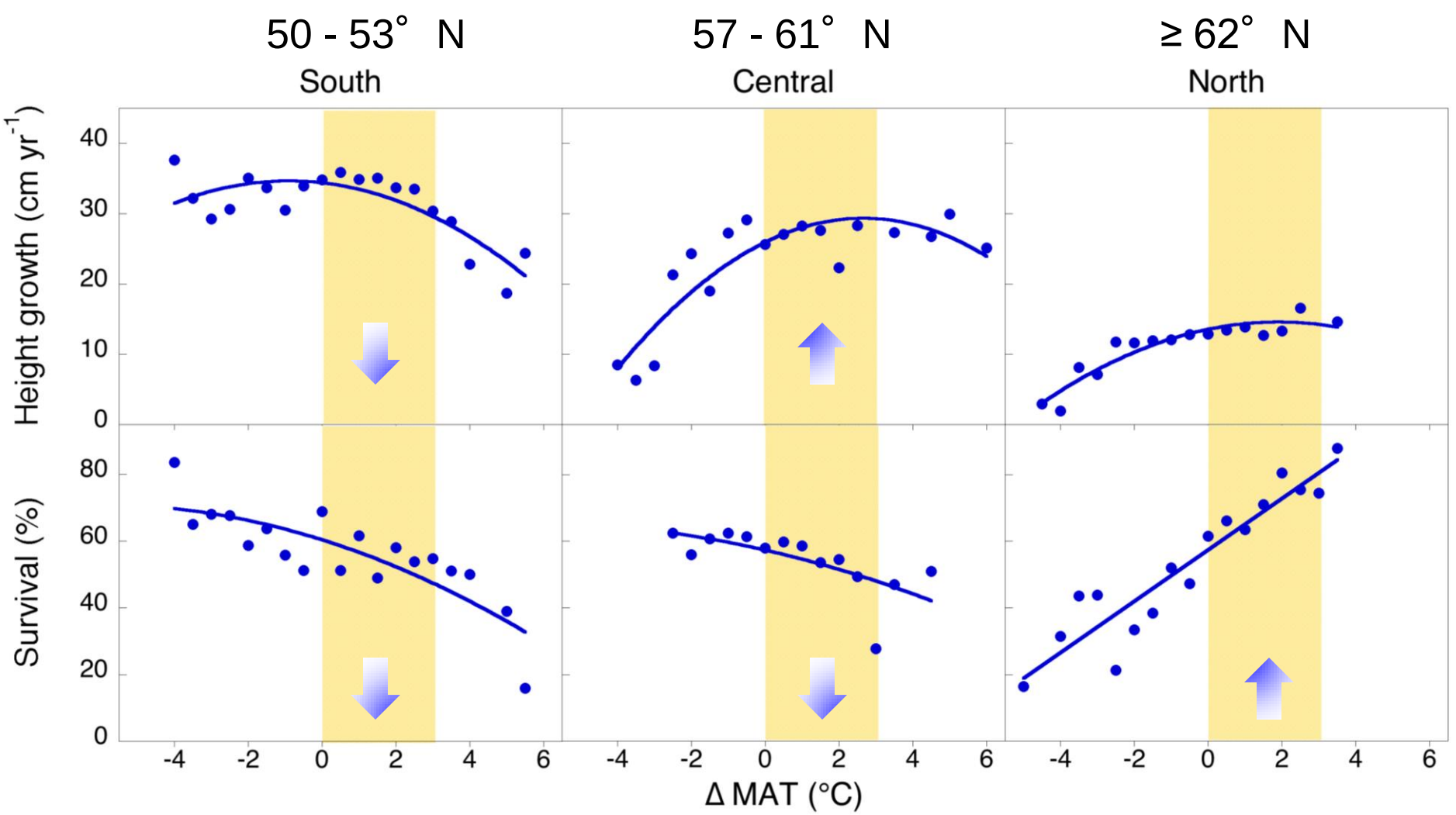

29 14:32



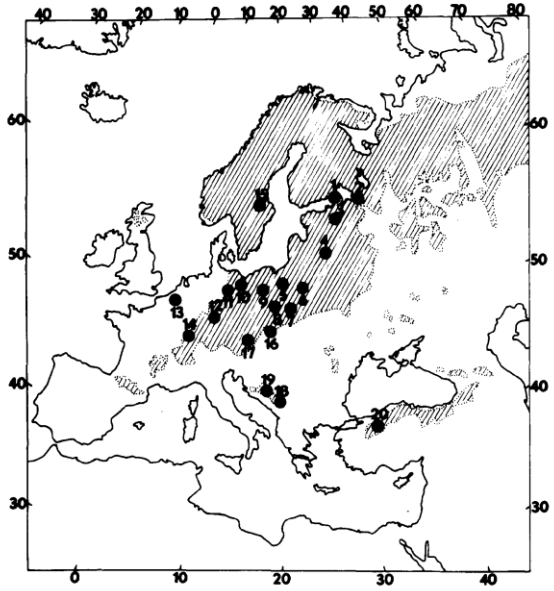
95 sites, 295 seed sources of Scots pine

Mean annual temperature -1.7 to 14° C, precipitation from 294 to 698 mm, growing season length from 124 to 224 days. Plantation age - 17±10 yrs.


Seed transfer
south
north
Seed transfer
cold
warm
Height growth increment (% of local)
DBH (% of local)
Survival (% of local)
r² = 0.82
p < 0.0001
r² = 0.88
p < 0.0001
r² = 0.92
p < 0.0001
r² = 0.95
p < 0.0001
r² = 0.85
p < 0.0001
r² = 0.82
p < 0.0001
² Latitude (°N)
² Temperature (°C)



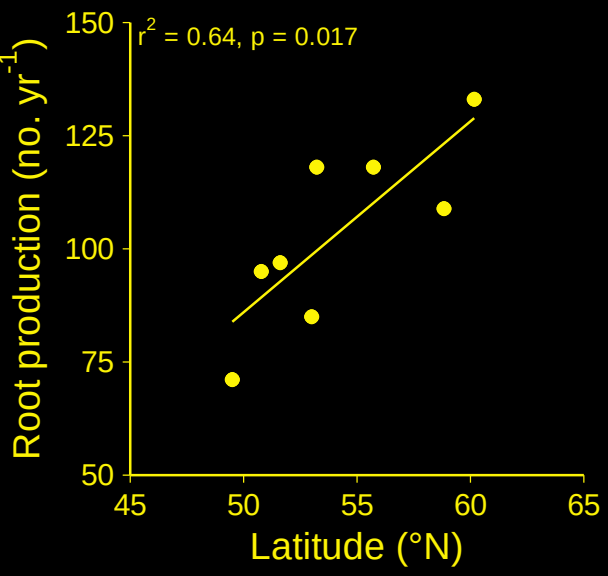
Climate transfers equivalent to warming by 1-3 ° C markedly increased the survival of populations in northern Europe (≥ 62° N, < 2 ° C MAT) and modestly increased height growth ≥ 57° N but decreased survival at < 62° N and modestly decreased height growth at < 54° N latitude in Europe. Thus, even modest climate warming will likely influence Scots pine survival and growth, but in distinct ways in different parts of the species range.

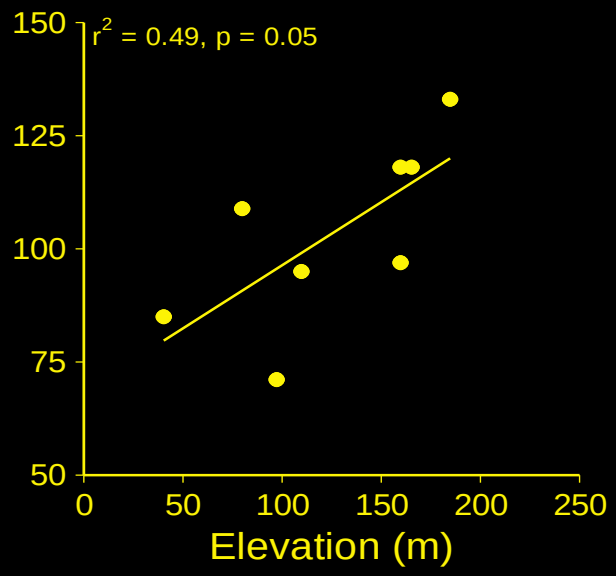


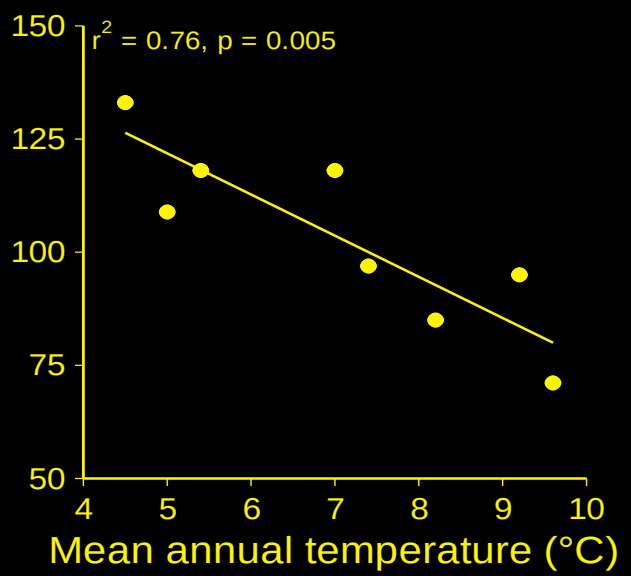
IUFRO – Scots pine-1982

Provenance experiment

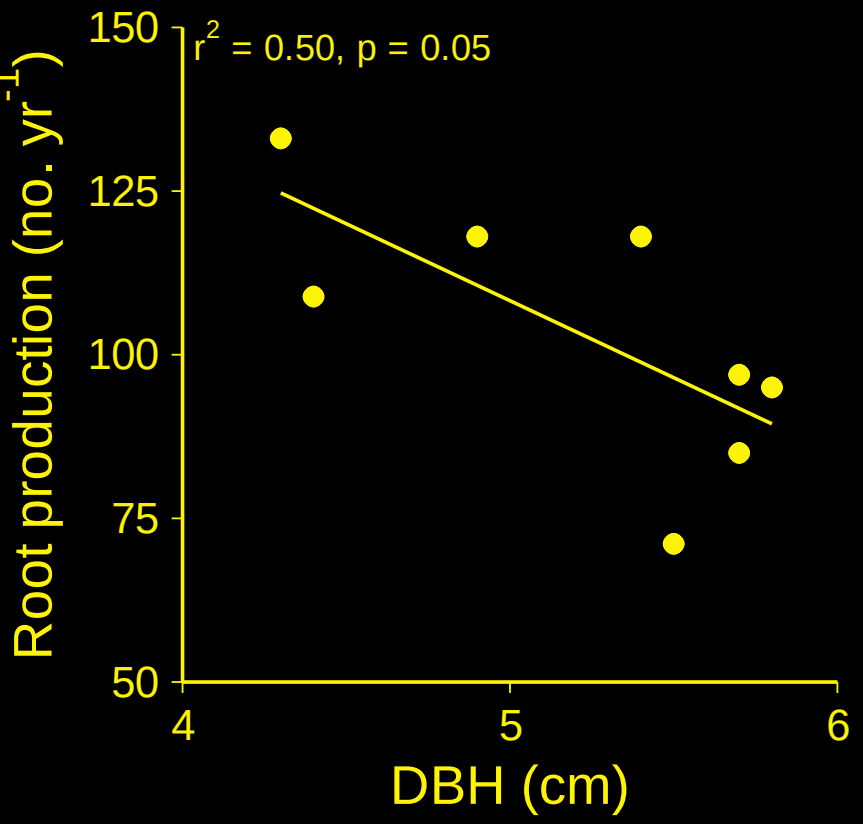
IUFRO – Scots pine-1982
Provenance experiment

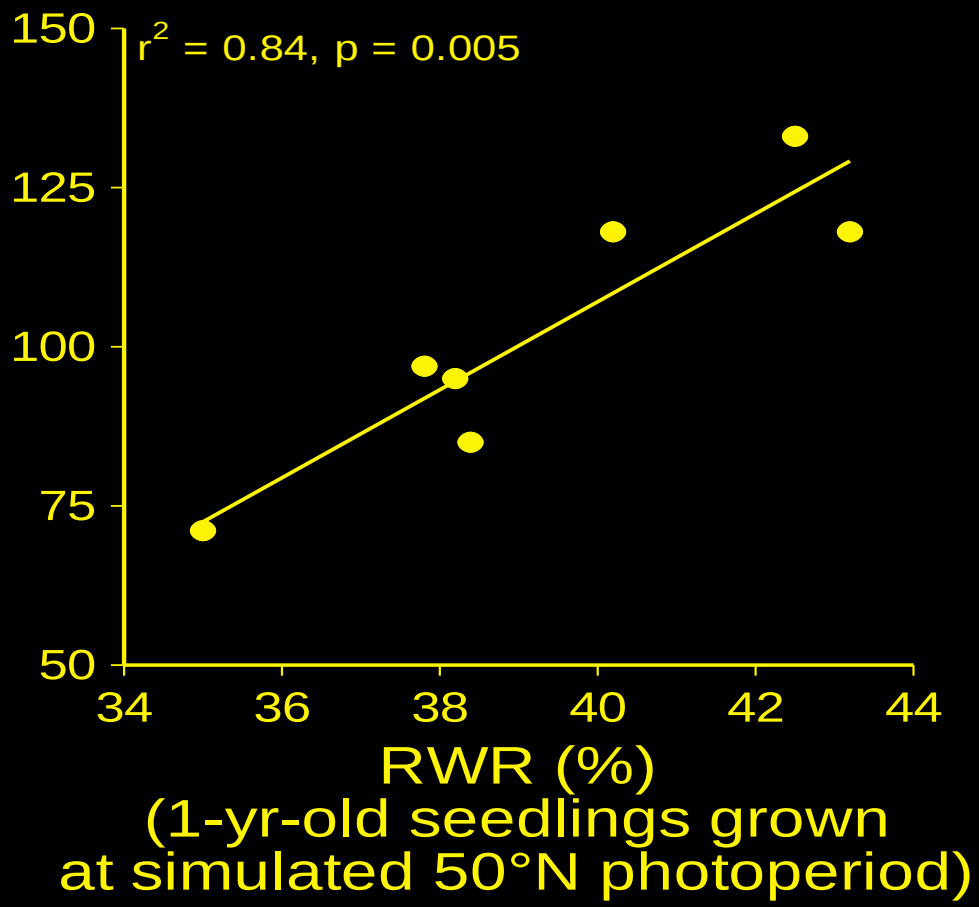






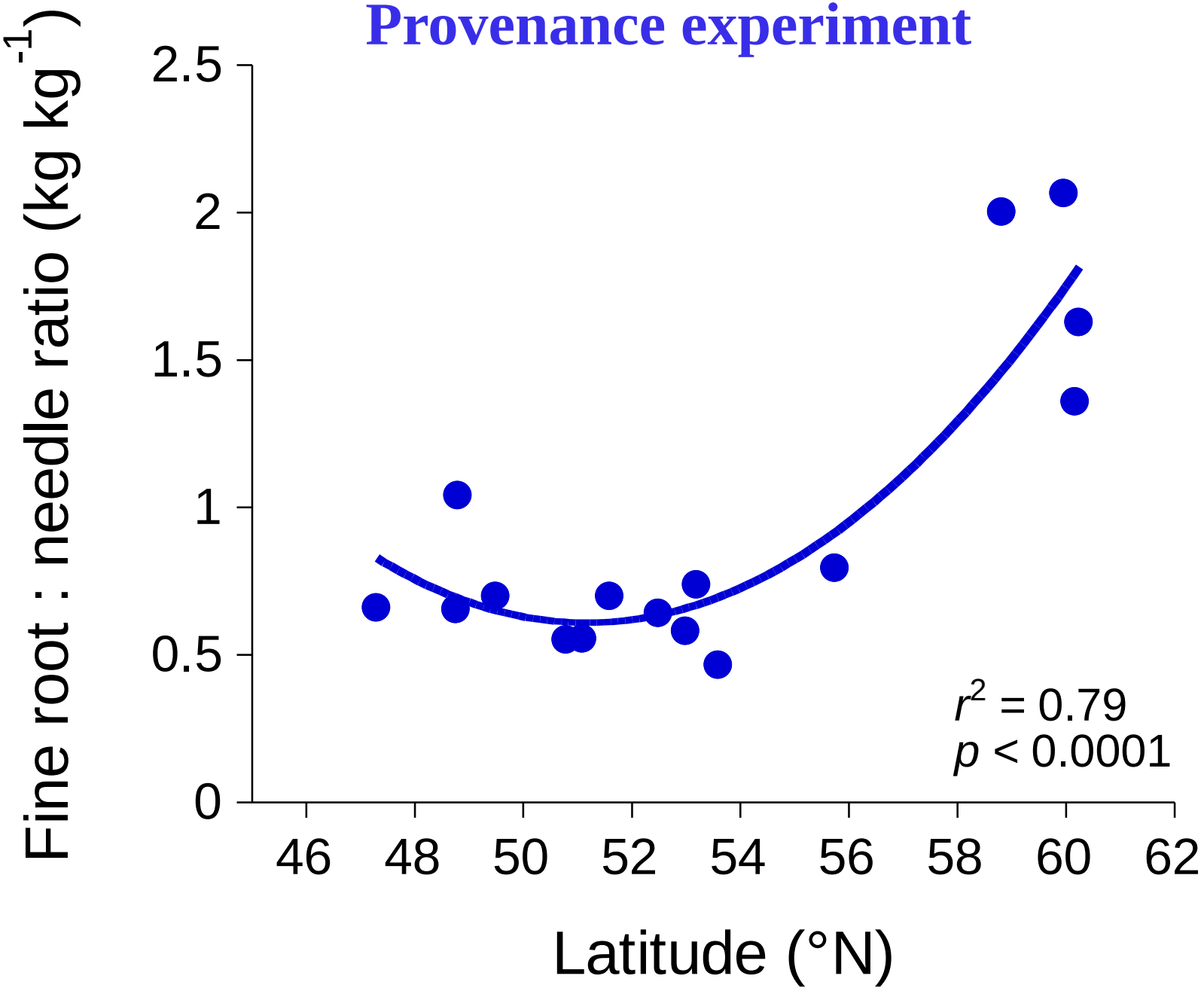
IUFRO – Scots pine-1982
Provenance experiment



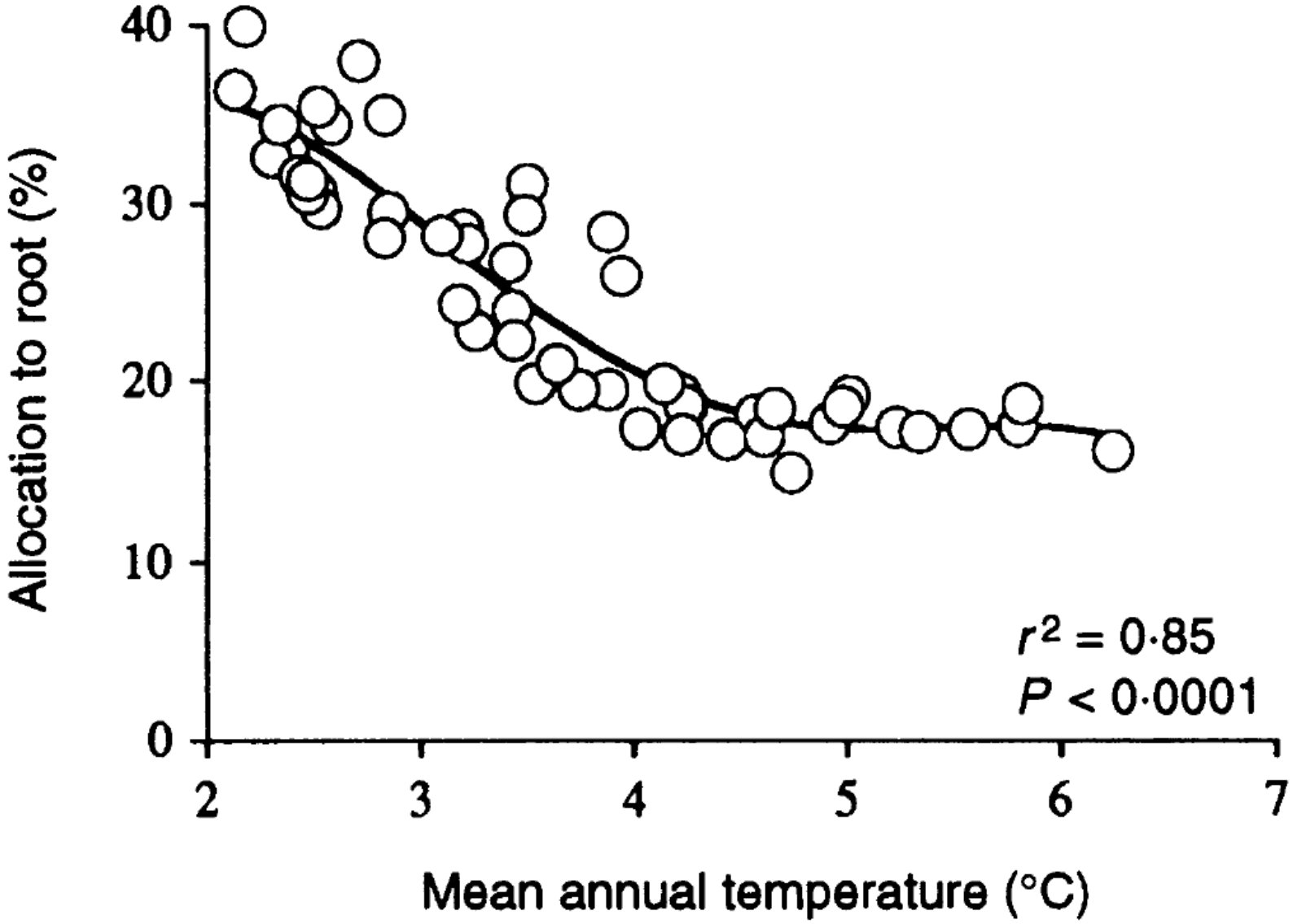


IUFRO – Scots pine-1982

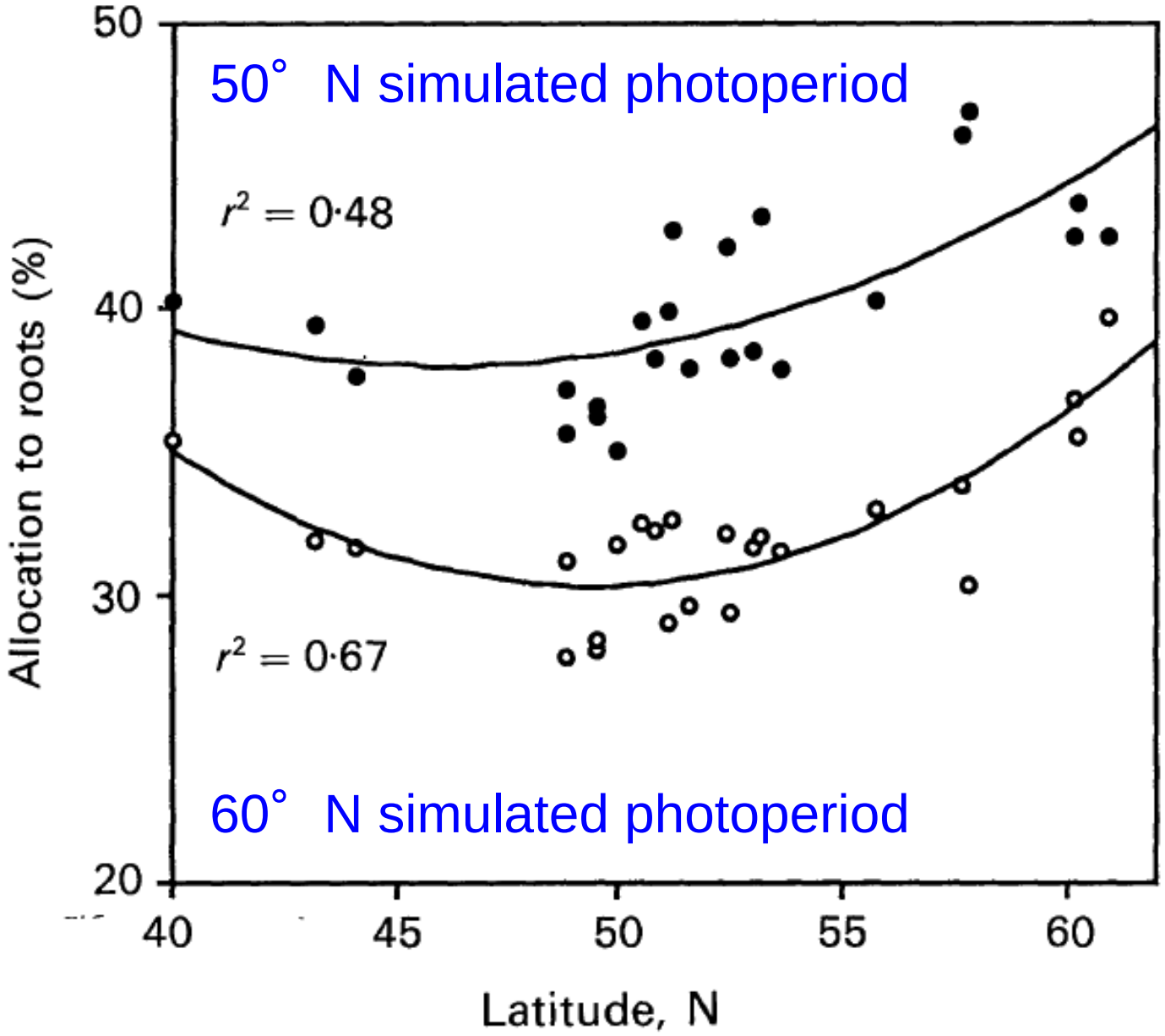
Provenance experiment


IUFRO – Scots pine-1982
Provenance experiment
Fine root : needle ratio (kg kg-1)
2.5
2
1.5
1
0.5
0
46
48
50
52
54
56
58
60
62
Latitude (°N)
r2 = 0.79
p < 0.0001

2-yr-old *seedlings*
Picea abies
provenance experiment



1-yr-old seedlings
IUFRO – Scots pine-1982
Provenance experiment



Growth phenology, Scots pine (*Pinus sylvestris*)

Mean annual temp. in seed origin 3.6 ° C

onset of growth

month | May | Jun | July | Aug | Sep | Oct | Nov

onset of growth

Mean annual temp. in seed origin 7.7 ° C

Δ ≈ 10 days

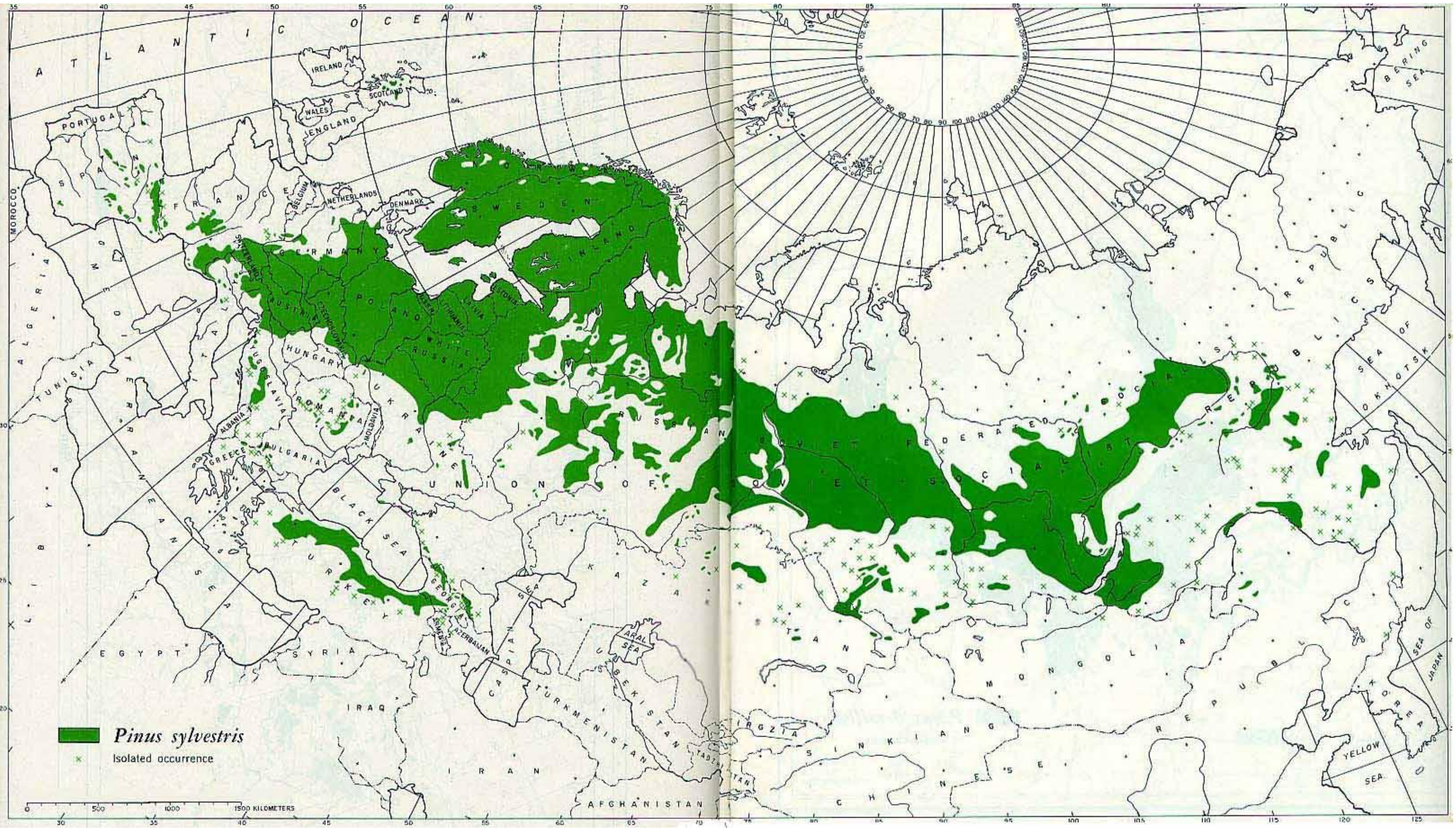
Δ ≈ 45 days

Δ ≈ 60 days

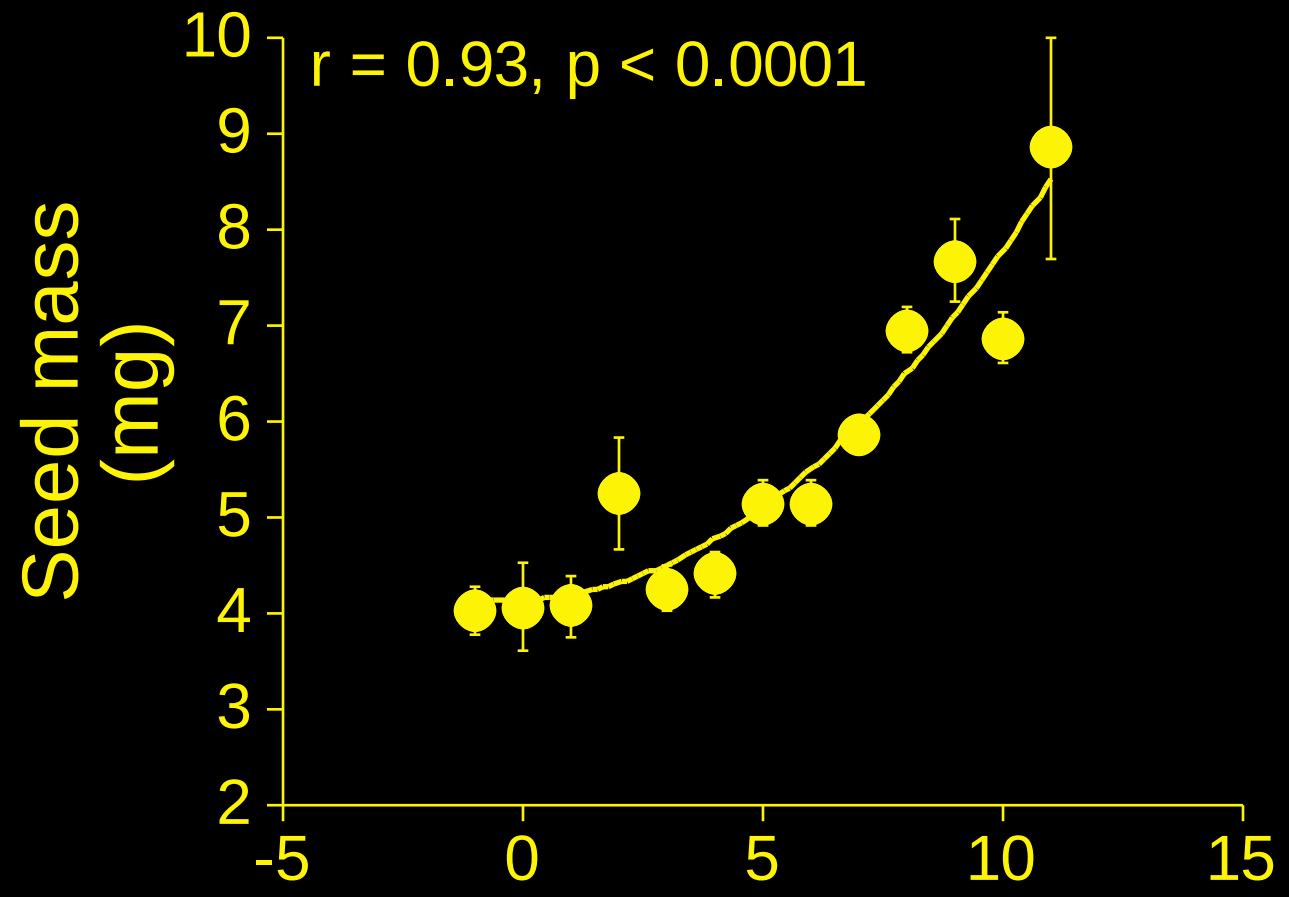
Sweden, 62° N

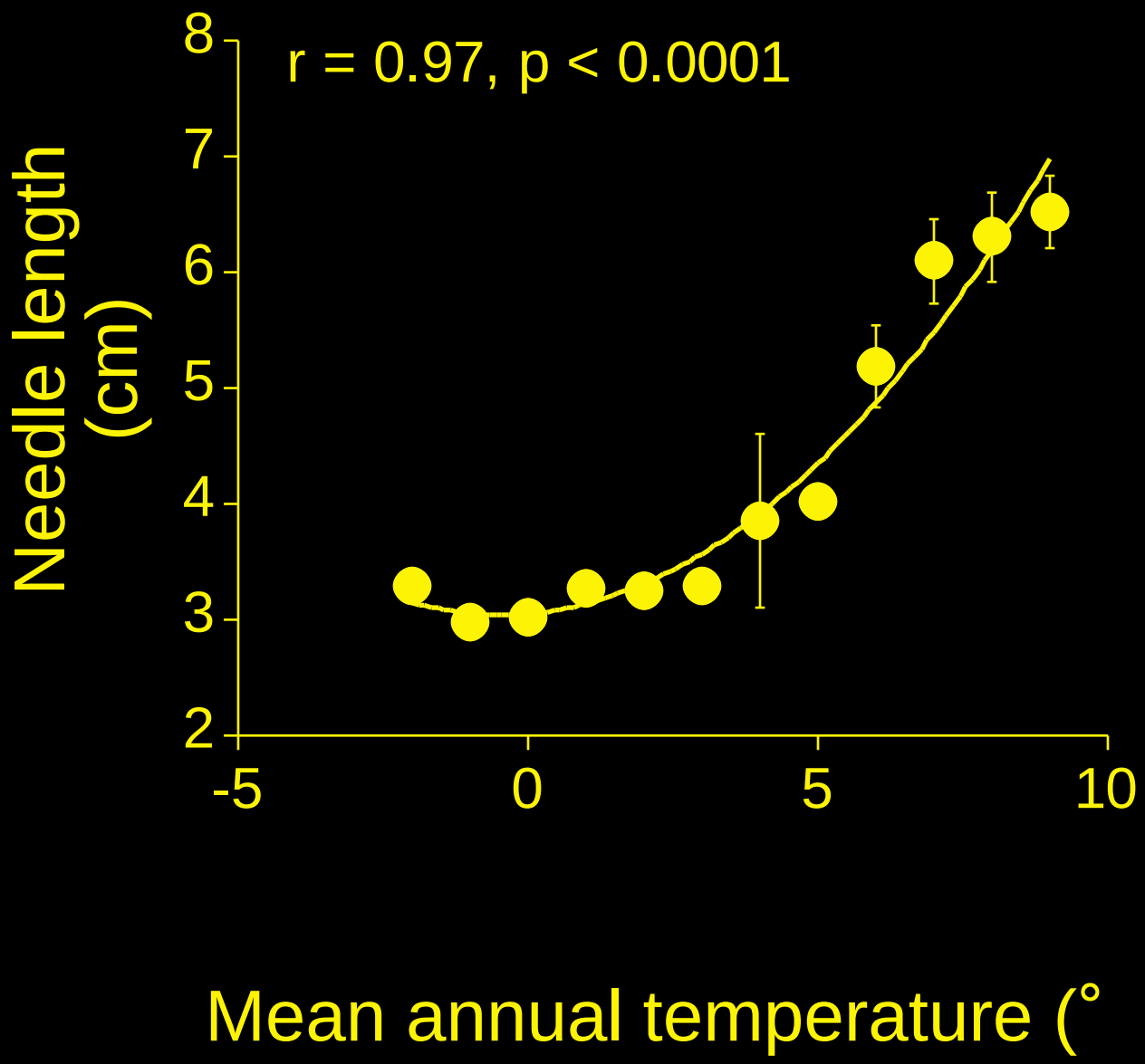
Poland, 52° N

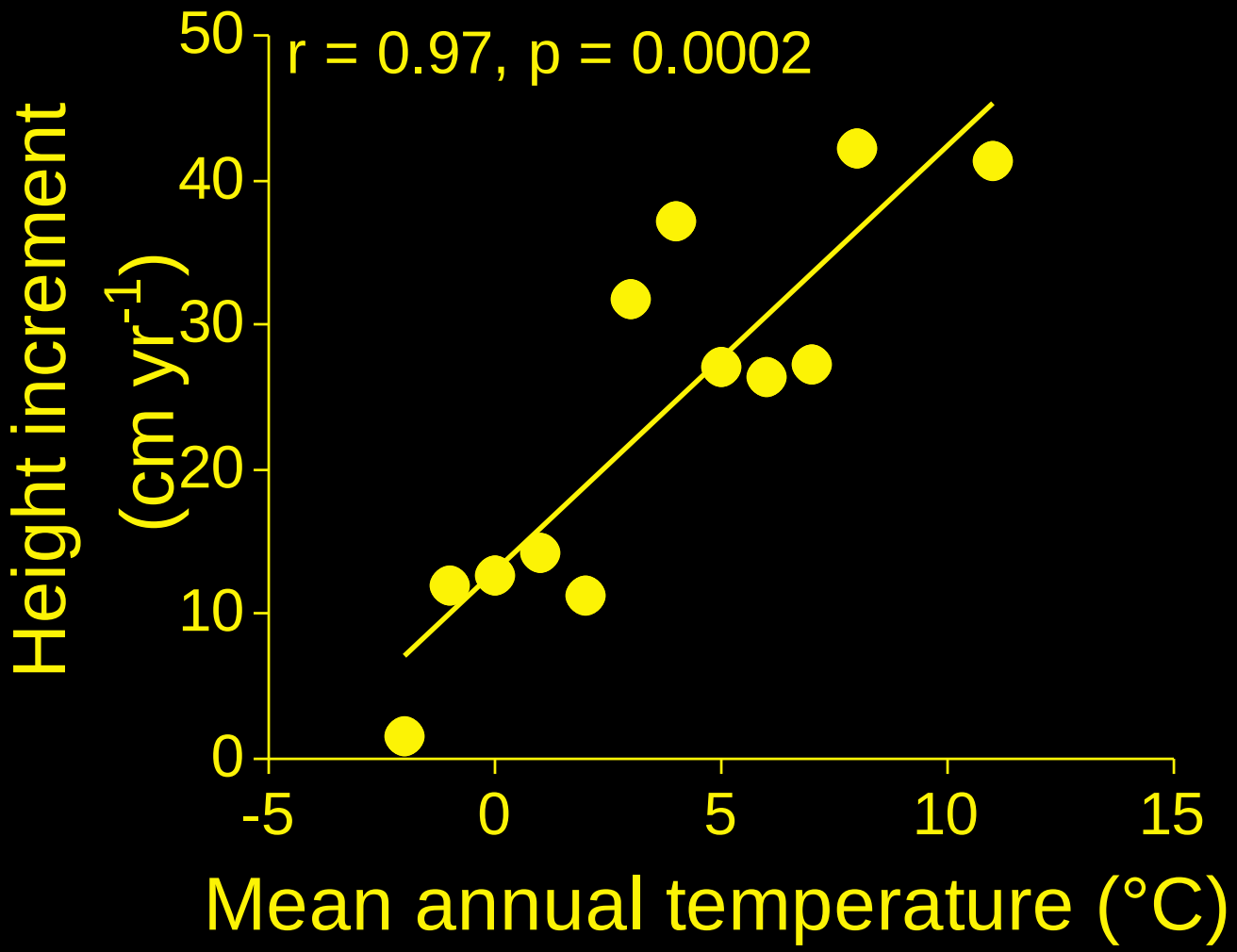

Sweden, 62° N
Poland, 52° N


Pinus sylvestris
Isolated occurrence
0
500
1000
1500 KILOMETERS
ATLANTIC OCEAN
IRELAND
SCOTLAND
WALES
ENGLAND
PORTUGAL
SPAIN
FRANCE
BELGIUM
NETHERLANDS
DENMARK
GERMANY
SWEDEN
FINLAND
POLAND
AUSTRIA
HUNGARY
ROMANIA
MOLDAVIA
UKRAINE
WHITE RUSSIA
LITHUANIA
LATVIA
ESTONIA
ALBANIA
GREECE
BULGARIA
ITALY
MOROCCO
ALGERIA
TUNISIA
LIBYA
EGYPT
SYRIA
IRAQ
IRAN
TURKEY
GEORGIA
AZERBAIJAN
BLACK SEA
CASPIAN SEA
ARAL SEA
MEDITERRANEAN SEA
TURKMENISTAN
UZBEKISTAN
AFGHANISTAN
KAZAKHSTAN
UNION OF SOVIET SOCIALIST REPUBLICS
RUSSIAN SOVIET FEDERATED SOCIALIST REPUBLIC
MONGOLIA
SINKIANG
CHINESE REPUBLIC
KOREA
YELLOW SEA
SEA OF JAPAN
SEA OF OKHOTSK
BERING SEA

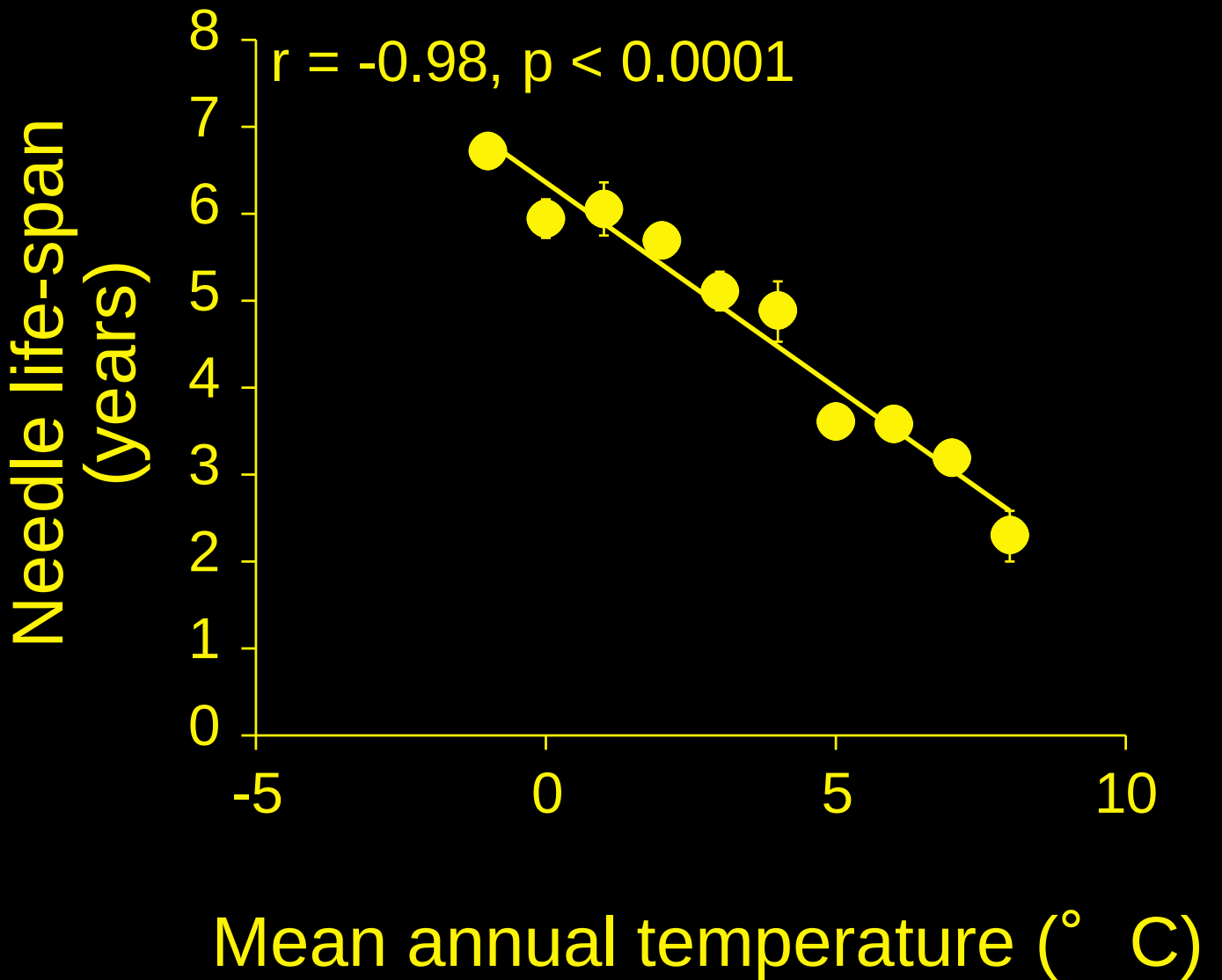
Pinus sylvestris (*in situ* data)



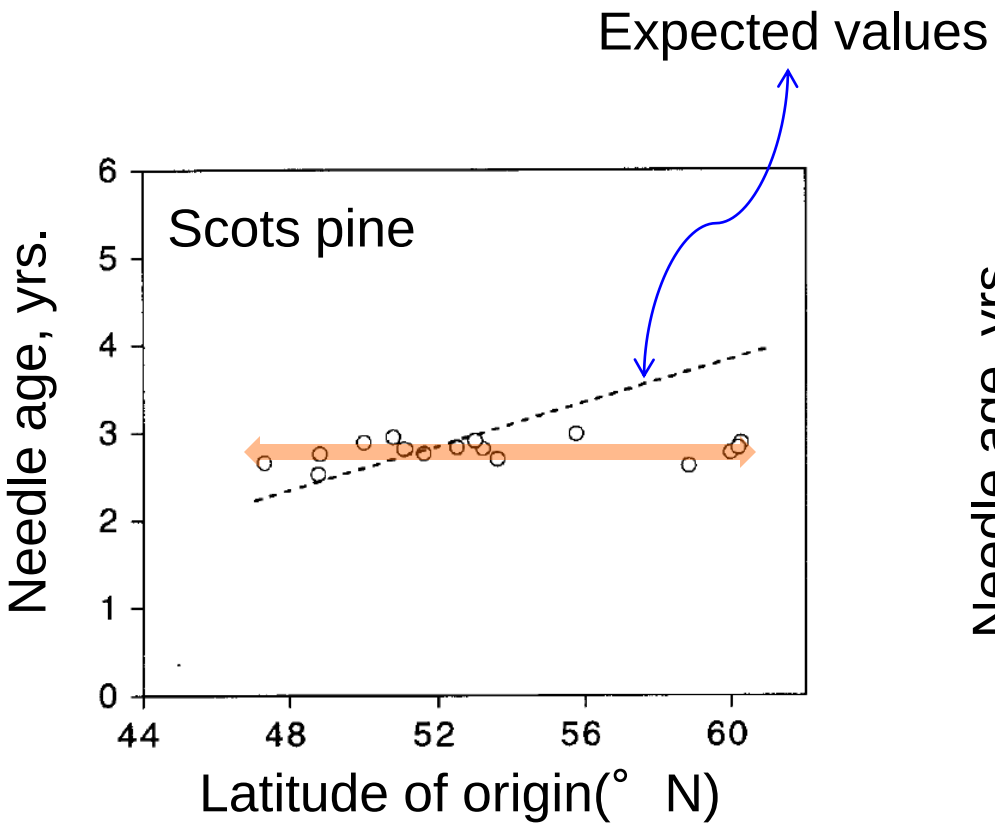

r = 0.97, p < 0.0001
Needle length (cm)
8
7
6
5
4
3
2
-5
0
5
10
Mean annual temperature (˚ C)

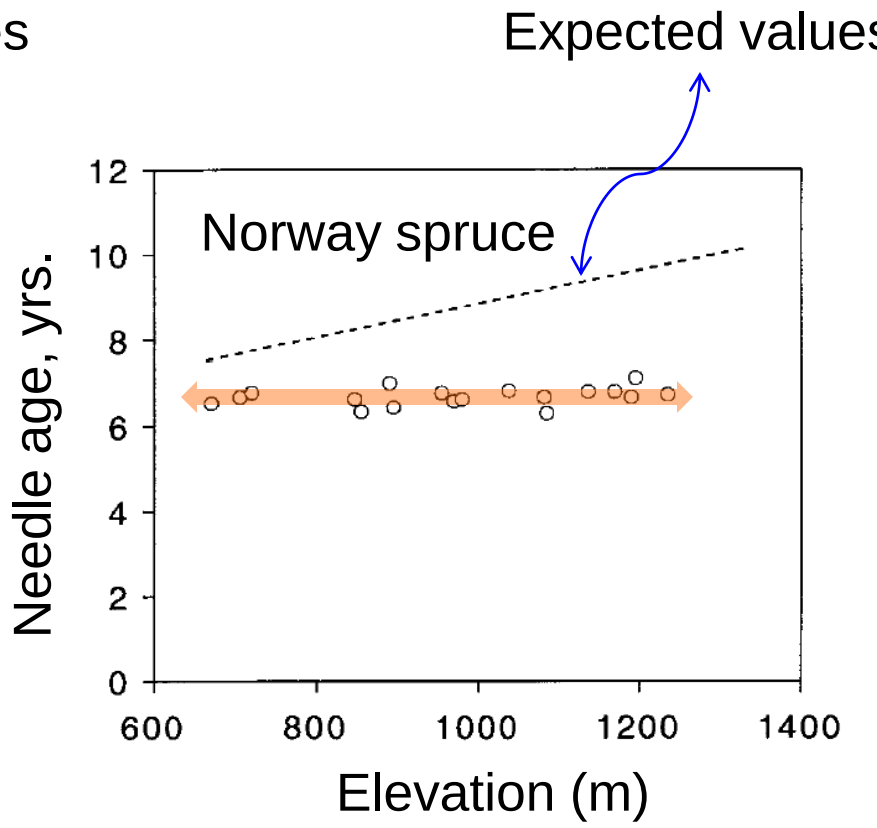

r = 0.97, p = 0.0002
Height increment
(cm yr-1)
50
40
30
20
10
0
-5
0
5
10
15
Mean annual temperature (°C)

Pinus sylvestris (*in situ* data)

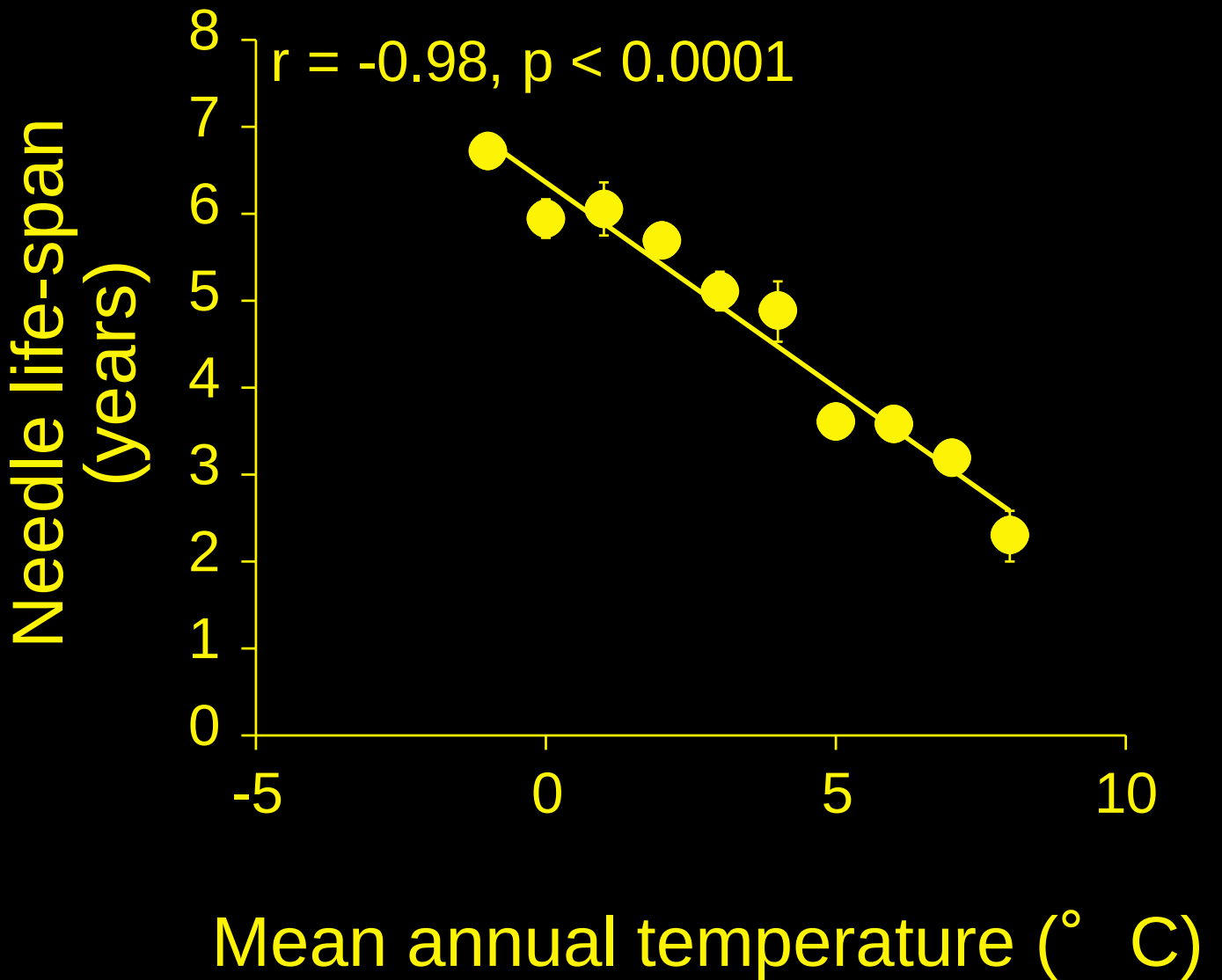


Provenance experiments





Pinus sylvestris (*in situ* data)



***Picea abies* 7-yr-old provenance experiment**

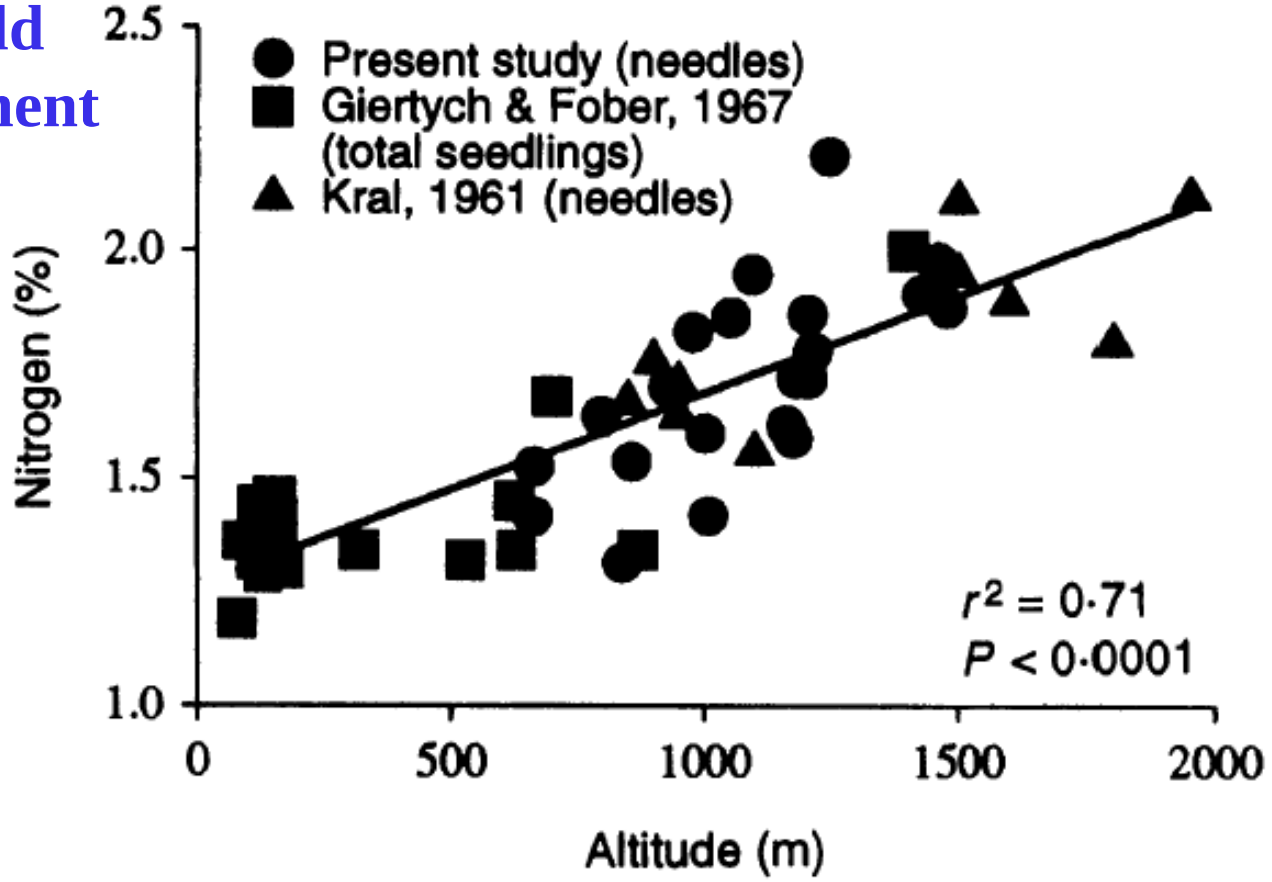
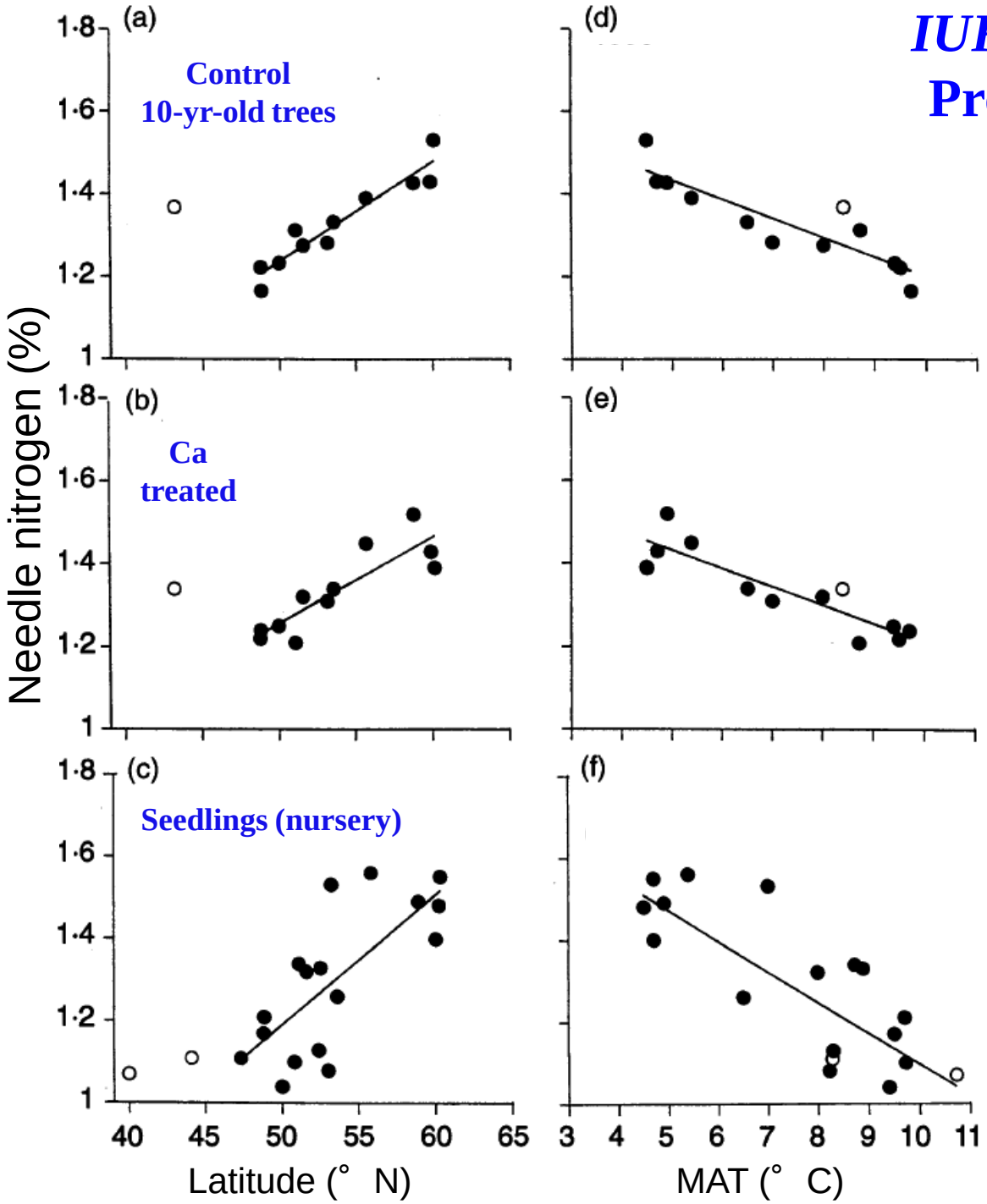


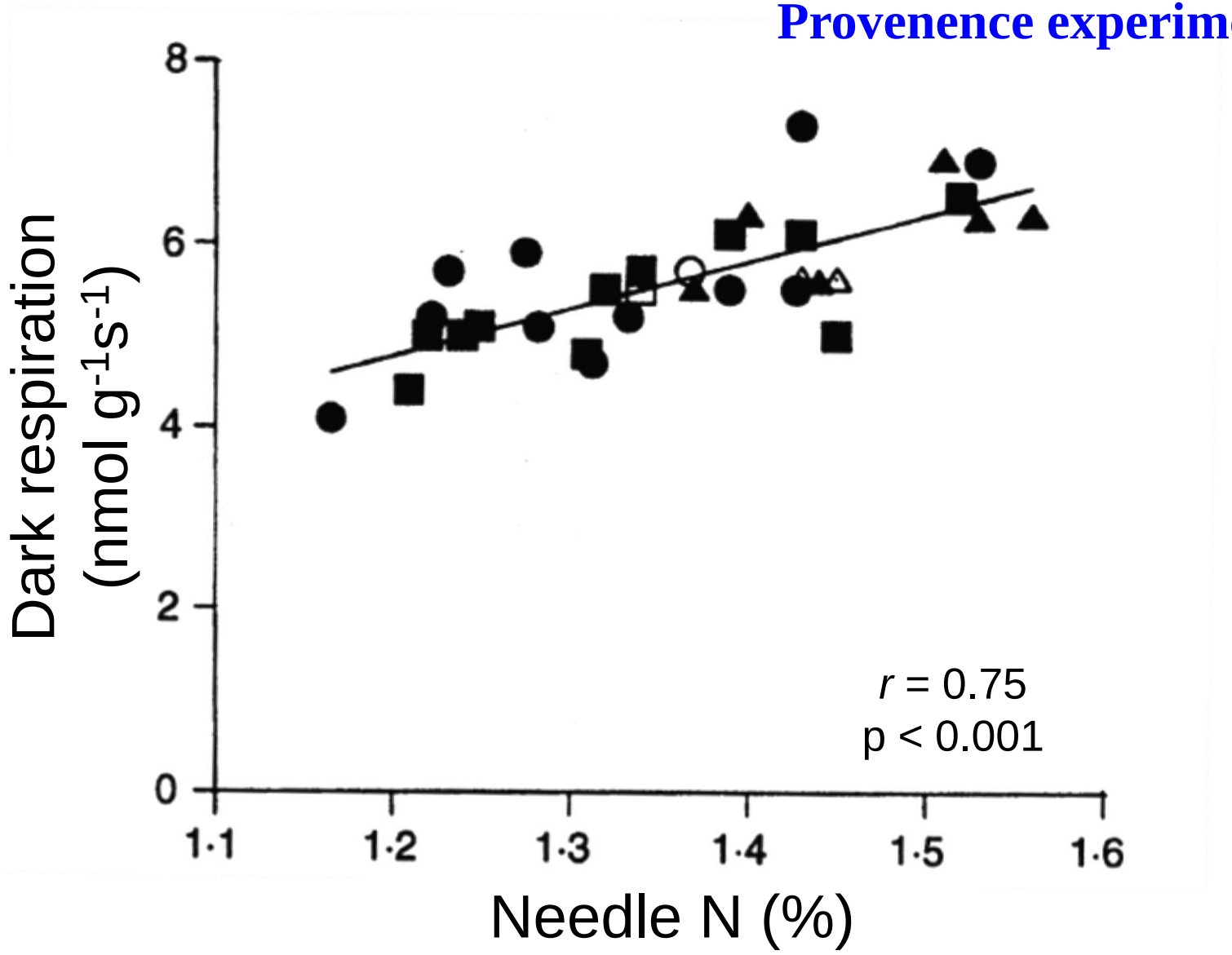
Fig. 8. Needle or total plant nitrogen concentrations in Norway spruce populations in a common garden in the present study and those of Kral (1961) and Giertych & Fober (1967) in relation to the population's altitude of origin. Relationship between altitude of seed stand and needle or plant %N were significant for each study ($r^2 \geq 0{\cdot}48$, $P \leq 0{\cdot}01$).

IUFRO – Scots pine-1982
Provenance experiment

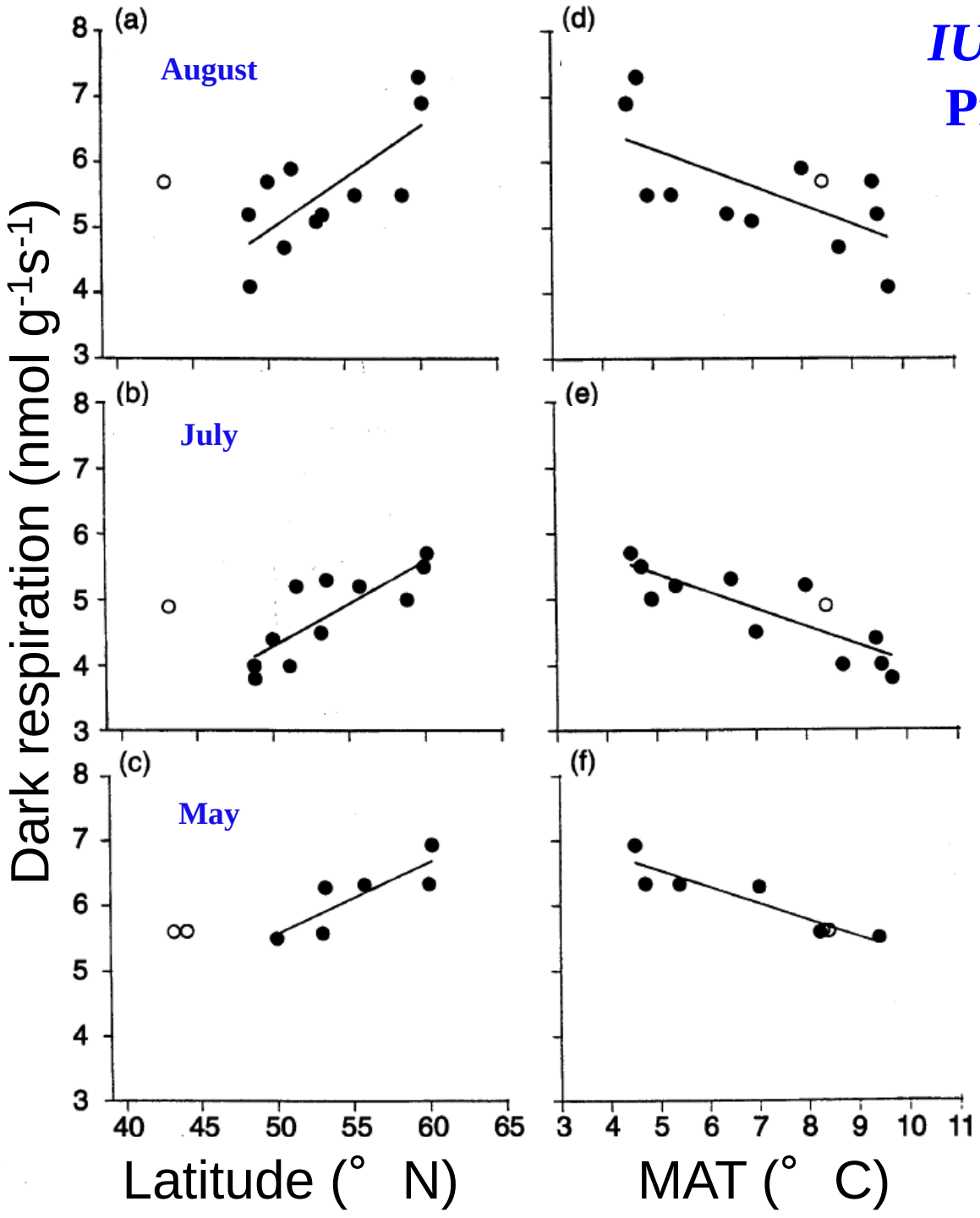


IUFRO – Scots pine-1982

Provenence experiment



IUFRO – Scots pine-1982
Provenance experiment



Picea abies
Provenence experiment

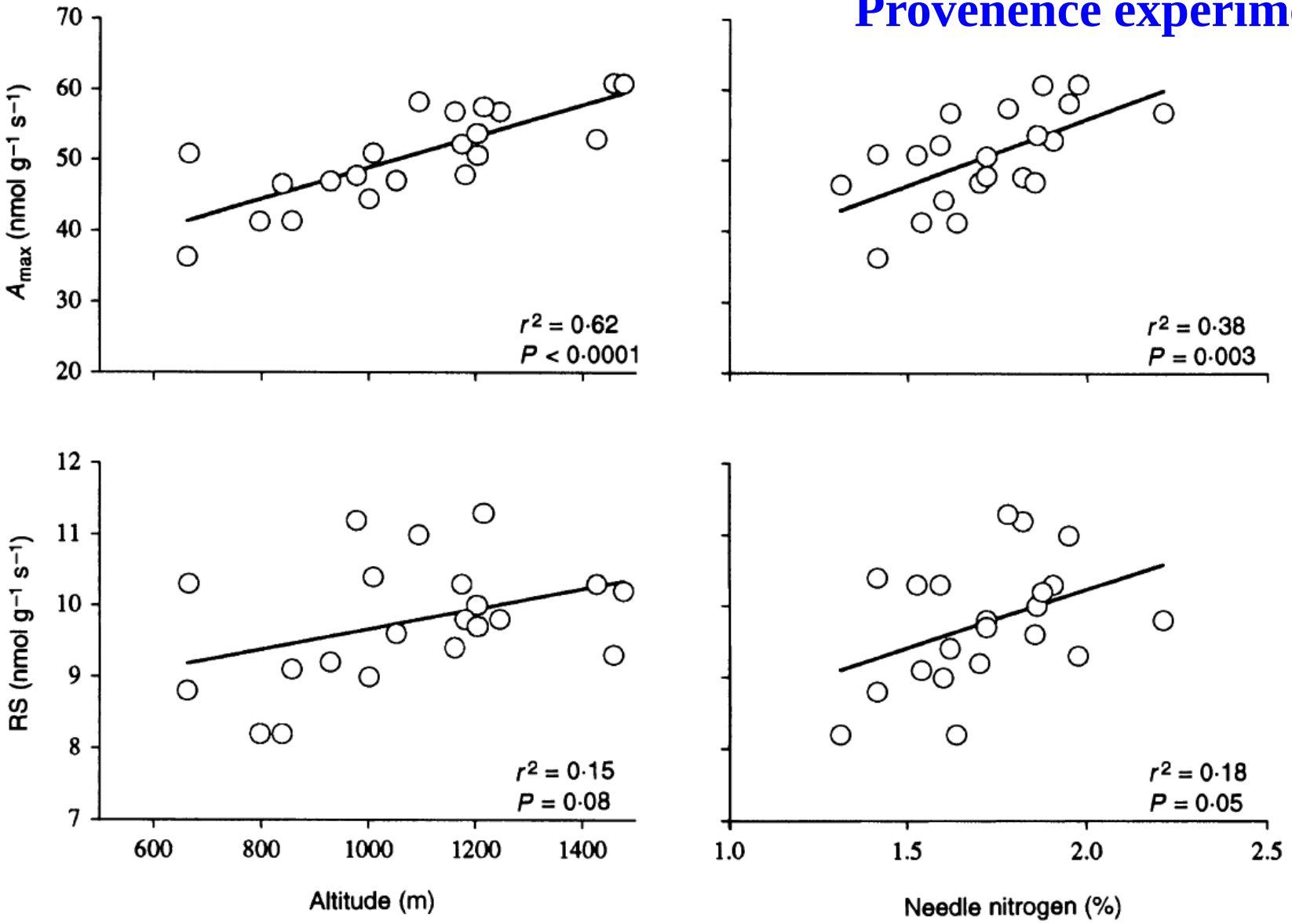
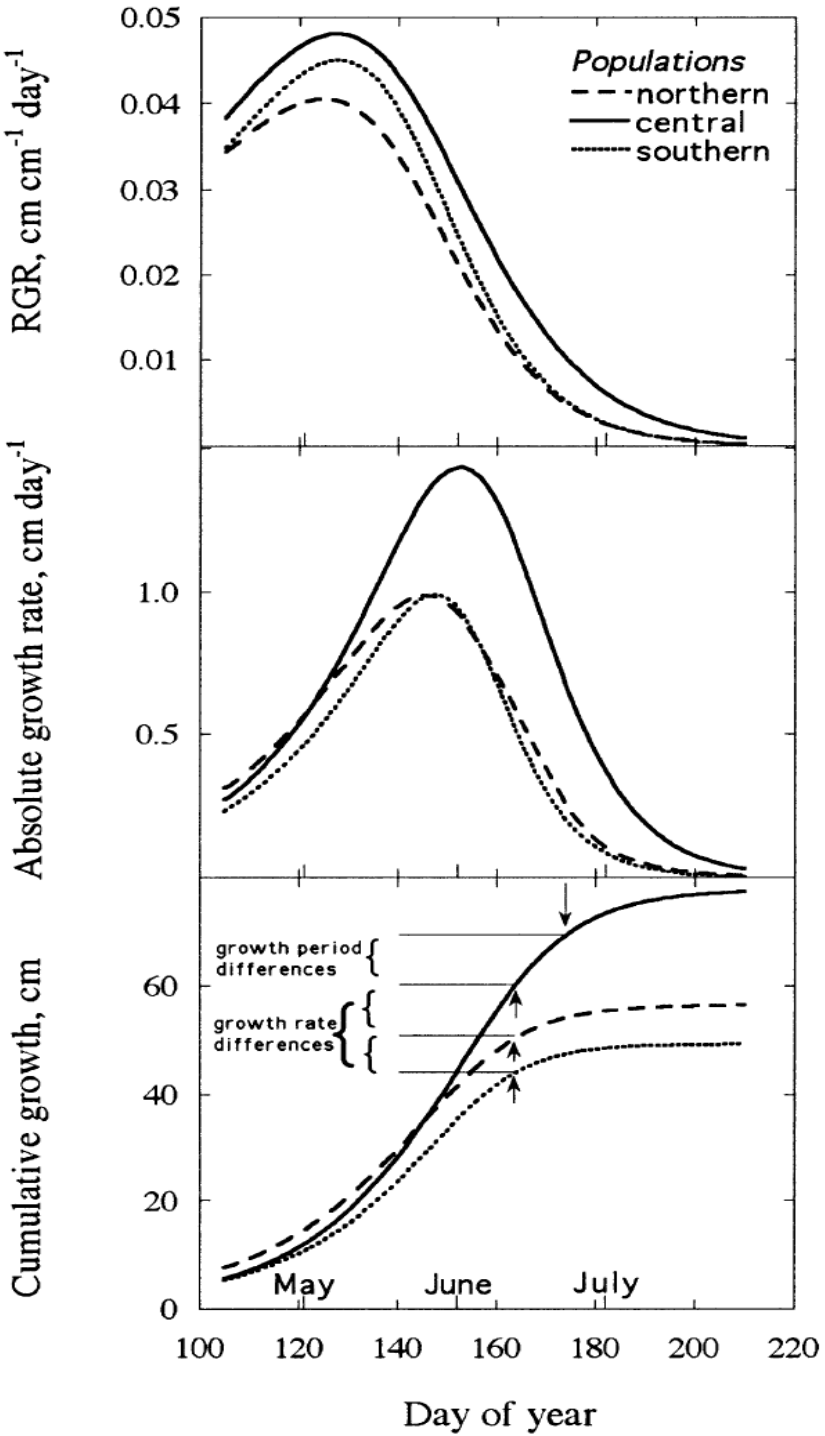
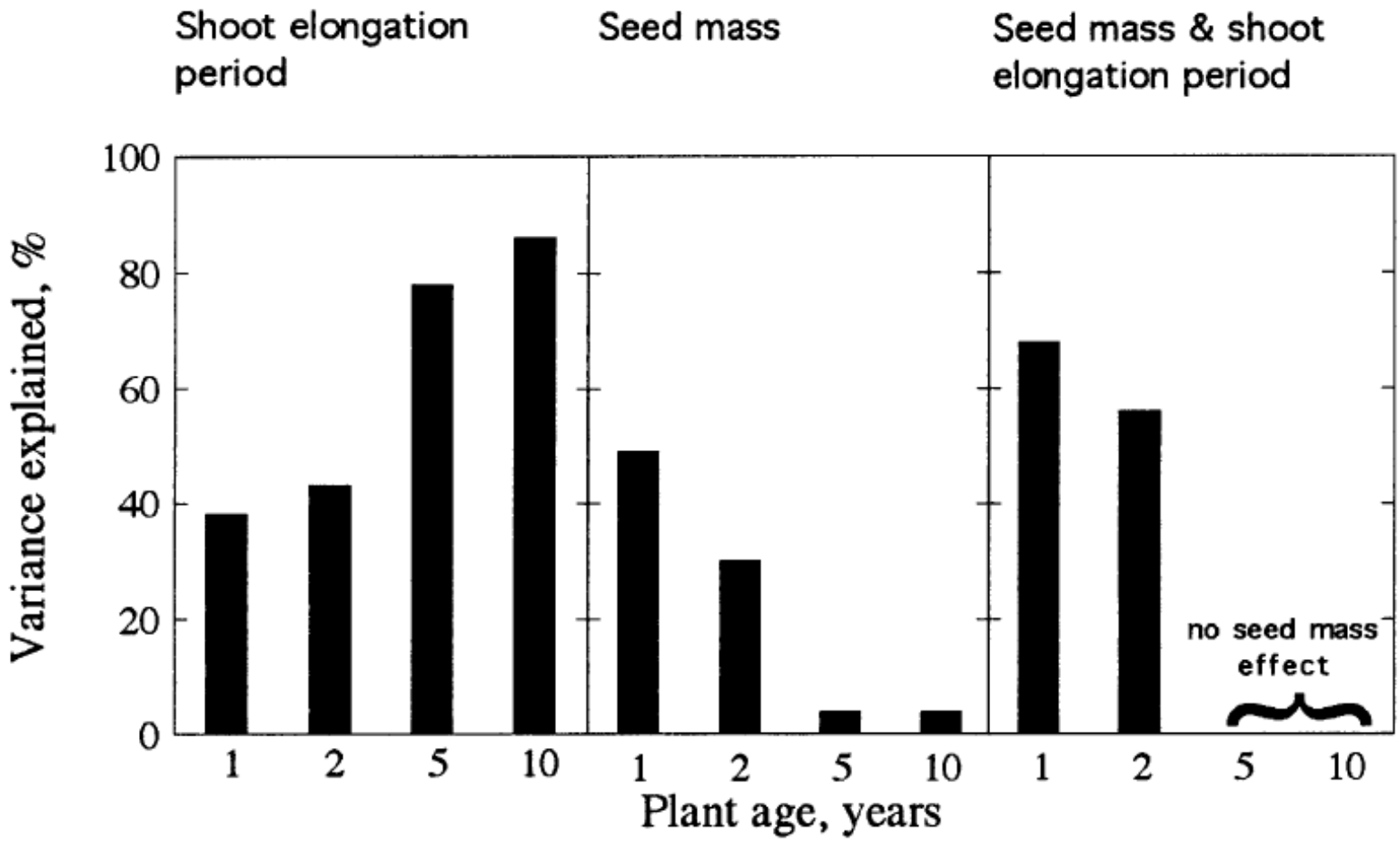


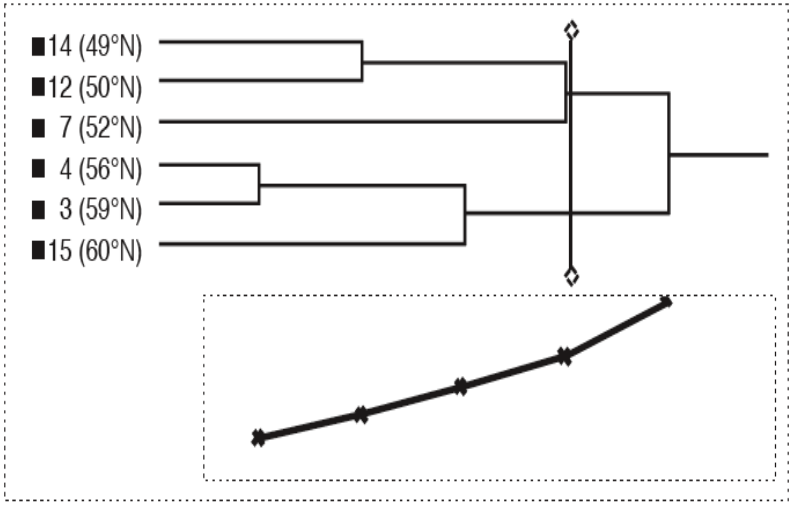
Fig. 7. Mean needle light-saturated net photosynthesis (A_{max}) and respiration (RS) rates in Norway spruce populations growing in common-garden conditions in relation to the altitude of origin or needle nitrogen concentration of each population.

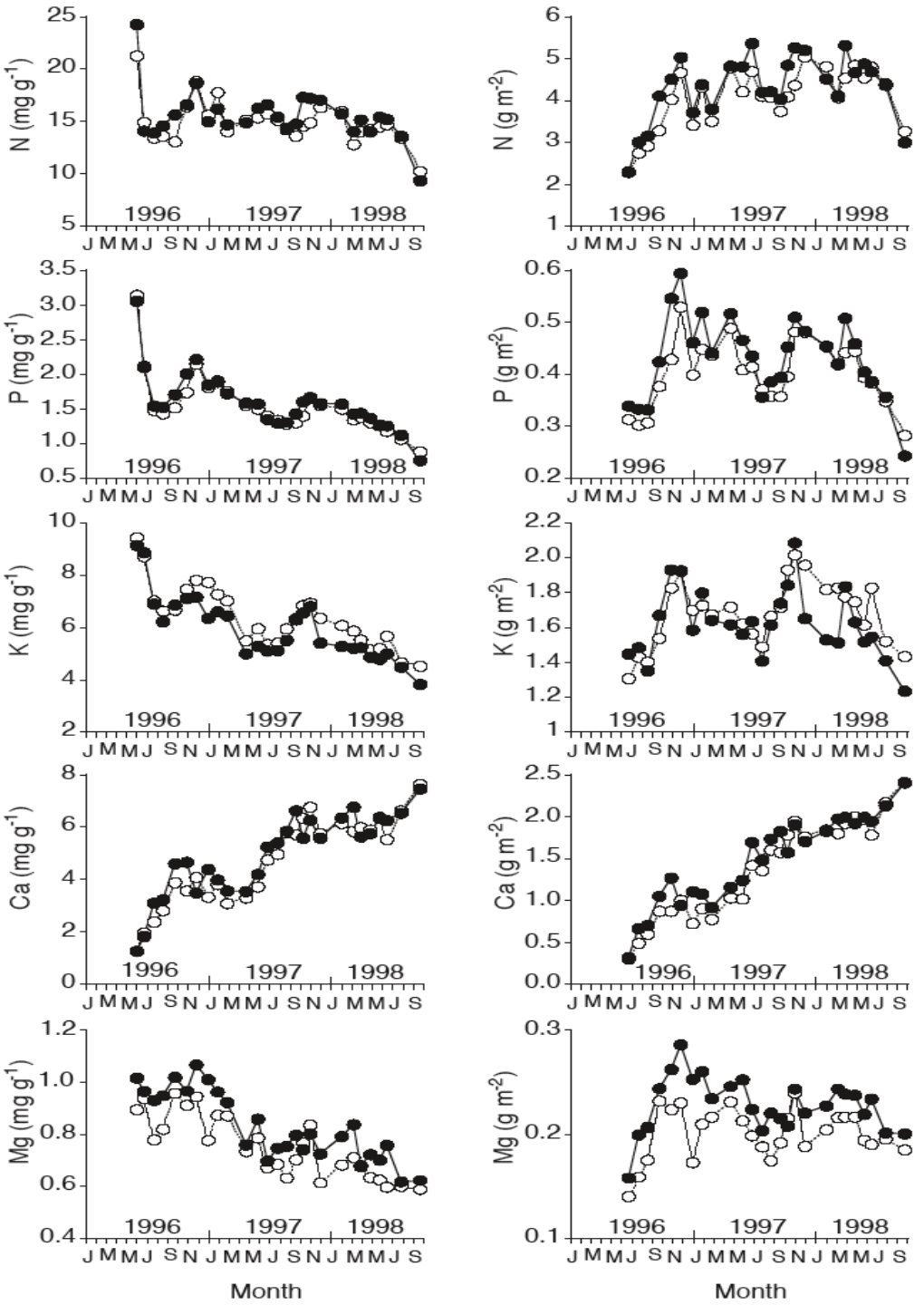
IUFRO – Scots pine-1982
Provenance experiment



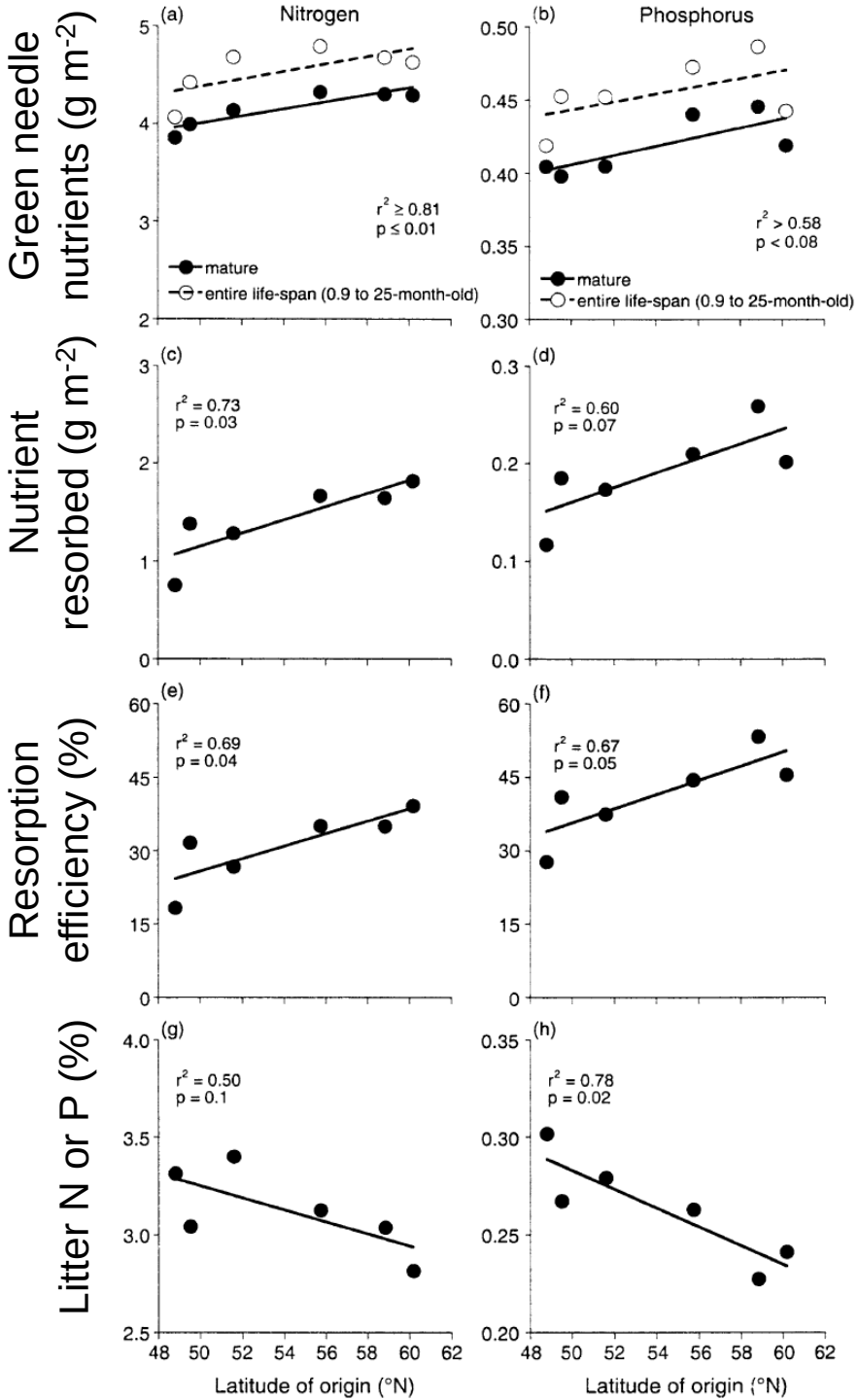
IUFRO – Scots pine-1982
Provenance experiment




14 (49°N)
12 (50°N)
7 (52°N)
4 (56°N)
3 (59°N)
15 (60°N)


N (mg g-1)
N (g m-2)
P (mg g-1)
P (g m-2)
K (mg g-1)
K (g m-2)
Ca (mg g-1)
Ca (g m-2)
Mg (mg g-1)
Mg (g m-2)
1996
1997
1998
J M M J S N J M M J S N J M M J S
Month

IUFRO – Scots pine-1982
Provenance experiment



IUFRO – Scots pine-1982

Provenance experiment