

GROUP A: NEEDLE DISCOLOUROUS, outer surface without stomata lines (LENS).

▶ ALL lateral shoots pendulous. Needles often 25-35 mm. → *P. breweriana* → *P. spinulosa*

▶ Lateral shoots spreading to pendulous in part, OR needles predominantly ≤25 mm.

▶ Leafy lateral shoot predominantly long and slender: L/W ≥4/1. → *P. brachytyla* → *P. farreri*

▶ Leafy lateral shoot predominantly short and wide: L/W ≤4/1.

▶ Shoot pubescent.



Needles 7-14 mm, +/- imbricate.
→ *P. purpurea*



Needles 10-22 mm, +/- raised.
→ *P. omorika*

▶ Shoot glabrous.



Needle Ø flattened, apex obtuse/acute.
→ *P. jezoensis*



Needle Ø rhombic-quadrangular, apex acute/acuminate: pungent. → *P. sitchensis*

GROUP A: NEEDLE DISCOLOUROUS, outer surface with 1-4 stomata lines (LENS).

▶ Needle long, predominantly (15-)20-35 mm.

▶ Shoot pendulous. Needles all pointing forward. → *P. spinulosa*

▶ Shoot spreading/pendulous. Needles forward + sideward.

▶ Shoot glabrous, needle pungent. → *P. sitchensis*

▶ Shoot pubescent, needle not pungent.



Needle Ø flattened, few stomata. → *P. omorika*



Needle Ø rhombic/quadrangular, many stomata. → *P. likiangensis*

▶ Needle short, predominantly 8-15 mm.

▶ Needles above shoot imbricate. → *P. purpurea*

▶ Needles above shoot raised.

▶ End bud not resinous, basal scales acicular.



Needle slender, Ø ≤0,8 mm. → *P. mariana*



Needle thicker, Ø 1-1,5 mm. → *P. glehnii*

▶ End bud resinous (basal scales triangular).



Pulvini small: 0,5 mm. → *P. alcoquiana*



Pulvini larger: 1-1,5 mm. → *P. likiangensis*

GROUP B: NEEDLE CONCOLOUROUS, SHORT: predominantly ≤15(-17) mm.

▶ Needle short, length rather constant. → *P. orientalis*

▶ Needle length more variable.

▶ Current year shoot GLABROUS.

▶ Needles above shoot +/- appressed to slightly raised. → *P. morrisonicola*

▶ Needles above shoot at least in part +/- strongly raised to assurgent on strong shoots.



Needles above shoot at least in part +/- strongly raised.
Bud not resinous. → *P. mariana*

Needles above shoot at least in part assurgent.
Bud resinous. → *P. koyamae*

▶ Current year shoot PUBESCENT.

▶ Bud resinous, OR bud scales triangular. → *P. maximowiczii*

▶ Bud not resinous, basal scales acicular. → *P. rubens*

GROUP B: NEEDLE CONCOLOUROUS, LONG: predominantly 15-25(-more) mm.

▶ Shoot +/- pendulous. All needles directed forward AND 25-50 × 1 mm. → *P. smithiana*

▶ Shoot spreading, OR needles partly directed sideward, OR needle ≤35 × 1-1,5(-2) mm.

▶ Current year and second year shoot CONSPICUOUSLY PALE, sometimes almost ivory.

▶ Shoot slender, Ø +/- 2 mm. Needles below shoot directed sideward to forward, not pungent. → *P. wilsonii*

▶ Shoot stout Ø 2-4 mm. Needles below shoot directed rather forward, often pungent. → *P. schrenkiana*

▶ Shoot YELLOW TO BROWN or at least so the second year.

▶ Needles not pungent. → *P. abies* → *P. engelmannii*

▶ Needles pungent.

▶ Needle Ø +/- flattened AND extremely sharp painfully pungent. → *P. chihuahuana* → *P. martinezii*

▶ Needle Ø rhombic to quadrangular (roll between fingers).



Bud apex obtuse. Needles very painfully pungent. → *P. torano*

Bud apex acute. Bud resinous. → *P. asperata*

Bud apex acute. Bud not resinous. → *P. pungens*