# PINUS PINASTER AS A RAW MATERIAL FOR THE PAPER INDUSTRY

by

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**Summary**

Anatomical and pulping properties of *Pinus pinaster* are described and compared with those of *P. nigricans*. *Pinus pinaster* is a promising species for the paper industry.

*Key words:* Tracheids, rays, resin canals, pulp.

## Introduction

*Pinus pinaster* (maritime pine, swamp pine, seaside pine) is a fast growing timber species which deserves our attention as an additional source to secure a continuous supply for the paper industry. Its natural distribution is restricted to the Mediterranean region; the species requires a warm climate and does not endure temperatures below -16°C (Eisenreich, 1956; Stefanow & Ganchew, 1953; Warburg, 1913). In Bulgaria there are only few plantations, but in older stands along the coast of the Black Sea the species propagates itself by seed and appears to grow well in localities which are unsuitable for other species.

Probably *P. pinaster* was not used before for the paper industry in Europe on account of its high resin content. In this study the wood anatomy and some paper making properties of the species will be briefly reported and compared with data on *P. nigricans*, another resinous species.

## Material and Methods

Two trunks of *Pinus pinaster* and two of *P. nigricans* from a 19-year old mixed stand were studied. For microscopic examination discs were taken at 2 m intervals from the base to the crown. Samples for density determination were selected according to the Bulgarian standard. Pulp samples were prepared according to the sulfate process.

## Results and Discussion

In Table 1 some data are given on the trees studied. Note that in the 19-year old trees *Pinus pinaster* has produced 77% more wood than *P. nigricans*.

The annual rings of *P. pinaster* resemble those of other *Pinus* species. The earlywood tracheids have thin walls (5.2–7.6 μm) and wide lumina. The latewood tracheids have thick walls (8.0–11.9 μm) and narrow lumina which are almost slit-like in the latest formed latewood (Fig. 1). The transition from early- to latewood is gradual. The resin canals are mostly confined to the summer wood. Their diameter averages 40 μm at the stem base and 33 μm at the top. The rays (Fig. 2) have 1–4 rows of tracheids with dentate walls. There are 2–6, mostly pinoid pits per cross field. 95% of the rays are uniseriate (Fig. 3) and are 3–22 cells (up to 192–226 μm) high. The fusiform rays are up to 302 μm high at medium height level of the stems. The earlywood tracheids are 3.42 mm long and the latewood tracheids 3.35 mm at a stem height of 7 m. At the stem base 40% of the wood volume consists of cell wall material. This percentage decreases with stem height.

Table 1. Properties of the trees studied. (Averages for two trees)

| | *Pinus pinaster* | *Pinus nigricans* |
|---|---|---|
| Bole height | 12.7 m | 9.5 m |
| Diameter at breast height | 12.9 cm | 9.8 cm |
| Timber volume per tree | 0.140 $m^3$ | 0.079 $m^3$ |
| Density | 420 $kg/m^3$ | 480 $kg/m^3$ |

In Table 2 some results of sulfate pulping are summarised. The yield changes little with the sulfate concentration. For the two species it is highest at 30%. Active alkali fractions in the residue are more or less similar for the highest and lowest sulfate concentrations, and higher for medium concentrations which give a lower yield, however. Test sheets of *P. pinaster* appear somewhat more satisfactory than those of *P. nigricans*. This is probably due to a better earlywood/latewood ratio in *P. pinaster*.

*Pinus pinaster* appears to be a suitable raw material for the paper industry. This is corroborated by results with plantations in Australia (Phillips, 1967). Considering its good performance on poor sandy soils, planting on a larger scale of this species can be recommended, especially of cold tolerant forms.

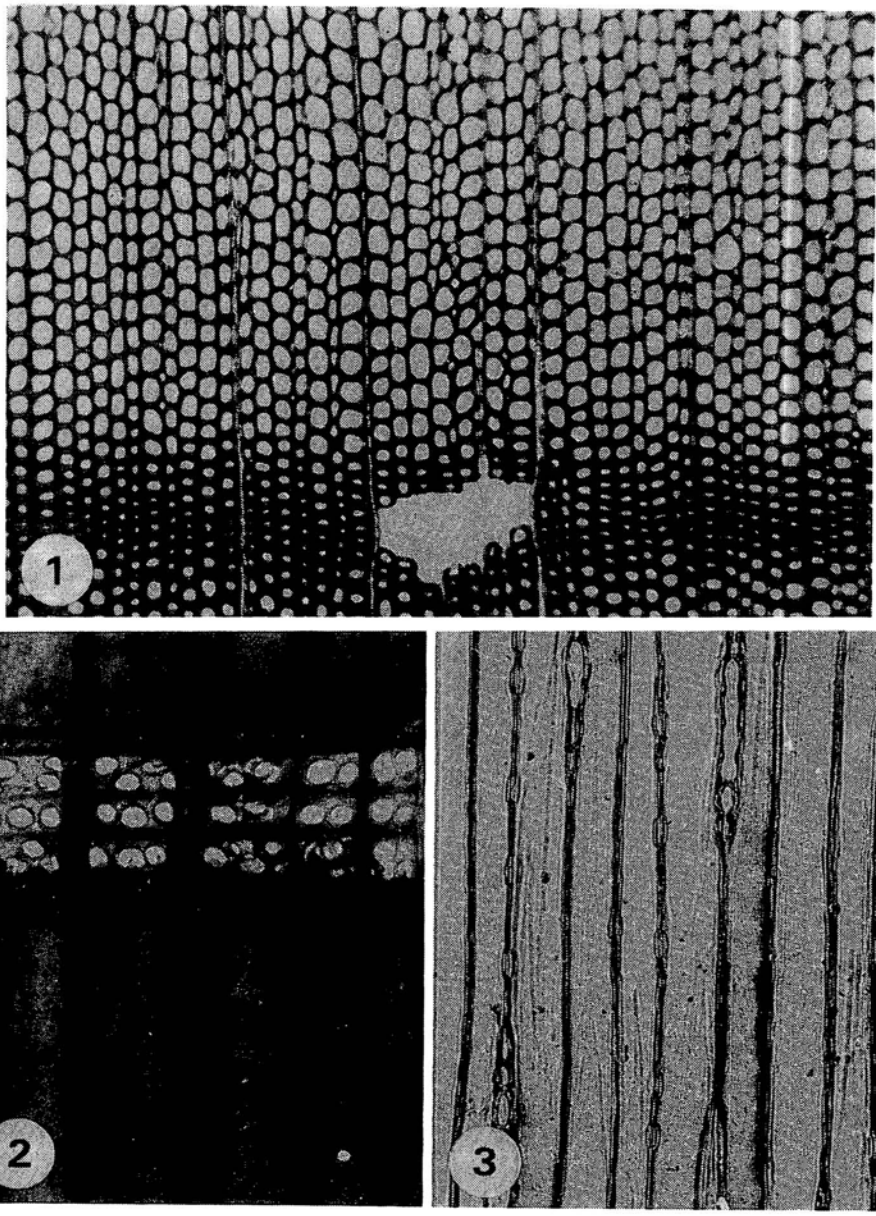


Fig. 1–3. *Pinus pinaster*. – 1: Cross section, x 50. – 2: Radial section showing cross-field pits and dentate ray tracheids, x 140. – 3: Tangential section (part of the ray parenchyma cell walls damaged), x 130.

Table 2. Sulfate pulping trials of *Pinus pinaster* and *P. migricans.*

(Pulping conditions: liquor to material ratio 4 : 1, time for raising the temperature to 170°C 140 minutes, cooking period 120 minutes, cooking temperature 170–172°C).

| | *Pinus pinaster* | | | | *Pinus nigricans* | | | |
|---|---|---|---|---|---|---|---|---|
| Pulping trial | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Sulfidity (%) | 15 | 20 | 25 | 30 | 15 | 20 | 25 | 30 |
| Yield (%) | 45.1 | 44.8 | 44.5 | 45.6 | 47.1 | 45.7 | 45.4 | 47.3 |
| Kappa number | 34.7 | 32.0 | 31.7 | 31.4 | 34.9 | 31.6 | 30.6 | 31.6 |

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