The aril of *Taxus baccata* L. – an unexploited source: histochemical, phytochemical and in ovo evaluation

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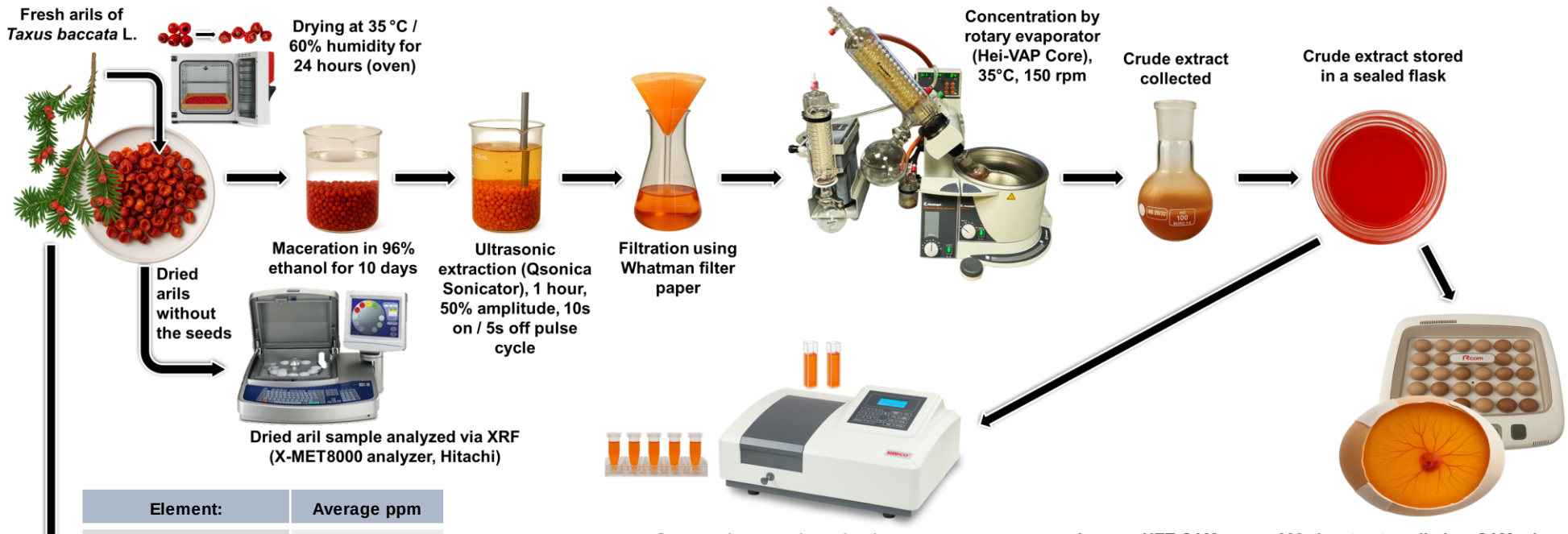
BACKGROUND

Taxus baccata L. is a coniferous species well known for its diterpenoid alkaloids, yet its fleshy red aril represents the only non-toxic part of the plant. Despite its potential nutritional and therapeutical value, the aril has received little pharmacognostic attention and remains underexplored compared to other plant parts. A few recent studies have highlighted the presence of valuable phytochemicals and bioactive compounds, suggesting possible applications in nutrition, toxicology, and bioprospecting [1,2]. However, systematic evaluations combining histochemical, phytochemical, and biosafety assessments of the aril are still scarce.

AIM & OBJECTIVES

This study aimed to provide an integrated characterization of the *Taxus baccata* aril by investigating its elemental profile, assessing the presence or absence of alkaloids, evaluating biosafety through *in ovo* assays, and determining both antioxidant capacity and total polyphenol content (TPC).

MATERIALS & METHODS



Element:	Average ppm
Potassium (K)	35383
Calcium (Ca)	2173
Barium (Ba)	175
Zinc (Zn)	54
Scandium (Sc)	51
Tantalum (Ta)	21
Rubidium (Rb)	20
Copper (Cu)	17
Molybdenum (Mo)	13
Vanadium (V)	9
Zirconium (Zr)	5
Mercury (Hg), Iron (Fe), Antimony (Sb), Nickel (Ni), Gold (Au), Thorium (Th), Lead (Pb), Cadmium (Cd), Uranium (U), Thallium	Non-detectable

Table 1. Elemental composition of Taxus baccata aril determined by XRF spectroscopy. The XRF analysis revealed potassium and calcium as the dominant macroelements in the aril, while trace levels of barium, zinc, scandium, and other elements were also detected. Importantly, heavy metals such as Pb, Cd, Hg, and Ni were below the detection limit, supporting the biosafety profile of the aril.

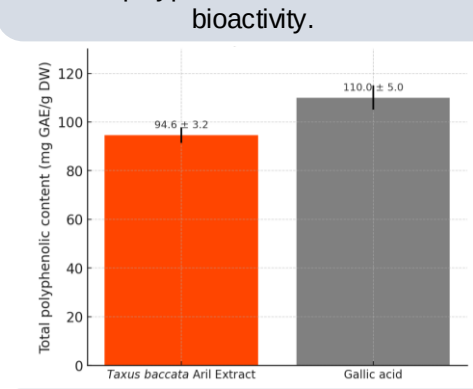


Figure 1. Antioxidant activity of Taxus baccata aril extract assessed by DPPH assay. The aril extract exhibited strong antioxidant activity, reaching 63.4 ± 2.1% inhibition at ~112.5 µg/mL (IC_{50}). The radical scavenging capacity increased dose-dependently up to ~85% at the highest tested concentration, indicating a notable polyphenolic contribution to its bioactivity.

Figure 2. Total polyphenolic content (TPC) of Taxus baccata aril extract compared to gallic acid standard. The aril extract showed a high polyphenolic content (94.6 ± 3.2 mg GAE/g), comparable to the gallic acid reference (110.0 ± 5.0 mg GAE/g). This rich phenolic profile supports the strong antioxidant capacity observed in the DPPH assay.

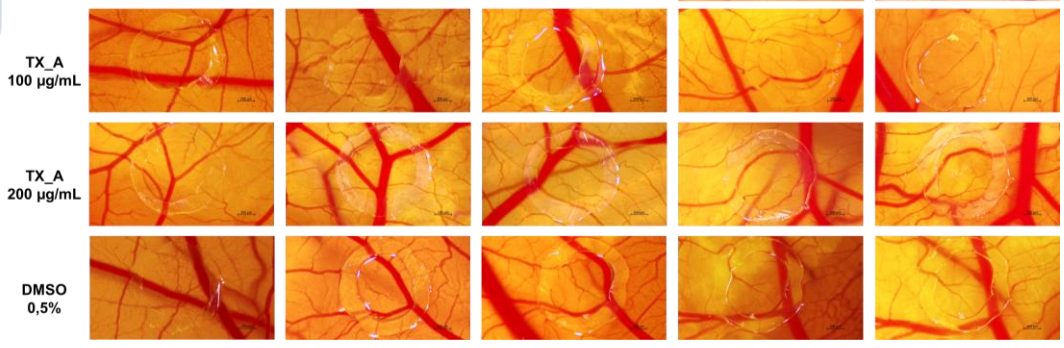
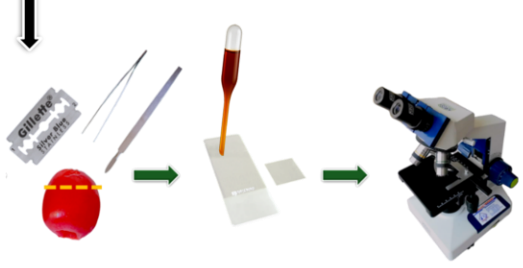


Figure 3. HET-CAM evaluation of Taxus baccata aril ethanolic extract at 50, 100, and 200 µg/mL, compared with negative (H_2O_d, IS = 0.07) and positive (SLS 1%, IS = 18.07) controls. No hemorrhage, lysis, or coagulation was observed at any tested concentration. Irritation scores (IS) were identical to the negative control (IS = 0.07), confirming the absence of irritant effects and supporting the favorable biosafety profile of the aril extract.

Figure 4. CAM assay showing the anti-angiogenic effect of Taxus baccata aril extract compared to vehicle control (0.2% DMSO). The extract induced a clear anti-angiogenic effect at all tested concentrations, evidenced by the absence of new vessel formation within the silicone ring areas over the 5 days of study. In contrast, the 0.2% DMSO control displayed normal angiogenesis, with progressive vessel branching and thickening throughout the observation period.



Manual sectioning of fresh aril and seed tissue → Sulfuric vanillin staining (1%) to visualize alkaloids (Kruss MBL2000)

Figure 5. Histochemical staining of a cross-section through the aril of Taxus baccata L., including a seed fragment. Staining with 1% sulfuric vanillin produced an intense red reaction in the seed, while the aril remained unstained. This confirms the absence of diterpenic alkaloids in the aril, supporting its safety profile compared to other plant tissues.

CONCLUSIONS

- ✓ The aril of *Taxus baccata* L. demonstrated a favorable phytochemical profile, with high polyphenolic content and strong antioxidant capacity.
- ✓ Elemental analysis confirmed the absence of heavy metals, while histochemical staining excluded diterpenic alkaloids in the aril.
- ✓ *In ovo* assays (HET-CAM, CAM) indicated excellent biosafety and revealed anti-angiogenic potential, this property being effective especially in cancer therapy.
- ✓ These findings highlight the underexplored potential of the aril as a bioactive source that warrants further pharmacological and nutraceutical investigation.

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