Romanian Wooden Churches Wall Painting Biodeteriration

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Abstract
The Romanian wooden churches are a category of monuments which belong to the great family of European wood architecture. The inside decoration based on tempera painting technique is the most vulnerable part of these monuments. Based on the biological examination for a number of over 300 wooden churches, the paper presents the causes of the decay for this artistic component. The most extended and irreversible decays are the infiltrations of rain water, followed by biological attacks produced by fungi and insects. The most important species of fungi and insects are presented, their localization and piculiarity of attacks. We have concluded with some results and proposals to prevent this kind of decay.

1. INTRODUCTION

Wooden churches are a category of monuments widely spread all over the space inhabited by the Romanians [5]. They are to be found in great numbers not only in Maramureş, but also in Transylvania, Moldova, Muntenia, Oltenia, Banat and Crişana (figure nr.1 and 2).
Being considered a specific achievement, they belong to the great family of European wood architecture [5]. Out of the 1250 wooden churches declared historical monuments, 8 are included in the UNESCO Patrimony (Surdeşti, Plopiş, Bârsana, Budeşti, Deseşti, Rogoz, Ieud Deal, Poienele Izei).

(a) (b)
Figure 1 Wooden churchis: (a) abandoned; (b) restored

The inside decoration with these churches was based on the tempera painting technique, taken over from the Byzantine space and perpetuated up to the present day. The painted scenes entirely cover the walls, the vaults and the ceilings of the narthex, nave and altar (figure 2 and 3).
The support of the painting, at the wall level, is made of the surfaces of the wooden beams, between which strips of interstitial canvas was stuck with animal or vegetal glues.
The vaults can be made of beams or planks, between which the strips of canvas were applied.

Calcium carbonate and glue were used to make the start of preparation.
The pigments, based on mineral oxydes, were applied over the ground colour by means of organic binders, especially egg.

Figure 2 and 3 - Painted ceilings

2. SUBMISSION

After 1994, I was involved in several national and international projects, whose purpose was the wooden churches restoration. Thus, I had the opportunity of analysing and elaborating the biological examinations for a number of over 300 wooden churches from different geographical areas of Romania.
According to my experience, I understood that the most vulnerable part of these monuments is their painting. We might replace without much difficulty the roofs, the beems, or even entire walls, but we could hardly replace a lost painting.
Whatever we can do is to evaluate the reasons of the decays and to try to prevent them.
Among the causes that produce the most extended and irreversible decays, infiltrations of rain water, followed by biological attacks rank first.
The clapboards are the constituent parts whose degradation takes the shortest time and if they are not replaced in good time (35-40 years) [1], infiltrations of rain waters will wash away a good part of the inside paintings or leave dirt stains difficult to remove. At the same time, moistured wood is attacked by biological factors (micro-organisms, fungi and xylophagous insects).
In the first stage, the interstitial canvases are affected by infiltrations of rain water and their moisturing leads to the appearance of micro-organisms attacks (bacteria, and moulds), followed the textile fibre roting.
There were quite rare cases in which I came across the period during which the microfungi produce colonies that are visible without effort. An eloquent example in this respect is the Wooden Church of Spălnaca/county of Alba, where white colonies, having a diameter of 20 to 50mm developed abundantly on the painting at the level of interstitial canvas. (picture no.)
With laboratory colonies, out of the drawn samples, four species of micromicetes have been identified, belonging to *Mucor*, *Penicillium*, *Aspergillus* etc.(figure nr.4 and 5).

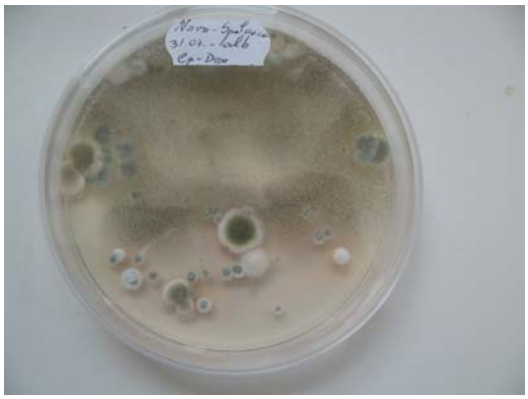

Figure 4 and 5 – Micromicetes identified in laboratory, out of the drawn samples

The restriction of the decay to the canvas only indicates the preference of these species for the glue used to stick them.
The effect of the decay on the canvas which gets rot very rapidly was also noticed.
The cause of the massive decay is the infiltrations of rain waters through the degraded wrapping, which led to the rapid growth of the humidity of the support.
When the wood stays wet for a long time, the xylophagous macromicetes will develop.
The attacks produced by macromycetes are not visible in their first stage, but when the fruit bodies appear, the timber has already lost part of its mechanic strength. Their evolution is fast and will lead, in a few years, to collapse.
On the level of painted elements, I have identified 15 species of macromycetes, among which the most frequent are: *Coniophora puteana, Fibroporia vaillanti, Phellinus cryptarum, Phellinus contiguus, Dacrymyces stillatus, Hyphodontia breviseta, Fomitopsis rosea, Gloeophyllum abietinu, Gloeophyllum sepiarium, Schizopora paradox, Grandinia arguta, Hyphoderma puberum, Vesiculomyces citrinus* [2]
Coniophora puteana has the highest occurrence both on resin wood and on sapwood on the studied monuments [2]. The fruiting bodies are spread on the surface of the painting, attached tightly and are especially frequent with vaults. The decayed wood is degraded in its depth, under the form of prismatic brownrot (figure nr.6).

Figure 6 -Vault decayed be the *Coniophora puteana* and other fungi

Phellinus cryptarum is frequent with and specific of oak and it was recordet be us for the first time in Romania [4].The fruiting bodies are quite widely spread, adherent to the support and the painting beneath them is no longer recovarable. The decayed wood is degraded in its depth, as whiterot.
Phellinus contiguus is specific of resin woods. The fruiting bodies are widely spread, adherent to the support and the painting beneath them is no longer recovarable. The decayed wood is degraded in its depth, as whiterot.
Gloeophyllum abietinum and *Gloeophyllum sepiarium* and *Fomitopsis rosea* were noticed in but few cases, with churches having already reached a high level of degradation. They are specific of resin wood.
Dacrymyces stillatus, *Hyphodontia breviseta and Grandinia arguta* occur with wood already degraded by the above mentioned species, when the mechanic resistence of the support is almost entirely lost.
The next stage in wood decay is that of the occurrence of the mixofungi of the *Stemonitis* and *Arcyria* type, which contribute to its turning to clay.
There are successions of the fungi species and the combined attacks of fungi and xylophagous insects which at the same time indicate the state of the timber [3].
The attack of insects depends on the wood essence, the percentage of sapwood, its position in the trunk, the moisture content, previous or simultaneous fungi attacks, the contribution of organic substances from glues or bird excreta. With the same wall, an elm or sycamore maple element will be strongly attacked at its heartwood level, as compared to one of oak wood that does not present any attack, except for possibly in its sapwood zone.
It is common knowledge that the attacks of *Anobium punctatum* are more intense on the peripheral areas of the wood, but we can often notice them under the interstitial canvases that were glued or in areas with infiltrations that brought organic substances (figure nr.7).

(a)

(b)

Figure 7 *Anobium punctum* atacks: (a) areas with infiltrations; (b) under interstitial canvases

With higher intensity attacks (which we appreciate by the number of holes of flight per 100 cm²), the wood becomes fragile, brittle or breakable.
With some churches we came across nave ceilings made of beech wood (*Fagul silvatica*), which had been massively decayed by *Ptilinus pectinicornis* and the brittled wood easily broke under mechanic pressure.

Xestobium rufivillosum can only affect the alburn areas of oak wood but when in combination with fungi decay, it can extend to the duramen, too. With beams component of vaults and those inside the walls, where infiltrations of water were of long duration, we came across combined attacks of *Phellinus cryptarum*, which compromised the wood in its depth [3]
In the case of combined attacks of *Anobidae* and fungi, the wood becomes spongy and extremely fragile. Consolidation by means of injection with with Paraloid B 72 or other items is not enough to give back its mechanic resistence, especially in the case of planks or vault beams.
Hylotrupes bajulus, specific of resin wood, can only attack alburn. The larvae make wide galleries, parallel to the surface of the wood, which gives in easily and comes off together with the painting strata. Those degradations occur especially with the side walls of the nave.
In the case of wooden churches, the parts of the building most vulnerable to biodegradation are the ceilings and the vaults. By their position, they are directly exposed to infiltrations of rain waters, the moment when the wrappings are degraded. The upper part of the vaults, the beams at their basis and the arches sustaining them are the components where water from infiltrations can stagnate. At these levels, the first fungi attacks occur and decays progress rapidly. The arches and the planks come off or break, the beams subside and the vault collapses (figure nr.8)

Figure 8 – Vault in collapses

3.CONCLUSIONS

We study the biologic agents, but they are not the main cause of the loss of these values. The most important factor of degradation is human negligence.
Where communities have built new brick churches, the old wooden ones were replaced. The priests are not aware of the value of the latter and, unfortunately, they are the first to leave them. The communities treat them as old people having reached the age of death.

In this case, the solutions we must look for are not the chemical ones (fungicides or insecticides), but the change of people's mentalities.
The funds alotted by the Ministry of Culture for the restoration of wooden churches, quite a lot in the recent 18 years, cannot cope with the rhythm of degradations.
A former student of ours, graduate of Theology Studies and then Conservation Studies, wrote his diploma paper on a group of wooden churches. I succeeded in making him aware of the value of these monuments and talking him into the ways by which we could act so as to have an influence on the local community.
The spur we have given has developed and has now turned into a project for 80 churches in the Gorj area, and succeeded in involving the County Inspectorate for Culture and the Mitropolitan Church of Craiova, in gathering and instructing the local priests, in editing a photo album, organizing a conference and initiating a project of cataloguing and monitoring.
These modest attempts can give us a hope that positive examples will have a chance to increase and we will be able to rescue most of these monuments, which, at present, are part of a lost patrimony in most European countries.
In the new context of getting financial support for the cultural projects and through the possibility of accessing the European Structural Funds, we hope to succeed in restoring a greater number of the wooden churches which are historical monuments. Consequently, we are considering the following measures to take:
1.**The setting of standards (norms) for settling a deadline within which the replacement of the roof clapboards is obligatory and the type of roof which can be manufactured.**
2.**The introduction of supplementary restoration norms, concerning the painting protection measures, during the restoration intercessions on the building.**
3.**The design of an insulation system of the vaults for the churches in function,** in order to reduce warmth loss, but to prevent condense and to offer an additional, long term protection of the vaults and side walls paintings. We would like to prevent in this way improvised solutions made by parishioners that could produce condense or maintain moisture and the appearance of biological attacks.
4.**Making the priests aware and through them the flock** of the value of these monuments, which could become touristic assets.

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