



## PLANTS SIGNIFICANCE IN JUDICIARY INQUIRY

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### Abstract:

*When an offence was perpetrated within a vegetal environment (wood, park, field with vegetation etc.) the plants can play a significant role in the circumstances clarification in which the offending act was carried out, or even in the author identification. That is the reason we proposed to show in the herein paper the information significance obtained by the vegetal traces/ micro traces examination for the judiciary inquiry. To facilitate the understanding of the manner in which the plants can be analysed in criminalist purpose, we shown in the introduction several general data about them, with reference to the plants development cycle and the vegetative bodies thereof. We have shown also methods of searching, discovery and collection of vegetal nature traces, aspects that can be clarified by the interpretation thereof, as regards to the place and time of the offence perpetration, but also possibilities and determining limits of the species of which the vegetal remains come.*

**Keywords:** *offence, place of deed, traces, vegetative bodies, species, A.D.N.*

### General data about the plants

The plants existence in a certain place often gives information about the life conditions in that place. It concerns both the physical state of the environment and the anthropogenic one.

So, the vegetal remains, in case of archaeological diggings, offered important information concerning the natural potential of a region and the manner in which the people have exploited it.

The plants or parts thereof can be used to get information as regards the living or environment conditions in the past.

The development cycle duration of the plants varies from a species to another, as follows:

- the plants whose cycle is of few months, in which their complete development is performed are named *annual*;
- the plants which in the first life year give birth to roots in the earth and at the soil surface a short stem and a basilar leaves rosette, and in the second year, the stem develops, on it appearing stem leaves, flowers and fruits, are named *biannual*;

- the plants living several years, but each year bloom and make fruits, are named *perennial* or *vivacious*;
- the plants living several years, but bloom one time during their life, are named *monocarp*.

The body of superior plants named *corm* comprises three vegetative organs: *the root, the stem and the leaf*.

The **root** has two specific functions: *fixing* the plants and the water and mineral substances *absorption* from the soil. Besides these, the root can serve also as *deposit* organ of the reserve nutritive matters, as vegetative *multiplying* organ etc.

The **stem** is the second vegetative organ of the plant that develops from the embryo stem, mostly aerial, with orthotropic position and has as specific functions the branches support on which burgeons, leaves, flowers and fruits, as well as the direction function.

The **buds** that develop on the stem are of three kinds, namely: foliates, from which leafs develop; floral, from which flowers develop, and the mixed burgeons, of which branches develop – on which leafs and flowers appear. The buds from the top of the stem and branches are named terminal ones and they assure the growth in length thereof, and those that develop at knots, usually at the leafs armpits, are

named axillary burgeons, of which lateral branches grow.

The **leafs** have mostly an oblique or perpendicular position relating to the stem or the branch axis, by this reason they have two different faces, namely an upper or ventral one and a lower or dorsal one. They fulfil the main physiological functions on which the plant life depends, namely the photosynthesis or the chlorophyll assimilation, the respiration and the transpiration. They have a limited growth, short life duration, and, even if they grow from the stem, their structure is completely different of that of the stem. In case of the leafs, there are also several differentiating features. The leaf form can be very different, from the forms multitude we shall mention a few: round, oval, lanceolate, linear, lombate, pennate etc. The openings of the leaf can be also useful. The leaf margin can be even, dentate, notched, rough or soft. If anatomic analyses are necessary, we must be especially careful at the diasporas. Most of the dicotyledonous leafs are made of three different parts, namely: limb, petiole and pod. The *limb* or lamina is the most important part of the leaf. Usually it is large, green and with nervures going through, those are the driving fascicles coming from the stem and are prominent on the lower face.

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The limb epidermis can be even or with hair. The hair can vary as it concerns the form, the orientation (it can be simple, in group, as a star form or as a shield). If it is no hair or it is isolated arranged, the limb aspect is rather even, but a haired structure gives the soft or rough impression.

The *petiole* is a belt with cylinder or convex – concave form growing from the upper part of the foliar primordial. The petiole can be dilated, at the base, having some swellings named pulvinulae (poplar leaves or vegetables leaves). Sometimes it is enlarged as a leaf, having role in assimilation. In most cases it is fixed at the limb base. The leaflets at which the limb is centrally fixed by the petiole on the dorsal part are named *pelted*.

The *pod* is the enlarged basic part of the petiole with which it fixes at the stem knots and it grows from the lower part of the foliar primordial.

The **fruit** appears after the oosphere and the secondary nuclei fecundation of the embryonic sac, when in the flower are performed profound transformations, which result in the forming thereof and of the seeds.

According to the seeds number from a fruit one can make the following classification: mono-sperm fruits, containing a single seed, poly-sperm fruits

containing several seeds and partenocarpic fruits without seeds.

**Data about the place of the deed**

When a criminal deed was perpetrated, the macro-remains/micro-remains can be also analysed in criminalist purpose.

This is the reason for which as essential premise for the present searches and assessments is the context explanation, resulting in the appearance, sedimentation and obtaining of the proofs in the judiciary inquiry. In this respect, the causes of the vegetal traces existence must be explained within the perimeter in which the criminal deed was perpetrated and the significance they could have in clarification of the circumstances in which the criminal deed was carried out and the guilty person identification.

Therefore, in case of the place search in which the criminal deed was perpetrated permanently must be considered the traces existence created by and on supports of vegetal nature (plants or parts thereof). They can give indications about the place or the manner of an offence carrying out. Taking into account the various and multiples possibilities, which could lead to the proofs performing, the analysis of the vegetal traces with the purpose to obtain specific information for the criminalist activity is not yet performed sufficiently often.

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Taking into account that the vegetal traces, as well as the other traces categories that can be discovered at the deed place can influence the judiciary inquiry, it is necessary and compulsory to collect and analyse with special attention the found vegetal material.

As object of the criminalist identification all the plant parts must be taken into account, from the seeds, roots, stem, buds and buds envelope, until the flowers, respectively the fruits.

The vegetal macro-remains can have criminalist importance as it concerns the assessing of the place in which an offence was perpetrated. A premise in this respect is the fact that remains of the plants can remain on the author, on the victim, the transport mean or on the stolen good. This could happen at the deed place or during the transportation.

In the same time, one cannot exclude the fact that the found plants parts could fall on the way toward the deed place, so before the offence perpetration, on the future victim or on the author.

In such cases the plants found cannot offer indications about the place of the deed or about the manner of the deed perpetration.

The very good places where one can find the plants remains to victims or t the authors are in the pockets of the pants, in the belt buckles, in the hoods or in the hair

of the head or of the beard. If glasses have been worn, there also are big chances to find some plants fragments. For the other clothes, there are most favourable places to keep the plants remains.

For instance, the knitted pullovers have several places to keep the plants than the smooth and glossy clothes.

If the author used a car at the offence perpetration, than the biggest chances to find vegetal traces there are in the luggage carrier or in the seats upholstery. Small branches pieces, buds or buds envelopes, as well as leafs or leafs fragments can arrive inside the car or in the luggage carrier by the doors closing. In this way one can get indications about the place of the deed.

One must pay high attention in searches because there are many diaspores which have thorns and which can be discovered on the clothes of the author, of the victim, on the stolen good or in the transport mean used for the transport thereof. The dispores and the sticky envelopes of the buds can adhere almost at all clothes parts. If they are on the parts close to the earth, for instance on the socks, pants, coat or on the shoe laces, then they arrive there during the walk. In this way one can reconstitute the way (iter criminis) by various plants communities, respectively biotypes. In this respect, a phyto-sociologic experts report (a botany

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branch dealing with the study of the plants grouping) is a premise.

The seeds and the fruits of other plants have “little wings”, “helices” or “parachutes” by which the diaspores dissemination is very efficient. From this category we can mention trees as the maple tree (*acer*), the birch tree (*betula*), ash tree (*fraxinus excelsior*), the elm tree (*ulmus*), as well as plants like the hawk bit (*taraxacum officinale*) or the goat’s beard (*tragopogon pratensis*). Especially the birch tree small and light fruits can protrude in the very narrow spaces of the clothes.

Some species are favoured by the anemocoria, for example those disseminating on isolated walls. In these places arrive also other wood species like the yew tree (*taxus baccata*). The zoo cores species are also in this category because, owing to the pulpous envelope of the seeds (*tegument*) respectively of the fruits which is food for the birds, their fruits and seeds are carried thereby. The big and heavy fruits of beech tree (*fagus sylvatica*) and of the oak tree (*quercus*) are also food for squirrels and magpies.

One must keep in mind the plants can “migrate” from a place into another. So, the seeds and the fruits can be the food for birds, and the big and heavy fruits of beech trees and oaks are also the food for squirrels and magpies and can be

disseminated thereby on large land surfaces. The ants contribute also to the “plants migration”, as long as the seeds contain a protein which calls for the insects and which is the food there for. During the transport they lose seeds, from which grow the respective plants along with the “ants route”. In this way such plants can be disseminated on large surfaces. To this category belong also the sweet violet (*viola odorata*), the hollow wort (*corydalis*) and the common celandine (*chelidonium majus*). The aquatic plant traces indicate the victim or the stolen good has been staying in the water. Here there are namely the frog foot (*lemna minor*), green algae and the water moss (*fontinalis antipyretica*). Even the diatomea show the object stayed in the water. If in the lungs one find water containing some diatomea cells, one suppose the death was by drowning. If in the lungs of a cadaver found in aquatic environment there is no water, it means it was put there after the death.

**Data about the deed perpetration**

By means of the vegetal remains one can get information concerning the hour or the time period in which an offence was perpetrated. The criteria according to which the search can be performed include the resistance in time of the vegetal remains and the decomposition time thereof.

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According to the time of the perpetration, the offences can be classified as follows:

- actual deed with almost synchronic effects;
- deed in the past whose effects are persisting;
- deed committed in the past, whose effects ceased, but whose traces can yet be detected.

During one year, the plants grow various organs, so finding these ones as macro-remains shows the long existence of the plant. In case such macro-remains are related to the context of an offence committing, then one can state the time at which it was committed.

From this point of view, the knowledge concerning the plants development is very important, such as the buds and fruits growing at various species. The maturity degree of the fruit and leaves' falling can give clear indications about a certain time period of the year.

Data relating to the annual development of the plants disseminated on large surfaces are shown in phenologic charts. The comparison of the development step of the concerned vegetal trace with the information from the phenologic charts makes possible the time placing of the searched deed.

The time of an offence committing can be searched also if at the place where the

victim of the stolen object were found, one can see laid down plants or pale colour on the leaf's surface. This process is due to the lack of light on the surface which lies directly on the earth. The intensity of the pale colour is partially specific to the species.

This is true also for the duration of the plant re-greening process, after removing of the objects that have caused the light lack. Analysing the actual step one can get important information for the offence clarifying. At present it is no elaborated presentation of this method.

During the offence perpetration the plants at the concerned place can be broken or bent. If there are only bent plants, it means the deed was relatively recently committed, because the plants lift themselves after a while. The most quickly lift the cereals stems.

#### ***Data about the species setting out***

For the criminalist investigation of an offence from which vegetal traces have been collected it is necessary and useful to set out the plant or the plant fragment belonging to the species or population from which they come. In order to be able to constitute proofs by these traces, their belonging setting out is compulsory when the vegetal remains are fragmentary.

The belonging to the species can be set out firstly examining the typical features (characteristics of the limb, of the leaf

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edges, the nervures placement, the petioles consistency, the dimension and form of the thorns) and the comparison thereof with the existing information in the publications in the field containing data but also images (photos, drawings, macroscopic images) about plants.

As the species from which a plant remnants come cannot be recognised often from the anatomic or morphologic features alone, the utilisation of the molecular markers becomes more and more important. Essentially, the work method in case of the molecular-genetic research of the plant fragments follows the steps in the ADN analyses of the animal or human tissue. Firstly one must extract from the vegetal tissue sufficient ADN both qualitatively and quantitatively.

From the fresh wood samples, from the wood and leafs chips or from the dry stored samples, generally, one can isolate good quality ADN. One must keep in mind the temperature or the storage of the vegetal material in a humid place result in the quick ADN degradation. Depending on the plant species, the tissue type (e.g. root, leaf or wood), the tissue age or state of the sample (e.g. dimension or possible contamination with other organisms) one select the extraction method to get optimal results.

The detailed ADN analysis, mostly, is based on the multiplication (amplification)

of certain ADN fields by PCR (chain polymerisation reaction). From the quality of the isolated ADN it results also the possibilities of markers analysis. If the ADN is mostly damaged, by PCR one can only multiply, in a happy situation, some ADN fragments.

Besides the length of the amplified fragments, the ADN markers must fulfil also other criteria in order to be able to identify with very high accuracy a species, as such:

- they must be easily multiplied to various plants species with the same universal primers;
- they must be specific to the plant;
- in the available data bases (EMBL, NCBI, „BAR-CODE of life”) must be as much as possible comparison data (ADN sequences);
- must be strong variations between species but low within the same species;
- there must be in multiple copies into the genome.

The molecular analysis of the plants fragments from the site or from the clothes of the suspect individual, of the victim and the comparison thereof with the reference samples, more specifically with the plants growing on the site, can result in the solution of the criminal cases.

Owing to the high questions diversity, that can appear in criminalist field, to the



research material and methods, it is difficult to state compulsory standards for the molecular analysis of the plants fragments. The accuracy can be reached rarely by the ADN analysis of the plants, rather than by the human ADN analysis, even if the analysis procedures are similar. For this reason, in each case, one must carefully verify the completeness of the analyses of the plants fragments. In the same time, it is necessary to take into account also other complementary methods for the species setting out as such: analysis of the stables isotopes or the analysis of the volatile tracers.

A significant role in the criminal cases elucidation has, besides the plant parts above mentioned, the pollen grain (powder, usually yellow, consisting in microscopic grains produced by the stamina anthers) which, by the composition changes produced during the year, make possible to be proved the presence at the deed place of the author, of the victim but also the period of time when the offence was committed. These can be collected, by means of some adhesive strips, and subject to the analysis by reflexion spectroscopy.

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