

Purpose of the Illustrated Observing Guide

Experience has shown that supplementing the phase definitions with pictures has eased the problems of observers and generally improved results. The observing phases “Leafing” and “Beginning of blossom” have relatively easy and exact forms of definition in contrast to the phase “First ripe fruits”, “General turning (colouring) of the leaves” and “General fall of the leaves (Leaf fall)”, Yet even these phases “Leafing” and “Beginning of blossom occur spasmodically and are of short duration; the changes involved are also often of a very small nature. It is hoped that the illustrations will help remove any doubts.

Pre – phases – Observing-phase – After – phases

To make the “Observing-phase” more easily recognisable it was decided to define and illustrate so-called “Pre-phases” and “After-phases” (not for observation). Therefore the phase definitions begin generally with an “early Pre-phase (1)”. They progress through a Pre-phase (2) to the actual “Observing-phase (5)”. Then follow on “After-phase (4)” and finally a “late After-phase (5)”. There is generally a long time lapse from the “early Pre-phase (1)” to the “Pre-phase (2)”. There may even be a lapse of some days from the beginning to the end of this “Pre-phase (2)”. However the transition from the end of “Pre-phase (2)” to the setting-in of the “Observing-phase (3)” generally occurs rapidly, often on the following day. The “Observing-phase (5)”, when it has set in develops quickly to the “After-phase (4)”, while this “After-phase (4)” and especially the subsequent “late After-phase (5)” are frequently of long duration.

In the arrangement of the separate phases and choice of illustrations an attempt has been made to define the “Observing-phase (5)” as narrowly and unmistakably as possible through a comparison of the Pre- and After-phases and to make the dividing line between the unobserved “Pre-phase (2)” and the “Observing-phase (3)” clearly visible.

Phase definitions of the unfolding of the needles(Leafing) of Larix decidua (European larch)

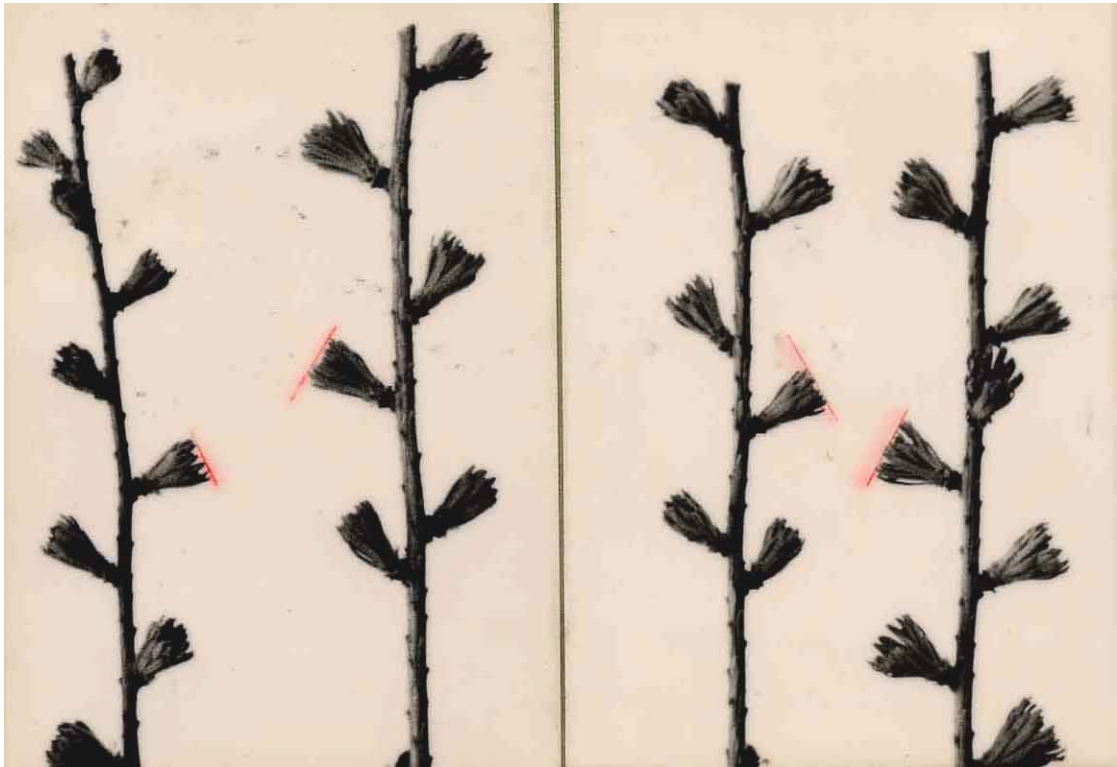
Early Pre-phase (1) The buds have opened and show at the apex a small closed, symmetrical rounded surface of light pine-green colour. The length of this green top does not attain (in a side view) the length of the earlier bud.

Pre-phase (2) The green bundle of needles including the apex is still compact or closed. It has now become a cylindrical bundle about the same length or a little longer than the young bud in the bud scales.

Observing-phase (3) The previously closed (compact) bundle of needles begins to open out into a needle- fascicle: the needles have still by no means attained their full length; they separate however at the apex, the cylindrical bundle becoming a cone shaped fascicle. The apices of the needles lie in a somewhat circular plane (the base of the cone) while at the other end the needles are still tightly closed in the bud scales (the apex of the cone).

After-phase (4) The fascicle has expanded generally, particularly as regards its spread} the needles have become larger and have separated down to their base, The apex of the needles are no longer in a level plain but in the shape of a well formed arc.

Late After-phase (5) The growth and spreading of the needle have progressed. The apices of the needles are now in the shape of a somewhat half-formed sphere.



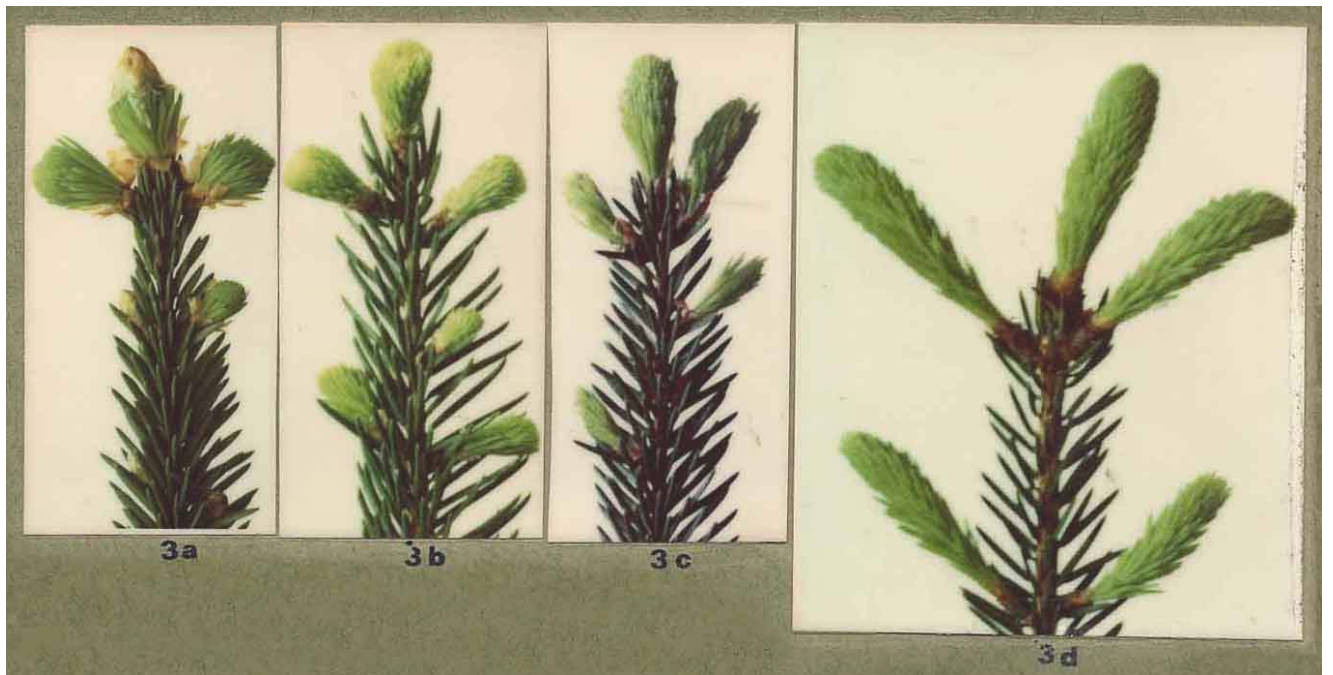
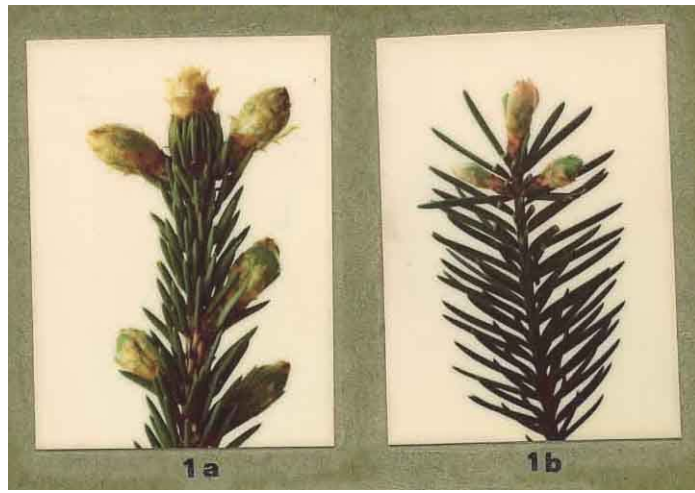
Phase definitions of “Unfolding of the needles (First May Sprouts)” of *Picea abies* (Fir)

Preface The opening of the buds and also the expanding and spreading of the bundles of needles in the May sprouts can occur in different ways.

Early Pre-phase (1) Normally -the brown bud scales detach themselves from around the bud above the base and remain on the top as a little scale cap. The first green needles appearing between the little cap and the base of the bud are still largely covered by fine transparent scales. But It can also happen that the bud scales open at the top or at different places along the side and that the green colour of the needles shows faintly through.

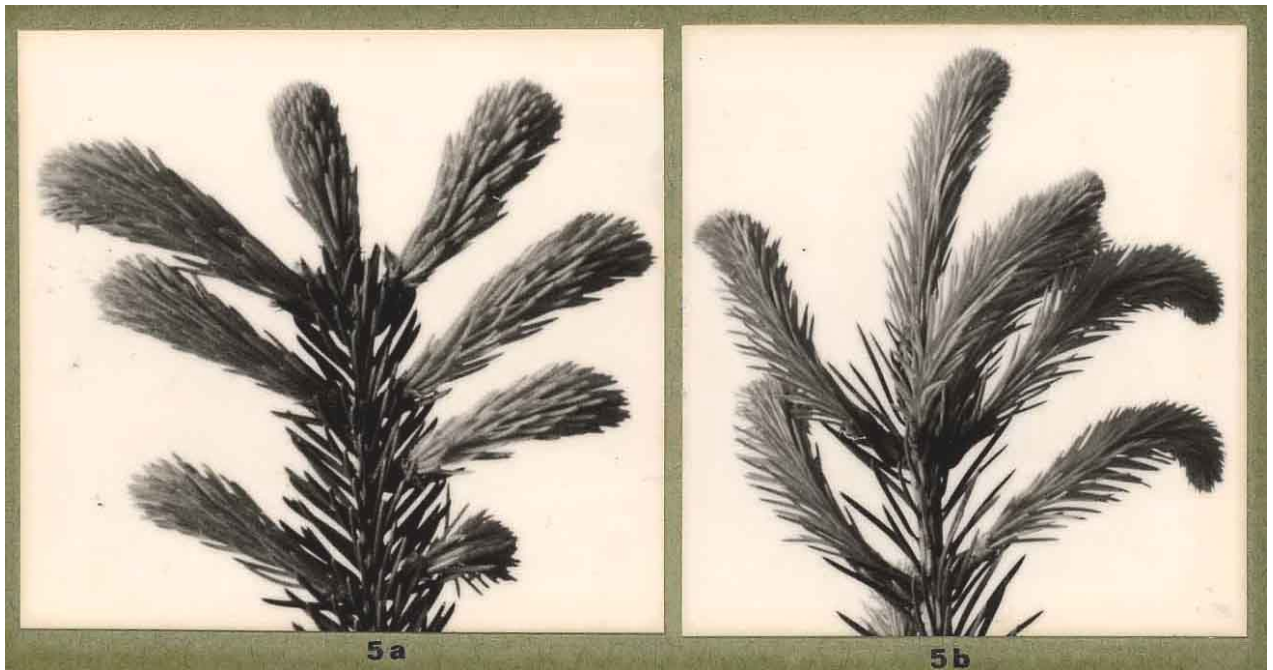
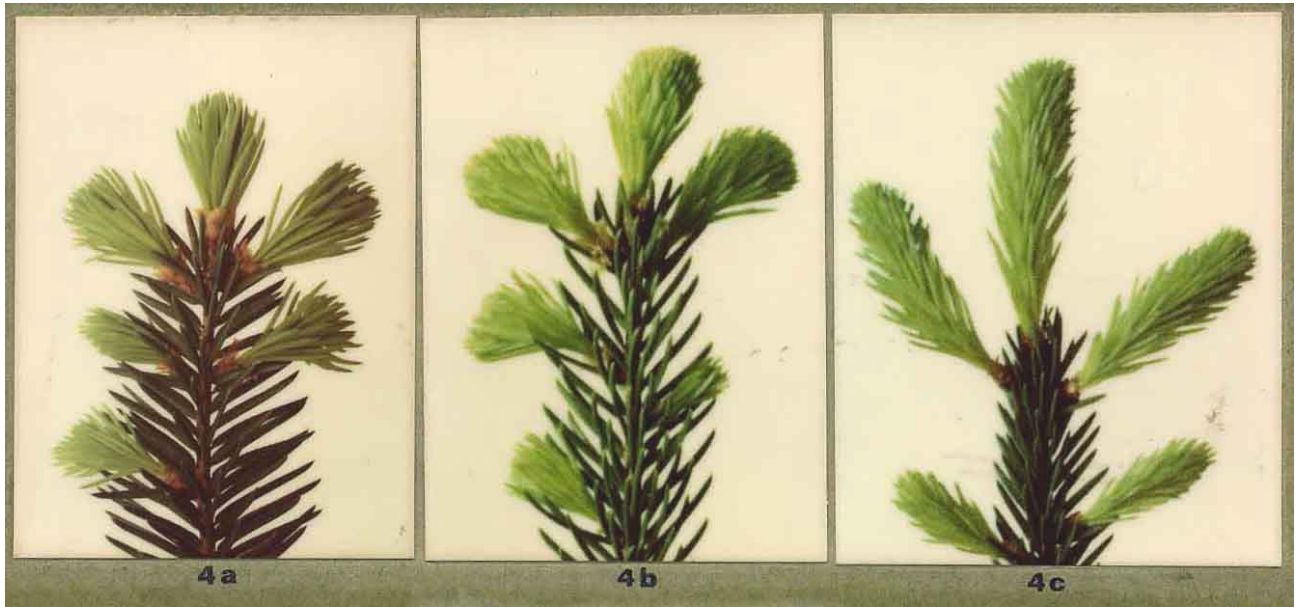
Pre-phase (2) In most cases the green needles first become visible on a large surface all around the bud in the lower or middle part of it, or, if the little scale cap falls down, on the whole surface of the united bundle of needles. The green needles can however also first come out on the top or in other places of the bud while occasionally some more or less connected parts of the scales can still stick to it. In any case the needles still form a solid and rather short united bundle with an entirely closed surface.

Observing-phase (3) The formerly closed united bundle of needles begins to disunite. Usually the separation of the different needles begins at the bottom of the young sprout simultaneously with the elongation growth of the united bundle of needles, while its top remains still rather closed and in exceptional cases can even still bear the little scale cap. This process of spreading begins less often from the top and generally only when the needles have first come out on the top of the bud.



After-Phase (4) The united, “bundle of needles continues to expand and to unfold from the base of the sprout while the needles remain in rather dense united bundles on the top of the sprout. But it can also occur that the separation of the needles proceeds more rapidly on the top of the sprout, especially if the growth is rather weak.

Late After-Phase (5) Further expanding of the sprout and greater separation of the needles.



Different Phases of *Picea Abies* on a single shoot.

Phase-definitions of “Unfolding of the leaves (Leafing)” of *Betula pubescens* (Hairy-, Scented-, Bog-, Black-birch)

Early Pre-phase (1) The buds have emerged and the tops of the narrow rolled leaves are visible as light green spindles. They are still covered with bud scales and tightly bound lengthways in pairs (photos 1a and b, 2a). Regarding the bending of the leaf tops observable in phases 2, 3 and 4 it is noticeable even during this early Pre-phase that the tops begin to arch over slightly.

Pre-phase (2) Two small leaves have generally emerged from each leaf bud which begin to open quickly (photos 2a to e). At the beginning, both leaves are still cylindrical and later very narrow and at an acute-angle (30° to 45°) to the leaf-base at the opposite side of the shoot to the common casing of the bud-scale. As a result the whole leaf surface down to the base is not visible. The upper surface of the leaf has developed a trough-shaped (concave) form, remaining in the same direction as the leaf-base especially at the beginning of this phase. However, in the course of the phase the parts of the leaf near the edges begin to arch over outwards. Towards the end of the phase the leaves may have a weak roof-shaped (convex) appearance from the top of the leaf over an increasingly large part of the upper surface. The leaves may also be already fairly wide. Therefore in the course of Pre-phase (2) the distinct trough-shaped upper surface of the leaf changes to a convex form.

Observing-phase (3) Generally, both leaves of the same bud have simultaneously emerged from the bud-scale of the leaf-base (photos 3a to e). The leaf stalk (petiole) is still short but most of it is visible without having to turn over the leaf. The pairs of leaves initially form right angles which later become obtuse. The complete upper surfaces of the leaves are now visible as both leaves and leaf-bases have now moved completely apart. The leaves are fairly strongly arched-over all around (convex leaf upper surfaces) and are now very clearly sulcated (furrowed).



After-phase (4) The leaves have increased, a little in size, are also now strongly sulcated and arched- over all around; moreover the leaf stalks have clearly grown longer (up to $\frac{1}{4}$ the size of the leaf). As a result both leaves are markedly separated (photos 4a to c). These stalks now lie in the same plane as the leaf upper surface or else form an angle of more than 180° with it (photo 4b - top).

Late After-phase (5) The leaves and especially the leaf stalks have grown even larger. It is only in this phase that the leaves generally reach the “normal” form of a birch leaf (photo 5). They are always smaller and more strongly sulcated than the ripe leaf.



Phase definitions of “Leafing” of *Populus canescens* (grey poplar)

Preface The development of the leaves does not occur uniformly on the long shoots. Generally the lower leaves of a long shoot have reached phase (5) while those at the top of the shoot are still at phase (1). The onset of phase (3) over the whole shoot should therefore not be awaited. It is sufficient if one leaf on either a long or short shoot has reached the stage of observing- phase (3). The fixing of this date is simplified by the fact that not one but usually several (2 or 3) of the lower leaves on many shoots reach this stage on the same day.

Early Pre-phase (1) The buds have opened and, exposed a pointed, fairly long (10 mm or more), tightly rolled bundle with graduated edges of young or immature leaves (photos 1a to d). The outer surface of this bundle has a striking light grey- green colour with diagonal striping. Towards the end of phase (1) the tops of the lowest leaves begin to open out and together with the adjoining edges of the immature leaves begin to arch downwards or outwards.

Pre-phase (2) The lowest (or generally several lower leaves) further separate(s) from the top of the bundles (Photos 2a to c). They are still however closed, around the bases of the bud scales. The leaves in question are fairly acute-angled at the leaf-base, forming an angle of less than 90° with the shoot. Most of the leaf upper surface (leaf spread) has clearly bent outwards both lengthwise and cross- wise and is clearly convex. Only at the leaf base can the surface remain slightly concave where the young leaves are still encased by the bud scales. The leaf-stalks (petiole) are still not visible. The leaf colour remains definitely light grey-green.



Observing-phase (3) The lowest or lower leaves of a shoot are visible up to the leaf-base and have developed, on all sides a fairly arched, convex form; the leaf tip in particular, tends to point downwards along the long leaf-axis (photos 3a to f). The leaves are inclined at an angle of greater than 90° (mostly far greater) to the shoot. The leaf spread is still however fairly small with a length/width ratio of about 1:0.6 (The details regarding ratio of leaf length to width refer to early developed leaves. Later developing leaves {of the long shoot} are inclined to be longer). The leaf stalks exist at this stage although only one or two mm. long (as compared with their later obvious length). They are mostly visible but are occasionally covered by the bud scales or by young leaves and can only be seen by moving the leaves aside.

After-phase (4) The lowest or lower leaves of the shoot have clearly separated from each other on all sides. This is mainly caused by the fast growth of the leaf stalks which have already attained $\frac{1}{3}$ to $\frac{1}{2}$ of their full length (photos 4a and b). The upper leaf surface is now less convex. The length/width ratio of the leaf has narrowed to about 1:0.7/0.75.

Late After-phase (5) The lowest leaves of the shoot have still not attained, their final size, form or colour but have clearly separated from one another. The stalk has grown to about the same length as the leaf (photos 5a and b). The upper surface of the leaf is practically flat. The length/width ratio of the leaf has further narrowed, to about 1:0.80/0.85. It will finally become 1:1.



Short shoot with leaves at different phase stages.



Phase definitions of the “Unfolding of the leaves (Leafing)” of *Populus -tremula* (Aspen, trembling Poplar)

Early Pre-phase (1) The leaf “buds have opened and a fairly pointed spindle of bright leaf-green colour emerges (photo 1a). The numerous young leaves of the later short, medium and long shoots have developed towards the end of phase (1) into what approximately resembles a uniform cylindrical roll (photo 1b).

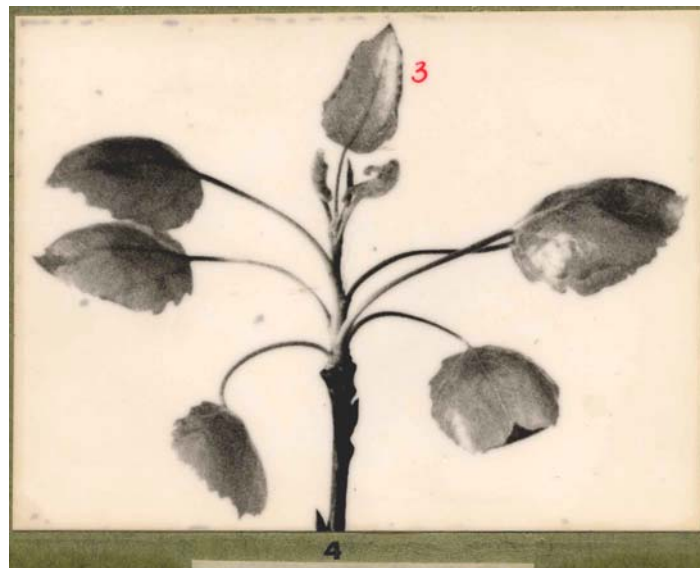
Pre-phase (2) The previously uniform overlapping of all leaves forming on the shoot “begins to develop into a number of very narrow “single rolls” of leaves with a leaf length to diameter ratio of about 1:0.1/0.2 (photos 2a to c). Each leaf is still so tightly rolled, that the edges of both sides lie parallel to the main vein while the upper and under surfaces are touching. The young leaves still bear little or no resemblance to the “normal” Aspen leaf. Towards the end of this phase the leaves have unrolled only to such an extent that the upper surface is barely visible. Since the start of phase (2) the leaf stalks have been visible and in the course of the phase have noticeably grown in length.

Observing-phase (3) The rolls of leaves have further opened on both sides. The transverse arching tends to “be greatest in the parts furthest from the main vein. In consequence, a clear top view of the upper leaf surface as far as the serrated edges is still not obtained; however only a little further unwinding would be sufficient. The underside of the leaf has also almost “unfolded”. The upper surface of the leaf now resembles less than half a cylindrical cross-section. If levelled out the upper surface would have a length/width ratio of 1:0.5. Although the leaf still has not the “normal” appearance of the aspen leaf there is sufficient resemblance both in shape and its position



After-phase (4) The arching of the leaf has further flattened. From a top view it appears broader and if completely levelled would have a length/width ratio of about 1:0.65/0.85. The stalks have also increased in length.

Late After-phase (5) The leaves have become flat-surfaced and have now the “normal” appearance of the aspen leaf, although they will continue to alter in shape, size and colour (photo 5). The length/width ratio is now about 1:1 (or greater).



Phase definitions of the “Beginning of blossom” of *Salix ×smithiana (Osier)

**Note; The shrubs in the Irish Phenological Gardens named Salix caprea (Sallow) are in reality a cross “caprea x viminalis” which is properly defined as Salix ×smithiana (Osier).*

Preface When weather conditions cause slow blossoming it will often happen, especially on large Inflorescences, that all five phases are simultaneously present - from the silvery parts without a hint of yellow anthers of phase I to the empty stamen of phase 5. Under these circumstances no anthers at all will develop on large parts of the Inflorescences. The development of “Observing-phase (3)” over the whole Inflorescence should not therefore be awaited. It is quite sufficient if this stage is reached on part of the Inflorescence as in photos 4 to 6.

Early Pre--phase (1) The male Inflorescence still has a silvery gloaming appearance. The single anthers are recognisable at the base of the hair-covering but have not yet turned yellow.

Pre-phase (2) The anthers become yellow “but are still on short stamen within the hair-covering and. do not protrude above the surface. The yellow of the anthers gleams through the white hair-covering over a more or less large surface of the Inflorescence.

Observing-phase (3) The yellow anthers at the end of long stamen project clearly out of the hair-covering, are fully developed and sought after by insects. It is sufficient if this stage is reached on part of the “blossoming surface.

After-phase (4) Part of the anthers of the Inflorescence are already empty, while others may still be in varying stages of development.

Late After-phase (5) All anthers of the Inflorescence which have at all developed, are empty and brown coloured.



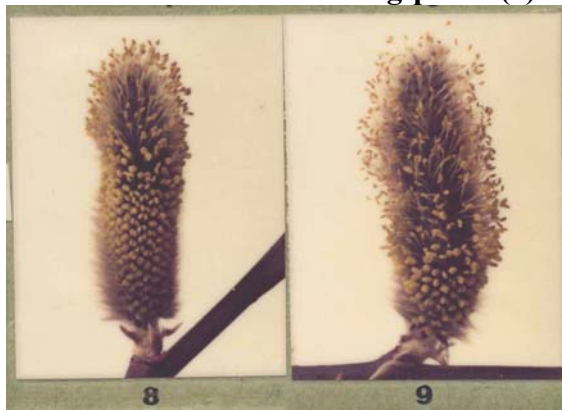
Early Pre--phase (1)



Pre-phase (2)



Observing-phase (3)



After-phase (4)



Late After-phase (5)