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# Notes on the Development of the Carpophore of some Agaricaceae.

BY

RUDOLF BEER, B.Sc., F.L.S.

With Plate LII.

THE exact order and manner in which the different parts of the carpophore develop is still uncertain in a large number of Agaricaceae. In his earlier work De Bary (1) attributed an internal origin to the hymenium of *Agaricus* (*Psalliota*) *campestris* and some other Agarics which he had studied. In 1874, however, Robert Hartig (3) described the development of the carpophore of *Agaricus* (*Armillaria*) *mellea*, and he found that the pileus arises through a superficial annular furrow which in the beginning is completely open to the outside, and that later, through growth of the marginal hyphae of the pileus and of the stem, the annular furrow becomes covered over with a hyphal layer, the veil.

In his 'Comparative Morphology and Biology of the Fungi, &c.,' published in 1884, De Bary (2) renounces his former opinion and accepts that of R. Hartig. He now believes that in *Agaricus campestris*, as in *A. mellea*, the primordium of the hymenium is first exposed in the open annular furrow which marks off the rudimentary pileus from the stem, and that only subsequently it becomes enclosed by hyphae, which grow towards one another from the edges of the furrow and form the marginal veil.

Fayod (4) studied a very large number of Agaricaceae, and he concluded that the primordium of the pileus was always the first to be differentiated *within* the rudiment of the carpophore. It arises as a definite layer, the 'couche piléogène,' which has the form of a shallow inverted bowl, convex above and concave below. This is surrounded externally by a thin layer which he calls the 'cuticule primordiale'. Fayod divides the Agaricaceae into angiocarpous, subangiocarpous, gymnocarpous, and endocarpous forms, and he attempts to trace his 'cuticule primordiale' in all of them. He very obviously, however, brings together several very different structures under the one name. For seventeen years after the publication of Fayod's work

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no additions were made to our knowledge of the development of the fruit-bodies of these Fungi. In 1906, however, the long silence was broken, and Professor G. F. Atkinson (5) published an admirable account of the development of the carpophore of the mushroom.

He found that the young homogeneous fruit-body, in its earliest stage, shows no differentiation into parts (except the rudimentary universal veil), and is to be considered as the primordium of the carpophore. The first differentiation consists in the appearance of a ring of deeply staining hyphae near the upper end of the young fruit-body and some distance below the surface. This is the primordium of the hymenium, and it marks the differentiation of the primordium of the fruit-body into the primordium of the pileus and that of the stem and marginal veil, the latter being the tissue of the young fruit-body external to the hymenial primordium and continuous with what is to be the margin of the pileus above and with the undifferentiated stem surface below.

Soon after the hymenial primordium has been formed the tissue of the pileus primordium becomes definitely organized, and appears as a deeply staining area lying some depth below the surface.

The three salient facts which Professor Atkinson demonstrated in *Agaricus campestris* were :—

1. The hymenial primordium was the first structure to become differentiated in the homogeneous fruit-body.

2. This hymenial primordium arises endogenously and the marginal veil is not an aftergrowth.

3. The tissue of the pileus (the 'couche piléogène' of Fayod) arises in this plant after the appearance of the hymenial ring.

A few years later C. C. E. Fischer (6) published an account of his study of the development of the carpophore of *Armillaria mucida*. He finds that this does not at all agree with the description given by Robert Hartig in the case of *A. mellea*.

No open furrow is formed round the young fruit-body which subsequently becomes closed by the aftergrowth of a marginal veil. On the contrary, Fischer finds the development of this plant to resemble that of the mushroom, as given by Atkinson, in so far as, in both species, the hymenium originates endogenously and is separated from the exterior from the first by a layer of neutral tissue which constitutes the marginal veil.

If I read his account correctly, however, *Armillaria mucida* differs from *Agaricus campestris* in that in the former plant the pileus ('couche piléogène' of Fayod) precedes the appearance of the hymenial rudiment.

Fischer states that the hyphae near the apex of the young fruit-body show a tendency to radiate towards the periphery and form a subcuticular palisade layer of tissue. This palisade layer defines the rudiment of the





pileus. Later the palisade tissue spreads inwards to form the primordium of the hymenium.

Some time ago I collected material of a number of Agarics in order to determine their mode of development. A few of these have now been sectioned, and in the present note I have brought together the photographs of these sections and have added a few words of description.

The great difficulty in studying the development of the carpophore of these Fungi, when growing in the open, usually lies in obtaining sufficiently young stages. In the case of *Hypholoma fasciculare* (Huds.), however, no trouble is experienced in finding all stages of development from the youngest rudiment to the mature fruit-body.

In the earliest stage the primordium of the carpophore consists of a mass of narrow, closely packed, much interwoven hyphae, which for the most part take a clearly marked longitudinal course. Over the surface the hyphae are broader in diameter and more loosely arranged. This layer of superficial hyphae constitutes the universal veil. In Fig. 1, Pl. LII, three young fruit-bodies at this stage are seen developing side by side.

Fig. 2 represents a slightly older carpophore rudiment. It will be noticed that the body has elongated considerably and that it now shows the first signs of a differentiation of its parts. Near the apex a cup-shaped layer of hyphae has become conspicuous in consequence of the deeper stain which it takes. This layer constitutes the primordium of the pileus, the 'couche piléogène' of Fayod. The hyphae which compose it appear to be richer in protoplasm than their neighbours; they do not assume, in this fungus, a palisade arrangement such as Fischer described in *Armillaria mucida*, but on the contrary they tend rather to run transversely, so that their course is parallel with the surface of the 'cup' which they form.

The layer of deeply staining hyphae increases in thickness and then spreads inwards, so that the edges of the 'cup' become incurved towards the centre of the young carpophore. This incurved and somewhat thickened area of the deeply staining layer of hyphae forms the rudiment of the hymenium (Fig. 3). In the next figure (Fig. 4) a slightly older stage is represented.

In the section of the fruit-body here represented there are to be seen the first signs of the loosening of the tissue just below the primordium of the hymenium. The hyphae in this locality cease to keep pace with the growth of the rest of the carpophore. In consequence there is first a loosening of the tissue below the hymenial rudiment, and a little later an actual cavity is formed there. This cavity is the gill cavity. An early stage in its formation is shown in Fig. 5. In this photograph we can distinguish the different parts of the carpophore: the universal veil, the pileus, the stipe, the hymenium, the gill cavity, and the marginal veil. In slightly older fruit-bodies we find that the whole structure, and more particularly the pileus, is broadening

out laterally. This can be seen by comparing Fig. 6 with Fig. 5, Pl. LII. At this period of the development the hymenial layer is composed of a large number of narrow hyphae, densely filled with deeply staining protoplasm, and arranged very regularly and closely together side by side over the whole hymenial surface. The marginal veil can now be very clearly distinguished, and it will be seen that it is composed of the neutral tissue lying just outside the gill cavity and within the universal veil. About this time or slightly later the stipe shows a differentiation into medullary and cortical regions. The former is composed of loosely arranged hyphae which stain very lightly, whilst in the cortical area the hyphae are more closely arranged and stain more deeply. The gill cavity continues to enlarge as the carpophore grows and the hymenial surface increases in area (Fig. 7). The gills are next developed as a series of down-growths from the hymenial surface (Fig. 8).

The further history of the fruit-body is largely that of the expansion of its parts. The increased growth of the lower surface of the pileus and of the gills at length leads to the rupture of the marginal veil, which is left in the older carpophore as a fringe to the edge of the pileus and a darkened area upon the stipe. The stipe has in the meanwhile become hollow.

Another Agaric which I have examined is *Clitocybe laccatus* (Scop.).

Here also the first differentiation of the carpophore primordium consists in the demarcation of the pileus (Fig. 9). Just below the surface in the upper part of the elongated carpophore primordium a cup-shaped aggregate of closely interwoven hyphae appears and marks the rudiment of the pileus. Soon the rim or edge of the 'cup' grows inwards, and this internal extension of the closely arranged hyphae forms the rudiment of the hymenial layer. It will be noticed in Fig. 10, which represents this stage, that both pileus and hymenium have originated below the surface of the fruit-body, and that this is completely surrounded by a rather poorly developed, but still quite distinct, universal veil. The pileus now grows laterally, and in doing so soon ruptures the feebly developed universal veil (Fig. 11). The rest of the development of the hymenium takes place whilst this is exposed to the air and uncovered by any universal or marginal veil (Fig. 12).

I have also cut a series of sections of the young fruit-bodies of *Armillaria mellea* (Vahl). These preparations do not bear out the account given of the development of this carpophore by R. Hartig; they are, on the contrary, in general agreement with the description given by Atkinson of the mushroom and that given by Fischer of *Armillaria mucida*.

The first differentiation of the previously homogeneous fruit-body consists in the appearance (in longitudinal sections) of two darkly stained patches lying a little way below the surface and near the upper end of the carpophore (Fig. 13). These darkly coloured patches in the longitudinal



sections naturally correspond to a ring-shaped area in the entire carpophore, and they represent the primordium of the hymenium. Very soon afterwards the differentiation of a cup-shaped layer of deeply staining hyphae takes place, which extends upwards from the primordium of the hymenium over the summit of the carpophore, but always some distance below its surface (Fig. 14). This cup-shaped layer forms the primordium of the pileus. A little later a gill cavity is formed just below the hymenial primordium by the cessation in growth of the hyphae at that spot (Fig. 15). The gill cavity increases in size and the differentiation of the various parts of the fruit-body becomes more distinct (Fig. 16). The marginal veil, formed of neutral tissue *present from the first*, covers in the gill cavity. The universal veil, which is well developed over the summit of the young pileus, can only with difficulty be traced in the neighbourhood of the marginal veil as a distinct structure from this. The whole development of the hymenium and the formation of the gills takes place within the cavity which is curtained off from the exterior by the marginal veil (Fig. 17).

Not until a late stage does the growth of the pileus rupture the marginal veil along its margin and leave this structure as the 'annulus' upon the stipe. The chief facts which result from my observations upon *Armillaria mellea* are that the primordium of the hymenium is the first part of the carpophore to be differentiated in this plant, and that this differentiation takes place endogenously. Fischer found that a palisade layer, marking off the pileus, was the first area to differentiate in *Armillaria mucida*. It is not unlikely that there may be some variation in the exact spot in which the differentiation commences; in any case, my preparations of *A. mellea* show that the differentiation of the pileus follows rapidly upon that of the hymenium, and it is quite possible that under certain circumstances the differentiation of pileus and hymenium may be practically simultaneous, or that the 'couche piléogène' may even be distinguished before the hymenium.

On the other hand, however, the order of differentiation may be constantly distinct in the fruit-bodies of *Armillaria mellea* and *A. mucida*. Further observations can alone decide this. However this may be, the particular set of plants which I have examined correspond in this respect more closely with Atkinson's observations upon *Agaricus campestris*, in which he found the primordium of the hymenium to be the first part to differentiate in the young carpophore. I am in complete agreement with both Atkinson and Fischer with regard to the endogenous origin of the hymenial primordium, and in finding the marginal veil to be present from the first and not formed as an aftergrowth as Hartig believed.

In conclusion, I should like to express my thanks to the staff of the department of Cryptogamic Botany at the British Museum (Natural History) for their kind assistance in identifying the Fungi described above.

## Summary.

A. *Hypholoma fasciculare* (Huds.).

1. The very young carpophore consists of a mass of densely interwoven hyphae enveloped in a layer of looser hyphae.

2. The first differentiation of parts in this carpophore consists in the appearance of a cup-shaped layer of deeply staining hyphae a little way below the surface at the upper end of the young fruit-body. This marks the primordium of the pileus, which is thus the first part to differentiate in *Hypholoma*.

3. The inward extension of the edge of this cup defines the hymenial layer.

4. Below this primordium of the hymenium an air-space—the gill cavity—is formed. A marginal veil can now be clearly distinguished. It is derived from the neutral tissue just outside and below the hymenial layer; it is present from the first and is not an aftergrowth.

5. The stipe differentiates into a cortical and a medullary region. It later becomes hollow.

B. *Clitocybe laccatus* (Scop.).

6. In this plant also the first differentiation of the carpophore consists in the demarcation of the pileus. It appears as a cup-shaped layer of hyphae lying a little way below the surface at the upper end of the elongated carpophore primordium.

7. The rim or edge of the 'cup' grows inward to form the rudiment of the hymenial layer.

8. A poorly-developed universal veil surrounds the whole carpophore at first. At an early stage, however, the lateral growth of the pileus ruptures this universal veil, and the whole of the rest of the development of the hymenium takes place whilst this is exposed to the air and unprotected by either a marginal or universal veil.

C. *Armillaria mellea* (Vahl.).

9. The primordium of the hymenium is the first part to become differentiated in the plants which I have examined. It has an endogenous origin.

10. The pileus becomes differentiated soon after the hymenium has been marked off.

11. The hymenium is never exposed in an open furrow. On the contrary, the marginal veil is present from the first, and is never an aftergrowth as Hartig supposed.




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## EXPLANATION OF FIGURES IN PLATE LII.

Illustrating Mr. Beer's paper on the Carpophore of some Agaricaceae.

All the figures are from untouched photographs taken by the author.

Figs. 1–8 represent *Hypholoma fasciculare* (Huds.).

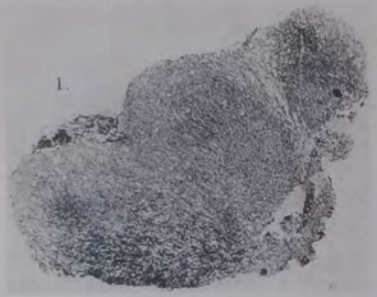
Fig. 1. Three very young carpophores with tissues still undifferentiated. × 41.
Fig. 2. Differentiation of rudiment of pileus. × 41.
Fig. 3. Further differentiation of pileus and commencement of differentiation of hymenial rudiment. × 46.
Fig. 4. Loosening of hyphae below the hymenial rudiment to form gill cavity. × 44.
Fig. 5. Early stage in development of gill cavity. × 45.
Fig. 6. Broadening of pileus and further development of gill cavity. × 45.
Fig. 7. Gill cavity further enlarged. Universal and marginal veils shown clearly. × 42.
Fig. 8. Later stage of development. Formation of gills. × 44.

Figs. 9–12 represent *Clitocybe laccatus* (Scop.).

Fig. 9. Differentiation of pileus. × 45.
Fig 10. Differentiation of hymenial rudiment. × 45.
Fig. 11. Hymenial layer exposed by lateral expansion of the pileus. × 43.
Fig. 12. Older stage. × 43.

Figs. 13–17 represent *Armillaria mellea* (Vahl.).

Fig. 13. Differentiation of hymenial rudiment. × 41.
Fig. 14. Differentiation of pileus. × 41.
Fig. 15. First indication of formation of gill cavity. × 41.
Fig. 16. Older stage. × 41.
Fig. 17. Development of gills. × 43.






















BEER—AGARICACEAE.

B8a

# Notes on the development of the Carpophore of some Agaricaceae

By Rudolf Beer F.S.E. F.L.S.

The exact order & manner in which the different parts of the carpophore develope is still uncertain in a large number of Agaricaceae. In his earlier work De Bary[1] attributed an internal origen to the hymenium of Agaricus (Psalliota) campestris & some other Agarics which he had studied. In 1874, however, Robert Hartig[3] described the development of the carpophore of Agaricus armillaria) mellens & he found that the pileus arises through a superficial annular furrow which in the beginning is completely open to the outside, & that later through growth of the marginal hyphae of the pileus & of the stem the annular furrow becomes covered over with a hyphal layer, the veil*.

In his ~~Comparative Morphologie~~ "Comparative Morphology & Biology of the Fungi etc"

published in 1884 De Bary[2] renounces his former opinion & accepts that of R. Hartig. He now believes that in Agaricus campestris, as in A. mellens, the primordium of the hymenium is first exposed in the open annular furrow which delimitates the rudimentary pileus from the stem & that only subsequently it becomes enclosed by hyphae which grow towards one another from the edges of the furrow & form the marginal veil.

Fayod[4] studied a very large number of Agaricaceae & he concluded that the primordium of the pileus was always the first to be differentiated within the rudiment of the carpophore. It arises as a definite layer the "couche piléogène", which has the form of a shallow inverted bowl, convex above & concave below. This is surrounded externally by a thin layer which he calls

the "cuticle primordiale".

Fayod divides the Agaricaceae into ~~three great divisions~~ groups angiocarpous, Subangiocarpous, gymnocarpous & Endocarpous forms & he ~~seeks~~ attempts to trace his "cuticle primordiale" in all of them. He very obviously, however, brings ~~so many kinds~~ together several very different structures ~~together~~ under the one name. For seventeen years after the publication of Fayod's work no additions were made to our knowledge of the development of the fruit-bodies of these Fungi. In 1906, however, the long silence was broken & Prof G. F. Atkinson (5) published an admirable account of the development of the carpophore of the mushroom.



He found that the young homogeneous fruit body, in its earliest stage, shows no differentiation into parts (except the rudimentary universal ~~veil~~ veil) & is to be considered as the primordium of the carpophore

The first differentiation consists of in the appearance of a ring of deeply staining hyphae near the upper end of the young fruit body & some distance below the surface. This is the primordium of the hymenium & it marks the differentiation of the primordium of the fruit body into the primordium of the pileus & that of the stem & ~~veil~~ marginal veil, the latter being the tissue of the young fruit body external to the hymenial primordium & continuous with what is to be the margin of the pileus above & with the undifferentiated stem surface below. ~~Soon, by unequal growth, a gill cavity is formed below the hymenial primordium~~



Soon after the hymenial primordium has been formed the tissue of the pileus primordium becomes definitely organized & appears as a deeply staining area lying some

depths below the surface.
The three Salient facts which
Prof. Atkinson demonstrated ~~in this~~ in Agaricus campestris were: (1) The hymenial primordium was the first structure to become differentiated in the homogeneous fruit body.
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A few years later C.C.J. Fischer (6) published an account of his study of the development of the carpophore of Armillaria mucida. He finds that his does not at all agree with the description given by Robert Hartig. He No open furrow is formed round the young fruit body which subsequently becomes closed by the after growth of a

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spreads inwards to form the primordium of the hymenium.

Some time ago I collected material of a number of Agarics in order to determine their mode of development. A few of these have now been sectioned ~~& I thought it might be worth while~~ & in the present note I have brought together the photographs of these sections & have added a few words of description.



The great difficulty in studying the development of the carpophore of these fungi, ~~is usually the~~ when growing in the open, usually lies in obtaining sufficiently young stages. In the case of Hypholoma fasciculare (Huds.) Fr., no trouble is experienced in finding all stages of development from the youngest rudiment to the mature fruit-body. ~~His readers~~

In the earliest stage the primordium of the carpophore consists of a mass of narrow, closely packed, much interwoven hyphae which for the most part take a clearly marked longitudinal course. Over the surface the hyphae are broader in diameter & more loosely arranged. This layer of superficial hyphae constitutes the universal veil. In Fig 1 three young fruit-bodies at this stage are seen developing side by side.



Fig 2 represents a slightly older carpophore rudiment. It will be noticed that the body has elongated considerably & that it now shows the first signs of differentiation of its parts. Near the apex a cup shaped layer of hyphae has become conspicuous in consequence of the deeper stain which

it takes. This layer constitutes the primordium of the pileus, the "couche pileigène" of Fayod. The hyphae which compose it appear to be richer in protoplasm than their neighbours; they do not assume, ~~a palisa~~ in this fungus, a palisade arrangement such as Fischer described in Armillaria mucida but on the contrary they tend rather to run transversely so that their course is parallel with the surface of the "cup" which they form.



The layer of deeply staining hyphae increases in thickness & then spreads inwards so that the edges of the "cup" become incurved towards the centre of the young carpophore. This incurved & somewhat thickened area of the deeply staining layer of hyphae forms the rudiment of the hymenium. (Fig 3) In the next figure (Fig 4)

a slightly older stage is represented. ~~After this~~ In the sections of this fruit body there are to be seen the first signs of the loosening of the tissue just below the primordium of the hymenium. The hyphae in this locality cease to ~~grow so fast at this level as at the~~ keep pace with the growth of the rest of the carpophore. In consequence there is first a loosening of the tissue below the hymenial rudiment & a little later an actual cavity is formed there. This cavity is the gill cavity. An early stage in its formation is shown in Fig 5 In this ~~section~~ photograph we can ~~clearly~~ distinguish the different parts of the carpophore: the universal veil, the pileus, the stipe, the hymenium, the ~~marginal veil~~ gill cavity & the marginal veil. In slightly older ~~specimens~~

fruit bodies we find that the ~~pileus~~ whole structure + more particularly the pileus is broadening out laterally. This can be seen by comparing Fig 6 with Fig 5. At this period of the development the hymenial layer is composed of a large number of narrow hyphae, ~~bands~~ densely filled with deeply staining protoplasm, & arranged very regularly & closely together side by side over the whole hymenial surface. The marginal veil can now be very clearly ~~distinguished~~ ~~as the Primordium~~ & it will be seen that it is composed of the neutral tissue lying just ~~beneath~~ outside the gill cavity & within the universal veil. About this time or slightly later the stipe shows a differentiation into a medullary + ~~a~~ cortical regions. The former is composed of ~~almost empty~~ loosely arranged hyphae which stain very lightly whilst in the cortical

area the hyphae are more closely arranged & stain more deeply. The gill cavity continues to enlarge as the carpophore ~~expands~~ grows & the hymenial surface ~~extends~~ increases in area (Fig 7). The gills are next developed as a series of downgrowths from the hymenial surface (Fig 8).

The further history of the fruit body is largely that of the expansion of its parts. The ~~growth~~ increased growth of the lower surface of the pileus & of the gills at length leads to the rupture of the marginal veil which is left in the older carpophore as a fringe to the edge of the pileus & a darkened area upon the stipe. The stipe has in the meanwhile become hollow. ~~The basidia Basidia, each bearing four basidiospores, have developed over the surface of the lamellae.~~

Another Agaric which I have examined is Clitocybe laccatus (Scop.)
Here also the first differentiation of the carpophore-primordium consists in the delimination of the pileus (Fig 9) Just below the surface in the upper part of the elongated carpophore-primordium a cup-shaped aggregate of closely interwoven hyphae appears & marks the rudiment of the pileus. Soon the rim or edge of the "cup" grows inwards & this ~~inturn~~ internal extension of the closely arranged hyphae forms the rudiment of the hymenial layer. It will be noticed in Fig 10, which represents this stage, that both pileus & hymenium have originated below the surface of the fruit-body & that this is completely surrounded by ~~enveloped in~~ a rather poorly developed

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The gill cavity increases in size & the differentiation of the ~~different~~ various parts of the fruit body becomes more distinct (Fig 16).
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The whole ~~further~~ development of the hymenium & the formation of the gills takes place within the cavity which is curtained off from the exterior by the marginal veil. (Fig 17).

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differentiation of the pileus follows ~~very~~ rapidly
upon that of the hymenium + it is quite

possible that under certain circumstances the differentiation of pileus & hymenium may be practically simultaneous or that the "couche piléogène" may even become be delimitated before the hymenium.

On the other hand, however, the order of differentiation may be constantly distinct in the fruit bodies of Armillaria mellea & A. mucida. Further observations can alone decide this. However this may be the particular set of plants which I have examined correspond in this respect more closely with Atkinson's observations upon Agaricus campestris in which he found the primordium of the hymenium to be the first part to differentiate in the young carpophore. I am in complete agreement with both Atkinson & Fischer with regard to the endogenous origin of the hymenial primordium & in finding the marginal veil to be present from the first & not formed as an aftergrowth as Harting believed.

## Summary

A. *Hypholoma fasciculare* (Huds.)

(1) The very young carpophore consists of a mass of densely interwoven hyphae enveloped in a layer of looser hyphae.

(2) The first differentiation of parts in the carpophore consists in the appearance of a cup-shaped layer of deeply staining hyphae a little way below the surface at the upper end of the young fruit body. This marks the primordium of the pileus which is thus the first part to differentiate in *Hypholoma*.



(3) The inward extension of the edge of this cup defines the hymenial layer.

(4) Below this primordium of the hymenium an air-space — the gill cavity — is formed. A marginal veil

can now be clearly distinguished. It is derived from the neutral tissue just outside ~~the~~ & below the hymenial layer; it is present from the first & is not an aftergrowth.

(5) The stipe differentiates into a cortical & a medullary region. It later becomes hollow.

B. Clitocybe laccatus (Scop.)

(6) In this plant also the first differentiation of the carpophore consists in the delamination of the pileus. It appears as ~~a little way below the Surface~~ a cup-shaped layer of hyphae lying a little way below the surface at the upper end of the elongated carpophore primordium.

(7) The rim or edge of the "cup" grows inward to form the rudiment of the hymenial layer

(8) A poorly developed universal Veil surrounds the whole carpophore at first. At an early stage, however, the lateral growth of the pileus ruptures this universal veil + the whole of the rest of the development of the hymenium takes place whilst this is exposed to the air & unprotected by either a marginal or universal veil.

C. Armillaria mellea (Vahl.)

(9) The primordium of the hymenium is the first part to become differentiated in the plants which I have examined. It has an endogenous origin.



(10) The pileus becomes differentiated soon after the hymenium has been delineated.

(11) The hymenium is never exposed in an open furrow. On the contrary, the marginal veil is present from the first & is never an aftergrowth as Hartig supposed.

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## Explanation of Figures in Plates A & B.

All the figures are from untouched photographs taken by the author. ~~from the sections~~.

### Plate A

~~Fig 1~~ All the figures on this plate are of *Hypholoma fasciculare* (Huds.).

Fig 1 Three very young carpophores ~~with still undifferentiated~~ with tissues still ~~undifferentiated~~ undifferentiated. × 41



Fig 2 Differentiation of rudiment of pileus × 41

Fig 3. Further differentiation of pileus & commencement of differentiation of hymenial rudiment × 46

Fig 4. Loosening of hyphae below the hymenial rudiment to form gill cavity × 44

Fig 5. Early stage in development of gill cavity × 45

Fig 6. Broadening of pileus & further development of gill cavity. X 45

Fig 7. Gill cavity further enlarged. Universal + marginal Veils shown clearly X 42

Fig 8 Later Stage of development. Formation of gills. X 44.

Plate B.

Figs 9 – 12 represent Clitocybe laccatus (Scop.)

~~Figs 13 – 17 represent Armillaria mellea (Vahl.)~~



Fig 9 Differentiation of ~~Hymenial rudiment~~ pileus X 45

Fig 10 Differentiation of ~~pileus~~ (Hymenial rudiment) X 45

Fig 11 Hymenial layer exposed by lateral expansion of the pileus X 43

Fig 12 Older Stage X 43

Figs 13 – 17 represent Armillaria mellea (Vahl.)

Fig 13. Differentiation of hymenial rudiment
× 41

Fig 14 Differentiation of pileus × 41

Fig 15 First indication of formation of
gill cavity × 41

Fig 16 Older stage × 41

Fig 17 Development of gills × 43