

MUTINUS BAMBUSINUS (ZOLL.)**ED. FISCHER.**

(With Plates XIV–XVI.)

By T. Petch, B.A., B.Sc.

IN May, 1912, a single specimen of a *Mutinus* was collected in the Royal Botanic Gardens, Peradeniya. Two years later, in October and November, 1914, the same species appeared in abundance in the decaying debris of an old clump of the Giant Bamboo (*Dendrocalamus giganteus*). From its general shape it was thought to be *Mutinus bambusinus* (Zollinger) Ed. Fischer, and it was recorded under that name in the *Annals of the Royal Botanic Gardens, Peradeniya*, VII, p. 57 (1919).

In August, 1923, this species again sprang up in hundreds in a similar decaying clump of the same bamboo, and as the specimens appeared to present some peculiar features, they were critically compared with the former collections, and with the descriptions and figures of *Mutinus bambusinus*. The gathering of 1923 proved to be the same as those of previous years, but it was found that none of them quite agreed with the published accounts of *M. bambusinus*. Except in one particular, the general appearance of the fungus is the same as that of the latter species, but the structure of the head differs from that described and figured for *M. bambusinus*.

The "eggs" occur in dense clusters. They are small, considering the size of the expanded fungus, oval, about 3.5 cm. high and 2 cm. diameter, sometimes covered above with a grey, tomentose layer, which splits into patches as the egg increases in size.

The expanded fungus (receptaculum) is fusoid in shape and up to 16 cm. high, the head being about one-half the total height. The lengths of stalk and head respectively in a series of specimens were 8 cm., 8 cm.; 8 cm., 7 cm.; 8 cm., 6 cm.; 6 cm., 6 cm.; 5 cm., 7 cm.; 5 cm., 6 cm. The greatest observed difference between the lengths of the stalk and the head was in a specimen 15 cm. high, in which the stalk was 9.5 cm. and the head 5.5 cm.

The stalk is 0.9–1.2 cm. in diameter, attenuated downwards into the volva. It is pinkish above, fading into white below, hollow, with a wall composed of a single layer of large chambers, the exterior walls of which are frequently perforated, while the interior walls are continuous.

The head is elongated conical, sharply defined from the stalk. The diameter of the head, at its junction with the stalk, is

greater than that of the latter, either slightly greater, or exceeding it by 2 mm. The head is not covered with gleba up to the apex, but usually terminates in a sterile tip, up to 5 mm. long. Examples with a bifurcated apex (Plate XV, fig. 2) are not uncommon. When bearing the gleba, the head is dark red or brownish red, but after the gleba has been washed off it is bright crimson. The sterile tip is pinkish in colour, and of the same structure as the stalk. It may be perforated at the apex or not. In general, it is perforated, often laterally compressed with the two sides in contact. In some examples, the tip is almost suppressed, and the head then appears truncate.

The structure of the head differs from that of *Mutinus caninus* and *M. Fleischeri*. The wall is red throughout as in those species, and as in them it has a single layer of large chambers, generally widely perforated on the inner side. But it differs, in that the outer surface bears irregular parenchymatous processes, simple or variously branched, attached to the head and more or less perpendicular to the wall. These are evident in the photograph on Plate XV, fig. 1. The large chambers in the lower part of the figure correspond with those of the head of *M. Fleischeri*, while the processes above are an additional feature, not existing in the latter species. Consequently, whereas the head of *M. Fleischeri* is smooth externally, that of the present species is rough or granular when fresh, or somewhat spongy when drier.

The gleba is dark olive. On small examples, it may form discontinuous, dark olive patches. But, owing to the enormous elongation of the head on expansion, the gleba is usually spread out in a very thin film which does not completely hide the red colour of the underlying tissue. The gleba in the expanded fungus lies to a great extent between the processes of the head. The spores are cylindric or oblong-oval, $2-4 \times 1 \mu$.

The odour of the fungus is strong, but not unpleasant. It resembles that of some decaying fruits. There is a slight foetid odour apparent when the plant is held very close, but if two or three specimens are kept in a room only an extremely strong, fruity smell is perceptible.

The points in which this fungus appeared to differ from *Mutinus bambusinus*, according to the published descriptions of the latter, are (1) the sterile apex of the head, (2) the structure of the glebiferous region, (3) the colour of the head, and (4) its odour.

The sterile tip is not an accidental feature, due merely to absence of the gleba, as it differs in structure from the glebiferous part of the head.

The descriptions and figures of *Mutinus bambusinus* suggested that that species is a *Eu-mutinus*, with a head similar in structure

to that of *M. caninus*. In the Ceylon species, the head is rough, and similar in character to that of *Pharus Gardneri*, *Clautriavia irpicina*, and the *Rugulosi* section of *Ithyphallus*, though the processes are not so stout as in the first two species. But no details were available concerning the nature of the head in expanded specimens of *M. bambusinus*.

Zollinger's description of *M. bambusinus* (*fide* Fischer) was "Volva coriacea sordide albida irregulariter lacerata, interiore brevior tenuissima alba; stipite tereti roseo deorsum tenuiore et pallidior elastico cribroso, capitulo stipiti contiguo conico acuto impervio tuberculoso intense purpureo." This agrees with the Ceylon species in shape, having a conical head and a stalk attenuated downwards, and in the colour of the stalk; but it differs in its deep purple, tuberculate head. Whether the apex is closed or open may not be a material character. Zollinger's specimens were collected among dead bamboos at Buitenzorg in Java.

Berkeley recorded *M. bambusinus* in *The Intellectual Observer*, IX (1866), with a copy of a figure by Kurz who had collected the specimens in Java. He stated that it had an elongated conical, subacute receptacle (*i.e.* head in this instance), strongly papillose and of a deep purple-red, and a rose-coloured stem.

In 1885, Fischer published an account of *M. bambusinus* in *Ann. Jard. Bot. Buitenzorg*, VI, based upon material, preserved in alcohol, which had been collected in the bamboo grove of the Botanic Gardens, Buitenzorg, by Solms-Laubach. Fischer described the stalk as pale brownish red and the head as dull purple. In alcohol, the Ceylon fungus retains the crimson colour of the head for some time, while the stalk becomes white. The surface of the head was wrinkled tuberculate, and the length of the head was equal to or greater than that of the stalk. The head was elongated conical, almost of the same diameter below as the stalk. The stalk was cylindrical, with a wall composed of a single layer of large chambers, often perforated externally. The structure of the head was similar, but the internal, not the external walls of the chambers were perforated. [This difference is general in *Mutinus*.] The apex of the head was not perforated.

Fischer's figure of the receptaculum (No. 29) shows a specimen 10.5 cm. high, with an elongated conical head, terminating in an acute apex. The head is slightly greater in diameter than the stalk at the junction of the two, and is about one-half the total height of the fungus. The stalk is almost uniformly cylindrical. The head is marked with polygonal areas, the outer walls of the chambers of which it is composed. Fischer's description as "tuberculate" apparently refers to these convex outer walls. There is no indication on the figure or in the description of any

projecting processes on the head. But fig. 31, which shows a section of a developing head, strongly suggests that the outer walls of the chambers of the head bore projecting processes in that specimen.

In 1888, Cooke recorded the occurrence of *Mutinus bambusinus* in Britain, specimens having appeared in open ground among young plum trees in Noble's Nursery at Sunningdale. He stated that the fungus had a very strong foetid odour, whereas *M. caninus* was inodorous. The whole fungus was 10 cm. high, and according to Cooke's account the head was acutely conical and half the entire length. But that is so greatly at variance with his figures that it would appear that his description is chiefly a translation of Zollinger's.

Cooke gave coloured figures, including copies of Kurz's drawings and drawings of the British specimens by Masee. Kurz's figures show one specimen just breaking through the volva, and another in which the head has emerged but the stalk is not fully expanded. In the latter the head is 3.3 cm. long and the stalk (at most) 2.5 cm. It is difficult to imagine how Kurz obtained specimens in that state. He must have risen very early in the morning to collect them in that condition, and even then expansion would have continued while he was drawing them. The only explanation which appears at all probable is that the specimens were collected in the egg stage, and began to expand next morning while lying indoors, but had not sufficient moisture to enable them to complete their expansion.

Masee's figure *h* bears some resemblance to *Mutinus bambusinus*, though the head is short, about one-half the length of the stalk, and too convex. But figure *i*, which shows an ovato-conoid head about one-quarter the length of the stalk, is quite unlike any other figure of *M. bambusinus*.

Fischer, after an examination of these British specimens in Herb. Kew, was of opinion (1893) that they were only *Mutinus caninus*. There seems to be no doubt that they are not *M. bambusinus*.

In 1890, Fischer described a new species, *Mutinus Muelleri*, from Brazil, which is apparently closely allied to *M. bambusinus*. It had a conical head and a cylindrical stalk, the length of the head being about one-fourth to one-fifth the length of the stalk. The total height of the fungus was from 2 to 8 cm. The stalk was white or reddish and the head dirty purple-red. From the figures, it would appear that the glebiferous layer extended to the apex, and the apex was generally truncate. The surface of the head was transversely wrinkled, evidently different from that of the stalk, and often sharply limited from the latter by a definite constriction.

Fischer claimed that *Mutinus Muelleri* differed from *M. bambusinus* in the relative lengths of the head and stalk, the colour of the stalk, and in that in *M. bambusinus* the chambering (Kammerung) of the head was less different from that of the stalk than in *M. Muelleri*. Fischer states that in *M. Muelleri* the outer walls of the chambers of the stalk are composed of two to three cell layers, and those of the head of six cell layers, while in *M. bambusinus* the outer walls of the stalk chambers have two to four cell layers and those of the head four to six.

Möller, in 1895, described the same fungus, which he found growing among bamboos in Brazil. He disagreed with Fischer's identification and referred it to *Mutinus bambusinus*, after comparison with the specimens from Java in the Berlin Herbarium which had been examined by Fischer. According to Möller, the fungus may attain a height of 11 cm. and the ratio of the lengths of head and stalk is variable, from one-fifth to a half. The stalk is white, and the head dirty purple-red. The apex is always perforated.

Möller's photograph shows a specimen with a cylindrical stalk and a conical head, the apex being distinctly truncate. A well-marked furrow divides the stalk from the head. The surface of the head is covered with gleba, but the photograph gives the impression that the head is tuberculate under the gleba, the tubercles being the convex outer walls of the chambers of the head. The wall of the stalk is not perforated.

Fischer investigated the young stages of *Mutinus Muelleri*, and found that, contrary to what occurs in *M. caninus*, the tissue which lies between the gleba and the head formed in this species loose spherical cells, and his figure (27) shows these cells in contact in irregular rows. He also made comparisons with the young stages of *M. bambusinus* from Java, and found that the latter had essentially the same structure, but that the spherical cells were less strongly developed. In his key to the identification of the species, Fischer distinguished *M. Muelleri* by its having in the young stage numerous spherical cells between the receptaculum and the gleba.

Fischer stated, with regard to *M. Muelleri*, that when the fungus expanded, the gleba lay directly on the zone formed by the spherical cells, and the latter rested upon the head. But when the spore mass ran off, the spherical cells also for the most part disappeared, so that on examination of specimens which no longer bore gleba, the head was for the most part not covered by loose pseudoparenchyma cells.

Möller stated that spherical cells, loose or united into small parenchymatous masses, occurred in greater or smaller quantity

between the gleba and the head in *M. Muelleri*, but that the amount of these varied in different examples.

Mutinus boninensis, described by Fischer from specimens from the Bonin Islands, is not very different from *M. bambusinus*, according to the figures and description. In its young stage, before expansion, it has a parenchymatous layer between the gleba and the head, which forms a continuous layer over the latter; but what becomes of this layer on expansion was not recorded.

In a recent note on *Staheliomyces cinctus*, Fischer again discusses the processes of the head which occur in several species of phalloids, especially in *Clautriavia irpicina*, and states that in *Mutinus Muelleri* the region between the gleba and the head consists of a loose tissue similar to the pseudoparenchyma of the head.

Penzig, in his paper on the phalloids of Java, stated that *Mutinus bambusinus* was common in Java, but that he refrained from describing it as it was already well known. That was somewhat unfortunate, as he was the first investigator of phalloids who had an opportunity of examining the Javan species in a fresh state.

As regards the odour of these fungi, Möller stated that the odour of *M. Muelleri* was not specially strong and resembled that of fresh horse dung. He also quoted Solms-Laubach that the odour of *M. bambusinus* in Java was weak and very offensive, resembling that of human excrement. Cooke recorded that the alleged British specimens of *M. bambusinus* had a very strong foetid odour, whereas *M. caninus* was inodorous. The Ceylon specimens have a strong odour, but it is not offensive and resembles that of decaying fruits. It is to be expected that opinions on this character will be as varied as those on colours, but nevertheless the recorded observations differ so widely that one would not expect them to relate to the same species.

The colour of the head in *M. bambusinus* is said to be deep purple by Zollinger, and dull purple by Fischer. Möller stated that the head of *M. Muelleri* was dirty purple-red. Fischer recorded that the head of *M. boninensis*, as far as could be determined from specimens preserved in alcohol, was dull red. In the Ceylon specimens, the head, when covered with the gleba, is dark red or brownish red, but after removal of the gleba it is bright crimson.

Whether the perforation of the apex in *Mutinus* is a valid character or not, depends upon the structure of the species. In some species of *Mutinus*, e.g. *M. Fleischeri*, the glebiferous layer extends over the apex, and in this species the apex is truly imperforate. On the other hand, in the Ceylon species

under discussion, the glebiferous layer does not extend to the apex, and the tip of the head is composed of tissue of the same nature as that of the stalk. In the latter species the apex may be perforated or not. Möller stated that the apex of *M. Muelleri* was always perforated; the truncate apex shown in his photograph supports his contention, and Fischer's figures show a perforated apex. A similar truncate apex is figured by Fischer for *M. boninensis*. On the other hand, Zollinger described the apex of *M. bambusinus* as imperforate, and Fischer describes and figures an imperforate apex in that species. The difference depends upon the structure of the head. In some species, the glebiferous layer is a continuous conical cap, and in these the head is consequently imperforate; in other species, the glebiferous layer is a cylinder with open ends, and in these the head is perforated at the apex, or is closed by a tissue different from that of the glebiferous layer and resembling that of the stalk.

To decide the identity of the Ceylon species, application was made to Dr C. Bernard, of Buitenzorg, for specimens of *Mutinus bambusinus*, and through his friendly offices, Dr C. van Overcem kindly forwarded examples of that species in alcohol. An examination of these furnished somewhat unexpected results.

The general stature of the Javan specimens is the same as that of the Ceylon examples. One is 7 cm. high, with a head 3.5 cm. long; another, 9 cm. high, has a head 5 cm. long; and a third, 5 cm. high, has a head 1.5 cm. long. The diameter of the head is slightly greater than that of the stalk. In all three, the glebiferous layer does not extend over the apex. The two larger have a distinct sterile tip, while in the smallest the tip is almost suppressed. In two examples the apex is closed, but in the third it is open. Two have lost their colour in alcohol, but the head of the third is bright red. The outer wall of the stalk is perforated.

In one specimen, the head bears irregular processes similar to those of the Ceylon form, but they are not so strongly developed. Here and there they appear to be wanting, so that the outer walls of the chambers of the head are visible as small pulvinate elevations. But on examining these areas with a lens it is seen that they are very minutely granular. In the other two specimens the head appears smooth, and merely bullate and transversely wrinkled, as in *M. Fleischeri*, but on close examination it is found to be minutely granular and to have remains of the processes scattered over the head.

In the Ceylon specimens, the lateral walls of the chambers of the head nearly all attain the same level, so that the inner surface is even, with numerous perforations. In the Javan specimens, the walls of some of the chambers are shorter than

the others, so that when viewed from the inner side, the surface presents numerous large cavities, with a network of ridges at the base. This, however, is not universal in the one specimen, and some sections show a structure exactly the same as that of the Ceylon forms. The walls of the chambers of the head tend to be thicker in the Javan specimens than in the Ceylon ones.

A section of part of the head of a Ceylon example is shown on Plate XVI, fig. 1. Below are the chambers of the head, one of which is closed and the others perforated on the inner side. External to this layer (above in the figure) are numerous parenchymatous masses, with darker masses of gleba between them. These are the sections of the processes, and here and there they can be seen to be attached to the outer wall of the head. They arise from the wall of the head as a sheet of tissue, which divides above into lobes more or less parallel to the head. Hence, in section, some pieces appear to be attached by a definite stalk, while others are sections of the lobes and appear to be loose. The outer surface of the wall of the head is the continuous line across the figure, its angular outline being due in part to contraction in alcohol. When fresh and expanded, the outer walls of the chambers are convex.

Fig. 2, Plate XVI, shows a similar section of a Javan specimen. It will be noted that the walls of the chambers are, in places, thicker than those of the Ceylon specimen, though they vary greatly in that respect. The external processes are feebly developed, and are absent for a short length in the middle of the figure.

Fig. 3, Plate XVI, is another section from the same serial series as the last. In this section, the lateral walls of the chambers on the left are as long as those of the Ceylon specimen, but in the centre they are much shorter. It will, however, be evident from the two sections that this variation in the length of the lateral walls is not a constant feature of the Javan form; and it is not a distinguishing character between the Ceylon and the Javan forms, as it occurs, on a less extensive scale, to the left of the section of the Ceylon example.

Fig. 4, Plate XVI, is a section of another Javan specimen, the head of which appeared smooth. In this the walls of the chambers are short and massive. It is to be noted that all the photographs of sections are taken with the same magnification. The processes in this case are distinguishable only with difficulty. They are almost in contact with the outer wall of the head, with a thin layer of gleba beneath them. The interrupted black line in the figure is the gleba, the processes forming comparatively large parenchymatous masses external to that.

It will be evident that the structure of the head is the same

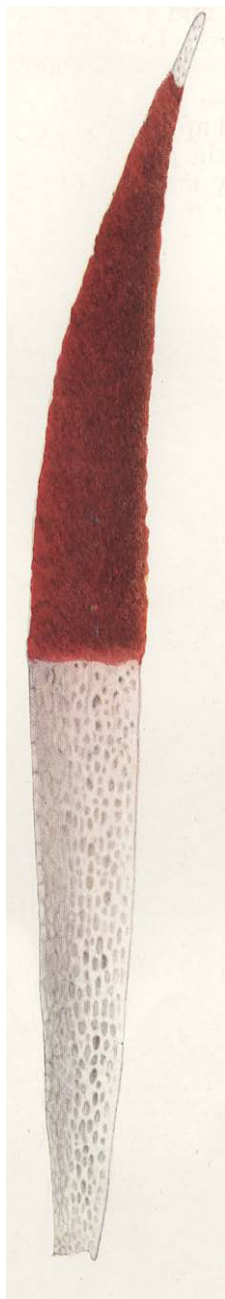
in both the Javan and the Ceylon examples, the differences being merely of degree. In the available examples of the Ceylon form, the processes of the head are strongly developed and crowded together, so that the outer wall of the head is not visible and the head appears rough when the gleba is removed. In the Javan form, the processes are, in general, not so strongly developed, and they may be widely scattered, or absent over certain areas, so that the head may appear smooth, bullate, and transversely wrinkled, when the gleba is removed.

According to Fischer, the processes on the head of such phalloids as *Clautriavia*, etc. are of the nature of paraphyses, which penetrate between the trama plates of the gleba. Some species do not possess them, and consequently their heads are smooth when the gleba ripens. It would also seem probable that, in those species which possess these paraphysoid structures, the latter might be involved in the deliquescence which occurs in the gleba mass when ripe. In that case one would expect a variation in the degree of development, or rather in the extent of persistence, of these structures. The apparently smooth areas on the head of *Mutinus bambusinus* bear minute points which appear to be the attachments of vanished processes.

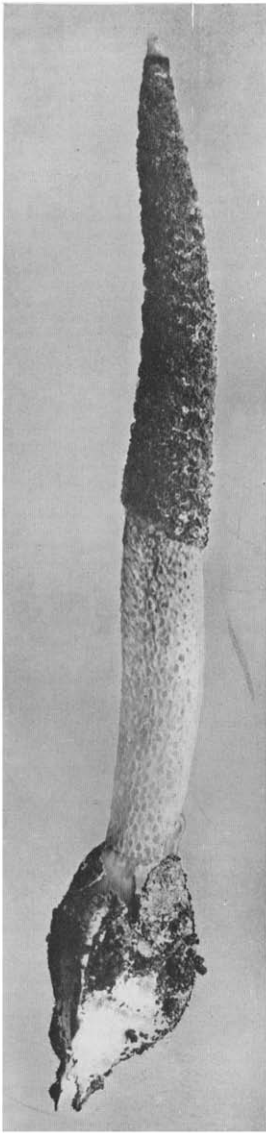
The Javan specimens of *M. bambusinus* examined were from Buitenzorg, near sea-level. The Ceylon specimens were from Peradeniya, at an elevation of 1600 ft. It would be of interest to determine whether specimens from the low-country of Ceylon more closely resemble the Javan examples, but up to the present the fungus has not been found in Ceylon except at Peradeniya. It is possible that the difference in mean temperature might have some effect on the development of the fungus, as regards the relative amounts of gleba and paraphyses, or on the deliquescence of parts of the fungus at maturity.

In view of the variation which occurs in *M. bambusinus* from the type locality, there can be little doubt that the Ceylon fungus must be referred to that species. Moreover, it would seem equally certain that *Mutinus bambusinus*, *M. Muellerei* and *M. boninensis* must all be regarded as the same species, the differences recorded being merely minor variations of the same structure.

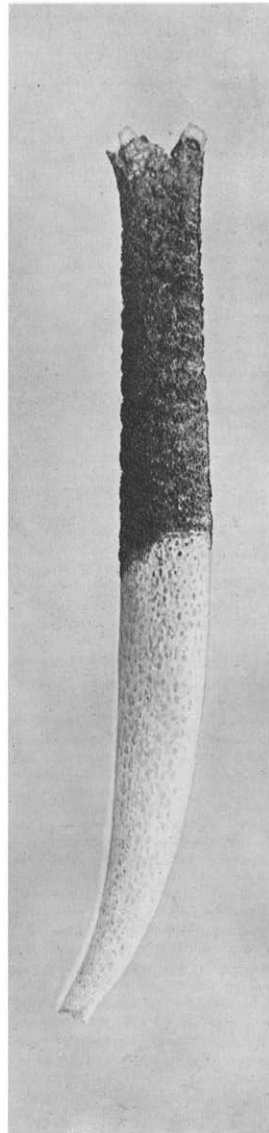
There are two distinct types of structure of the glebiferous layer in the stalked phalloids. In the one type, the head is glabrous, either tuberculate, or regularly reticulated with raised bands. In the other, the head is covered with irregular parenchymatous processes and appears granular. Examples of the two types, parallel as regards general shape, are afforded by *Dictyophora phalloidea* and *Clautriavia irpicina*; by *Lysurus australiensis* and *Pharus Gardneri*; by *Ithyphallus tenuis* and



MUTINUS BAMBUSINUS

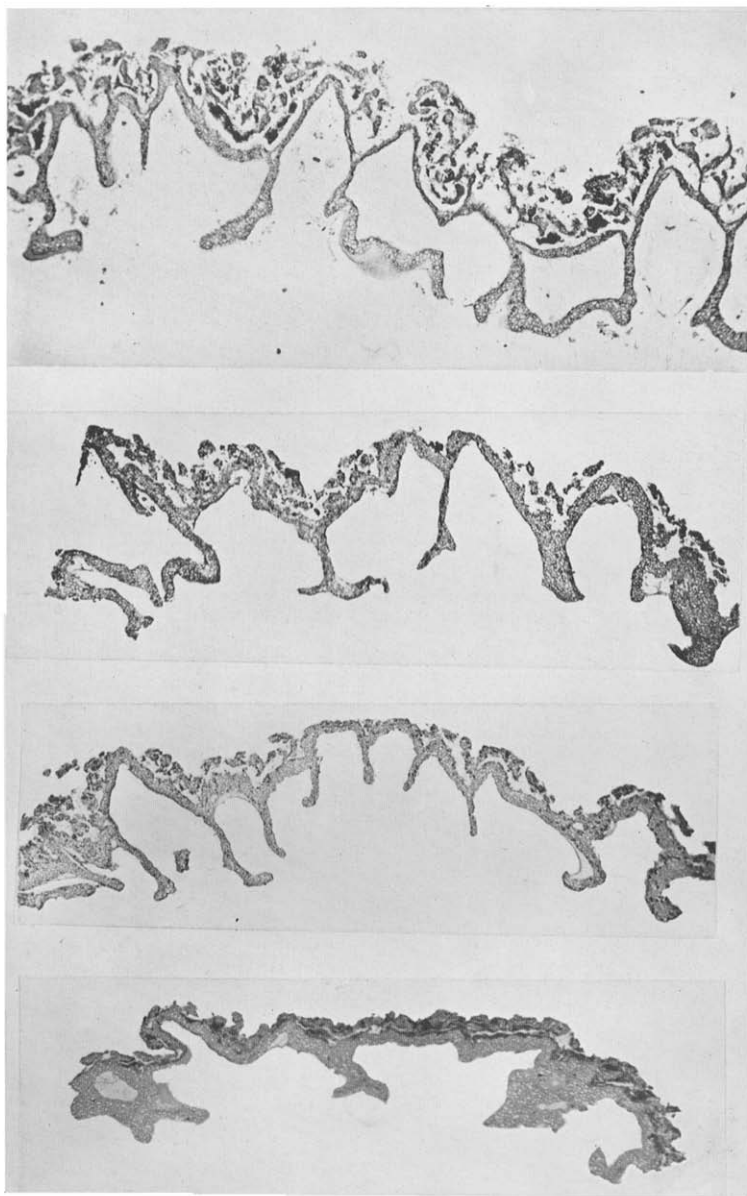


I



2

MUTINUS BAMBUSINUS



MUTINUS BAMBUSINUS

I. rugulosus. The difference is of generic value. It cannot, however, be ascertained until the gleba is removed, and hence many figures of phalloids do not afford sufficient evidence to enable them to be classified even generically.

Mutinus bambusinus, because of the comparatively feeble development of its processes, and their absence in some examples from at least part of the head, provides a link between the two types referred to above. But as the head is furnished with these parenchymatous processes, it should be classed in the second group, not in *Eu-mutinus*.

Penzig proposed the genus *Jansia* for certain species of *Mutinus* in which the head bears projecting appendages. In these species, the appendages are regular, hollow, finger-like outgrowths from the wall of the head, and quite different from the irregular, solid, parenchymatous processes of *Clautriavia irpicina*, *Mutinus bambusinus*, etc. It is not possible to include the present species in *Jansia*. Fischer (1900) placed *Mutinus boninensis* in *Jansia* (as a subgenus), but from his figures and description it differs in structure from Penzig's species.

[Note. It has been pointed out to me that the generic name *Pharus*, proposed by me for *Colus Gardneri* in *Ann. Perad.* VII, p. 59, has been applied previously to a genus of North American grasses. Following the usual practice, *Pharus* Petch may be replaced by *Mycopharus*.]

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EXPLANATION OF PLATES XIV, XV AND XVI.

PLATE XIV.

Mutinus bambusinus, gleba removed; natural size.

PLATE XV.

Fig. 1. *Mutinus bambusinus*, gleba removed; natural size.

Fig. 2. Specimen with a bifurcated apex, gleba removed; natural size.

PLATE XVI.

- Fig. 1. Section of the wall of the head of a Ceylon specimen.
Fig. 2. Ditto, specimen from Java.
Fig. 3. Ditto, same specimen as Fig. 2.
Fig. 4. Ditto, Javan specimen macroscopically smooth. All $\times 20$.

FUSARIUM PALLENS (NEES) LINK.

By T. Petch, B.A., B.Sc.

THE present century has witnessed a notable development of what may be termed stock-taking in systematic mycology. The earlier mycologists, working in different countries and with scanty facilities for communication or publication of their descriptions of fungi, each in his separate star described the species which came under his notice, with the natural result that the same species might be described several times under different names. It cannot be claimed that the practice is obsolete at the present day; and a cursory examination of any critical monograph of a limited group of fungi will immediately show how extensive the resulting synonymy has become.

It has been truly said that when Saccardo completed the first eight volumes of the *Sylloge Fungorum* in 1889, the mycological world then had a basis on which to produce lasting work—but failed to rise to the occasion. It has been left to a later generation to attempt the task of weeding out superfluous names; and now that time has diminished the resentment with which the implication that there could be any errors in systematic mycology was at first received, it is becoming recognised that in the conditions under which the subject has grown up, mistakes were inevitable, and if it is to deserve rank as a science these mistakes must be rectified.

One of the chief obstacles in the way of attaining a stable nomenclature in systematic mycology (apart from generic changes) is the interpretation of the descriptions, and consequently the application of the names, of the pioneer mycologists. Descriptions in early days were usually brief, and were drawn up with a view to distinguishing between a few species. Consequently they are inadequate when distinctions have to be made between a score or more species. In some instances the early descriptions are, from the modern standpoint, practically generic descriptions. This of course was scarcely avoidable. It is not given to everyone to write with a knowledge of what will be required a hundred years hence.

In dealing with the species described by Berkeley and other mycologists of his era it is generally possible to decide what was