

CLAMP CONNECTIONS AT THE CHEILOCYSTIDIA  
IN MYCENA

R. A. MAAS GEESTERANUS

*Oegstgeest*

Clamp connections at the cheilocystidia in *Mycena* are invariably correlated with their presence in other elements of hymenium and subhymenium. In some species of the genus clamped cheilocystidia occur in both the four- and two-spored forms; in others, the cheilocystidia are clampless in the two-spored form. Two of the sections examined are shown to comprise species with clamped and species with clampless cheilocystidia, suggesting that the presence of clamps at the cheilocystidia is a character of specific rather than sectional importance. Two examples are given to illustrate the value of clamps at cheilocystidia as a distinguishing character. *Mycena iacobi* and *M. niveipes*, long regarded as being identical, are here considered to represent two separate species.

The incidental observation of a clamp connection at the base of cheilocystidia in some species of *Mycena* and the apparent absence in others elicited a more directed investigation, the result of which seems worth recording. Before presenting my own findings, a brief survey of the literature should precede.

Josserand (1937) reported on various species of *Omphalia* which were subsequently transferred to *Mycena* by Kühner. Josserand neither described nor depicted clamps at the cheilocystidia, although they are known to be present in *Mycena gracilis* (Quél.) Kühn.

Kühner in his monograph (1938) occasionally did observe clamps, usually at the septa of hyphae, but did not accord special importance to them. In figure 94 (page 299) one of the cheilocystidia (depicted by R. Maire) is shown to possess a clamp. In his chapter on cystidia (pp. 77-84) Kühner did not mention the presence of clamps.

Smith (1947) was reticent about clamp connections, and so was Favre (1955, 1960).

A change took place with the appearance of the publications of Kühner & Valla (1972) and Malençon & Bertault (1975) in that these authors described and depicted clamps whenever they saw them, sometimes at septa of hyphae, sometimes at hymenial elements. But, whereas Malençon & Bertault ignored the significance of the clamps, Kühner & Valla frequently used them for the distinction of two closely resembling species.

The above review is by no means an exhaustive one, but suffices to show that if clamp connections were noticed at the cheilocystidia, the observation was rarely and only quite recently put to use with a view to facilitate the distinction between species.

In the course of my investigation I found that the ostensible lack of clamps at the cheilocystidia

in mature basidiomata was not necessarily evidence of their absence also in a younger stage.<sup>1</sup> During, or perhaps in the later stages of, the development of the hymenial region, the cheilocystidia in some species would appear to lose every trace of the earlier presence of a clamp connection at their base. It may be reminded that a similar phenomenon is also known in the basidia of some species of *Rhodophyllus*. Clamp connections found to occur at the younger basidia may be hard to distinguish at a later stage. To avoid uncertainties of a similar nature in the work I had undertaken, the investigation was extended to include also other hymenial elements. It was found that in all species examined the presence or absence of clamps at the cheilocystidia is invariably correlated with their presence or absence at the basidia and at the septa of the subhymenial hyphae. This was to be expected since cheilocystidia and basidia both arise from subhymenial hyphae, but I wanted confirmation of my assumption. This principle sometimes facilitates the search for clamps at the cheilocystidia (since clamps at the septa of subhymenial hyphae are less subject to change) and may, under circumstances, prove the only means of demonstrating the presence or absence of clamps.

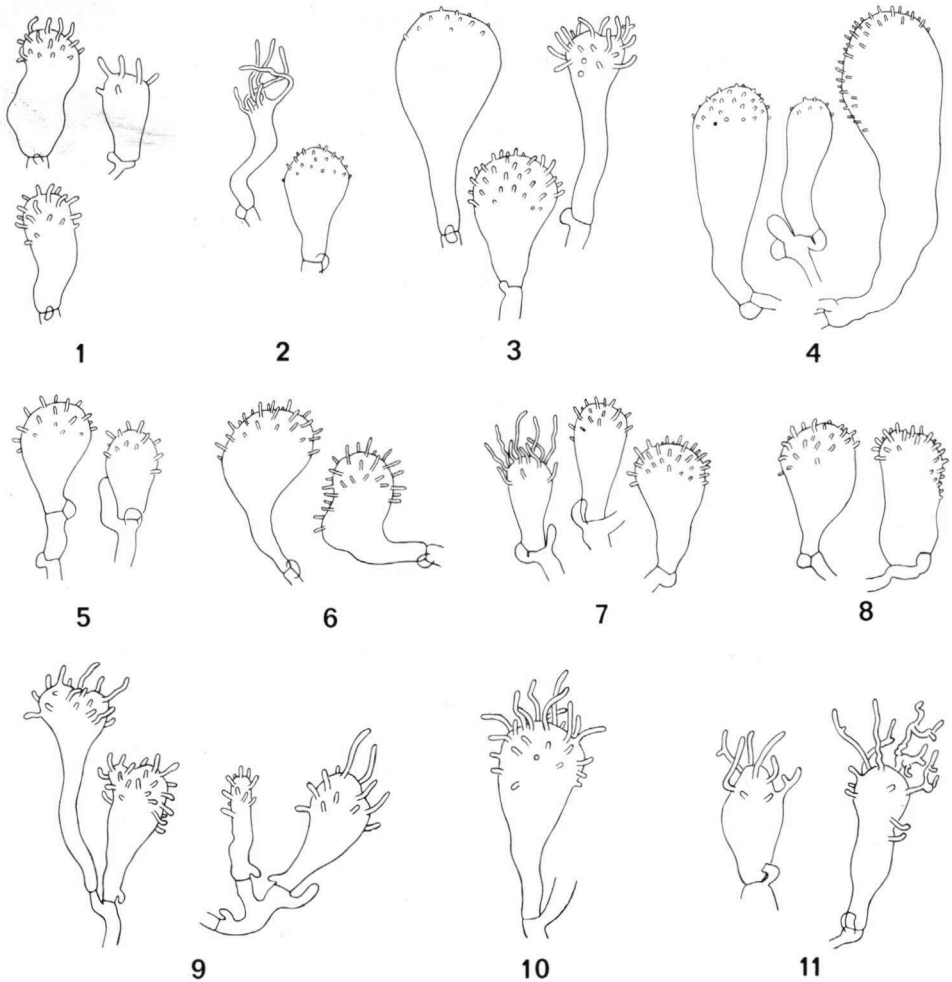
The next question that arose was whether the presence (or absence) of clamps at the cheilocystidia would or would not depend on the species being in its four-spored or two-spored form. Four- and two-spored forms of the same species are known (or reputed) to occur in various sections throughout the genus *Mycena*. The following species were selected for closer inspection. They are arranged according to the sections and subdivisions as indicated by Kühner & Romagnesi (1953), while their nomenclature follows the Check List by Dennis & al. (1960).

1. *Filipedes*: *M. filopes* (Bull. ex Fr.) Kummer (Figs. 1, 2), *M. metata* (Fr.) Kummer (Figs. 3–5), *M. sepia* J. E. Lange (Figs. 6–8).
2. *Rigidipedes*: *M. galericulata* (Scop. ex Fr.) S. F. Gray (Figs. 9–11).
3. *Adonidae* § *Hiemales*: *M. hiemalis* (Osb. apud Retz. ex Fr.) Quél. (Figs. 12–14), *M. olida* Bres. (Figs. 15–18).
4. *Adonidae* § *Amabilissimae*: *M. flavoalba* (Fr.) Quél. (Figs. 19, 20).
5. *Adonidae* § *Lacteeae*: *M. lactea* (Pers. ex Fr.) Kummer (Fig. 21; for illustration of the cheilocystidia in the four-spored form, see Kühner & Valla, 1972: fig. III 3).

Examination showed the species of sections 1, 4, and 5 to possess clamps at the cheilocystidia in both the four- and two-spored forms. The species of sections 2 and 3 were found to possess clamped cheilocystidia in the four-spored form, clampless cheilocystidia in the two-spored form.

Yet another species, which does not figure in the above enumeration, is *M. delectabilis* (Peck) Sacc. It was regarded by Kühner & Romagnesi (1953: 118) as a member of the genus *Delicatula*, but afterwards restored in *Mycena* by Kühner & Valla (1972: 48). Like in e.g. *M. galericulata* of section 2, the four-spored form has cheilocystidia with clamps, the two-spored form has clampless cheilocystidia (Kühner & Valla, 1972: 48–49).

<sup>1</sup> In this respect I am and have been constantly aware of the truth of the admonition: 'Absence of evidence is not evidence of absence.'



Figs. 1, 2. *Mycena filopes*, cheilocystidia. — 1. Two-spored form; Netherlands: Wieringermeer, Robbenoord, 23 Oct. 1976, *C. Bas* 7106 (L). — 2. Four-spored form; Netherlands: Breda, 15 Nov. 1964, *P. B. Jansen* (L).

Figs. 3–5. *Mycena metata*, cheilocystidia. — 3. Two-spored form; Netherlands: Oost-Flevoland, 9 Dec. 1976, *F. & G. J. M. G. Tjallingii* (L). — 4. Four-spored form; as preceding. — 5. Four-spored form; Sweden: Fgi exs. succ. praes. upsal. 119 (UPS).

Figs. 6–8. *Mycena sepia*, cheilocystidia. — 6. Two-spored form; Netherlands: Drongelens kanaal, 1 Nov. 1970, *P. B. Jansen* (L). — 7. Four-spored form; Netherlands: Kootwijkerveld, Oct. 1970, *G. S. de Hoog* (L). — 8. Four-spored form; Denmark: Silkeborg, Østerskov, 24 Oct. 1947, *M. Lange* (C).

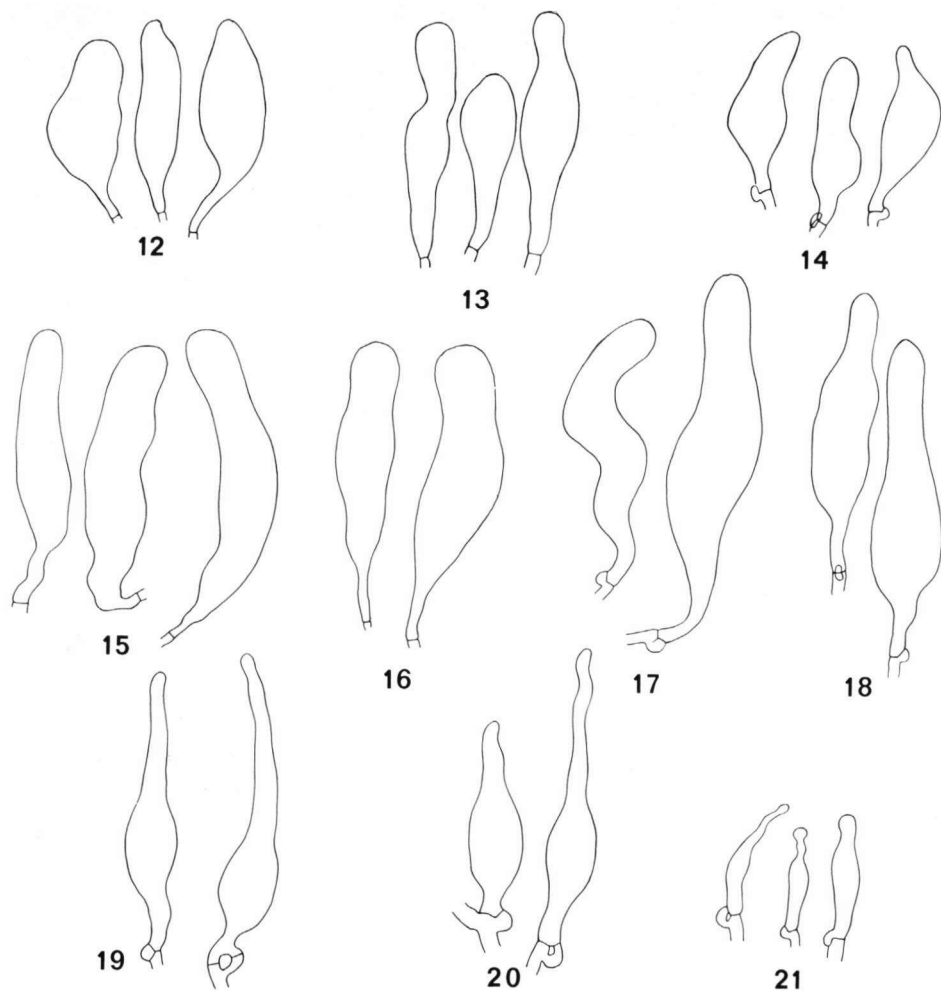
Figs. 9–11. *Mycena galericulata*, cheilocystidia. — 9. Two-spored form; Netherlands: Laag Soeren, 27 Sept. 1976, *R. A. Maas Geesteranus* 15510 (L; note abortive clamps). — 10. Two-spored form; Netherlands; Baarn, 15 Apr. 1977, *W. Gams* (L). — 11. Four-spored form; Netherlands: Koning's Hof, 5 Dec. 1976, *J. van Brummelen* 5162 (L). — All figures  $\times 2800$ .

From these observations the fact emerges that two kinds of two-spored forms appear to exist — one which has clamp connections at the cheilocystidia, and another which has cheilocystidia devoid of clamps. The cytological, genetic, and taxonomic implications would seem well worth investigating, but are beyond the scope of the present note. The urgency of such an investigation is the more pressing since matters may well prove more complicated than they appear on the outside. A. H. Smith (1934) published a paper on two-spored forms in various species of *Mycena*. His investigations, however, rather more concerned the nuclear behaviour of the basidia, offering no clue in answering the questions posed in the present note. Kühner (1938: 125), in his chapter on parthenogenetic forms in *Mycena*, stated that '... la forme bisporique de *M. galericulata* possède des hyphes sous-hyméniales et des basidioles à un seul noyau ....' He proceeded by referring to A. H. Smith who '...a eu le mérite de montrer que les formes à basidioles uninucléées que l'on rencontre dans la nature, ne sont pas forcément bisporiques... mais qu'elles peuvent présenter, sur le même chapeau ... des basides 2-, 3- et 4-sporiges, ou même des basides en majorité tétrasporigues ...' As an example for the last named Kühner mentioned *M. citrinomarginata* which, as will be shown presently, has clamped hymenial elements. The uninucleate condition of the basidia apparently does not necessarily imply that the basidia (and the cheilocystidia) must be devoid of clamps. Would it be too bold a thought to assume that some of the uninucleate species of *Mycena*, irrespective of the number of spores produced per basidium, may present themselves as a dikaryotic population (with clamped cheilocystidia) or a monokaryotic one (with clampless cheilocystidia)? It seems we still have a long way to go.

A further question which required investigation was whether it would be correct to assume the character to have general applicability if within a section of four-spored species some of its randomly selected members are found to possess clamps at the cheilocystidia. The 'Fragilipedes typiques' (Kühner & Romagnesi, 1953: 106) is a case in point. Of this group, *M. abramsii* Murrill (2 North American collections, L), *M. aetites* (Fr.) Quél. (3 Dutch coll., L; 1 Swedish coll., UPS), *M. alcalina* (Fr. ex Fr.) Kummer (3 Dutch coll., L; 2 Danish coll., C; 2 Swedish coll., UPS), *M. jacobi* Maire<sup>2</sup> (2 Dutch coll., L; see also Malençon & Bertault, 1975: 279, as *M. niveipes*), *M. leptcephala* (Pers. ex Fr.) Gillet<sup>3</sup> (6 Dutch coll., L; 1 Swedish coll., C; 2 Swedish coll., UPS), *M. praecox* Vel. (2 Dutch coll., L; 3 Czechoslovakian coll., L), and *M. zephrus* (Fr. ex Fr.) Kummer (1 Austrian coll., L) have cheilocystidia with clamps. Two others, *M. niveipes* Murrill<sup>2</sup> (2 North American coll., L) and *M. strobilicola* Favre & Kühn. (1 Swiss coll., L), have their cheilocystidia devoid of clamps.

<sup>2</sup> It may cause some surprise that *M. jacobi* and *M. niveipes*, regarded as being identical ever since Kühner (1938: 486), are here taken to represent two independent species. In view of the preceding, however, I do not wish to exclude the possibility that these two taxa, both of which are four-spored, are specifically different, precisely because of the presence of clamps in the former and the lack of clamps in the latter. This seems the more prudent course as long as there is no knowing what exactly the presence of clamps portends.

<sup>3</sup> There seems to be a growing, but unwarranted, tendency to use the name *M. chlorinella* (J. E. Lange) Sing. for this species.



Figs. 12–14. *Mycena hiemalis*, cheilocystidia. — 12. Two-spored form; Netherlands: Amsterdam, Amsterdamse Bos, 10 Oct. 1977, *J. Reijnders* (L). — 13. Two-spored form; Sweden: Fgi exs. succ. praes. upsal. 1746 (UPS). — 14. Four-spored form; Netherlands: Fortmond, Duursche Waarden, 18 Dec. 1977, *G. & H. Piepenbroek 1074c* (L).

Figs. 15–18. *Mycena olida*, cheilocystidia. — 15. Two-spored form; Netherlands: St. Odiliënberg, Munnicksbos, 7 Oct. 1962, *C. Bas 2839* (L). — 16. Two-spored form; Czechoslovakia: Moravia, Zdravá Voda near Zárošice, 5 Sept. 1945, *V. Vacek* (PRM 13465). — 17. Four-spored form; Netherlands: Overveen, Elswout, 7 Nov. 1974, *E. Kits van Waveren* (Herb. v. W.). — 18. Four-spored form; Great Britain: Wales, Lake Vyrnwy, 2 Sept. 1960, *E. Kits van Waveren* (Herb. v. W.).

Figs. 19, 20. *Mycena flavoalba*, cheilocystidia. — 19. Two-spored form; Netherlands: De Lutte, 30 Oct. 1948, *H. S. C. Huijsman* (L). — 20. Four-spored form; Netherlands: Heusden, 19 Nov. 1976, *P. B. Jansen* (L).

Fig. 21. *Mycena lactea*, cheilocystidia. — Two-spored form; Netherlands: Kuinderbos, 9 Oct. 1976, *P. B. Jansen* (L). — All figures  $\times 2800$ .

The group of species designated by Kühner & Romagnesi (1953: 104) as the 'second group of the Calodontes' may serve as another instance. Of the species examined, *Mycena atromarginata* (Lasch) Kummer (1 Belgian coll., L) has cheilocystidia without clamps. *Mycena capillaripes* Peck (2 Dutch coll., L), *M. citrinomarginata* Gillet (2 Dutch coll., L), *M. olivaceomarginata* (Massee apud Cooke) Massee (4 Dutch coll., L), *M. purpureofusca* (Peck) Sacc. (1 Belgian, 1 Polish coll., both L), *M. rubromarginata* (Fr. ex Fr.) Kummer (1 German coll., L; 2 Swedish coll., UPS), and *M. seynii* Quél. (2 Dutch coll., L) all possess clamped cheilocystidia.

Thus, it would seem from the few examples examined that the presence of clamps at the cheilocystidia (or their absence, as the case may be) is a character of specific rather than sectional significance. The following cases are recorded to demonstrate the value of the character.

*Mycena leptocephala* and *M. vitilis* (Fr.) Quél. are both common members of the genus, and yet of either species there may be found forms which are hard to recognize. Kühner (1938: 468) described the former species as *M. metata* sensu Schroeter, the latter (504) as *M. filopes* sensu Schroeter. Although his descriptions do show points of difference, there is ample occasion for the two taxa to be confused on account of the many characters they have in common. It is true that Kühner & Romagnesi (1953: 107) placed *M. leptocephala* in section *Fragilipedes* and *M. vitilis* in section *Rigidipedes* (108), but a great deal of experience is required to appreciate such a qualitative character as is the rigidity of a slender stipe in fresh condition, let alone the difficulty of judgment once the material is dried. However, there is one infallible differential character — *M. leptocephala* possesses clamped cheilocystidia, whereas those of *M. vitilis* are clampless.

As a second example I may refer to the remark accompanying Kühner's description of *M. polygramma* f. *ambigua* (1938: 503): 'Cette forme relie le *M. polygramma* au *M. filopes* [= *M. vitilis*] et serait peut-être mieux placée comme forme de cette dernière espèce, dont elle ne diffère guère que par le pied strié.' I do not know this form but if its cheilocystidia should prove to possess clamps, the taxon definitely belongs to *M. polygramma*.

#### ACKNOWLEDGEMENTS

Collections of several of the species discussed in this paper have been received on loan or for incorporation in the 'Rijksherbarium' from the herbaria at Ann Arbor (MICH), København (C), Praha (PRM), Uppsala (UPS), as well as from Mr. P. B. Jansen (Breda), Dr. E. Kits van Waveren (Amsterdam), Mr. E. Schild (Brienz). To all these I wish to express my indebtedness. Appreciative acknowledgement is also made to Mr. M. Jossierand (Lyon) for the interest he has shown in my work. Thanks are due to the Director of the 'Rijksherbarium' for providing working facilities.

#### REFERENCES

- DENNIS, R. W. G., ORTON, P. D. & HORA, F. B. (1960). New check list of British agarics and boleti. *In* Suppl. Trans. Br. mycol. Soc.

- FAVRE, J. (1955). Les champignons supérieurs de la zone alpine du Parc National suisse. *In* Résult. Rech. sci. Parc natn. suisse V, 33.
- (1960). Catalogue descriptif des champignons supérieurs de la zone subalpine du Parc National suisse. *In* Résult. Rech. sci. Parc natn. suisse VI, 42.
- JOSSEMAND, M. (1937). Description de quelques Omphales blanches. *In* Annl. Soc. linn. Lyon 80: 77–96. '1936'.
- KÜHNER, R. (1938). Le genre *Mycena* (Fries). *In* Encycl. mycol. 10.
- KÜHNER, R. & ROMAGNESI, H. (1953). Flore analytique des champignons supérieurs (Agarics, bolets, chanterelles). Paris.
- KÜHNER, R. & VALLA, G. (1972) Contribution à la connaissance des espèces blanches à spores non amyloïdes du genre *Mycena* (Fries) S. F. Gray (Basidiomycètes Agaricales). *In* Trav. Lab. "La Jaysinia" 4: 25–71.
- MALEŃON, G. & BERTAULT, R. (1975). Flore des champignons supérieurs du Maroc. 2. Rabat.
- SMITH, A. H. (1934) Investigations of two-spored forms in the genus *Mycena*. *In* Mycologia 26: 305–331.
- (1947). North American species of *Mycena*. *In* Univ. Mich. Stud., Scient. ser. 17.