

## THE TERMINOLOGY OF RUSTS: Suggestions for a compromise

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ABSTRACT. Some modifications of the two systems of Rust terminology in current use are proposed in order to avoid confusion. It is recommended that the terms 'aecium' and 'uredinium' be reserved for the ontogenic system, that 'aecidium' will replace 'aecium' in the morphological one, and that 'cupulate' will serve as a substitute for 'acidoid'. The Roman numerals 0-III should designate morphologically defined sori.

### INTRODUCTION

Uredinology is plagued by a deeply rooted disagreement between two different schools of terminology, the 'morphological', and the 'ontogenic', respectively. (For a review of the situation and its historical background, see Holm, 1984). This state of affairs is unfortunate and confusing but each system has its ardent spokesmen, and it does not seem very probable that one or the other party will strike its colours. For the foreseeable future we apparently have to live with both systems, and I think that we may well do that, on the condition that the two systems give up using the same terms differently. In order to minimize confusion and to promote a tolerable *modus vivendi* I would suggest that the terminology of both systems be slightly modified. This means that both systems have to make certain concessions, as outlined below.

### THE MORPHOLOGICAL SYSTEM

The fundamental soral types are pycnium (spermogonium), aecidium, uredosorus, telium.

1. The *pycnium* (spermogonium) represents no problems in this context, as these terms are unequivocal and can be used in either system. (Another question is the choice between pycnium and spermogonium).
2. The *aecidium* should be defined as a sorus producing catenate spores which give rise to a dicaryotic mycelium. Thus the aecidium will embrace some variants: the cupulate, as well as the caeomoid and the peridermioid ones. Adherents of the morphological system (like myself) have often used the term 'aecium' in this wide sense, following Arthur (1905). However, as Arthur later (1925) altered the meaning of that term of his, it may be wise and right to accept that. It can be properly objected that the term 'aecidium' has often been restricted to the cupulate form, thus excluding e.g. caeomata. The usage in this respect has varied. However, some recent authors, like Gäumann and Henderson have employed the term 'aecidium' in the wide sense here recommended.

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3. The *uredosorus* produces pedicellate spores (uredospores) which, like the aecidiospores, germinate to form a dicaryotic mycelium. I think that we should follow Laundon (1974) in considering the mode of spore formation (catenate versus pedicellate) as the deciding criterion for discriminating between aecidia and uredosori. It is very interesting that this difference seems to be correlated with spore ornament ontogeny. As now proved by several investigators the uredospore spines develop in invaginated pockets in the secondary spore wall, whilst the aecidiospore ornaments are laid down in the primary wall; see e.g. Littlefield & Heath (1979), Spiers & Hopcroft (1985a, b). In this connection the significant case of *Trachyspora intrusa* should be remembered. This rust has traditionally been credited with a primary uredo (= uredinoid aecium). According to Henderson (1973) these sori in fact produce catenate spores, and their ornaments are formed in conformity with the aecidiospore pattern.

4. Teleutosorus or *telium*. I am convinced that we must admit that Y. Hiratsuka (1973) is right to emphasize that the only workable definition of a teliospore, is that it will form basidia upon germination. If accepting this definition also for the morphological system, the term 'telium' is unequivocal. This will imply that even the spores of *Endophyllum* are called teliospores in the morphological system (although from the point of comparative morphology they are aberrant aecidiospores). Such telia can properly be referred to as 'endotelia' as suggested by Durrieu (1979).

#### THE ONTOGENIC SYSTEM

The fundamental soral types are pycnium (spermogonium), aecium, uredinium, telium.

1. *Pycnium* (spermogonium)—see above.
2. *Aecium*. This term can be used as now, in the sense of Arthur (1925) and later. For the different kinds of aecia, the current terms can also be used, but with one exception: the expression 'aecidioid' should be replaced with 'cupulate' if 'aecidium' is given the wide definition suggested above.
3. *Uredinium* is also used in the sense of Arthur (1925); 'uredium' should be discarded (Savile, 1968). It is important that in this system we use the terms 'uredinium' and 'urediniospore', in order to avoid confusion with the morphological term 'uredospore'.
4. *Telium* and teliospore—see above.

#### DESIGNATION OF SPORE STATES

With regard to the Roman numerals 0–III much confusion has reigned. Those symbols were coined for morphologically defined sori, and should be used in the morphological system only. In the ontogenic system they could perhaps be replaced by Arabic figures. Primary uredosori should be designated II<sup>I</sup> and repeating aecidia I<sup>II</sup>, not the reverse as proposed by Arthur (1929).

## TERMINOLOGY OF LIFE CYCLES

The terms *macrocyclic* and *demicyclic* were introduced by Arthur and should be reserved for the ontogenic system. Their use in the morphological system will lead to severe confusion. The term 'brachycyclic' should be discarded. In the morphological system another set of terms is available, viz. *Eu-*, *Brachy-*, *Opsis-*forms, etc. For further discussion see Holm (1973).

## REFERENCES

- ARTHUR, J. A. (1905). Terminology of the spore structures in the Uredinales. *Bot. Gaz.* 39:219–222.  
 — (1925). Terminology of the Uredinales. *Ibid.* 80:219–223.  
 — (1929). *The Plant Rusts*. Boston.  
 DURRIEU, G. (1979). Les cycles des Urédinales. Problèmes de terminologie. *Bull. Soc. Myc. France* 95:379–392.  
 HENDERSON, D. M. (1973). Studies in the morphology of fungal spores: *Trachyspora intrusa*. *Rep. Tottori Myc. Inst.* 10:163–168.  
 HIRATSUKA, Y. (1973). The nuclear cycle and the terminology of spore states in Uredinales. *Mycologia* 65:432–443.  
 HOLM, L. (1973). Some notes on rust terminology. *Rep. Tottori Myc. Inst.* 10:183–187.  
 — (1984). Terminology of life cycle in rust fungi. *Ibid.* 22:221–225.  
 LAUNDON, G. F. (1974). Uredinales. In AINSWORTH, G. C., SPARROW, F. K. & SUSSMAN, A. S. (eds), *The Fungi. An advanced treatise*. Vol. IVB. New York & London.  
 LITTLEFIELD, L. J. & HEATH, M. C. (1979). *Ultrastructure of Rust Fungi*. New York & London.  
 SAVILE, D. B. O. (1968). The case against 'uredium'. *Mycologia* 60:459–464.  
 SPIERS, A. G. & HOPCROFT, D. H. (1985a). Ultrastructural studies of the spermatial and aecial stages of *Melampsora larici-populina* and *Melampsora epitea* on *Larix decidua*. *New Zealand J. Bot.* 23:101–116.  
 — (1985b). Ultrastructural studies of pathogenesis and uredinial development of *Melampsora larici-populina* and *M. medusae* on poplar and *M. coleosporoides* and *M. epitea* on willow. *Ibid.* 117–133.