Critical Notes on some Plant Rusts from India

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I. Taxonomic Status of *Phragmidiella stereospermi*

Introduction

The rust, *Phragmidiella stereospermi* (MUNDK.) THIRUM. and MUNDK. was collected by the senior author on *Stereospermum suaveolens* WALL. and *S. chalanoides* (L. f.) D. C. in Nagpur, during the survey for rust fungi of Vidarbha region. Indicdently, Nagpur (Maharashtra) is the type locality. The rust is macrocyclic, euform-autoecious (PATIL and THIRUMALACHAR, 1970). All stages were collected from the same locality during the year.

Previous literature revealed that the rust has been placed under various names. SYDOW (1915), was the first to describe the uredial stage occuring on *Stereospermum chelanoides* under the name *Uredo stereospermi* SYD. In the year 1922, R. T. PEARL collected the type material on *S. suaveolens*, which was deposited in the Herb. Crypt. Ind. Orient. without name (in MUNDKUR, 1943). After 21 years, MUNDKUR (1943) examined the same material for the first time and placed the rust on *S. suaveolens* in the genus *Phakopsora*. On re-examination of the same rust, MUNDKUR and THIRUMALACHAR (1945) established the new genus *Mehtamyces*. RAMKRISHNAN and RAMKRISHNAN (1949) described the rust under the name *Melampsora stereospermi*. In the subsequent report, THIRUMALACHAR and MUNDKUR (1949) reduced *Mehtamyces stereospermi* to synonymy with *Phragmidiella stereospermi*. A transfer of *Phragmidiella stereospermi* to *Physopella stereospermi* was proposed by SATHE (1965), but PATIL and THIRUMALACHAR (1970) did not agree with SATHE's statement and treated the rust under its original name *Phragmidiella stereospermi*. This repeated re-shuffling of the rust induced the senior author to revise the taxonomic status of *Phragmidiella stereospermi*.

Material and Methods

The type material of the relevant rust was collected from Nagpur and surrounding localities in all stages, from July to April 1973. Especially, telial material was collected after every fortnight. Free hand sections were cut and stained with cottonblue in lactophenol and mounted in lactophenol. The telium was studied in surface view under low powered (10 × 10) microscope.

Observations

The detailed observations of various spore forms given below are identical with those found by previous workers except minor variations.

Spermogonia appear within 10 to 15 days after sporidial infection. They are strictly sub-cuticular, minutely developed in concentric rings, amphigenous on hypertrophoid spots, conoid, measuring 90—120 μ in breadth and 60—165 μ in height with compact ostiolar paraphyses. Spermatia extrude in groups along with colourless fluid. Flexuous hyphae are absent.

Aecia or primary uredia immediately follow the spermogonia in the development and cause considerabl hypertrophy. They are mostly epiphyllous, sub-cuticular, erumpent, aparaphysate, numerous and coalescent, measuring 90—165 μm in height and 150—621 μm in breadth. Aeciospores or primary uredospores are pedicellate, pale-brown, obovate to ellipsoid, sparsely echinulate, measuring 23—38×22.5—30 μm in diameter, thickwalled, up to 6.5 μm bilaminate, with 2- subequatorial germpores. It resembled the secondary uredospores in structure. Secondary uredia are amphigenous, subepidermal, erumpent, scattered, paraphysate, measuring 120—170× 150.5—617 μm in diameter. When numerous they coalesce. Uredospores are pedicellate, pale-brown, obovate to ellipsoid, bilaminate, sparsely echinulate with 2 sub-equatorial germpores. Secondary uredia can be differentiated easily from primary uredia because of the subepidermal nature and association with telia.

Telia are in irregular waxy crusts and measuring 0.28—0,56× 0.65—2.2 mm in diameter. They are blackish-brown, epiphyllous, rarely amphigenous, sub-epidermal. Teliospores are cuboid to rectangular, yellowish-brown, smooth, thickwalled, measuring 7—30× 15.5—45 μm in diameter, germpores 2 to 3. At maturity, the epidermis raptured along with the cuticle and thereby exposing the telia to the atmosphere.

The telium is erumpent and the process of peeling of epidermis and cuticle can be observed clearly under low power in the microscope. As the season advanced, the telia become mature. The chains of teliospores push the epidermis and cuticle above and broke off ultimately. In this process, the cuticle breaks first followed by the epidermis with the ultimate exposure of teliospores. No doubt in early stages, the telium remained intact, which is proved by cutting transverse sections of the telium. After peeling of the epidermis a dark-brownish layer of tissue remains as a cover of the upper layer of the teliospores, which might give the false impression of a non-erumpent nature of the telium.

Material examined: *Phragmidiella stereospermi* (Mundk.)

THIRUM. and MUNDK. on *Stereospermum suaveolens* WALL. Nagpur, 17 September, 1922; Leg. R. T. PEARL.

Discussion

THIRUMALACHAR and MUNDKUR (1949) have shown the close taxonomic relationship of *Mehtamyces stereospermi* with *Phragmidiella stereospermi* and reduced *Mehtamyces* to synonymy of *Phragmidiella*.

RAMKRISHNAN and RAMKRISHNAN (1949) described the rust as *Melampsora stereospermi* on the basis of telia which were single layered crusts against multi-layered ones found in *Phragmidiella stereospermi*. A re-examination of material has revealed that the so called telia were in fact the cells of the glandular epithelium characteristic for several species of *Bignoniaceae* (PATIL and THIRUMALACHAR, 1970). Therefore the rust described by RAMKRISHNAN and RAMKRISHNAN (1949) represents also *P. stereospermi*.

SATHE (1965) transfered *P. stereospermi* to *Physopella stereospermi*. The transfer of the genus was based on the fact that the telia are non-erumpent. Unfortunately his observations were based on insufficient and old herbarium material which did not provide the opportunity to study the telium critically. Based on studies of fresh material PATIL and THIRUMALACHAR (1970) observed the telia to be erumpent. They concluded that SATHE (1965) has mistaken the black epithecial covering on the teliospores for the epidermis. Our studies on *P. stereospermi* agree with PATIL and THIRUMALACHAR's (1970) observations. No doubt a fully grown telium resembles a telium of *Physopella* where the epidermis remains intact. But, at maturity, the cuticle and the epidermis are "peeling off" and thus exposing the telia which remain covered by a layer of dark-coloured tissue. Under these circumstances the correct taxonomic position of this rust is as follows.

Phragmidiella stereospermi (MUNDK.) THIRUM. and MUNDK. — Indian Phytopath. 2: 193—144 (1949).

Synonyms: *Uredo stereospermi* SYD. — Monographie Uredinearum 3: 314—419 (1915).

Phakopsora stereospermi MUNDK. — Mycologia 35: 538—554 (1943).

Mehtamyces stereospermi (MUNDK.) MUNDK. and THIRUM. — Mycologia 37: 619—628 (1945).

Melampsora stereospermi RAMKRI. and RAMKRI. — Proc. Indian Acad. Sci. 29B: 48—58 (1949).

Physopella stereospermi (MUNDK.) SATHE. — Sydowia 14: 138—142. (1965).

II. Evalution of *Masseeella narsimhanii*

Introduction

While surveying the rust fungi of Vidarbha region, Maharashtra State, the senior author collected the rust *Masseeella narsimhanii*

THIRUM. on *Securingea leucopyros* (WILLD.) MUELL. ARG. (= *Flueggea leucopyros* WILLD.) and *S. virosa* (BAILL.) PAX. et HOFFM. (= *Flueggea virosa* BAILL.). The same rust has been already reported on both hosts by SINGH and SINGH (1967) from Delhi. The present collection was compared with the type description and material of *M. narsimhanii* as originally described by THIRUMALACHAR (1943) on *Securingea leucopyros* and it was found to be identical in all aspects. The type species is characterized by aecidiod aecia, in which the peridium becomes evanescent in late stages of development, and hence appears to be of the caeomoid type. Aeciospores are not catenulate. Uredia are aparaphysate and erumpent.

Revising *Masseeella narsimhanii* THIRUM., SATHE (1965) suggested that the rust should be placed in the new genus *Kamatomyces* on the basis of caeomoid aecia and aparaphysate uredia which open by ostiole. Apparantly these characters were mis-interpreted by SATHE and are not found in the present rust collection on *S. virosa* and *S. leucopyros*.

The literature on *Masseeella* has been already reviewed by THIRUMALACHAR (1943), SATHE (1965) and SINGH and SINGH (1967).

Material and Methods

The type or authentic material of *Masseeella narsimhanii* was obtained from Herbarium Cryptogamiae India Orientalis, I. A. R. I., New Delhi, while fresh material of the rust was collected from infected plants of *S. virosa* and *S. leucopyros*. Thin sections were cut, stained with cotton-blue and mounted in lactophenol.

Results

The comparison between various species of *Masseeella* is presented in the following table:

No.	Species	Aecia	Uredia
1.	*M. capparidis* (= *M. flueggea*)	Peridiate	Paraphysate
2.	*M. breyniae*	Peridiate	Paraphysate
3.	*M. narsimhanii*	Peridiate (Evanescent)	Aparaphysate
4.	*M. putranjivae*	—	—
	(— Aecia and uredia are not reported for *M. putranjivae*)		

The spermogonial and telial characters are common to all the species.

Revised description of *M. narsimhanii* (aecium and uredium only) which corresponds more or less to the observations published by THIRUMALACHAR (1943), and SINGH and SINGH (1967):

Aecia hypophyllous, slightly hypertrophied, sub-epidermal, erumpent, deep-seated in the host tissue, with evanescent peridium which degenerates ultimately and gives non-peridiate appearance at maturity, measuring 106—175 μm in height and 124—225 μm in breadth. Aeciospores are white, ovate-ellipsoid or round, verrucose, measuring 14—19 μm × 18—24.5μm in diameter, thickwalled, wall 1.5 μm to 2.5 μm thick. Germpores two, indistinct. Developing in succession, forming chains of aeciospores. Uredia are hypophyllous, white, minute, scattered, sub-epidermal, erumpent, aparaphysate, pulverulent, often develop independently but coalesce of 2 to 3 was not rare. Uredospores are ovate-ellipsoid or round, white, minutely echinulate, measuring 15—27 μm × 11—22.5 μm in diameter, developed singly, sub-sessile, on nonpersistent stark, wall 1.7 μm to 2.1 μm thick at sides and apex while 3.4 μm thick at the base. Germpores 1 or 2 indistinct.

All species of *Masseeella* are characterised by the presence a of peridium in the aecium. It remains intact throughout the development in *M. capparidis* and *M. breyniae*. *M. narsimhanii* has an evanescent peridium as observed in *Cystopsora aloese* (THIRUMALACHAR, 1945) which clearly can be seen in the early stages of development of the aecium. The peridial cells collapse during the subsequent development and the mature aecia appear non-peridiate. Most probably, SATHE's (1965) observations on the caemoid nature of the aecium is based on mature aecial material only. The aeciospores are thickwalled and verrucose, develop in succession, form chains and are not catenulate as reported by SATHE (1965).

Further, SATHE (1965) has reported that the uredia are aparaphysate and of pycnidial type. However, our studies revealed that, no doubt, the uredia are aparaphysate and erumpent and neither of pycnidial type nor do they open by an ostiole (which is a characteristic of primitive rusts). SATHE (1965) might have mistaken the young telium as the uredium which develops deep below the epidermis and traverses the entire leaf tissue and it gets opened by an ostiole-like opening. At maturity the teliospores, embedded in mucilage, are released in form of long hair-like columns. In the early stages of development, in oblique section, the telium might appear like the uredium. Uredospores are echinulate and thick walled and not catenulate and develop singly on a non-persistent stalk. These observations do not tally with "catenulate" uredospores, reported by SATHE (1965).

All 4 species of *Masseeella* are identical regarding telial characters (THIRUMALACHAR, 1943) and telia and teliospores are the main diagnostic features of the rust genera. PATWARDHAN (1964) reported *M. terminaliae* as a new rust species and considered it as the perfect stage of *Uredo terminaliae* P. HENN. On re-examination of material, PATIL (1971) made it clear that what PATWARDHAN (1964) reported to be telia or perfect stages of *M. terminaliae* PAT. were infact pycnidia of the imperfect fungus, *Coniothyrium terminaliae* PAT. The nature of the aecium and the uredium of *M. narsimhanii* do not tally with

SATHE's observations and do not warrant the erection of *Kamatomyces narsimhanii* solely due to the aparaphysate nature of the uredia. Therefore, it will be appropriate to call this rust *Masseeella narsimhanii*, as originally described by THIRUMALACHAR (1943).

Synonym: *Kamatomyces narsimhanii* (THIRUM.) SATHE. — Sydowia 21: 187—(1965).

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