

ADDITIONS TO FUNGI OF MADRAS—VI

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(42) *Goplana indica* Ramakrishnan, T. S. and K., sp. nov.

Telia only known; spots amphigenous, brown, up to 3 cm. in diam.; *telia* hypophyllous, subepidermal, erumpent, waxy, gregarious, bright orange when young, turning dark brown with age; *teliospores* sessile, one celled, club-shaped, produced in pairs on basal cells, contents orange, wall thin and gelatinising when moistened, $52 \times 13 \mu$ ($44-72 \times 8-20 \mu$), germinating at once by an internal promycelium; sterigmata stout; basidiospores spherical.

On living leaves of *Beilschmiedia roxburghiana* Nees., Chinnakallar, Anamalais, 4-2-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Telia tantum nota; maculis amphigenis, brunneis, 3 cm. diam.; *telii* hypophyllis, subepidermalibus, erumpentibus, cereis, gregariis, tenera aetate fulgido luteo colore, provecta aetate fusco-brunneo colore; *teliosporis* sessilibus, unicellularibus, clavatis, binis ex cellulis inferis prodeuntibus contentis luteo colore, pariete levi, gelatinoso $52 \times 13 \mu$ ($44-72 \times 8-20 \mu$) statim germinantibus; promycelio interno, sterigmatibus pinguibus; basidiosporis rotundis.

In foliis vivis *Beilschmeidia roxburghiana* Nees., Chinnakallar, Anamalais, 4-2-1948, T. S. Ramakrishnan et K. Ramakrishnan.



FIG. 1. *Goplana indica*—a pair of teliospores (one germinating) ($\times 325$)

This interesting rust belongs to a genus not previously recorded from India. The telia are very crowded, conspicuously waxy, and prominent

from the brilliant orange colour in the early stages. When the telia are teased out it is seen that a number of orange coloured club shaped cells are present at the base which give rise to apical clusters of secondary and tertiary sporogenous cells. The terminal cells give rise to two teliospores each which may be of different ages. On germination, the teliospores divide into five cells of which the lowermost is sterile. The four fertile cells produce one basidiospore each, on long thick sterigmata. Meanwhile the wall of the teliospore becomes gelatinised and all the spores stick together embedded in the gelatinous matrix.

Four species of this genus have been recorded, three from Java (Saccardo, 1902 and 1912) and one from Samoa and the Philippines (Cummins, 1935). The rust under study differs from these in spore size, and its host plant.

(43) *Chrysocelis indica* Ramakrishnan, T. S. and K., sp. nov.

Telia only present, hypophyllous, forming bright golden yellow patches covering large areas of the leaf surface, subepidermal; *teliospore* one celled cylindric to clavate, thin walled, orange yellow in colour, sessile, $30 \times 8 \mu$ ($24-40 \times 6-12 \mu$), germinating immediately *in situ*; basidium light coloured, sporidia globular or oval.

On living leaves of *Justicia betonica* L., Burliar, Nilgiris, 24-1-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Telia tantum nota, soris teleutosporiferis hypophyllis, fulgido aureo flavo colore, dense gregariis, sæpe totam fere inferiorem foliorum superficiem occupantibus; *teleutosporis* unicellularibus, cylindricis vel clavatis, sessilibus, membranis hyalinis tenuissimis, $30 \times 8 \mu$ ($24-40 \times 6-12 \mu$), *in situ* statim germantibus, contentis luteo colore; basidiis pallidis; sporidiis globosis vel ovalibus.

In vivis foliis *Justiciæ betonicæ* L., Burliar, Nilgiris, 24-1-1948, T. S. Ramakrishnan et K. Ramakrishnan.

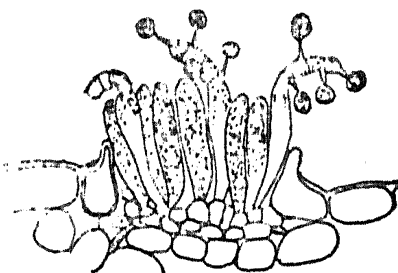


FIG. 2. *Chrysocelis indica*—section through telium ($\times 200$)

This rust presents a striking appearance forming continuous golden yellow patches on the lower surface of the leaves. With age the colour becomes lighter. The upper surface is very much puckered and pale green

in colour. The telia develop in the substomatal air spaces. There is a compact stroma of one or two layers of fungal cells. From the upper layer of this stroma groups of sessile teliospores are produced. These protrude through the stomatal pore pushing the epidermal cells apart. The germination is almost immediate and owing to the formation of large numbers of basidia the surface of the leaf has a velvety appearance.

Chnoopsora butleri Diet and Syd. has been recorded on *Adathoda vasika* (*Justicia adathoda*) (Dietel, 1906). The rust under study has free sessile teliospores and thus is a *Chrysocelis*. It differs from *Chnoopsora* in not having a crustaceous sorus.

(44) *Cronartium fici* Ramakrishnan, T. S. and K., sp. nov.

Pycnia and *aecia* not known; *uredia* hypophyllous, minute, scattered, subepidermal, covered by an evanescent peridium; *urediospores* subglobose or elliptic, to angular, echinulate, apex slightly thickened and darker coloured, $27 \times 20 \mu$ ($20-36 \times 16-24 \mu$), short stalked; *telia* hypophyllous, filiform, up to 5 mm. in length, dark brown, subepidermal in origin; *teliospores* closely united, oblong, $35 \times 9 \mu$ ($20-48 \times 6-16 \mu$), wall smooth, germinating immediately; basidia short, lateral, 4 celled, basidiospore spherical.

On living leaves of *Ficus* sp., Burliar, Nilgiris, 24-1-1918, T. S. Ramakrishnan and K. Ramakrishnan.

Pycnia et *aecia* non cognita; *uredosoris* hypophyllis, minutis, sparsis, peridio evanescente coopertis; *uredosporis* subglobosis, ellipticis vel

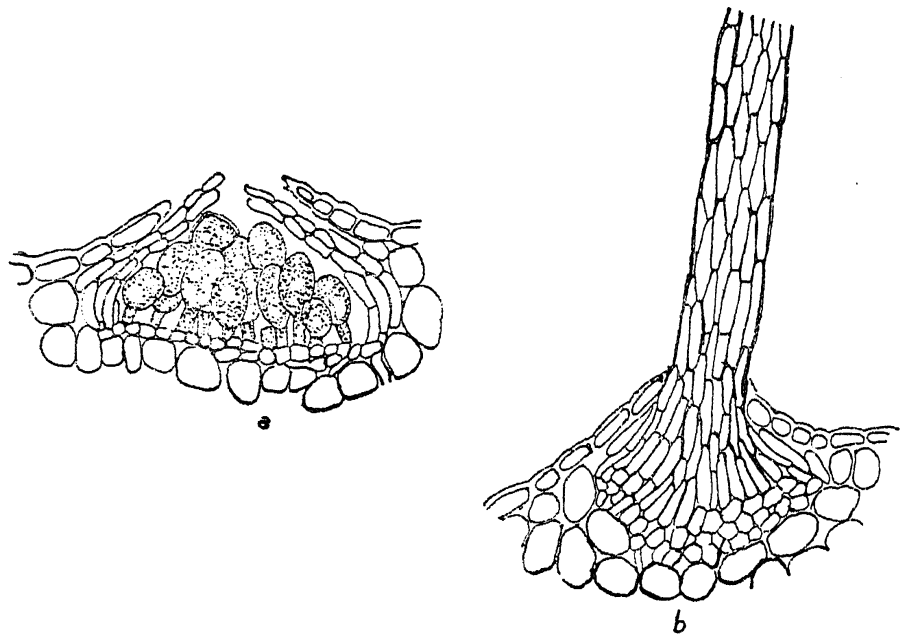


FIG. 3 a. *Cronartium fici*—Section through uredium ($\times 200$)
FIG. 3 b. Telium ($\times 30$)

angulatis, echinulatis, breviter pedicellatis, apice leniter incrassatis; *teleutosoris* hypophyllis, filiformibus, rectis vel curvatis, usque 5 mm. longis, fusco-brunneo colore; *teleutosporis* unilocularibus, arcte cohaerentibus, oblongis, membranis levibus, statim germinantibus; basidiis brevibus, laeteralibus, 4-cellularibus; sporidis globosis.

In vivis foliis *Fici* sp., Burliar, Nilgiris, 24-1-1948, T. S. Ramakrishnan et K. Ramakrishnan.

Crossopora fici Arth. and Cumm. has been recorded on *Ficus capensis* from Uganda and on *F. variegata* from the Philippines (Cummins, 1945). But the rust under study is not a *Crossopora*, as the uredia possess peridia and are not surrounded by paraphyses.

(45) *Melampsora stereospermi*, Ramakrishnan, T. S. and K. sp. nov.

Spots circular, amphigenous, hypertrophied, of varying sizes, dark brown; *pyenia* minute, black, amphigenous, interspersed with the uredia, subcuticular, hemispherical, paraphysate; *uredia* amphigenous, mostly hypophyllous, subcuticular, arising from a plectenchymatous stroma, pulvinate, hazel coloured, paraphysate; *urediospores* pedicellate, subglobose to irregular, inner wall brown, outer wall thick hyaline, gelatinising, spinulose, inner measurements $23 \times 18 \mu$ ($16-28 \times 16-24 \mu$) outer measurements $31 \times 30 \mu$ ($28-36 \times 28-36 \mu$), pedicel hyaline; germ pores two, subequatorial.

Telial spots amphigenous, chocolate brown; *telia* hypophyllous, circular, scattered, subcuticular, in one layered crusts; *teliospores* sessile, one celled, cylindric, laterally closely united, $45 \times 8 \mu$ ($36-52 \times 4-12 \mu$), occasionally transversely divided, subhyaline.

On living leaves of *Stereospermum tetragonum* DC., Gudalur, Nilgiris, 21-5-1947, T. S. Ramakrishnan and T. V. Subramanian; Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan and K. Ramakrishnan, (type) and *S. suaveolens*, DC., Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Maculis orbicularibus, amphigenis, fusco brunneis, amplificatis, diversis, amplituolinibus; *pyeniis* minutis atris, amphigenis; *urediis* immixtis, subcuticularibus, hemisphericis, paraphysatis; *soris* uredosporiferis amphigenis, plerumque hypophyllis, subcuticularibus, pulvinatis, subfulvo colore. paraphysatis; *uredosporis* subglobois vel irregularibus, pedicellatis, fulvo pariete interiori; pariete exteriori pingui, hyalino, gelatinoso, spinuloso; mensuris interioribus $23 \times 18 \mu$ ($16-28 \times 16-24 \mu$), mensuris exterioribus $31 \times 30 \mu$ ($28-36 \times 28-36 \mu$); pedicellis hyalinis, poris germinationis duobus, subequatorialibus.

Maculis amphigenis; soris teleutosporiferis hypophyllis, orbicularibus, sparsis, subcuticularibus, crustiformibus; *teleutosporis* cylindricis, unicellularibus, sessilibus, arcte cohaerentibus, $45 \times 8 \mu$ ($36-52 \times 4-12 \mu$), subhyalinis, aliquando cum uno septo transverso.

In vivis foliis *Stereospermi tetragoni* DC., Gudalur, Nilgiris, 21-5-1947, T. S. Ramakrishnan et T. V. Subramanian; Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan et K. Ramakrishnan, (typus) et *S. suaveolens* DC., Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan et K. Ramakrishnan.

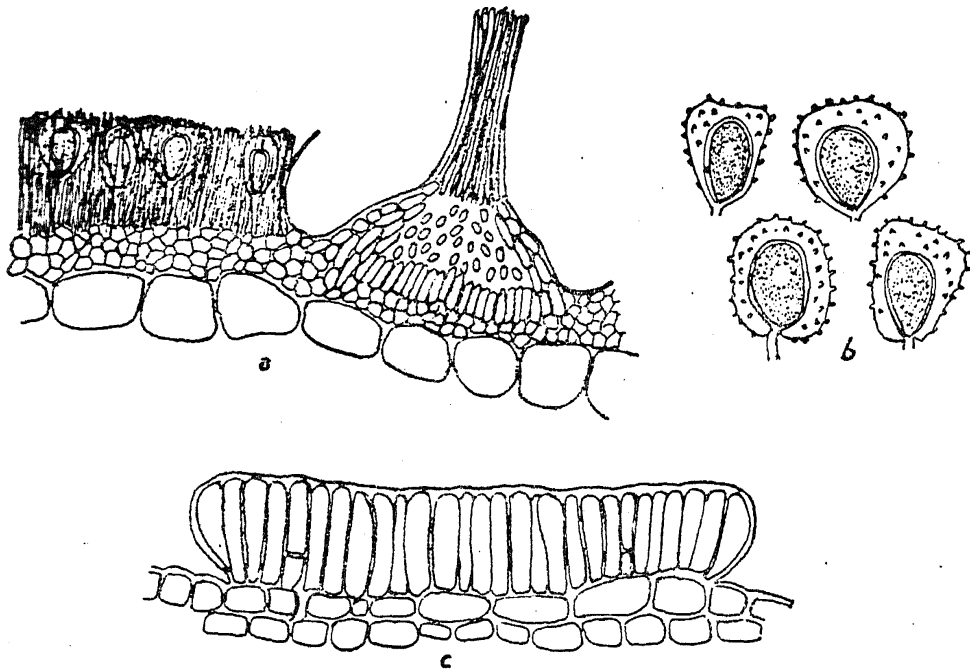


FIG. 4. *Melampsora stereospermi*—(a) section through uredium and pycnium ($\times 125$) (b) urediospores ($\times 250$), (c) section through telium ($\times 200$)

Infections are first seen as small circular brown spots in which the pycnia are prominent. Later the spots enlarge and the tissue becomes hypertrophied. A convex bulge forms towards the lower surface and a corresponding depression on the upper surface. By this time numerous uredia have been formed mostly on the lower surface giving a hazel colour to the spots. The pycnia stand out as black dots in the midst of the uredia. The uredia form compact round sori often coalescing. A multilayered stroma is developed under the cuticle and from this the urediospores project, rupturing the cuticle. The hyphae of the fungus are intercellular. They send in peculiar clustered haustoria into the mesophyll cells. The urediospores are pedicellate and often formed in clusters. The wall of the spore is bilamellate, the inner brown and the outer hyaline and irregularly thickened. The outer wall is thinnest at the base. Hyaline, filiform, thin-walled paraphyses are seen mixed with the urediospores. A peridium is not

evident. Two germ pores can be seen in the inner wall in the lower half of the spore.

The telia develop as circular, depressed, shining, definite crusts having slightly raised margins. The colour deepens with age. Finally the entire spot bearing the telium falls off leaving shot holes. The teliospores are closely packed, sessile, laterally united and form one layered compact crusts. Sometimes a partition wall develops in the spore dividing it into two cells, the lower cell being much smaller.

The telial characters suggest that the rust is a *Melampsora*. Mundkur and Thirumalachar (1945) have described *Mehtamyces stereospermi* on *Stereospermum suaveolens*. The urediospores of the two rusts are very much alike. But in the present rust the uredia are subcuticular and are mixed with the pycnia, whereas in *Mehtamyces* the uredia are subepidermal and the pycnia have not been observed. The telia of *Mel.tamyces* are in many layered crusts while in the present rust they form single layered crusts.

(46) *Puccinia jasminicola* Ramakrishnan, T. S. and K. sp. nov.

Spots amphigenous, irregular, pale yellowish green to light brown; *telia* hypophyllous, rarely amphigenous, minute, crowded, isolated, erumpent, chocolate brown; *teliospores* 2-celled, brown, constricted at the septum, $37 \times 19 \mu$ ($25-44 \times 14-25 \mu$) apex rounded or obtuse, thickened up to 9μ , germ pores one in each cell, pedicel hyaline, short; mesospores present, paraphyses rare, capitate.

On living leaves of *Jasminum flexile* Vahl., Burliar, Nilgiris, 22-7-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Maculis amphigenis, irregularibus, pallide flavo-viridibus, vel sub-brunneis; *telis* hypophyllis, minutis, aggregatis, isolatis, erumpentibus, subepidermalibus; *teliosporis* bicellulatis, brunneis, medio constrictis,

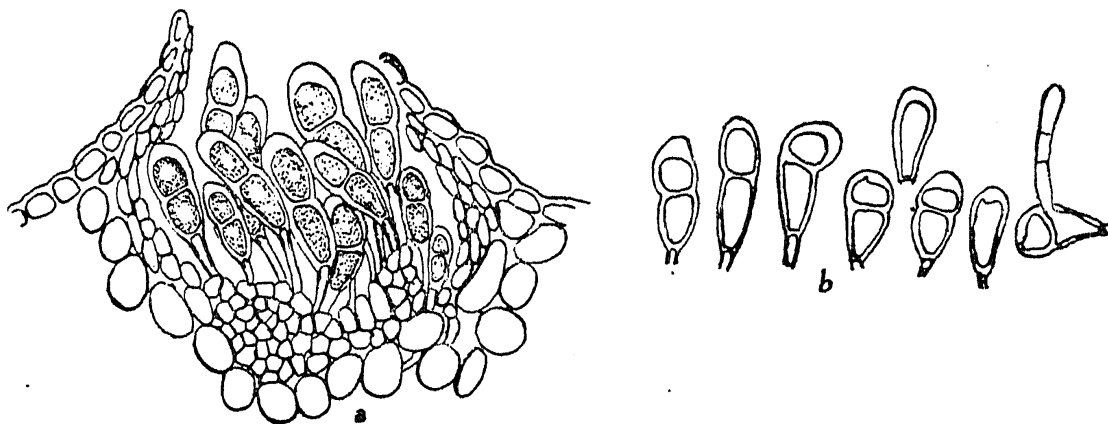


FIG. 5. *Puccinia jasminicola*—a. section through telium, b. teliospores ($\times 200$)

$37 \times 19 \mu$ ($25-44 \times 14-25 \mu$), apice rotundatis vel obtusis, incrassatis usque 9μ ; pedicellis hyalinis, brevibus; mesosporis praesentibus, paraphysibus rariis, capitatis.

In vivis foliis *Jasmini flexile* Vahl., Burliar, Nilgiris, 22-7-1948, T. S. Ramakrishnan et K. Ramakrishnan.

Four species of *Puccinia* producing the telial stage have been recorded on *Jasminum* spp. namely *P. jasmini* DC., *P. exhauriens* Theum, *P. abyssinica* (P. Henn) Syd., and *P. Zimmermanniana* P. Henn., The rust under study has the telial stage only, on *Jasminum flexile*. The telia are amphigenous, isolated and deep seated. The remnants of the epidermis form a distinct ring round the telium. The spores have very short stalks. A few paraphyses with rounded thickened apices are seen in some of the telia. Mesospores are present.

The present rust is different from the others in the presence of the paraphyses and mesospores, in the amphigenous telia, short stalks of the spores and in the size of the teliospores.

(47) *Puccinia exhauriens* Theum

On leaves of *Jasminum pubescens* Willd., Cinchona, Anamalais, 4-2-1948, T. S. Ramakrishnan and K. Ramakrishnan.

This rust was noticed on the leaves of *Jasminum pubescens*, causing slight malformations. The spots are yellowish green on the upper side and on the convex lower surface numerous dark brown, pulverulent telia are seen arranged in circles. The telia are isolated when young but become confluent in older spots. The teliospores are very variable in shape and measure $47 \times 16 \mu$ ($27-61 \times 11-22 \mu$). The upper cell of the spore is shorter and broader. The apex is rounded or blunt, thickened up to 9μ or quite thin. The stalks are very short. These characters more or less resemble those described for *P. exhauriens*.

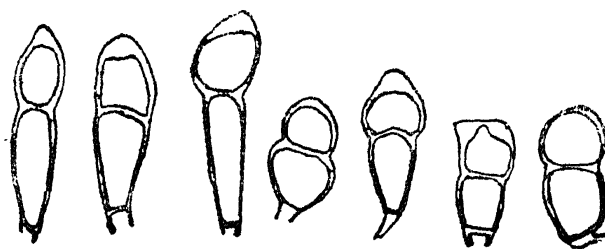


FIG. 6. *Puccinia exhauriens*—Teliospores ($\times 325$)

This species was first recorded on *Jasminum tortuosum* from Africa (Sydow, 1904).

(48) *Uredo malabarica* Ramakrishnan, T. S. and K. sp. nov.

Spots amphigenous, minute, limited by veinlets, isolated or confluent, angular, $\frac{1}{3}$ – $\frac{1}{2}$ mm. diam.; yellowish brown; *uredia* hypophyllous, isolated or gregarious, erumpent, minute, subepidermal; *urediospores* variable in shape, prominently echinulate, $24 \times 16 \mu$ (20 – 28×12 – 20μ); paraphyses numerous, clavate, subhyaline.

On living leaves of *Bridelia retusa* Spr., Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Maculis amphigenis, minutis, isolatis, vel confluentibus, flavo brunneo colore, angularibus, venis delimitatis; $\frac{1}{3}$ – $\frac{1}{2}$ mm. diam.; soris *uredosporiferis* hypophyllis, sparsis vel gregariis, subepidermalibus, erumpentibus, minutis; *uredosporis* globosis, subglobosis vel irregularis, prominenter echinulatis, $24 \times 16 \mu$ (20 – 28×12 – 20μ); paraphysibus numerosis, clavatis, subhyalinis.

In vivis foliis *Brideliae retusae* Spr., Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan et K. Ramakrishnan.

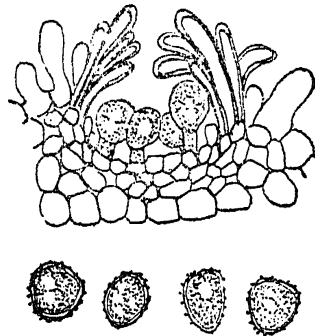


FIG. 7. *Uredo malabarica*—Section through uredium; urediospores ($\times 200$)

The rusted leaves often present a mottled appearance when viewed from above owing to the large number of small spots. The sori are subepidermal. The club shaped paraphyses with subhyaline apices are more numerous towards the periphery of the sorus and are bent inwards. A peridium is not evident.

Schroeteriaster cingens (Syd.) Syd. (*Melampsora cingens* H. and P. Syd.; *Bubakia cingens* (Syd.) Mundk.) has been recorded on *Bridelia* spp. (Sydow and Butler, 1912; Mundkur, 1943). This rust has a peridium for the uredium and paraphyses are absent. Doidge (1924) has recorded *Uredo brideliae* on *Fluggea microcarpa* from South Africa. The rust under study differs from *U. brideliae* in possessing longer, more echinulate urediospores and the paraphyses form a fringe round the mouth of the sorus and not a palisade-like row as described in *U. brideliae*. Hence this rust is considered to be a new species.

(49) *Uredo terminaliae-paniculatae* Ramakrishnan, T. S. and K. sp. nov.

Uredia hypophyllous, isolated or gregarious, each in the middle of a purple hypophyllous spot, subepidermal, with a distinct peridium; *urediospores* variable in shape, borne on very short, stout stalks, very light brown, echinulate $24 \times 17 \mu$ ($18-32 \times 12-20 \mu$).

On living leaves of *Terminalia paniculata* Roth., Walayar, Malabar, 7-1-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Maculis hypophyllous, rubris; soris *uredosporiferis* hypophyllis, sparsis, vel aggregatis, subepidermalibus, peridio distincto; *uredosporis* globosis subglobosis vel ellipticis, echinulatis, sub brunneis, $24 \times 17 \mu$ ($18-32 \times 12-20 \mu$), pedicellis brevi, pinguibus.

In vivis foliis *Terminaliae paniculatae* Roth., Walayar, 7-1-1948, T. S. Ramakrishnan et K. Ramakrishnan.

Numerous isolated or coalescent purple spots develop on the leaves. The uredia are formed hypophyllously in the middle of the spots. They are subepidermal and covered by a multicellular peridium made up of thin walled cells. The peridium is thicker on the sides and consists of one layer of cells at the top. The urediospores are produced singly on very short stout pedicels.

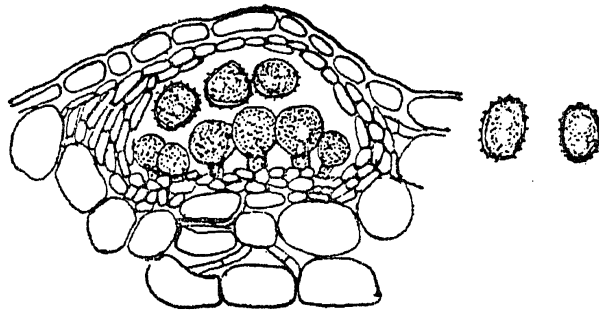


FIG. 8. *Uredo terminaliae paniculatae*—Section through uredium, urediospores ($\times 200$)

Uredo terminaliae P. Henn., *U. buchenaviae* Kern. and Whetzel. and *Aecidium terminaliae* Ramakr. T. S. and K. have been recorded on allied host plants. This rust differs from the two species of *Uredo* in possessing a peridium.

(50) *Aecidium marsdeniae* Ramakrishnan, T. S. and K. sp. nov.

Spots circular, amphigenous, pale yellow at first, later becoming dark brown, up to 15 mm. in diam.; *aecia* hypophyllous, rarely amphigenous, crowded in the spot, cupulate; margin of the peridium reflexed, white, lacerated cells of the peridium polygonal, unequally thickened, verrucose

$24 \times 16\mu$ ($18-32 \times 11-22\mu$), aeciospores subglobose to polygonal, orange yellow, $18 \times 12\mu$ ($15-22 \times 7-14\mu$); episporio thin, smooth.

On living leaves of *Marsdenia volubilis* T. Cke., Burliar, Nilgiris, 22-7-1948, T. S. Ramakrishnan and K. Ramakrishnan.

Maculis amphigenis, orbicularibus, primo pallido flavo colore, deinde fusco-brunneo colore, usque 15 mm. diam.; aeciis hypophyllis, raro amphigenis, aggregatis, poculiformibus; pseudoperidii margine reflexo, albido, lacerato; cellulis polygoniis, inequaliter, incrassatis, verrucosis, $24 \times 16\mu$ ($18-32 \times 11-12\mu$); aeciosporis subglobosis vel polygonis, luteo colore, $18 \times 12\mu$ ($15-22 \times 7-14\mu$); episporio levi, tenui.

In vivis foliis *Marsdenia volubilis* T. Cke., Burliar, Nilgiris, 22-7-1948, T. S. Ramakrishnan et K. Ramakrishnan.

At first the spots are small about 5 mm. in diameter and yellowish in colour. Later these enlarge, become grayish brown, and the tissues of the leaf tear off and fall leaving holes. The aecia are clustered on the lower surface of the leaf in the spotted region. An occasional aecium is found on the upper surface also.

Puccinia marsdeniae Diet. et Holw. has been recorded on *Marsdenia mexicana* (Saccardo, 1905). But no aecium has been described for this rust. The rust under study produces only the aecium and is therefore for the present included in the form genus *Aecidium*.

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EXPLANATION OF PLATE VIII

- (a) Urediospores of *Melampsora stereospermi*. ×300.
 (b) Section through uredium of *M. stereospermi*. ×200.
 (c) Section through telium of *M. stereospermi*. ×150.
 (d) Section through telium of *Chrysocelis indica*. ×300.
 (e) *Cronartium fici* showing uredia and telia slightly enlarged.
 (f) Section through a telium of *Goplana indica*. ×250.
 (g) A cluster of teliospores of *G. indica*. ×300.
 (h) Teliospore germination in *G. indica*. ×400.

