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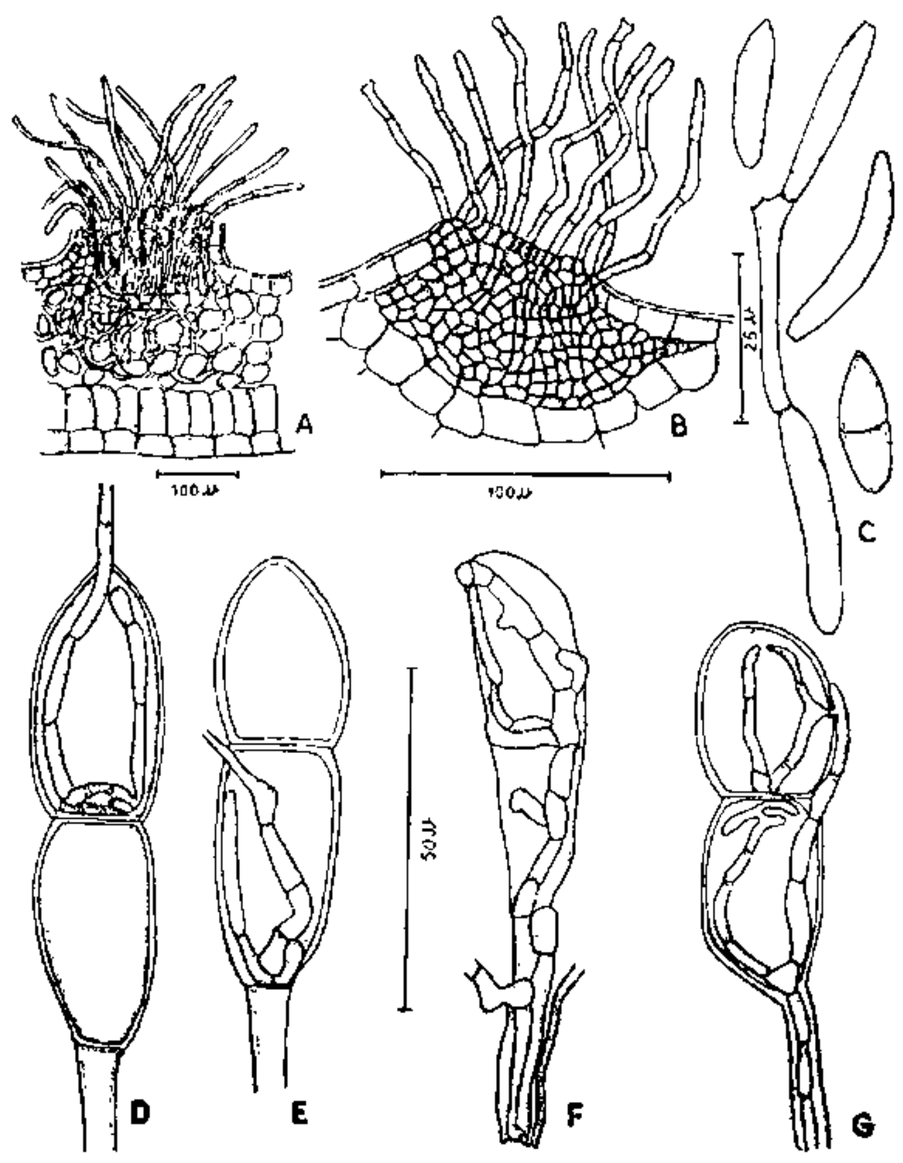
## *CLADOSPORIUM*: A NEW MYCOPARASITE ON RUST

AN undetermined species of *Cladosporium* (Deuteromycetes) was observed by the writer to parasitize the rust on *Polygonum chinense* L. incited by *Puccinia solmsii* P. Henn. in the forest area of Coorg, Mysore State, during the wet season (June-July) 1967. The rust pustules were covered over with the conidial fungus which exhibited itself in the form of circular light green, slightly raised, powdery, smooth colonies. The infection was exclusively confined to the rust pustules on the lower sides of the leaves, being absent from other parts of the lamina.

Sections through the infected pustules revealed that the mycelium of the mould fungus had penetrated deep into the pustules ramifying between the teliospores resulting in partial or complete disintegration of the telial sori (Fig. A). In advanced stages, the telial sorus is completely replaced by the stroma of the mould fungus which starts sporulation with the production of thin, olive green, flexuous conidiophore bearing one- to two-celled olive green conidia in chains characteristic of the form-genus (Figs. B and C). A large majority of the two-celled teliospores were found to be plasmolysed as a result of the attack by the mycoparasite, which was observed to enter both cells of the spores and even piercing the long pedicels. Infection of the teliospores is generally achieved through the germ pores rarely by means of infection peg (Figs. D, E. G.). The infection may also start from the basal stroma, the parasitic hyphæ piercing the pedicel and travelling upwards into the two cells and emerging out from the germ pores (Fig. F). On entering the cells of the teliospores, the intracellular hyphæ attach themselves firmly to the inner wall producing multicellular knob-like structures, which probably act as haustoria (Fig. A). Plasmolysis follows resulting in the complete collapse and disintegration of the rust spores and pustule in the process. It was noted that the teliospores obtained from the infected pustules lose their viability and failed to germinate.




FIGS. A–G. Fig. A. T.S. of *Polygonum chinense* leaf with telium affected by hyperparasite. Fig. B. T.S. showing the sub-epidermal stroma of hyperparasite with conidiophores. Fig. C. Conidiophore and conidia. Figs. D–E. Infection through the germpores. Fig. F. Infection through the pedicel. Fig. G. Direct penetration of the teliospore.

Since the rust material collected by the writer showed exclusively telial stage, the question as to whether the hyphomycetous mycoparasite was capable of parasitizing uredial and other spore forms of the rust fungus cannot be answered at present.

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## EFFECTS OF ATP AND EDTA ON CLEAVAGE OF *LIMNAEA* EMBRYOS

THAT ATP should play a role in the energetics of cleavage is quite expected in view of its well-known property, namely, providing the energy supply for biological endergonic pro-

cesses. Nevertheless, the results of experiments on the effects of ATP on developing eggs are contradictory. Brachet[1] and Wolpert[2] gave a short summary of such attempts. Wolpert[3] reported that sea-urchin eggs placed in ATP ($4 \times 10^{-2}$ M) ten minutes before cleavage would develop in a delayed, abnormal way or would be arrested altogether but later he[2] could not confirm this result and suggested that it was in artefact. In spite of this, the train of reasoning started by the above authors remains interesting especially in connection with the analogy of furrow formation and muscle contraction. We have now examined the effects of ATP on *Limnæa* embryos and, interestingly, we have evidence for arrestation of cleavage by ATP in this material.

*Limnæa* eggs and embryos were collected from the underside of aquatic leaves in the local pond or from earthen vessels in the laboratory where also eggs are laid if leaves are provided. One part of the egg mass was kept as the control and the other part was treated in ATP and then put back to water. By means of such experiments we have established that ATP (100 γ/c.c.) permits cleavage but higher concentrations (1000 γ/c.c. and 500 γ/c.c.) arrest cleavage irreversibly. Some batches of eggs are arrested within half-an-hour of treatment but others require as long as one hour. Uncleaved eggs treated for one hour do not cleave at all. The ATP-arrested eggs do not show any signs of decay and degeneration that usually follow death, till two or three days later.

The inhibitory action is less in later stages of development. For example, treated trochophores, when they do not succumb to the toxic action and degenerate altogether, are not arrested, though growth rate is subnormal.

Eggs were also treated with 0·5 c.c. apyrase (activity 2·7 units/c.c.) in Tris buffer medium. These eggs stop cleaving but the inhibition is reversible if treatment is not too long.

ATP-arrested eggs (uncleaved, 2-cell, 4-cell) were treated with apyrase for varying periods and some were left in the solution but none cleaved any further.

The result with apyrase shows that it can pass through the capsule and penetrate the embryonic cells where it exerts its effect, presumably by destroying the natural ATP content of the egg. This method may perhaps be employed to investigate the biosynthesis of ATP in developing eggs. It is also clear that arrestation of cleavage is not due to the formation of a protein-ATP complex at the cell surface of such a nature that apyrase can attack the ATP. If the contractile fibre theory be correct, ATP has of course been split and the result certainly does not contradict the theory.

ATP has however a chelating action and Falk[4] offered a startling suggestion that the contraction of muscle cell by ATP is also due to chelation. We therefore compared the action of ATP with that of EDTA, a well-known chelating agent. EDTA (1500 γ/c.c.) treatment for 1 hour stops cleavage. A longer treatment is necessary at 750 γ/c.c. Some of the uncleaved, EDTA-treated eggs later underwent an alteration of shape (*i.e.*, from spherical to dumbell) which was a clear indication of the attempt at cleavage though none succeeded in accomplishing it. Treated at 2-cell stage, some eggs may attain an "incomplete" division into 4 cells.

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## THERMORESPONSE OF *PORTULACA OLERACEA* SEEDS

*P. oleracea* is a widely distributed annual of tropical and certain temperate regions.[1] In tropics it survives almost throughout the year, whereas in temperate regions it occurs as summer annual.[2] This species is considered to be one of the 12 most vigorous colonising species.[3] The present studies are concerned with the effect of temperature on germination of seeds of *P. oleracea* (broad leaf variety).

Seeds were collected in the month of April and stored in glass-stoppered bottles at room temperature. Germination tests were carried out in Petri dishes containing 100 seeds between 2 moist filter papers. Three or four replicates were used for each treatment.

It is evident from Fig. 1 that the seeds can germinate well (73–94%) over a wide range of temperature (10–40°.). However, the rate of germination is significantly increased with the rise of temperature up to 40° C., beyond