

## THE LIFE-HISTORY OF *Puccinia* *blepharidis* P. Henn.\*

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A RUST with æcia and sometimes telia and pycnia was common in Coimbatore on *Blepharis boerhaaviaefolia* Pers., in the months of July to December. The same rust was prevalent throughout the year at Kallar, about 26 miles away at the foot of the Nilgiri hills. Advantage was taken of the presence of the telial and æcial stages on the same host to work out the life-history of this rust.

Pycnia were rare. When present they appeared as minute orange-yellow dots on pale translucent areas on the leaves. They were invariably formed on the upper surface and had a subepidermal origin. The pycnia measured 105–150  $\mu$  in height and 110–150  $\mu$  in width. A short fascicle of bristles projected from the ostiole.

Æcia were very common and formed the most prevalent type of fructification of the rust. These developed on the lower surface of the infection spots, closely arranged in concentric rings. They were cupulate measuring 120–210  $\mu$  in height and 140–250  $\mu$  in width. The peridium on dehiscence had white fimbriate margin exposing the orange coloured spores inside. The peridial cells were hyaline, polygonal or rhomboid and with verrucose wall. They measured 22–47  $\times$  12–25  $\mu$ . The æciospores were catenulate, angular or globose, with hyaline verruculose epispore and orange yellow contents. They measured 19  $\times$  16  $\mu$  (16–22  $\times$  12–19).

When floated on drops of water the æciospore germinated readily producing a flexuous germ-tube swollen at the tip. In order to find out whether these spores could infect the host, inoculations were carried out with fresh spores on the leaves of healthy plants of the host specially raised for the purpose in the green-house. Successful infection was obtained and a crop of æcial clusters developed in twenty days from the date of inoculation. Infection took place through both the surfaces of the leaves. Young and mature leaves were equally infected. The rust was maintained by repeated inoculations with the æciospores. These spores functioned as repeating spores. It was also noticed that when these spores were used for inoculation there was

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no development of pycnia. This should be the reason why the pycnia are rare in nature and æcia are generally noticed without any associated pycnia.

Telia were produced less frequently at Coimbatore but they were available throughout the year at Kallar. This must be attributed to the more humid and protected conditions under which the plants were growing at the latter place. They were mostly confined to the stem but in some instances the sori were observed on the leaves and even on the bracts. They were amphigenous, scattered or in small groups and long covered by the bullate epidermal tissue. The sori were 1–3 mm. long and 0.5–1 mm. broad and dark brown in colour. Each telium was often multiloculate, the compartments being separated by compact clusters of elongated brown structures which might be described as paraphyses. Cummins (1941) has reported such loculate telia separated by paraphyses in *P. makenensis* Cummins. Thirumalachar (1945) has observed similar structures in the telia of *P. boerhaaviæfoliæ* Thirum. but he preferred to describe them as plectenchyma.

The teliospores were pedicellate with brown pedicels up to  $50\ \mu$  long. The spore was two celled, chestnut brown, rounded or pointed at the apex and measuring  $49 \times 22\ \mu$  ( $39\text{--}60 \times 16\text{--}24$ ). The wall was smooth with apical thickening up to  $9\ \mu$ . Each cell had one germ pore. Abnormalities were common in the teliospores. Mesospores were common and these measured  $22\text{--}36 \times 18\text{--}25\ \mu$ . Sometimes three celled spores and spores with vertical septa were also observed. Doidge (1926) has noticed such abnormalities in *P. blepharidis*.

The teliospores germinated readily when mature, on floating them in drops of water, in the course of 48–72 hours. A stout promycelium was produced from each cell. This was three-septate and a sub-globose or oval basidiospore was borne on a sterigma from each cell. Young leaves of healthy plants were inoculated with germinating teliospores. In the course of 16–19 days pycnial development was observed on the inoculated leaves. These were formed in groups in the middle of an indefinite translucent spot. In another week æcia were formed hypophyllously.

The results obtained from these experiments showed that the rust was autoecious and an-opsis form. The uredial stage appeared to have been dispensed with. This stage was not observed on the host plants either in nature or in the course of these inoculation trials. The æcia evidently supplanted the uredia as the repeating spore form.

*Identity of the fungus.*—Hennings (1902) described *P. blepharidis* on *B. buchneri* Lindau from Africa. Hariot and Patouillard (1909) recorded an

*Aecidium* on *B. boerhaaviaefolia* from Congo and named it *A. blepharidis*. Hennings had described both the telial and æcial stages of the rust. Doidge (1926) had also observed the same rust from S.-W. Africa on *B. buchneri* and described the rust in detail. No pycnia were observed. She noticed that the teliospores varied in form and there was strong tendency towards abnormal spore formation. Cummins (1941) described another rust on *B. maderaspatensis* (Syn. *B. boerhaaviaefolia*) under the name of *P. makenensis*. Thirumalachar (1945) has stated that this rust somewhat resembled *P. blepharidis* but differed from it in loculate paraphysate telia. He has also described another rust on the same host (*B. boerhaaviaefolia*) giving it the name of *P. boerhaaviaefoliae*. The difference is reported to be in the size of the teliospores. The rust under study was compared with *A. blepharidis* collected by McRae and available in the herbarium of the Government Mycologist, Coimbatore. The two were found to be identical. Further the telial characters also agreed with those of *P. blepharidis*, even to the extent of the formation of abnormal spores. Hence it has been identified as *P. blepharidis*.

Three rusts have been recorded on the same host. The relative measurements of the æciospores and teliospores of these rusts as given by the respective authors are presented in Table I.

TABLE I  
Comparative measurements of the æciospores and teliospores  
of the rusts on this host

Rust	Measurements in microns	
	Aeciospores	Teliospores
<i>Puccinia blepharidis</i>	.. 15-22 × 12-19	35-58 × 18-28
<i>P. boerhaaviaefoliae</i>	.. 15-21 × 10-17	34-46 × 12-18
<i>P. makenensis</i>	.. 13-17 × 17-20	48-66 × 17-27
Rust under study	.. 16-22 × 12-19 19 × 16	39-60 × 16-24 49 × 22

A comparison of the measurements given above indicates a close relationship between these rusts. The range of measurements are either similar or intergrading. Measurements of the different kinds of spores of the rust under study collected from different places and on different occasions exhibited variations showing thereby that too much faith on the spore size alone

could not be placed for the limitation of the species. All the three species recorded above are found to infect the same host. Further all the three rusts are not forming the uredia. The absence of the mention of the loculate telia in the original description of *P. blepharidis* may be due to non-examination of sections. It was not possible for us to obtain the type specimen from Africa. Yet we consider that all the three species should be merged into one and that should be *P. blepharidis*. Thirumalachar (1945) has compared the specimen of *A. blepharidis* collected by McRae with those of *P. boerhaaviaefolia* and found them to be similar. The rust under study was also compared with the same specimen and found to be identical. Finally we are convinced that the three species which are attacking *B. boerhaaviaefolia* and which exhibit such close affinities in the life-history, spore forms and their measurements must be merged into one species.

#### SUMMARY

The life-history of *P. blepharidis* was worked out. Pycnia, æcia and telia are produced. Uredia have been omitted in the life-cycle. The æciospores function as the repeating spores. Pycnia develop when infection is through basidiospores. It is felt that *P. makenensis* and *P. boerhaaviaefolia* recorded on the same host should be merged with *P. blepharidis*.

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#### EXPLANATION OF PLATE

- A. 1. Germinating æciospores. 2. Section through a pycnium. 3. Section through a telium. 4 & 5. Teliospore, mesospore and three celled spore. 6. Germinating teliospore. 7. Section of an æcium.
- B. Telia on stem and æcia on leaf.
- C. Photomicrograph of germinating teliospore.
- D. Photomicrograph of germinating æciospores.

