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Critic's Choice Essay

# Cedar-apple Rust

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The photograph on the cover illustrates a phenomenon of nature that can be seen in the Oklahoma springtime at about the same time that the redbuds are in flower and the morels are fruiting. The orange-colored masses represent a stage in the life cycle of cedar-apple rust, *Gymnosporangium juniperi-virginianae,* and this stage is occurring on the eastern red cedar (*Juniperus virginiana*).

Rust fungi are obligate plant parasites; that is, they require a living host in order to obtain nutrition and survive. Rust fungi have among the most complicated of all fungal life cycles with most rusts requiring two hosts to complete their life cycles. You may have heard of the wheat rust (*Puccinia graminis*) that, throughout the history of cultivated crops, has been a devastating plant pathogen. Its second host is the barberry (*Berberis* spp.).

As the common name suggests, the cedar-apple rust divides its time between *Juniperus* species and apple or flowering crab trees. Since we have the photo of the stage on the *Juniperus,* that is where we will begin our examination of the life cycle (Fig. 1).

At first, brown gall-like structures that are rather hard and less than 2 inches in diameter form (Fig. 2). They can be seen developing on cedar trees in the wintertime and have been referred to as "cedar apples." Then, in response to spring rains, the galls expand considerably and send out the telial horns (Fig. 3). These orange, finger-like gelatinous structures, which are masses of teliospores, grow from the galls. The teliospores are two-celled and later a basidium grows from each and releases four basidiospores. The basidiospores are carried by the wind to distances of up to three miles, where they land and infect the leaves of an apple tree. In late spring or early summer light yellowish orange spots form on the upper surface of the leaves (Fig. 4). Small flask-shaped structures called spermagonia appear on the leaf surface. The spermagonia are sticky and produce spermatia (spores) that insects carry to another spermagonium where fertilization takes place. The hyphae (fungal filaments) that result from fertilization grow toward the lower surface of the leaf where small pustules called aecia are formed. The aecia release aeciospores during mid-summer that are wind-dispersed to *Juniperus* trees and the infection process starts over. The entire life cycle takes about two years to complete, with the longest developmental stage on the *Juniperus*.

The most damage is done to the apple trees, so the rust is of concern to apple growers because of their commercial importance. Trees may lose the infected leaves and apple production and quality will be diminished. Fungicidal sprays are available to treat both tree species. For more information and additional photos on the cedar-apple rust, visit http://www.ento.okstate.edu.

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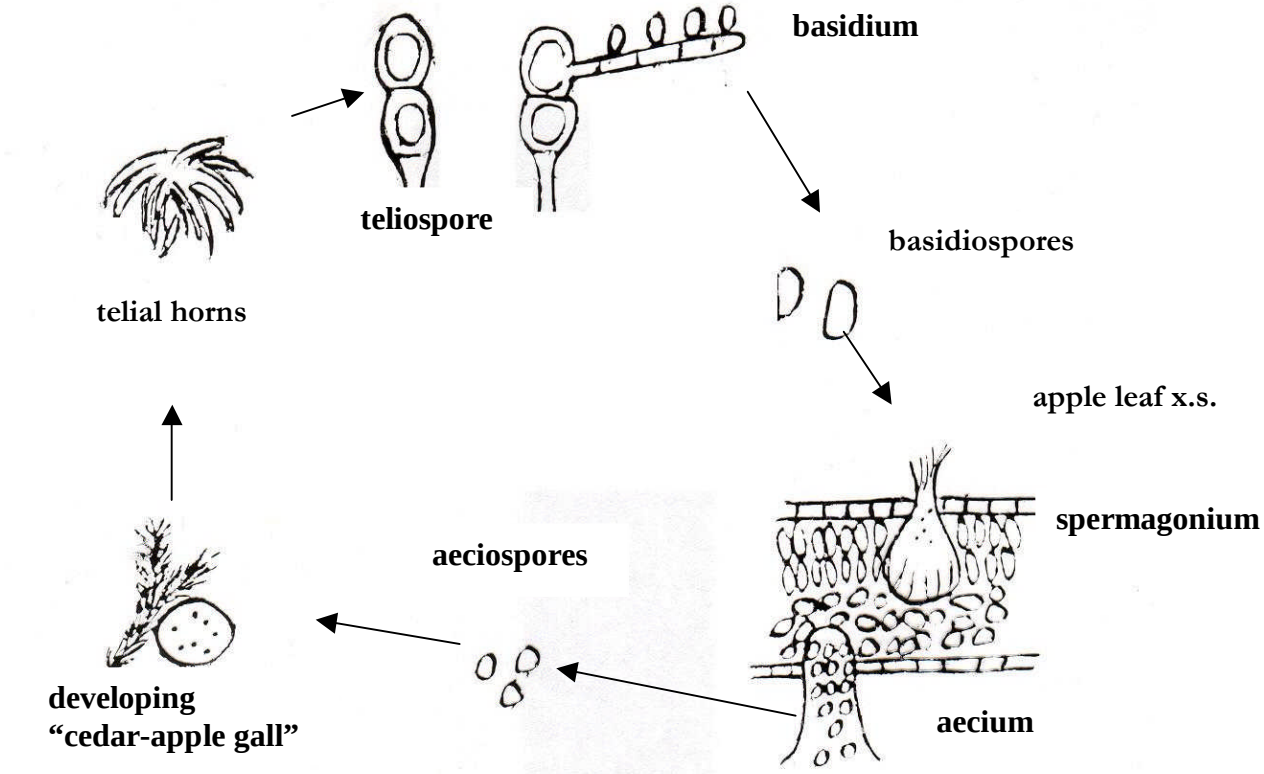


**Figure 1** Life cycle of *Gymnosporangium juniperi-virginianae*

**Figure 2** *Gymnosporangium juniperi-virginianae* "Cedar-apple gall". Photo by author.

**Figure 3** Telial horns. Photo by L.B. Stabler

**Figure 4** Rust spots on apple. Photo courtesy of Oklahoma State University Department of Entomology and Plant Pathology.