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PHOTOSYNTHESIS AND RESPIRATION IN POWDERY MILDEW AFFECTED LEAVES OF *HEVEA BRASILIENSIS*

Powdery mildew, caused by the fungus *Oidium heveae* is a common leaf disease of natural rubber (*Hevea brasiliensis*). This disease has been reported to infect the leaves irrespective of the age of the plant (Edathil *et al.*, 2000). The infection is seen mostly during the refoliating period after the annual wintering. Although young leaves are more susceptible, mature leaves also show considerable infection if the disease pressure is high. Partial to complete defoliation of the young foliage is noticed when the disease incidence is severe and this may adversely affect the growth of plants and rubber yield (Jacob *et al.*, 1992). Even a mild infection may impair the photosynthetic capacity of young leaves. The haustoria penetrate the epidermal cells and absorb nutrients, thus affecting photosynthesis and carbohydrate metabolism (Coghlan and Walters, 1992; Wright *et al.*, 1995). The photosynthetic electron transport, ATP production and CO_2 assimilation rate have been reported to be inhibited in sugar beet leaves as a result of powdery mildew infection (Magyarosy *et al.*, 1976). In general, diseases that cause necrosis of leaf tissues may reduce the total photosynthesizing area of the plant through loss of chlorophyll, leaf malformation or defoliation and thus adversely affect the carbon balance of the plant. A quantitative assessment of the loss of photosynthetic efficiency of rubber leaves due to *O. heveae* infection is not available in the literature and hence the present study was initiated.

Healthy and *O. heveae* infected leaves, both young (half/fully expanded) and mature (fully expanded), were collected randomly from four year old plants of clone RRII 105 during January and February 2002 (n = 8). Much care was taken in collecting the leaf samples with similar disease intensity from among the infected leaves. The infected leaves collected had around 35-40% of the extent of their leaf area with the disease spots (in both young and mature leaf samples) while the healthy leaves had no visible disease spots. Fresh leaf discs (10 cm^2) were punched under water immediately after collection. The surface of the leaf discs was quickly wiped with a blotting paper and the discs immediately transferred into a leaf disc oxygen electrode chamber (LD2/3, Hansatech, UK). The changes in the concentration of gaseous oxygen were monitored (Delieu and Walker, 1983; Walker, 1988). The leaf disc was first acclimatized to dark for five minutes and the rate of oxygen uptake during dark respiration was measured. The leaf disc was then exposed to the different light intensities such as 100, 200 and 400 $\mu mol/m^2/s$ using an LED source (LH 36, Hansatech, UK) for five minutes each and the photosynthetic oxygen evolution was measured at 25°C. To avoid any CO_2 limitation for photosynthesis, 100 µl of bicarbonate buffer (pH 9.2) was added to the spongy capillary matting of the electrode chamber (Walker, 1988) except for the respiration measurements made in the dark. At the end of the photosynthesis measurements, the leaf disc was taken out from the electrode chamber, dark adapted for 15 minutes at room temperature and the maximum potential quantum yield of PSII photochemistry was determined (Jacob 1995) using chlorophyll fluorescence techniques (PAM 2000, Walz, Germany). Afterwards, the chlorophyll content of the leaf disc was analyzed (Arnon, 1949). Leaf samples were collected between 9.00 and 11.00 h and the experiments were completed before 11.30 h every day.

A linear regression analysis was done for the rate of oxygen evolution (dependent variable) and light intensity (independent variable) for each leaf sample. The apparent quantum yield of photosynthetic oxygen (mol of oxygen evolved per mol of pho-