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EVALUATION OF *EUCALYPTUS* CLONES FOR SUSCEPTIBILITY TO THE GALL WASP *LETOCYBE INVASA* FISHER AND LA SALLE

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ABSTRACT

This study investigates the variation among *Eucalyptus* clones for incidence of gall wasp (*Letocybe invasa*) and relative changes in biochemical parameters. The three years, and replicated clonal trial involved 14 clones with monthly observations made on the gall wasp incidence. Significant variation was found among the clones, with maximum incidence being in F-316 and relatively the least incidence in C-413, PE-11, PE-14 and C-72. Gall wasp incidence gradually increased from January to April and declined thereafter. The total soluble sugars and phenol content in the infested leaves were found to increase by 49.2 and 22.8% respectively, whereas the protein content decreases (8.8% decrease).

Key words: Punjab, *Eucalyptus*, *Letocybe invasa*, incidence, soluble sugar, total phenol, protein, seasonal incidence, clone, F-316, C-413, PE-11, PE-14 and C-72

Eucalyptus is most widely planted exotic tree due to its wider adaptability, short rotation, straight stem, fast growth and variety of uses. Since the introduction of clonal technology from 1992, about 2,50,000 ha land had come under clonal plantations (Kulkarni, 2004). The plantations established from genetically uniform materials are highly vulnerable to climatic factors particularly for insects and diseases due to the narrow genetic base (Aradhya and Phillips, 1993). Since 2000, a new invasive pest (*Leptocybe invasa*) is wreaking havoc on *Eucalyptus* plantations throughout the world (Aytar 2003; Mendel et al., 2004; Fatih, 2006). This pest is reported in almost all of the tropical regions including India. In India, *L. invasa* was first reported from the Mandya district of Karnataka and later at Tamil Nadu (Kumar et al., 2007). In Punjab, it was first noticed in 2009 (Sangha et al., 2011). The spread of the gall wasp is causing huge economic losses to the clonal plantations of the country. More than 20,000 ha of young trees have already been affected in southern states of India (Jacob and Kumar, 2009). Severe attack leads to deformation of leaves, bump-shaped galls on leaves, midribs, petioles, reduction of growth. With the increasing pest threats, the future thrust of genetic improvement should be for productivity and tolerance against this severe pest. Another area for improvement is better management practices for insect-pests. Keeping in view the threat of large scale spread of the gall wasp, the present study evaluates the variation for tolerance to gall wasp and the biochemical changes as a consequence of the gall wasp infestation.

MATERIALS AND METHODS

The study was carried out at experimental area, Department of Forestry and Natural Resources, Punjab Agricultural University, Ludhiana (30°90'N, 75°81'E, 247 masl). Fourteen clones were planted at the spacing of 4x 3 m following randomized block design with three replications and plot size of five trees in each block. Five commercial clones (C-2135, F-316, C-413, C-72 and C-407) and nine PAU clones (PE-6, PE-14, PE-7, PE-5, PE-11, PE-13, PE-8, PE-12, PE-9) were used. The incidence of gall wasp was recorded at monthly intervals from March 2018 to February 2019. For this, three trees of each clone were selected in all three replications and further three branches were selected. The total number of galls induced on both leaf and petiole were counted and converted to % damage. Three sets of fresh leaves and infested leaves of all clones were taken to the laboratory of Department of Botany. Various biochemical parameters such as total soluble sugars (Dubois et al., 1956), total soluble proteins (Lowry et al., 1951) and total phenols (Swain and Hillis, 1959) were estimated following standard procedures. The data were subjected to ANOVA and means were compared using LSD (p=0.05) under completely randomized block design (CRBD) following the CPCS statistical software developed by Punjab Agricultural University, Ludhiana.

RESULTS AND DISCUSSION

The incidence of gall wasp given in Fig. 1 reveals significant differences among the months, with maximum infestation being in April (36.0%), which decreased thereafter, with moderate infestation in September (15.4 %) and February (12.7 %), and the least infestation being in November and December (7.5 %). The temporal variation reported by Rameshbhai (2010) in Gujarat revealed that the incidence increased from April, and peak was in June. Singh (2012) reported that the incidence starts increasing from February to May. Rajpoot (2012) found maximum leaf damage in *Eucalyptus* clones during May to June in *E. camaldulensis* and *E. citrodora.* The results from present study are in conformity with those of Kulkarni (2010) who found maximum gall intensity in April. Pooled data obtained from the clones revealed significant ($p<0.05$) differences among the clones in incidence (Fig. 2); three clones (F-316, PE-12 and C-2135 were found to be relatively more susceptible, while F-316 registered the maximum incidence (40.0%); no clone escaped from the attack. The minimum gall infestation was in C-413 which was statistically on par with PE-14, PE-11 and C-72. These results are in accordance with the findings of Rameshbhai (2010). Kumar et al. (2015) also found significant differences among the 19 clones.

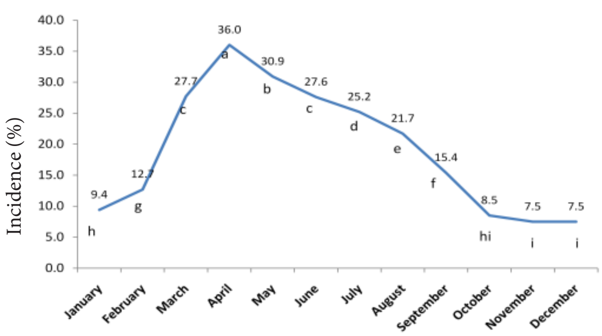

Fig.1. Seasonal incidence (%) of *L. invasa*
(pooled mean of months)

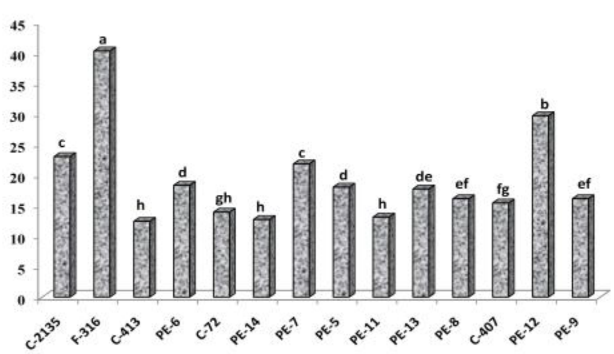

Fig. 2. Incidence of *L. invasa* on *Eucalyptus*
(pooled mean of all clones)

Javaregowda and Prabhu (2010) and Kulkarni (2010) also reported significant variation among the *Eucalyptus* clones in susceptibility.

These differences may be due to host physical and nutritional characteristics, and host biochemical defences (Bentur and Kaslode, 1996; Singh, 2012). The content of total soluble sugars was significantly higher in the infested leaves with mean increase being 49.2%, and this increase may act as growth stimulant for *L. invasa.* The higher sugar content in leaves was reported to be beneficial for the insect feeding (Hartleg, 1998; Yang et al., 2003). Similarly, Singh (2012) reported the increase of sugar content in gall infested leaves of highly susceptible entries of *Eucalyptus*. Similarly, total phenol content also increased after infestation (Fig. 3); mean increase was 22.8%. Mukherjee et al. (2016) also observed increased level of total phenol which increases with gall severity on leaves of *Terminalia tomentosa and T. arjuna.* The results are in conformity with findings Singh (2012), who reported the increase of total phenol content in gall infested leaves. The total protein content in the infested leaves was significantly lower and the relative decrease in infested leaves was of 8.8%. Similar findings were obtained by Khattab and Khattab (2005).

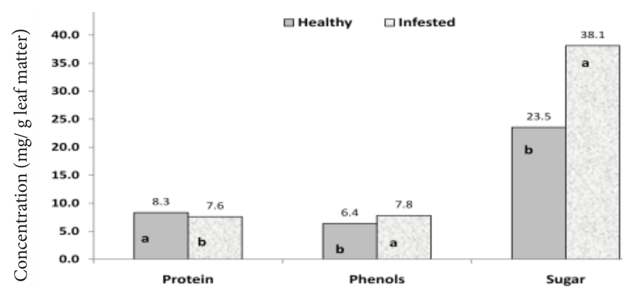

Fig. 3. Biochemical parameters of *Eucalyptus* leaf
(after infestation by *L. invasa*)

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