

Identification of a new race of *Hemileia vastatrix* in Brazil

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Abstract. In this study, a survey of physiological races of *Hemileia vastatrix* was carried out on 34 coffee leaf rust populations collected at several coffee genotypes in Brazil. After the inoculation on leaf disc of coffee differential clones, the races I, II, III, XIII, XVII and XXXVII were characterised. This is the first report of race XXXVII on *Coffea arabica* in Brazil, which shows the evolutionary potential of *H. vastatrix*. The emergence of complex races like XXXVII represents a challenge for breeders in the development of resistant cultivars.

Coffee leaf rust caused by *Hemileia vastatrix* Berk. et Br. is the most devastating disease on *Coffea arabica* in Brazil. The fungus is largely distributed in all the coffee-growing areas of the country, causing losses between 10% and 40% (Silva *et al.* 2006).

The development of coffee varieties with durable resistance to coffee leaf rust has been a challenge due to the great genetic variability of *H. vastatrix* populations. In the pathosystem coffee versus coffee leaf rust, 45 pathogenic races of *H. vastatrix* were described in the world (Várzea and Marques 2005). In Brazil, previous studies differentiated 14 races identified as I, II, III, VII, X, XIII, XV, XVI, XVII, XXI, XXII, XXIII, XXIV, XXV or XXXI. The race II is the most widely distributed in Brazil (Zambolim *et al.* 2005). Considering that no other studies have been carried out in the country since 2002 and the loss of resistance in some improved commercial coffee varieties, this survey aimed to identify the current physiological races of *H. vastatrix* occurring in Brazil.

This survey analysed 34 populations of *H. vastatrix* collected from diseased leaves of *Coffea arabica*, *C. canephora* and interspecific hybrids in the States of Minas Gerais, Espírito Santo and São Paulo, which represents the main production area of commercial coffee in Brazil. The urediniospores of *H. vastatrix* were collected from the infected leaves with a gelatin capsule and stored inside glass ampoules sealed with cotton. The ampoules were maintained inside a desiccator contained a sulfuric acid solution (density of 1.8 and concentration of 32.6%) to maintain the relative humidity around 50% at 5°C (Zambolim and Chaves 1974). Each sample was inoculated in the susceptible plants Catuaí Vermelho (*Coffea arabica*) or in the clone 02 of *Coffea canephora* in order to obtain the amount of urediniospores necessary for physiological race differentiation. Only urediniospores with a viability superior to 30% were considered appropriate for the inoculation tests (Capucho *et al.* 2009). The inoculations in the differential clones were done according to a leaf disc methodology (Eskes 1982) with modifications. Urediniospores from each of 34 *H. vastatrix* populations were individually inoculated with a

camelhair brush over the abaxial surface of nine leaf discs of each coffee differential clone. Each set of inoculated leaf discs per clone was then transferred to a polystyrene box (11 × 11 × 3 cm) containing a nylon and foam fabric saturated with water. The leaf discs were then sprayed with distilled water to maintain the moisture around 100% (Fig. 1). The gerbox containing the leaf discs were closed and stored in the dark for 48 h at 24°C, and then transferred to a chamber under controlled temperature and light conditions (22°C, 12 h fluorescent light). After this period the inoculated leaf discs were cleaned with sterilised cotton to eliminate non-germinated urediniospores and hyperparasitic contaminants (Capucho *et al.* 2009).

The characterisation of the physiological races present in the 34 populations of *H. vastatrix* was done based on the readings of the phenotypic expression (absence or presence of urediniospores) on the inoculated coffee leaf discs of the differential clones (Fig. 1). The evaluation started when the first urediniospores formed on the abaxial surface of the leaves on the susceptible controls (Catuaí Vermelho and clone 02 of *C. canephora*). Four evaluations were carried out at 7-day intervals and the recorded results were compared with the data described in the literature (Várzea and Marques 2005).

In the 34 evaluated populations the races I, II, III, XIII, XVII and XXXVII were identified (Table 1). Race I was characterised in five populations. Race II was predominantly found in 65% of the evaluated samples. Race III was identified in four samples and races XIII, XVII, XXXVII in one sample each.

This is the first report of the occurrence of race XXXVII in Brazil. This complex race was identified in a sample collected at Minas Gerais State in a growing *C. arabica* Catuaí Vermelho field located at 1137 m altitude, 19°40'91 S and 46°13'58 W. This find is of extreme importance due to the potential of this race to infect all the coffee rust-resistant varieties available to the producers in Brazil. This race has five virulence genes in its genetic constitution ($v_{2,5,6,7,9}$) able to infect the differentiators of five physiological groups of *Coffea*: groups D, E, R, 1 and 3.



Fig. 1. Scheme showing the inoculation of *Hemileia vastatrix* using the leaf disc method. (A) spread of urediniospores in the leaf disc with the help of a camelhair brush; (B) abaxial water-spraying of the leaf discs after inoculation; (C) urediniospores on abaxial epidermis of the susceptible cv. Catuai.

Table 1. Physiological races of *Hemileia vastatrix* identified by coffee differential clones

Number of isolates evaluated	Genes of the pathogen	Race identified
5	V 2,5	I
22	V 5	II
4	V 1,5	III
1	V 5,7	XIII
1	V 1,2,5	XVII
1	V 2,5,6,7,9	XXXVII

Therefore, it is of great importance to study how this race is disseminated and its capability to cause an epidemic in the country.

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