Protoplasma (2017) 254:1675–1691
DOI 10.1007/s00709-016-1062-z

ORIGINAL ARTICLE

Characterization of a bacterioferritin comigratory protein family 1-Cys peroxiredoxin from *Candidatus* Liberibacter asiaticus

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Received: 24 June 2016 / Accepted: 6 December 2016 / Published online: 16 December 2016

Abstract To defend against the lethality of the reactive oxygen species (ROS), nature has armed microorganisms with a range of antioxidant proteins. These include peroxiredoxin (Prx) super family proteins which are ubiquitous cysteine-based non-heme peroxidases. The phytopathogenic bacterium *Candidatus* Liberibacter asiaticus (CLA), an etiological agent of citrus plants diseases, posses many genes for defense against oxidative stress. The bacterioferritin comigratory protein (BCP), a member of Prxs, is part of an oxidative stress defense system of CLA. The key residue of these enzymes is peroxidatic Cys (termed C_PSH) which is contained within an absolutely conserved PXXX (T/S) XXC motif. In the present study, a 1-Cys Prx enzyme (CLa-BCP), having C_PSH/sulfenic acid cysteine (C-46) but lacking the resolving cysteine (C_RSH), was characterized from CLA. The peroxidase activity was demonstrated using a non-physiological electron donor DTT against varied substrates. The protein was shown to have the defensive role against peroxide-mediated cell killing and an antioxidant activity. In vitro DNA-binding studies showed that this protein can protect supercoiled DNA from oxidative damage. To the best of our knowledge, this is the first report on a 1-Cys BCPs to have an intracellular reactive oxygen species scavenging activity.

Handling Editor: Bhumi Nath Tripathi

Electronic supplementary material The online version of this article (doi:10.1007/s00709-016-1062-z) contains supplementary material, which is available to authorized users.

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Keywords *Candidatus* Liberibacter asiaticus (CLA) · Bacterioferritin comigratory protein (BCP) · 1-Cys peroxiredoxin · Peroxidase activity · DNA binding

Introduction

The reactive oxygen species (ROS) participates in free radical reactions that causes oxidative damage to DNA, proteins, and lipids (Halliwell and Gutteridge 1999; Storz and Imlayt 1999). The peroxiredoxins (Prxs) are thiol-specific antioxidant proteins known to play an important role in ROS detoxification (Chae et al. 1994a; Chae et al. 1994b). They exhibit thiol-dependent peroxidase activity against various peroxide substrates using thioredoxin and other thiol-containing reducing agents as an electron donor (Bryk et al. 2000; Hofmann et al. 2002). They are classified into 1-Cys and 2-Cys Prxs based on the number of cysteine residues involved in catalysis. The 2-Cys Prxs are further subdivided into typical or atypical types depending upon intermolecular or intramolecular disulfide bond formation, respectively, between peroxidatic cysteine (C_PSH) and resolving cysteine (C_RSH). The 1-Cys Prx members lack C_RSH and are less well characterized (Chae et al. 1994a; Kang et al. 1998). The bacterioferritin comigratory protein (BCP), a member of Prx super family, was originally named for their propensity to comigrate with the bacterioferritin proteins initially discovered in *Escherichia coli* (Neidhardt et al. 1983). The BCPs have been defined as the most diverse subfamily of Prxs and designated as the "C" group by Hoffmann et al. (2002). It has been further reclassified by Wakita et al. (2007) into α-group having characteristic conserved C_PXXXXC_R motif and β-group without C_RSH. The biological importance of BCPs, from different pathogenic bacteria, was evident