Betula utilis ethanolic extract elicits lifespan extension and attenuates age related Aβ-induced proteotoxicity in *Caenorhabditis elegans*

Swapnil Pandey, M.Sc. CSIR-National
Botanical Research Institute, Lucknow, India
Puneet Singh Chauhan, PhD. CSIR-National
Botanical Research Institute, Lucknow, India

Abstract

Betula utilis (BU) (family *Betulaceae*) is an important medicinal plant that grows in high altitudes of the Himalayan region in India. The plant parts are utilized as antibacterial, hepatoprotective, anti-tumor, etc. Here, we demonstrated the lifespan promoting and amyloid-β-induced toxicity attenuating activity of BU in a multicellular model organism, *Caenorhabditis elegans*. Our results showed that the ethanolic extract of BU (50µg/ml) extended the mean lifespan of *Caenorhabditis elegans* by 35.99% and increased its survival under both oxidative and thermal stress conditions. The BU (50µg/ml) also suppressed the levels of intracellular reactive oxygen species significantly by 22.47%. The BU treatment significantly improved the survival of CL4176 worms in response to proteotoxic stress induced by Aβ protein aggregation. Interestingly, the BU (50 µg/ml) supplementation was also able to reduce the aggregation of Parkinson's related protein, α-synuclein in the transgenic strain NL5901 and improved chemotactic behavior in wild-type *C. elegans*.

Moreover, the BU-mediated lifespan extension was found to be dependent on mev-1, daf-16, hsf-1, and skn-1 but not a sir-2.1 gene. Transgenic reporter gene expression assay showed that BU (50µg/ml) treatment enhanced the expression of stress protective genes such as sod-3 and gst-4. Therefore, the present findings suggested that reactive oxygen species scavenging and insulin/insulin-like growth factor signaling pathways partly involved in BU-mediated lifespan extension. Thus, BU may target multiple longevity mechanisms to extend lifespan and have a potency to prevent neuro-related disease progression.

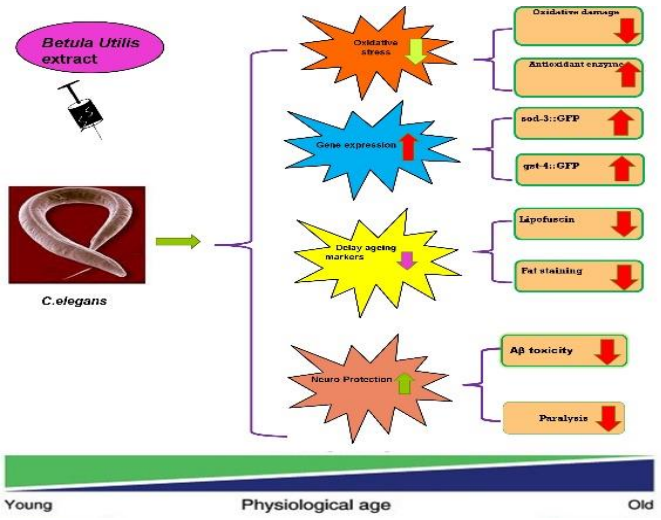


Fig 1. Effect of *Betula utilis* on anti-aging and neuroprotective effect in *C. elegans* model system

Recent Publications (minimum 5)

1. **Pandey, S.,** Tiwari, S., Kumar, A., Niranjan, A., Chand, J., Lehri, A., & Chauhan, P. S. (2018). Antioxidant and anti-aging potential of Juniper berry (Juniperus communis L.) essential oil in Caenorhabditis elegans model system. *Industrial Crops and Products*, *120*, 113-122.
2. Akhoon, B. A., Pandey, S., **Tiwari, S.,** & Pandey, R. (2016). Withanolide A offers neuroprotection, ameliorates stress resistance and prolongs the life expectancy of Caenorhabditis elegans. *Experimental gerontology*, *78*, 47-56.
3. Rathor, L., Akhoon, B. A., **Pandey, S.,** Srivastava, S., & Pandey, R. (2015). Folic acid supplementation at lower doses increases oxidative stress resistance and longevity in Caenorhabditis elegans. *Age*, *37*(6), 113.
4. Asthana, J., Yadav, A. K., Pant, A., **Pandey, S.,** Gupta, M. M., & Pandey, R. (2015). Specioside ameliorates oxidative stress and promotes longevity in Caenorhabditis elegans. *Comparative Biochemistry and Physiology Part C: Toxicology & Pharmacology*, *169*, 25-34.
5. Tiwari, S., **Pandey, S.,** Chauhan, P. S., & Pandey, R. (2017). Biocontrol agents in co-inoculation manages root knot nematode [Meloidogyne incognita (Kofoid & White) Chitwood] and enhances essential oil content in Ocimum basilicum L. *Industrial crops and products*, *97*, 292-301.

Biography

Swapnil Pandey has completed his M.Sc. From Bundelkhand University, Jhansi, India. Now he is pursuing Ph.D. from CSIR-National Botanical Research Institute, Lucknow, India. He is ICMR-Senior Research Fellow in CSIR-National Botanical Research Institute, Lucknow, India unique organization in field of botanical and medicinal plant research. Mr. Pandey has published more than 5 research papers in reputed journals. His current focus is on deciphering the role of phytomolecules for their anti-aging and neuroprotective effect using *Caenorhabditis elegans* model system.

Email: - swapnilnbri@gmail.com