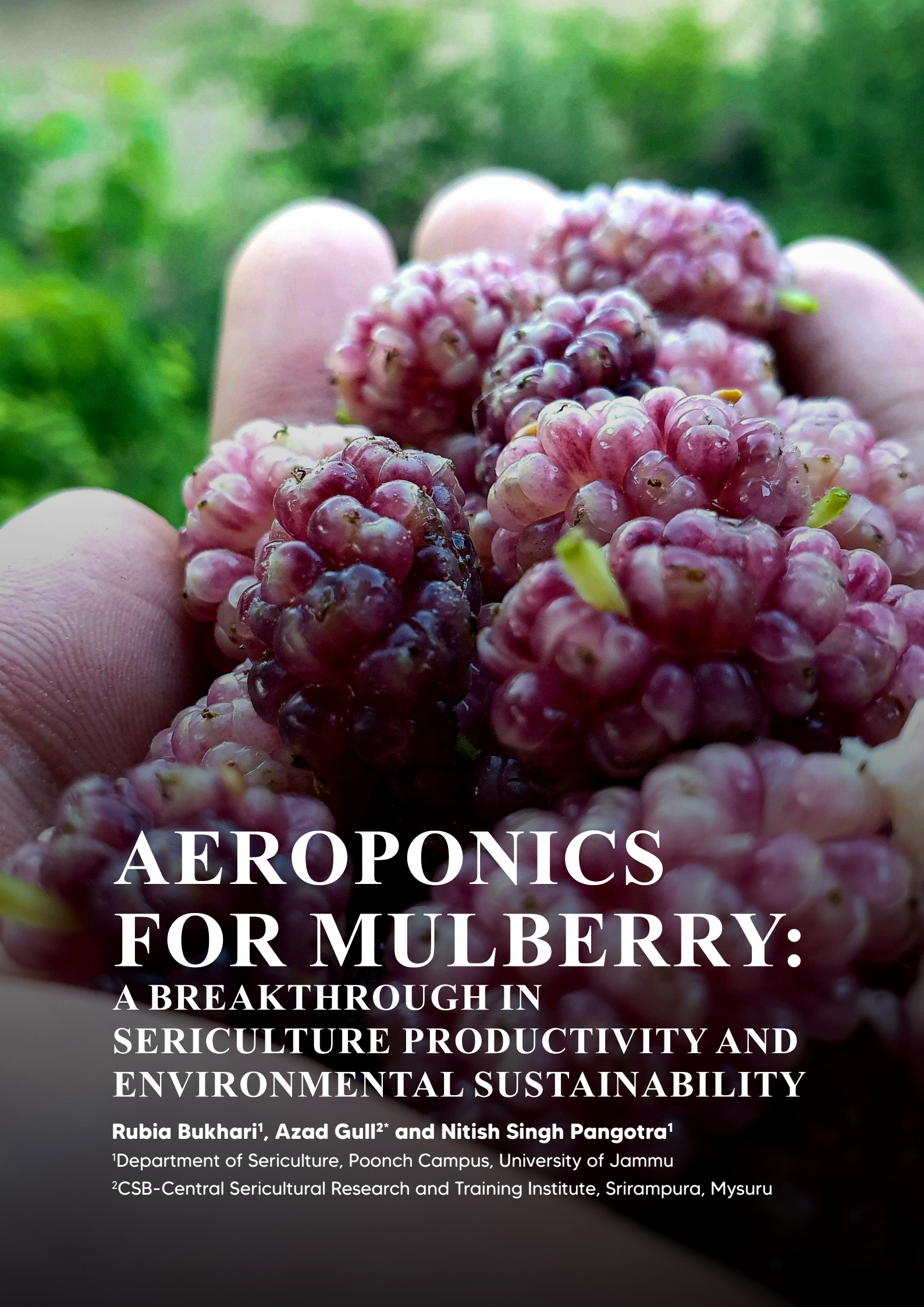

AEROPONICS FOR MULBERRY:

A BREAKTHROUGH IN SERICULTURE PRODUCTIVITY AND ENVIRONMENTAL SUSTAINABILITY

Rubia Bukhari[1], Azad Gull[2*] and Nitish Singh Pangotra[1]

[1]Department of Sericulture, Poonch Campus, University of Jammu

[2]CSB-Central Sericultural Research and Training Institute, Srirampura, Mysuru

INTRODUCTION:

Aeroponics is actually a 'high-tech' soilless cultivation technique, which is revolutionizing the art of agriculture to grow plants in an air mist environment without using soil or traditional growing media. Instead, roots are suspended in the air and periodically misted with a nutrient-rich solution for maximum delivery of water, nutrients and oxygen. This innovative system has exhibited much potential for increasing crop productivity, conserving resources and overcoming environmental constraints in agriculture. Among its different applications, aeroponics has brought much promise to the cultivation of mulberry Morus spp.), a crop backbone of the sericulture industry.

The roots of aeroponics date back to the 15th century where the study of plant roots can be found close to the waterfalls. In 1942, Carter developed the current system of aeroponics by coming up with a method to grow plants using water vapor for the evaluation of the roots. Over the decades, technology developed this method into a productive agricultural technology that can be used in high-density crop production.

Mulberry cultivation is of paramount importance because its leaves are the main food for silkworms (*Bombyx mori*), hence directly affecting cocoon quality and silk yield. Traditional mulberry farming is often marred by land degradation, whimsical climatic conditions and resource availability. Such factors lead to inconsistent yields, thereby affecting the value chain of sericulture. Aeroponics presents an advanced solution to such issues by providing a conducive environment that encourages rapid growth, uniformity and increased biomass production in mulberry plants. Research has shown that aeroponic cultivation of mulberry allows for faster root and shoot development, better nutrition uptake and superior leaf quality as compared to traditional methods in soil. With the potential to control the environment precisely, aeroponics permits year-round production, unfettered by seasonal and climatic changes. In particular, this technique offers advantages for areas where traditional farming is hampered by adverse weather or poor soil conditions. Besides, aeroponics requires less water and

eradicates soil-borne diseases and therefore can provide a great way of mass mulberry culture. Aeroponic mulberry cultivation will benefit other sectors aside from sericulture. Mulberry leaves are very affluent in bioactive compounds utilized in pharmaceuticals, functional foods and cosmetics. Aeroponics enhances the quality and concentration of these compounds under optimized growing conditions, heightening the economic value of mulberry cultivation.

MULBERRY CULTIVATION AND AEROPONICS:

Aeroponics was studied for mulberry plant growing, especially to enhance root ability in V-1 mulberry seedlings. Research showed that aeroponically raised mulberry plants have much higher root length and biomass than those grown under traditional systems, indicating the technology for sericulture production. Furthermore, the system also allows productivity throughout the year which is meant for constant leaf supply in sericulture.

COMPARISON TO HYDROPONIC AND SOILLESS SYSTEMS:

Several studies of comparisons between aeroponics and hydroponics, as well as other soilless cultivation methods, found more favourable outcomes in aeroponics.

ECONOMIC AND ENVIRONMENTAL ADVANTAGES:

Economic assessment shows a greater potential for aeroponics to increase the profitability from higher yields with improved quality parameters. Many researchers reported wet and dry weight of crops, like basil and lettuce, to be 40% greater in aquaponics compared to the conventional system. The water usage is also minimal with aeroponics; however, this system's energy dependency-a problem that includes the energy required by LED lighting and CO_2 management-must still be worked on.

THE FUTURE OF MULBERRY AND BEYOND:

Mulberry exhibits unique biological characters like dormant bud excitability that make it ideal for aeroponic cultivation. Aeroponics provides controlled growth independent of climate, soil type or land availability, which allows cultivation all through the year. This is essential for maximizing the output of leaves to supply the sericulture industry and raising farmers' income. These above-mentioned studies together collectively suggest the potential to grow mulberry, among other agricultural pursuits, with aeroponics. Its ability to provide precise management and resource optimization while improving productivity makes aeroponics a revolutionary approach towards contemporary agricultural issues.

CHALLENGES OF AEROPONICS SYSTEM:

The aeroponics engineering is a new and innovative method of plant cultivation that has not yet been fully adopted worldwide. This system faces several potential challenges that could be addressed through further research. The primary challenge in aeroponics systems is the size of the water nutrient droplets. Larger droplets can limit oxygen availability to the root zone, while smaller droplets may lead to excessive root hair growth without developing lateral root system. Most studies on aeroponics have focused on plant growth, yield, and quality, with limited research on the impact of droplet size on plant yield and nutrient solution properties. A significant drawback of the system is the constant need for power, as interruptions can disrupt nutrient supply and damage plants. Additionally, the ultrasonic transducers may require maintenance and could be susceptible to component failure.

ADVANTAGES OF AEROPONICS SYSTEMS:

Aeroponics, a modern agricultural technique, offers a promising solution for large-scale plant cultivation, especially in areas with unsuitable soil. By cultivating plants indoors in a nutrient mist, aeroponics minimizes water consumption by 98%, fertilizer use by 60%, and eliminates the need for pesticides and herbicides. This innovative approach has the potential to increase plant yield by 40-75% compared to traditional hydroponics or soil-based methods.

CONCLUSION

From medicine and sericulture to environmental sustainability and food security, mulberry's contributions are diverse. Alternative farming systems like hydroponics, aquaponics and aeroponics promise some hope to grow mulberry in difficult conditions of a cold climate, poor soils or limited availability of land. Already successful with crops other than mulberry, this new technique of growing with minimal water use and no pesticides can maximize mulberry yields per unit area. Considering the multipurpose applications of mulberry in medicine, pharmacy and food industrial production, sericulture, mulberry is a multifunctional candidate for "sustainable all-year-round production", particularly in areas climatologically or land-use limited. If implemented, aeroponics can revolutionize traditional sericulture, increase productivity among silkworms and be a means for sustainable agricultural development.