In terms of physical control, insect-proof and rain-proof nets have proven effective in waxberry production. They not only reduce pest damage but also improve fruit size and quality, while lowering infection risks caused by rain splash and mechanical injury (Furmańczyk et al., 2022). Other measures commonly used in organic orchards and IPM systems can also be applied, such as mass trapping, pheromone-based mating disruption, and mechanical removal and pruning of diseased branches.

7.4 Rational reduction of chemical pesticide use

Laboratory screening studies on waxberry twig blight show that prochloraz performs best, followed by pyraclostrobin, difenoconazole-prochloraz mixtures, difenoconazole alone, and myclobutanil (Li et al., 2020). However, excessive use of antibiotics and pesticides in waxberry systems can select for resistant pathogens and pest populations, while also increasing the abundance of resistance genes, mobile genetic elements, and virulence factors in soil, fruit, and associated fruit flies.

Waxberry production should follow these principles: make decisions based on thresholds, rotate modes of action, avoid calendar-based preventive spraying, strictly observe pre-harvest intervals, and prohibit unnecessary antibiotic use. This aligns with the IPM concept, where chemical control is used only as a last line of defense after preventive, biological, agronomic, and physical measures (Bai et al., 2023; Golan et al., 2023).

7.5 Green control technologies

Non-chemical management strategies for berry crops emphasize the central role of biological control, the use of resistant or tolerant varieties, agronomic practices that enhance plant immunity, and improved diagnostic techniques. At the same time, an increasing number of validated commercial biocontrol products are available for effective control of fungal diseases (Taoussi et al., 2024).

Mycoviruses isolated from Pestalotiopsis-infecting fungi in waxberry branches show high diversity and may reduce pathogen virulence (hypovirulence effect), providing a potential resource for a new type of biological control based on “internal regulation” of pathogens (Chen et al., 2021).

The theory and policy of biological control suggest that long-term success depends on balancing production efficiency, ecological function, social acceptance, and economic feasibility. This requires the development of integrated, adaptive, and multi-stakeholder-supported “green” control systems (He et al., 2021).

In practice, green management in waxberry orchards should include: the use of resistant varieties and disease-free seedlings, creation of habitats that support biodiversity, precise application of microbial agents (such as Bacillus spp.), use of low-risk inputs and physical barriers, and integration with advanced monitoring and early warning systems.

8 Harvesting and Postharvest Handling Techniques of Bayberry

8.1 Determination of appropriate harvest maturity

Bayberry is a typical climacteric fruit. After harvest, it shows a peak in ethylene release and softens rapidly, especially under room temperature conditions. When fruits are harvested at an “immature” stage or judged as “mature” only by color, they can still exhibit a clear climacteric respiration rise and ethylene peak within 48 hours at 20 °C. At the same time, the contents of sugars and organic acids change significantly. In contrast, fully “mature” fruits do not show a climacteric peak, but they deteriorate and decay quickly. During storage, total soluble solids (TSS) increase, while titratable acidity (TA) decreases. However, if fruits are overripe on the tree, shelf life is shortened and the risk of decay increases (Zhang et al., 2005).

With the development of machine vision and hyperspectral technologies, objective and non-destructive maturity evaluation in the field has become possible. By combining multiple features such as color and texture, maturity prediction accuracy can reach about 91%. The chromatic parameter a*/b* ratio is highly correlated with anthocyanin accumulation and visual maturity (Kai et al., 2021; Zheng et al., 2025). Image-based intelligent maturity detection helps determine optimal harvest timing for different varieties and orchard zones, reducing variability within batches and improving allocation between fresh consumption and processing markets.