

Research Article

Enset *Xanthomonas* Wilt in Ari Zone, Southern Ethiopia: Epidemiology, Disease Risk Factors, Food-Security Impacts, and Integrated Management Strategies—A Review

Daniel Abebe* 

Department of Plant Science, Jinka University, Jinka, Ethiopia

Abstract

Enset (*Ensete ventricosum*) is a vital food-security and livelihood crop in southern Ethiopia, supporting household food availability, livestock feeding, income generation, and resilience to food shortages. However, production is increasingly threatened by *Xanthomonas* wilt, a destructive bacterial disease caused by *Xanthomonas vasicola* PV. *musacearum*, characterized by rapid leaf yellowing, wilting, vascular discoloration, and eventual plant death. This review synthesizes available evidence on the epidemiology, distribution, risk factors, food-security impacts, and integrated management of enset *Xanthomonas* wilt in Ari Zone, southern Ethiopia. The disease is driven by interactions among pathogen, host, environment, and farming practices. Key risk factors include infected planting materials, contaminated cutting tools, movement of diseased plant residues, close plant spacing, and poor field sanitation. The disease reduces enset stands, destroys mature plants, increases production costs, and limits the availability of planting materials, thereby threatening household food supplies and farmer livelihoods. Effective management requires an integrated approach combining healthy planting materials, early detection, removal and destruction of infected plants, tool sanitation, restricted movement of planting materials, improved field hygiene, farmer awareness, and community-based disease surveillance. Further research is needed to identify resistant or tolerant landraces and to develop locally appropriate management strategies for Ari Zone.

Keywords

Enset (*Ensete ventricosum*), *Xanthomonas* Wilt, *Xanthomonas vasicola* pv. *musacearum*, Disease Management, Ari Zone

1. Introduction

Enset (*Ensete ventricosum* (Welw.) Cheesman) is a perennial herbaceous crop belonging to the family Musaceae and is one of the most important indigenous food crops of Ethiopia. It is mainly cultivated in the southern and southwestern highlands, where it forms an important component of smallholder farming systems. Enset is valued for its high productivity per

unit area, tolerance to periods of moisture stress, flexible harvesting period, and multiple uses as food, livestock feed, fiber, construction material, and for cultural purposes [1, 2]. The crop is particularly important for household food security because farmers can maintain plants of different ages and harvest them when food is required. Consequently, enset-based

*Correspondence: Daniel Abebe (danifaya91@gmail.com)

Received: 2 September 2026; **Accepted:** 11 September 2026; **Published:** 27 September 2026



Copyright: © The Author(s), 2026. Published by Science Publishing Group. This is an **Open Access** article, distributed under the terms of the Creative Commons Attribution 4.0 License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

farming systems contribute substantially to livelihood stability and resilience in southern Ethiopia [1, 2].

Ari Zone is one of the important enset-producing areas of southern Ethiopia. Enset production is closely associated with mixed farming systems in which the crop is integrated with livestock and other food crops. The crop therefore has importance beyond direct food production, contributing to household income, livestock feeding, soil management, and the overall sustainability of local farming systems. However, productivity of enset is constrained by several biotic and abiotic factors, among which *Xanthomonas* wilt is considered one of the most destructive diseases [2, 3].

Enset *Xanthomonas* wilt (EXW), historically referred to as enset bacterial wilt, is caused by *Xanthomonas vasicola* pv. *musacearum* (Xvm), formerly known in much of the Ethiopian literature as *Xanthomonas campestris* pv. *musacearum* (Xcm). The disease was first reported in Ethiopia in the early twentieth century and has subsequently become established across much of the enset-growing belt. It causes characteristic symptoms including yellowing and wilting of leaves, vascular discoloration, bacterial exudation, and eventual death of infected plants. Severe disease can lead to substantial loss of mature enset plants and consequently reduce the food reserves available to farming households [3, 4].

The epidemiology of EXW is strongly associated with human agricultural activities and the movement of contaminated plant materials and farm tools. Experimental studies have demonstrated that contaminated knives can efficiently transmit the pathogen from diseased to healthy plants. The pathogen can also survive for periods in plant debris, creating opportunities for further infection when infected materials remain in the field [4]. These findings are particularly relevant to enset production systems in which farmers repeatedly remove leaves, split pseudostems, harvest plants, and manage suckers using the same cutting tools.

Farmers' knowledge and management practices are also important components of EXW epidemiology. Studies in southern Ethiopia have shown that farmers recognize characteristic disease symptoms and several possible transmission pathways, but knowledge and adoption of recommended disease-management practices vary among communities [5]. The movement of infected planting materials, use of contaminated tools, inadequate removal and destruction of diseased plants, and other farm-to-farm activities can facilitate local dissemination of the pathogen. Recent research has also expanded understanding of possible biological transmission pathways, including the potential involvement of insect vectors, indicating that EXW epidemiology may be more complex than mechanical transmission alone [6].

Evidence from Ari Zone demonstrates that EXW is already an important disease problem in the area. A survey conducted in Ari Zone assessed nine kebeles in South Ari and six kebeles in North Ari. The disease was detected in both districts and in all surveyed kebeles, although its occurrence varied considerably. Disease prevalence reached 65% in North Ari and 40%

in South Ari, while disease incidence was 6.85% and 2.73% respectively. At kebele level, prevalence ranged from 10% to 90% and incidence from 1.21% to 15.46% [7]. These differences indicate that local environmental conditions, host characteristics, farm-management practices, and pathogen dissemination processes may interact to determine disease development and spread.

The consequences of EXW extend beyond individual plant mortality. Because enset is a long-duration crop and mature plants represent accumulated food reserves, the loss of infected plants may have effects that continue for several years. Disease-induced reduction in enset stands can decrease household food availability, reduce planting-material resources, and increase the labor and financial costs associated with field sanitation and re-establishment. Given the important contribution of enset to food security and livelihood resilience in southern Ethiopia, continued spread of EXW may therefore have consequences for both agricultural production and household food security [1, 2, 8].

Management of EXW is difficult because the pathogen can be introduced and disseminated through several pathways. No single control measure is sufficient under smallholder conditions. Effective management therefore requires an integrated approach combining the use of healthy planting materials, early disease detection, removal and destruction of infected plants, sanitation of cutting tools, restriction of movement of infected planting materials, improved field hygiene, farmer training, and community-based disease surveillance [3, 5, 7, 10]. The development and deployment of tolerant or resistant enset landraces may provide an additional component of long-term management [9].

Although several studies have investigated EXW in different parts of Ethiopia, information specifically synthesized for Ari Zone remains limited. Available evidence from North Ari and South Ari provides an important basis for understanding the local distribution of the disease, but information concerning epidemiological drivers, risk factors, effects on household food security, and the effectiveness of integrated management options remains fragmented. Therefore, a focused review is needed to bring together existing evidence and identify research and management gaps relevant to Ari Zone. Accordingly, this review aims to synthesize available evidence on enset *Xanthomonas* wilt in Ari Zone, with particular emphasis on its epidemiology, disease risk factors, impacts on food security, and integrated management strategies.

2. Methodology

2.1. Study Approach

This review was conducted using a systematic literature review approach to compile, evaluate, and synthesize published and unpublished information on enset *Xanthomonas* wilt (EXW) in Ari Zone and other enset-growing areas of southern

Ethiopia. The review integrates evidence from epidemiological studies, disease surveys, experimental research, extension reports, and policy documents related to the occurrence, spread, impacts, and management of EXW. Particular attention was given to studies conducted in Ari Zone.

2.2. Literature Search Strategy

Relevant literature published between 1990 and 2026 was identified through comprehensive searches of scientific databases, institutional repositories, and grey literature. Electronic databases included Web of Science, Scopus, PubMed, Google Scholar, AGRICOLA, CAB Abstracts, and African Journals Online (AJOL). Additional information was obtained from reports published by the Ethiopian Institute of Agricultural Research (EIAR), Southern Agricultural Research Institute (SARI), the Ministry of Agriculture, Jinka University Library, and international organizations working on enset research.

The search was conducted using combinations of keywords such as *Ensete ventricosum*, enset bacterial wilt, enset *Xanthomonas* wilt, *Xanthomonas vasicola* pv. *musacearum*, epidemiology, disease incidence, disease prevalence, Ari Zone, South Omo, food security, integrated disease management, and resistant enset landraces.

2.3. Eligibility Criteria

Studies were included if they:

Investigated enset *Xanthomonas* wilt in Ethiopia.

Reported information on disease epidemiology, distribution, incidence, prevalence, risk factors, yield or food-security impacts, or management.

Were peer-reviewed journal articles, theses, conference proceedings, technical reports, or government publications.

Were published in English.

Studies focusing exclusively on unrelated diseases or lacking sufficient methodological information were excluded.

2.4. Data Extraction and Organization

Information extracted from each publication included the author, year of publication, study location, agroecological zone, study design, sample size, disease prevalence, disease incidence, identified risk factors, management practices, and major findings. The extracted information was organized into thematic categories including disease distribution, epidemiology, transmission pathways, environmental and socioeconomic risk factors, food-security impacts, indigenous knowledge, and integrated disease management strategies.

2.5. Data Synthesis

The collected information was synthesized using a narrative review approach. Findings from different studies were compared to identify similarities, differences, and knowledge gaps.

Quantitative information such as disease prevalence and incidence reported from Ari Zone and other regions was summarized in tables and discussed comparatively. Risk factors influencing disease occurrence were categorized into host-related, pathogen-related, environmental, and management-related factors. Where studies reported conflicting findings, these discrepancies were highlighted and discussed in relation to differences in study context, methodology, and local conditions.

2.6. Quality Assessment of Literature

The quality and reliability of each source were evaluated based on publication type, methodological clarity, sampling procedures, relevance to the review objectives, and consistency of reported findings. Greater emphasis was placed on peer-reviewed scientific publications and nationally recognized research reports.

2.7. Scope and Limitations

This review focuses primarily on Ari Zone, Southern Ethiopia, while incorporating evidence from other enset-growing regions where information from Ari Zone is limited. Because published studies specific to Ari Zone remain relatively few, evidence from neighboring districts and national studies was used to provide a comprehensive understanding of the disease. Differences in survey methods, sampling intensity, and disease assessment procedures among studies were considered during interpretation of the findings.

3. Results of the Review

The reviewed literature indicates that Enset *Xanthomonas* wilt (EXW) is one of the most important bacterial diseases threatening enset production in southern Ethiopia. The disease is caused by *Xanthomonas vasicola* pv. *musacearum* (Xvm), a vascular bacterial pathogen capable of infecting different enset growth stages. Its importance is particularly high in areas where enset is grown continuously around homesteads and where infected planting materials, contaminated farm tools, livestock movement, and rainwater facilitate pathogen dissemination.

3.1. Distribution and Occurrence of Enset *Xanthomonas* Wilt

EXW has been reported from several enset-growing regions of Ethiopia, with disease occurrence varying among districts, kebeles, farms, and seasons. The disease can occur in both young and mature plants, although the consequences are particularly serious when productive plants are infected. Differences in disease occurrence among locations are associated with the availability of infected planting materials, sanitation practices, environmental conditions, cropping systems, and

farmers' awareness of disease-management practices. In Ari Zone and neighboring areas of southern Ethiopia, the disease is of particular concern because enset is an important food-security crop and is closely integrated with household farming systems. A survey conducted in South Omo Zone assessed nine kebeles in South Ari and six kebeles in North Ari. The disease was detected in both districts and in all surveyed kebeles, although its occurrence varied considerably. Disease prevalence reached 65% in North Ari and 40% in South Ari, while disease incidence was 6.85% and 2.73% respectively. At kebele level, prevalence ranged from 10% to 90% and incidence from 1.21% to 15.46% [7]. These differences indicate that local environmental conditions, host characteristics, farm-management practices, and pathogen dissemination processes may interact to determine disease development and spread. However, systematic epidemiological information specific to Ari Zone remains relatively limited compared with some other enset-growing areas of Ethiopia. This indicates a need for location-specific surveillance and epidemiological studies.

3.2. Symptoms and Disease Development

The principal symptoms observed in infected enset include yellowing and wilting of leaves, drying and collapse of leaves, and progressive discoloration of vascular tissues. In advanced

infections, the entire plant may wilt and die. A characteristic feature of bacterial wilt is the presence of bacterial ooze from cut tissues.

Disease development generally begins with infection through wounds or natural openings and progresses through the vascular system. Once the bacterium becomes established in the plant, it can multiply and interfere with water movement, resulting in wilting and eventual plant death. Infected plants can therefore become important sources of inoculum for neighboring plants.

3.3. Epidemiology and Major Risk Factors

The review identified several factors associated with EXW development and spread. Use of infected suckers and corms, contaminated cutting tools, movement of livestock, human activities, insect-mediated transmission, rainfall, and inadequate removal of diseased plants are among the major factors contributing to disease dissemination (Table 1). The role of farm sanitation is particularly important. Cutting an infected plant and subsequently using the same knife or machete on healthy plants without disinfection can mechanically transmit the pathogen. Similarly, leaving infected plants within the field allows bacterial populations to persist and provides inoculum for secondary spread.

Table 1. Major epidemiological factors associated with Enset *Xanthomonas wilt*.

Risk factor	Contribution to disease spread	Relative importance
Infected planting materials	Introduces the pathogen into disease-free fields	Very high
Contaminated cutting tools	Efficient mechanical transmission between plants	Very high
Delayed removal of infected plants	Maintains inoculum within the field	Very high
Rainfall and surface water	Facilitates movement of bacteria between plants	High
Insect activity	May contribute to mechanical transmission	Moderate-high
Livestock movement	Can transfer contaminated plant materials and bacteria	Moderate
Human movement between farms	Facilitates pathogen transfer	High
Dense/continuous enset production	Increases contact between susceptible plants	High
Poor field sanitation	Promotes pathogen survival and secondary spread	Very high
Use of healthy planting material	Reduces initial pathogen introduction	Protective

3.4. Disease Incidence and Severity

The reviewed studies show considerable variation in disease incidence and severity between locations and seasons (Table 2). Such variation is expected because disease development is strongly influenced by environmental conditions

and management practices. Fields with poor sanitation and repeated use of planting materials from unknown sources generally face greater risk.

Disease severity can increase progressively when infected plants are not removed. In severe outbreaks, infected plants may die before reaching their productive stage, resulting in direct loss of food and planting material. Because enset re-

quires several years to reach maturity, replacement of destroyed plants can create a prolonged production gap.

Table 2. Factors influencing EXW incidence and severity.

Factor	Expected effect on disease	Explanation
High rainfall	Increase	Enhances bacterial dissemination and favors infection
High plant density	Increase	Facilitates plant-to-plant transmission
Frequent cutting of plants	Increase	Creates wounds and increases tool-mediated transmission
Use of contaminated tools	Increase	Directly transfers bacteria to healthy plants
Infected suckers	Increase	Introduces pathogen before field establishment
Early removal of infected plants	Decrease	Reduces inoculum sources
Tool disinfection	Decrease	Interrupts mechanical transmission
Use of disease-free planting materials	Decrease	Prevents primary introduction
Regular field inspection	Decrease	Allows early detection and removal
Proper disposal of infected plants	Decrease	Limits pathogen survival and secondary spread

3.5. Effect on Enset Production and Food Security

The review indicates that EXW has implications beyond individual plant loss. Because enset is a major component of household food systems in southern Ethiopia, disease-induced destruction of mature plants can reduce the availability of food, planting materials, livestock feed, and other household resources (Table 3). The effect is particularly serious because enset has a relatively long production cycle. Consequently, replacing a diseased mature plant with a new sucker does not immediately compensate for the lost production. Recurrent outbreaks may therefore reduce the stability of household food supplies and increase dependence on other crops.

3.6. Integrated Management of Enset Xanthomonas Wilt

The literature indicates that no single management measure is sufficient to provide reliable control of EXW. Integrated management based on prevention, early detection, sanitation, destruction of infected plants, clean planting materials, and community participation is therefore essential (Table 4)

The most consistently recommended practice is the early identification and complete removal of infected plants. Cutting and destroying diseased plants reduces the amount of bacterial inoculum available for transmission. However, removal alone may be ineffective if farmers continue to use contaminated tools or exchange infected planting materials.

Tool sanitation is another important component. Knives, machetes, and other implements used for cutting enset should be disinfected before being used on healthy plants. Farmers should also avoid moving directly from diseased fields to healthy fields without appropriate sanitation.

Table 3. Potential impacts of Enset *Xanthomonas* wilt.

Impact area	Effect of EXW
Enset plant survival	Wilting and death of infected plants
Yield	Reduction through premature plant death
Food availability	Reduced quantity of edible enset products
Planting materials	Loss of suckers and corms
Household income	Possible reduction from surplus-product sales
Livestock feed	Reduction in available enset biomass
Production stability	Increased risk of food shortages
Labor requirement	Increased labor for disease removal and replanting
Biodiversity	Possible loss of susceptible/local enset clones
Long-term food security	Increased vulnerability where enset is a major staple

Table 4. Integrated management options for EXW.

Management component	Recommended practice	Expected benefit
Prevention	Use disease-free planting materials	Prevents introduction
Surveillance	Regularly inspect enset fields	Enables early detection
Rogueing	Remove infected plants immediately	Reduces inoculum
Sanitation	Disinfect cutting tools	Reduces mechanical transmission
Planting material management	Avoid exchange of infected suckers/corms	Limits long-distance spread
Field hygiene	Properly destroy infected plant residues	Reduces pathogen sources
Community action	Coordinate disease control among neighboring farmers	Prevents reinfection
Farmer training	Improve recognition and management skills	Improves adoption
Quarantine	Restrict movement from affected areas	Limits geographical spread
Resistant/tolerant materials	Promote promising less-susceptible clones where available	Provides longer-term protection

3.7. Knowledge Gaps Identified by the Review

Despite the importance of EXW, several knowledge gaps remain. In particular, location-specific epidemiological information for Ari Zone is insufficient (Table 5). Data on disease incidence, severity, seasonal dynamics, spatial distribution, cultivar response, and the relative importance of individual risk factors are not sufficiently documented. There is also a need to investigate the effectiveness of locally feasible integrated management practices under farmers' conditions. Future research should combine field epidemiology with farmer surveys, disease mapping, pathogen characterization, and evaluation of management interventions.

Table 5. Key knowledge gaps and priority research areas for enset *Xanthomonas wilt* management in Ari Zone, southern Ethiopia.

Research gap	Recommended research
Limited EXW data in Ari Zone	Conduct systematic disease surveys
Limited information on seasonal dynamics	Monitor disease during different seasons
Poor understanding of local risk factors	Conduct epidemiological and farmer-based studies
Limited information on clone susceptibility	Screen locally grown enset clones
Inadequate disease mapping	Develop GIS-based disease distribution maps
Variable farmer management	Assess farmers' knowledge and practices

Research gap	Recommended research
Reinfection after plant removal	Investigate major sources of secondary infection
Limited locally validated management packages	Conduct participatory field trials
Insufficient long-term surveillance	Establish regular EXW monitoring systems

3.8. Overall Synthesis of the Review

The results demonstrate that *Xanthomonas wilt* is established in both North Ari and South Ari, with substantial variation in disease occurrence among kebeles. North Ari showed greater prevalence and incidence than South Ari, while Kalet was the most severely affected kebele in the available survey. Disease occurrence was also higher in older enset stands and varied with altitude and cropping system. However, the available evidence also reveals an important research gap: Ari Zone lacks sufficiently detailed, long-term epidemiological studies linking disease development with weather, soil properties, enset landraces, farm sanitation, planting-material movement, vector activity and household-level food-security losses. Therefore, future research should move beyond simple disease surveys toward integrated epidemiological studies that quantify the relative contribution of these factors.

4. Discussion

The reviewed evidence demonstrates that enset *Xanthomonas wilt* (EXW), caused by *Xanthomonas vasicola* PV. *musacearum* (Xvm), is a major constraint to sustainable enset

production in Ethiopia, particularly in southern and southwestern areas where onset plays an important role in food security, livestock feeding, income generation, and livelihood resilience. Disease occurrence and severity are influenced by interactions among pathogen survival, susceptible planting materials, environmental conditions, and farming practices. Rainfall may facilitate bacterial dissemination through infected tissues, wounds, soil, and plant-to-plant contact, while the movement of infected planting materials represents an important mechanism for introducing the pathogen into new fields. Contaminated cutting tools, movement of infected plant residues, human activities, and livestock movement may further contribute to disease spread. These factors indicate that EXW epidemiology is closely associated with both biological and human-mediated processes and may vary among locations according to farming practices, sanitation, planting-material sources, and environmental conditions [11-17].

The consequences of EXW extend beyond the mortality of individual plants because onset is a long-duration crop in which mature plants represent accumulated food reserves and production over several years. Destruction of mature plants can therefore reduce household food availability, planting-material resources, livestock feed, and potential income, while increasing the labor and financial costs required for sanitation and field re-establishment [14, 15]. The reviewed evidence also indicates that no single management measure is sufficient under smallholder farming conditions. Effective management requires an integrated approach combining healthy planting materials, regular disease surveillance and early detection, timely removal and proper destruction of infected plants, sanitation of cutting tools, restriction of infected planting-material movement, improved field hygiene, farmer training, and community-level coordination [12-17]. Consistent implementation of these measures is particularly important because failure to address one major pathway, such as the exchange of infected suckers, can undermine other control efforts.

For Ari Zone, the available evidence highlights the need for locally focused epidemiological assessment and management research. Disease distribution, incidence, and severity should be systematically documented across locations and seasons, together with investigation of the relative importance of planting-material sources, sanitation practices, rainfall, tool use, livestock movement, and other potential risk factors. Research should also evaluate local onset landraces for tolerance or resistance and assess management practices under farmers' conditions. Participatory research involving farmers, agricultural experts, and local institutions could help identify management options that are technically effective, economically feasible, and socially acceptable. Strengthening disease surveillance, farmer awareness, access to healthy planting materials, sanitation practices, and community-based disease management would provide an important foundation for reducing the impact of EXW and protecting onset-based food security and livelihoods in Ari Zone.

5. Conclusion

Onset *Xanthomonas* wilt (EXW), caused by *Xanthomonas* *vasicola* pv. *musacearum*, is one of the major biotic constraints affecting sustainable onset production in Ethiopia. The review showed that the disease has serious implications for plant survival, productivity, availability of planting materials, household income, and food security. Its epidemiology is influenced by several interacting factors, including the use and movement of infected planting materials, contaminated farm tools, delayed removal of diseased plants, rainfall and surface water, human activities, livestock movement, and inadequate field sanitation. The disease is particularly challenging because onset is predominantly vegetative propagated and requires several years to reach maturity. Consequently, infection of mature plants represents not only an immediate production loss but also a long-term loss of accumulated production. Recurrent disease outbreaks can therefore increase household vulnerability to food shortages in communities that depend strongly on onset. The review further indicates that no single management practice can provide satisfactory and sustainable control. An integrated approach combining the use of healthy planting materials, regular field inspection, early detection, immediate removal and proper destruction of infected plants, disinfection of cutting tools, restriction of movement of potentially infected planting materials, and community participation is essential. Farmer awareness and coordinated action among neighboring households are particularly important because pathogen transmission frequently occurs across farm boundaries. For Ari Zone, southern Ethiopia, available information on the distribution, epidemiology, risk factors, economic consequences, and effectiveness of management practices remains insufficient. Therefore, EXW should receive greater attention from researchers, agricultural extension services, local administrations, and farming communities. Strengthening location-specific disease surveillance and integrated management will be essential for protecting onset production and maintaining household food security.

6. Future Research and Development Priorities

Future research should prioritize systematic assessment of the distribution, incidence, and severity of onset *Xanthomonas* wilt (EXW) across Ari Zone. Studies should examine seasonal and spatial patterns of disease occurrence and identify the major epidemiological factors associated with disease development and spread, including planting-material sources, rainfall, farm sanitation, cutting-tool practices, livestock movement, and other farmer management practices. Such information would provide a stronger evidence base for developing location-specific disease-management recommendations.

Research should also focus on the identification and evaluation of onset landraces with tolerance or resistance to Xvm.

Local enset diversity should be systematically characterized, and promising landraces should be evaluated under different agroecological and disease-pressure conditions. Where appropriate, pathogen characterization and molecular studies could be used to improve understanding of Xvm diversity and its relationship with disease distribution and cultivar response.

Further attention should be given to the development and evaluation of integrated management practices that are practical, affordable, and acceptable to smallholder farmers. Priority should be given to healthy planting-material production, early disease detection, removal and destruction of infected plants, tool sanitation, improved field hygiene, restriction of infected planting-material movement, and community-based disease surveillance. Participatory on-farm evaluation would help determine which combinations of practices provide effective and sustainable disease suppression under farmers' conditions.

Finally, future development activities should strengthen farmer awareness, extension services, disease surveillance, and community-level coordination. Collaboration among farmers, universities, research institutions, agricultural offices, and other relevant stakeholders will be important for implementing coordinated EXW management. Integrating epidemiological research with farmer knowledge, participatory approaches, and locally available management options will support the development of sustainable strategies to reduce EXW impacts and protect enset-based food security and livelihoods in Ari Zone.

Abbreviations

EXW	Enset Xanthomonas Wilt
XW	Xanthomonas Wilt
EBW	Enset Bacterial Wilt
IPM	Integrated Pest Management
FDRE	Federal Democratic Republic of Ethiopia
FAO	Food and Agriculture Organization
NGO	Non-Governmental Organization
SNNPR	Southern Nations, Nationalities and Peoples' Region
ETB	Ethiopian Birr
Ha	Hectare
Kg	Kilogram
t ha ⁻¹	Tonnes per Hectare

Acknowledgments

The author sincerely appreciates the researchers who have generated valuable information on the epidemiology, distribution, risk factors, food-security implications, and management of enset Xanthomonas wilt in enset-producing areas. Their contributions have been essential in compiling this review.

Author Contributions

Daniel Abebe: Conceptualization, Formal Analysis, Methodology, Project administration, Supervision, Validation, Writing – original draft

Conflicts of Interest

The author declares no conflicts of interest.

References

- [1] Borrell JS, Biswas MK, Goodwin M, Blomme G, Schwarzacher T, Heslop-Harrison JS, et al. Enset in Ethiopia: a poorly characterized but resilient starch staple. *Annals of Botany*. 2019; 123(5): 747–766. <https://doi.org/10.1093/aob/mcy214>
- [2] Borrell JS, Goodwin M, Blomme G, Jacobsen K, Wendawek AM, Gashu D, et al. Enset-based agricultural systems in Ethiopia: a systematic review of production trends, agronomy, processing and the wider food security applications of a neglected banana relative. *Plants, People, Planet*. 2020; 2: 212–228. <https://doi.org/10.1002/ppp3.10084>
- [3] Blomme G, Kearsley E, Buta S, Chala A, Kebede R, Addis T, Yemataw Z. Xanthomonas wilt of enset in Ethiopia: geographical spread, impact on production systems and the effect of training on disease management practices. *African Journal of Agricultural Research*. 2023; 19(1): 33–47. <https://doi.org/10.5897/AJAR2022.16243>
- [4] Welde-Michael G, Bobosha K, Addis T, Blomme G, Mekonnen S, Mengesha T. Mechanical transmission and survival of bacterial wilt on enset. *African Crop Science Journal*. 2008; 16(1): 97–102. <https://doi.org/10.4314/acsj.v16i1.54349>
- [5] Yemataw Z, Mekonen A, Chala A, Tesfaye K, Mekonen K, Studholme DJ, et al. Farmers' knowledge and perception of enset Xanthomonas wilt in southern Ethiopia. *Agriculture & Food Security*. 2017; 6: 62. <https://doi.org/10.1186/s40066-017-0146-0>
- [6] Kibatu B, et al. Experimental confirmation of the leafhopper *Cicadella cosmopolita* as a potential vector of Xanthomonas vasicola pv. musacearum of enset in Ethiopia. *European Journal of Plant Pathology*. 2025. <https://doi.org/10.1007/s10658-025-03174-2>
- [7] Bamud K, Shikur E, Handoro F. Assessment of the distribution of enset bacterial wilt disease (*Xanthomonas campestris* pv. musacearum) in South Omo Zone, Southern Ethiopia. *Advances in Crop Science and Technology*. 2023; 11(4): 566. <https://doi.org/10.4172/2329-8863.1000566>
- [8] Sahle M, Yeshitela K, Saito O. Mapping the supply and demand of enset crop to improve food security in Southern Ethiopia. *Agronomy for Sustainable Development*. 2018; 38. <https://doi.org/10.1007/s13593-017-0484-0>

- [9] Abrar S, Kenea FT, Tolessa S. Assessment and evaluation of enset landraces to bacterial wilt (*Xanthomonas campestris* pv. *musacearum*) disease of enset at Gedio Zone, Southern Ethiopia. *Journal of Science and Development*. 2022. <https://doi.org/10.20372/v5bkd609>
- [10] Bamud K, Shikur E, Handoro F. Assessment on farmers' enset bacterial wilt management practices in South Omo Zone, Ethiopia. *Research & Reviews: Journal of Herbal Science*. 2022; 11(3).
- [11] Blomme G, Dita M, Jacobsen KS, Pérez Vicente L, Molina A, Ocimati W, Poussier S, Prior P. Bacterial diseases of bananas and enset: current state of knowledge and integrated approaches toward sustainable management. *Frontiers in Plant Science*. 2017; 8: 1290. <https://doi.org/10.3389/fpls.2017.01290>
- [12] Addis T, Turyagyenda LF, Alemu T, Karamura E, Blomme G. Garden tool transmission of *Xanthomonas campestris* pv. *musacearum* on banana (*Musa* spp.) and enset in Ethiopia. *Acta Horticulturae*. 2010; 879: 367–372. <https://doi.org/10.17660/ActaHortic.2010.879.39>
- [13] Ocimati W, Blomme G, Ssekiwoko F, Karamura E, Ragama P. The timing and role of insect vectors in the spread of *Xanthomonas campestris* pv. *musacearum* on banana. *African Crop Science Journal*. 2013; 21: 111–121.
- [14] Nakato V, Beed F, Ramathani I, et al. *Xanthomonas campestris* pv. *musacearum*: a major constraint to banana, plantain and enset production in central and east Africa over the past decade. *Molecular Plant Pathology*. 2018; 19: 525–536. <https://doi.org/10.1111/mpp.12578>
- [15] Negash A. Diversity and Conservation of Enset (*Ensete ventricosum* Welw. Cheesman) and Its Relation to Household Food and Livelihood Security in South-Western Ethiopia. Wageningen: Wageningen University; 2001. <https://doi.org/10.18174/139427>
- [16] Addis T, Blomme G, Turyagyenda LF, De Langhe E. *Xanthomonas campestris* pv. *musacearum* on enset and banana: epidemiology and management options. *African Crop Science Journal*. 2010; 18(1): 1–10.
- [17] Yirgou D, Bradbury JF. Bacterial wilt of enset (*Ensete ventricosum*) incited by *Xanthomonas musacearum* sp. nov. *Phytopathology*. 1968; 58: 111–112.