

Full Length Research Paper

Assessment of the prevalence of major mango diseases and farmers' perceptions in Western Burkina Faso

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Mango production in Burkina Faso is severely constrained by anthracnose, bacterial black spot, and decline. From April 2024 to September 2025, this study assessed farmers' perceptions and the prevalence of these diseases in western Burkina Faso. A survey was conducted among 200 farmers in the provinces of Kénédougou, Comoé, Houet, and Léraba. Field assessments in 100 orchards were carried out to measure the incidence and severity of the three diseases. Results showed that only 14% of farmers were familiar with anthracnose, 7% with bacterial black spot, and 24% with decline. Diagnosis relied almost exclusively on visual observations (98%). Due to limited access to, or knowledge of, available control technologies, 97% of farmers resorted to local practices or relied on recommendations from agro-input vendors. Field inspections revealed high incidences: 71 to 80% for anthracnose, 65 to 78% for bacterial black spot, and 64 to 78% for decline. Severity levels ranged from 34 to 52%, 25 to 44%, and 35 to 51%, respectively. These findings highlight an alarming phytosanitary situation characterized by high prevalence and low farmer awareness. Strengthening training programs, implementing integrated disease management, and adopting digital tools for early diagnosis are crucial to reducing losses.

Key words: *Mangifera indica* L., phytosanitary, producers' knowledge, management.

INTRODUCTION

The mango tree (*Mangifera indica* L.) is a fruit species suited to tropical and subtropical areas (Europe-Africa-Caribbean-Pacific Liaison Committee [COLEACP], 2013; Drabo et al., 2024). In Burkina Faso, it occupies a strategic position in the fruit sector, accounting for nearly 50% of national fruit production and around 400,000 ton per year, which places the country third in West Africa

after Côte d'Ivoire and Mali (Value Chain Analysis for Development Project [VCA4D], 2018). The sector contributes 5% to the national Gross Domestic Product (GDP) and 2.9% to the agricultural GDP, generates 1.6 billion CFA francs in tax revenue, and mobilizes around 28,000 stakeholders (LEFASO.NET, 2023).

However, its profitability is compromised by several

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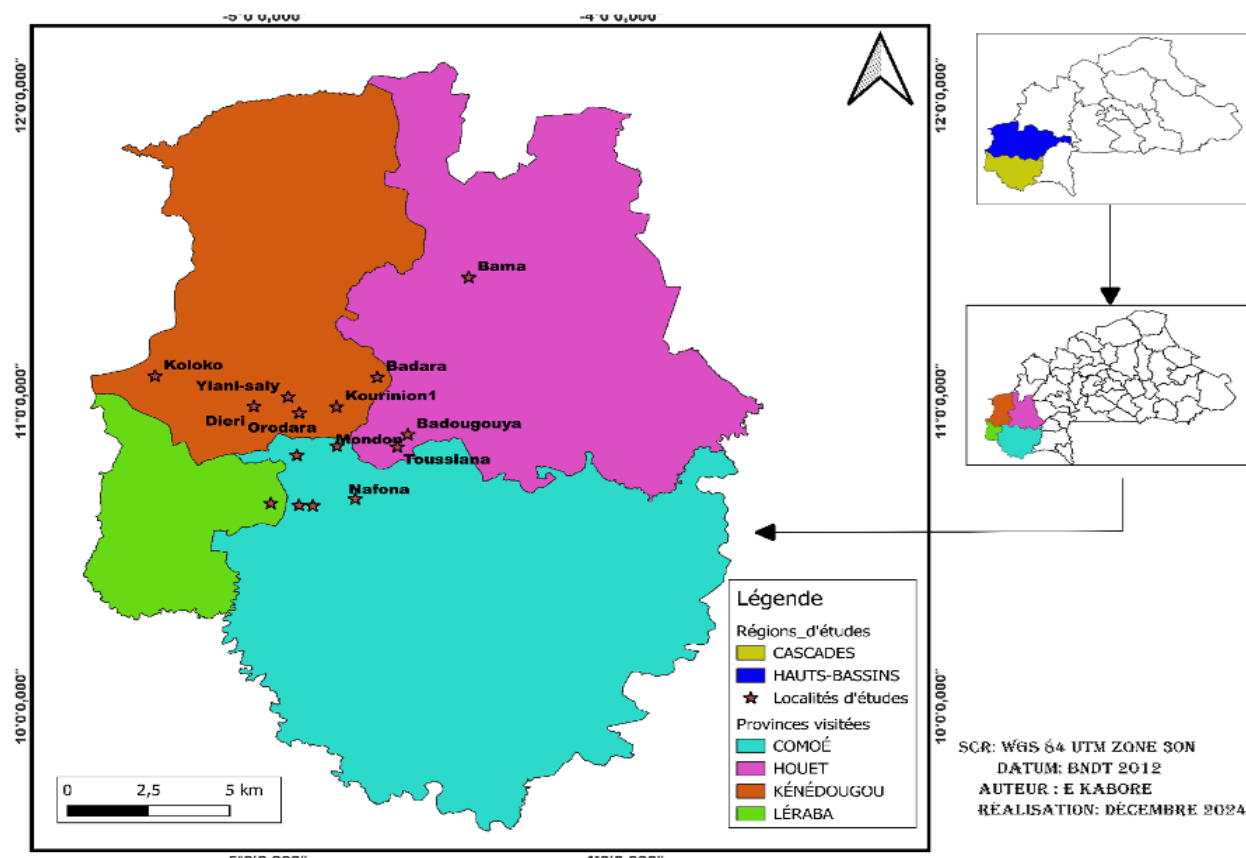


Figure 1. Map showing the location of sites in the study area.

major phytosanitary constraints, including anthracnose, bacterial blight and dieback (Zombré, 2016; Dianda et al., 2018; Drabo et al., 2024; Bougoum et al., 2023). These diseases affect flowering, fruit quality, productivity and producer incomes (Koffi et al., 2021; Bougoum et al., 2023). Anthracnose can cause up to 50% yield loss in humid conditions (Demele et al., 2019; Ghosh et al., 2015), while overall pre- and post-harvest losses can reach 30 to 40% (University of Florida [UF]/Institute of Food and Agricultural Sciences [IFAS], 2023). Dieback is the cause of mortality in orchards in various production areas in Burkina Faso (Saeed et al., 2017; Dianda et al., 2023). Bacterial cankers affecting fruit cause crop losses of up to 85% during the wet season (Koffi et al., 2021; Maiga et al., 2022).

Solutions exist, including improved cultivation practices, resistant or tolerant varieties, the use of fungicides, and biological control based on plant extracts or essential oils (Zombré, 2016; Dianda et al., 2023a, b; Drabo et al., 2024; Bougoum et al., 2023). Despite control efforts, disease symptoms persist in orchards, suggesting gaps in farmers' knowledge and low dissemination of management practices and favorable climatic factors. This study therefore aims to assess producers' perceptions of the management of dieback, anthracnose and bacterial blight, as well as the extent of these

diseases in orchards in Burkina Faso.

MATERIAL AND METHODS

Study area

The study was conducted in the Guiriko (Houet and Kénédougou) and Tannounyan (Comoé and Léraba) regions, which account for approximately 70% of national mango production (Figure 1).

These areas, with a tropical Sudano-Guinean and Sudanian climate, receive an average of approximately 900 to 1200 millimetres (mm) and 1200 to 1700 mm of rainfall per year, respectively (Agence Nationale de la Meteorologie [ANAM], 2024).

Collection of survey, incidence and severity data

A total of 200 producers, selected from the list of the Association of Mango Producers in Burkina Faso (APROMAB) based on the accessibility of orchards and the availability of producers, participated in the survey. A total of 100 orchards were selected for phytosanitary assessment. In each province, the study was conducted in 25 orchards, with 10 mango trees chosen at random along with diagonals per orchard. A questionnaire, developed on KoboCollect and administered via smartphones, was used to collect information on the producer, the orchard, knowledge of major diseases and management strategies, including smartphone use. The interviews were conducted in person in the orchards. Three diseases were assessed using the scales developed by Suharban

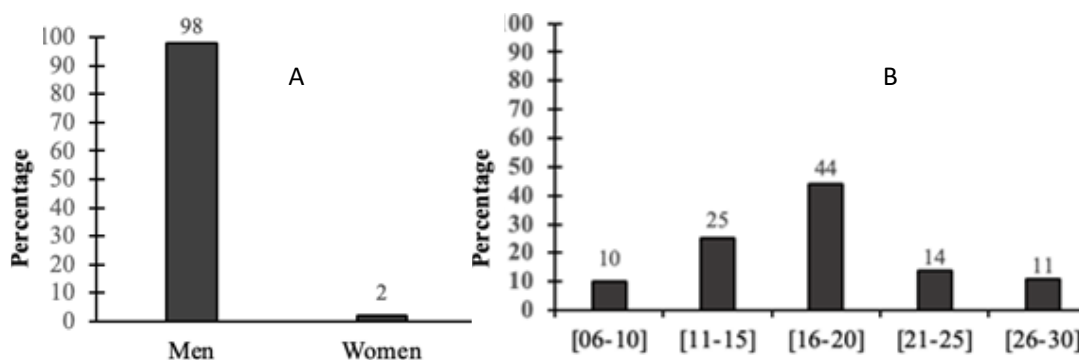


Figure 2. (A) Proportion of producers by age. (B) Number of years producing mangoes

et al. (1985) cited by Dembele et al. (2020) for anthracnose, (Gagnevin and Pruvost, 2001) for bacterial blight, and (Ramos et al., 1997) for dieback. These data were used to calculate incidence and severity in the four provinces.

Assessment of incidence and severity rates

Incidence rates (T_i) were determined using the method described by Cooke (2006) by comparing the number of diseased trees to the total number of trees inspected, according to the equation:

$$T_i = \sum \left(\frac{n}{N} \right) \times 100$$

where T_i represents the incidence rate of the disease at the orchard level, n is the number of diseased trees, and N is the total number of trees observed in the orchard ($N = 10$).

The severity rate (T_s) in an orchard was calculated according to the formula proposed by (Kranz, 1998):

$$T_s = \sum \frac{(X_i \times n_i)}{(N \times Z)} \times 100$$

where T_s corresponds to the severity rate, X_i to the severity score i assigned to a tree, n_i to the number of trees with this severity, N to the total number of trees observed ($N = 10$) in the orchard, and Z to the maximum value on the severity scale (score 5).

The average incidence and severity rates in each province were calculated from the rates obtained in the orchards.

Data analysis

Data was collected using pre-designed forms, then organized and classified in Excel 2019. KoboCollect software was used to design questionnaires and collect data on the severity and incidence of major diseases. The questionnaires were deployed on smartphones for face-to-face collection in the field. Statistical analyses were performed using R software (version 2025.05.1). Quantitative variables (incidence and severity) were first subjected to the Shapiro-Wilk test to verify the normality of their distribution. Where normality was verified, a two-factor analysis of variance (ANOVA) (diseases*provinces) was performed to assess variations in average incidence and severity rates according to disease and province. When significant differences were observed at the 5% threshold, a Tukey HSD post-hoc test was applied to group the

means into statistically homogeneous classes. Finally, the Geographic Information System (GIS) tool was used to record the geographical coordinates of the various sites for inclusion in the mapping of the areas studied.

RESULTS AND DISCUSSION

Producers' perceptions of mango tree diseases

Most producers surveyed are men (98%) (Figure 2A). The largest age groups are those aged (41 to 50) and (51 to 60), accounting for 34 and 40% respectively (Figure 2A). In addition, 25 and 44% of producers have solid experience in mango production, ranging from 16 to 20 years and 11 to 15 years, respectively (Figure 2B). The survey reveals that mango orchard management is largely dominated by men, confirming regional trends in West Africa (Carrico et al, 2022). This socio-economic structure, combined with a predominantly primary or secondary level of education, determines access to and adoption of technological innovations (Roussy et al., 2020).

Main difficulties encountered by producers

Figure 3 shows that pest persistence is the constraint most frequently cited by producers ($\approx 98\%$), followed by marketing concerns ($\approx 91\%$) and high input costs ($\approx 88\%$). Climate hazards and labour shortages affect around 80% of respondents, while $\approx 73\%$ mention stray animals. The decline in yield ($\approx 65\%$) appears to be a likely consequence of all these constraints. The difficulties encountered are manifold and combine biotic, economic, climatic and organizational factors. The major constraints identified include limited access to resources, a lack of specialized advisory services, and significant losses due to disease. Limited access to agricultural technicians (Doreus, 2012) and climate variability exacerbate this vulnerability. These factors, combined with a lack of diagnostic expertise, justify the

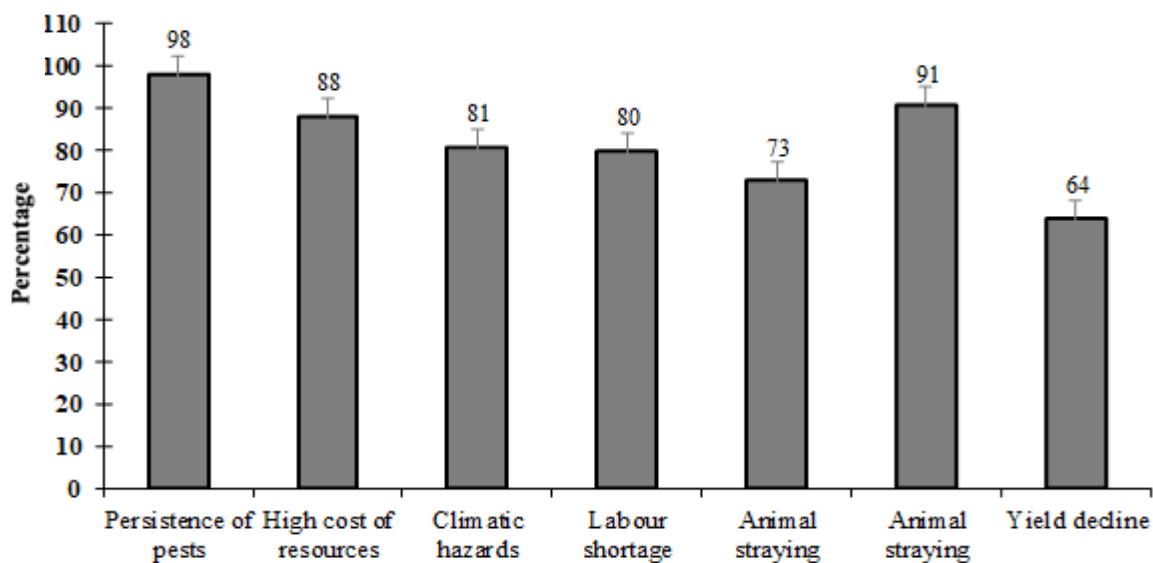


Figure 3. Main difficulties encountered by producers.

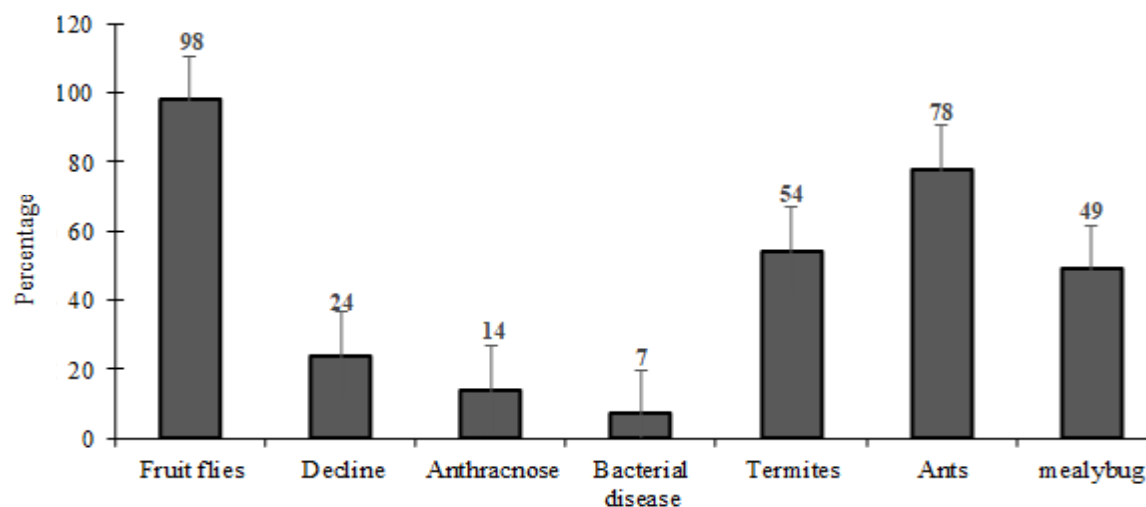


Figure 4. Main pests affecting mango trees according to producers.

implementation of integrated approaches combining targeted training and AI-based detection tools (Yassine et al., 2023).

Knowledge of the main pests affecting mango trees

Figure 4 shows that fruit flies are the most widespread pest, affecting nearly 98% of the orchards surveyed. They are followed by ants (~78%), termites (~54%) and mealybugs (~49%). High rates can be explained by a good knowledge of fruit flies and mealybugs, the main insect pests of mango trees. Indeed, producers recognize

these pests through their proliferation, noticeable damage such as fruit rot, larvae in the bite areas and oily or whitish deposits for the mealybug. However, producers have little knowledge of the different insect species, the factors favouring multiplication and propagation.

Producers' knowledge of plant health is limited: only 14% recognize anthracnose, 7% recognize bacterial blight, and 24% recognize dieback although they can cause significant losses locally. These low frequencies could translate into low knowledge of the initial symptoms of diseases by producers. This lack of knowledge compromises early detection and the effectiveness of interventions. Anthracnose, caused by *Colletotrichum*

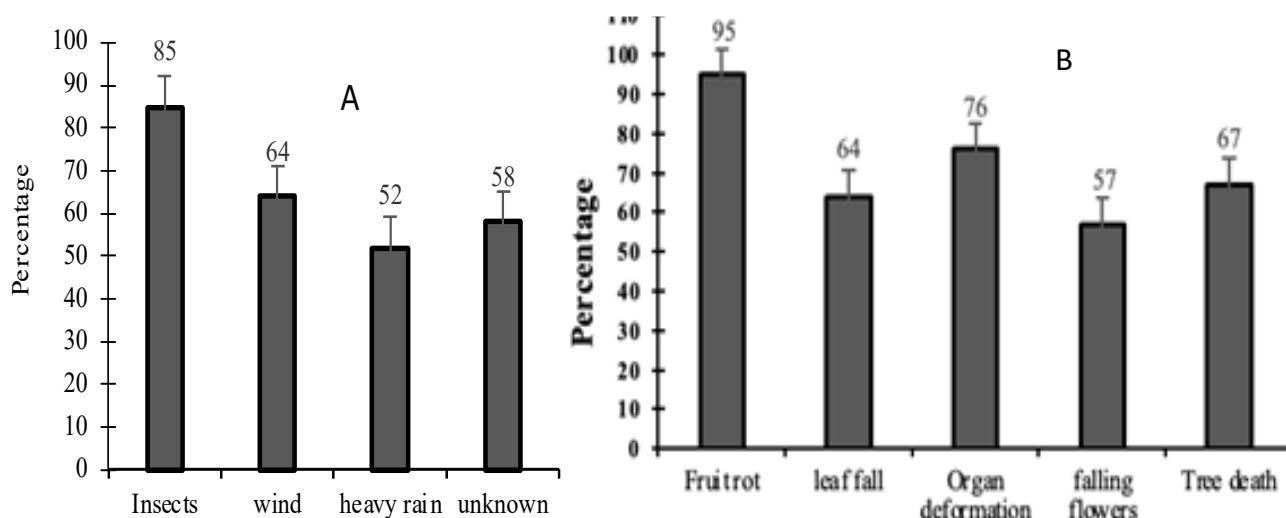


Figure 5. Causes (A) and damage (B) caused by the main diseases affecting mango trees.

gloeosporioides, remains the most widespread and damaging disease (Misra et al., 2012). Bacterial disease, caused by *Xanthomonas campestris* pv. *mangiferaeindicae* (Maiga et al., 2022), and dieback, often confused with abiotic stress, are even less well identified (Dianda et al., 2018; Dianda et al., 2023). The adoption of digital diagnostic tools could significantly improve the recognition and management of these diseases.

Main causes of damage to orchards according to producers

Insects are the most common cause of reported damage ($\approx 87\%$), followed by wind ($\approx 65\%$). The predominance of insects confirms the results in Figure 4 and highlights the need to strengthen integrated pest management strategies. Heavy rain ($\approx 53\%$) and unknown causes ($\approx 59\%$) also account for a significant proportion (Figure 5A). Fruit rot is the most common type of damage ($\approx 96\%$), directly linked to fruit fly attacks. Other types of damage include organ deformation ($\approx 78\%$), tree death ($\approx 68\%$), leaf fall ($\approx 66\%$) and flower fall ($\approx 64\%$). This diversity of damage reflects multiple impacts, affecting both the quality, quantity and longevity of production (Figure 5B).

Detection of symptoms

Visual observations are the predominant approach, used by approximately 98% of respondents, while field surveys are carried out by approximately 65% (Figure 6). The predominance of visual observations (98%) reflects a preference for methods that are quick, inexpensive and

directly applicable in the field, although their subjectivity may limit the accuracy of the diagnosis (Aljawasim et al., 2023).

Control techniques used by producers

Analysis of control techniques reveals a clear predominance of preventive approaches ($\approx 82\%$), followed by integrated pest management ($\approx 42\%$), while biological control ($\approx 28\%$) and chemical control ($\approx 25\%$) remain little used (Figure 7). The control strategies observed are mainly based on prevention (82%), through cultural practices such as weeding, pruning, and removal of infected parts, which reduce humidity and limit the spread of pathogens (Normand et al., 2011; Drabo et al., 2024). Biological control (28%) and integrated pest management (42%) are still marginal, despite their proven potential (Hassel, 2020). The preference for prevention reflects a desire to limit health and environmental risks but also highlights the need to strengthen the promotion and adoption of biological and integrated strategies for sustainable pest management.

Analysis of behavior in response to a plant health problem shows that most producers ($\approx 95\%$) first seek advice from their neighbors, followed by consulting plant protection product sellers ($\approx 73\%$) and taking no action at all ($\approx 81\%$). Less than half apply treatment directly (43%), while a minority use a specialized service ($\approx 12\%$) or consult documentation before treating ($\approx 5\%$) (Figure 8). The widespread use of local knowledge (95%) and resource sellers (73%), rather than technical agents (12%), leads to an increased risk of misdiagnosis and inappropriate use of treatments (Gouda et al., 2018). This predominance of informal exchanges and the lack of use of reliable sources of information reflects the low

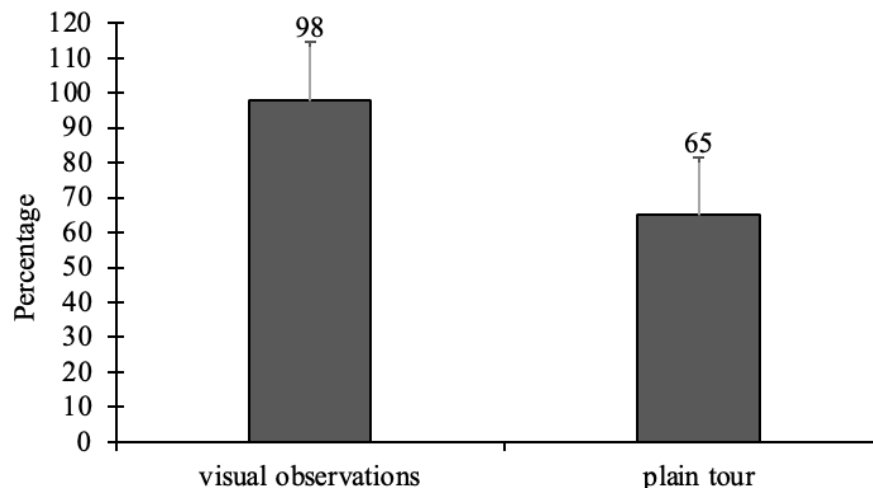


Figure 6. Diagnostic techniques are commonly used by producers.

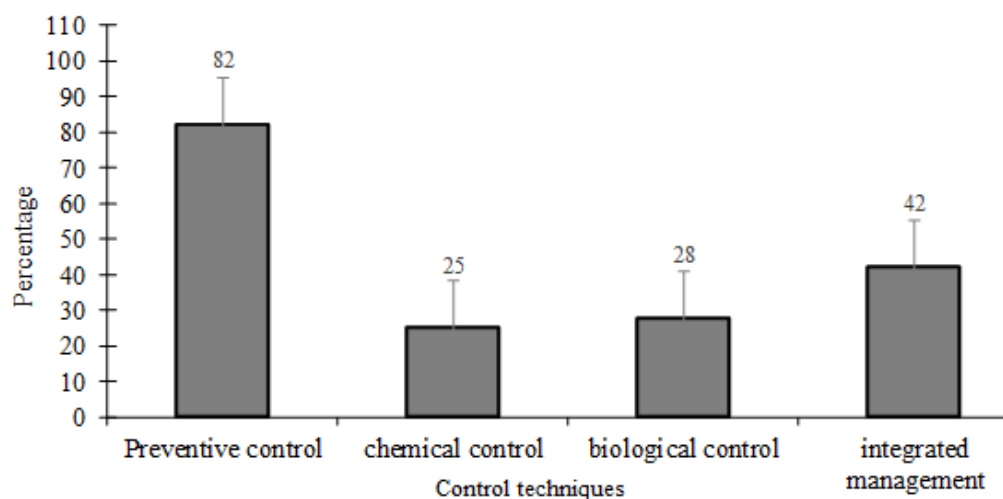


Figure 7. Control techniques commonly used by producers.

integration of specialized technical advice into the decision-making process, which could limit the effectiveness and sustainability of phytosanitary interventions.

Symptoms of the three main diseases found in orchards

Surveys conducted in orchards in the four provinces studied revealed symptoms of three diseases (anthracnose, bacterial canker, and dieback). The symptoms mainly affect the leaves, fruit, branches, and the entire tree. For anthracnose, we observed small black or dark brown spots on the leaves, which develop into necrosis and cause premature leaf fall (Dembele et al.,

2020; Dofuor et al., 2023). On the fruit, we observed slightly sunken black spots that form necrotic lesions (Figure 9) (Bougoum et al., 2023).

In terms of bacterial disease, the leaves show small, irregularly shaped translucent oily spots, developing between the secondary veins. At an advanced stage, these spots can perforate the leaf blade (Zombré, 2016). On the fruit, we observed the appearance of small, star-shaped, oily blackish lesions, developing into a cracked appearance, sometimes accompanied by a yellowish bacterial exudate (Figure 10) (Maiga et al., 2022). The decline is characterized by sudden wilting of the foliage, followed by browning of the leaves, which remain attached to the dead branches (Dianda et al., 2023). Depending on the coverage rate, we observed cases of



Figure 8. Attitudes of producers in cases where diseases are not identified.

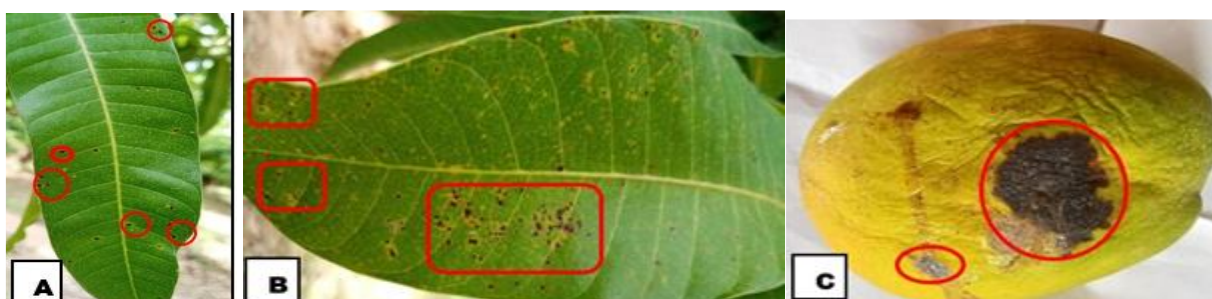


Figure 9. Symptoms of anthracnose in Toussiana in Houet: (A) Appearance of irregularly shaped black spots, (B) Growth and enlargement of black spots and leaf necrosis, (C) On fruit; slightly sunken black spots developing into necrotic lesions.

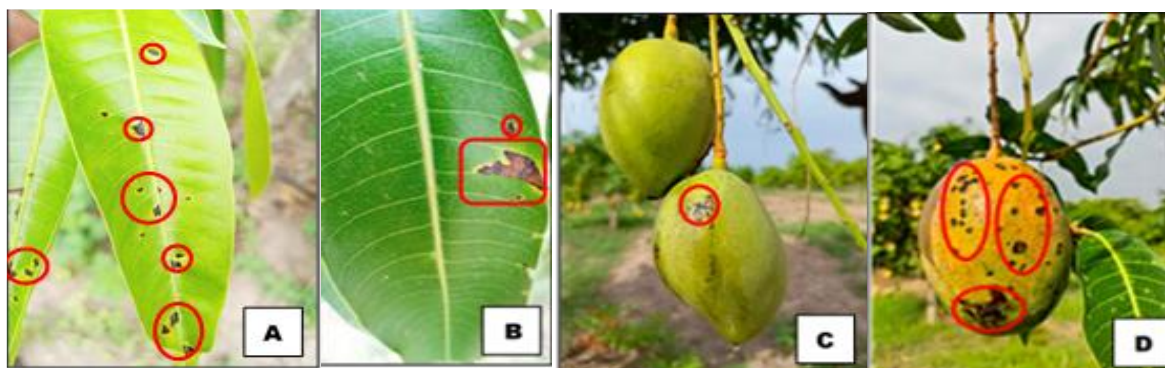


Figure 10. Symptoms of bacterial disease in Diarabakoko in Comoé: (A) Translucent oily spots turn brownish, bordered by yellow halos, (B) Advanced stage of spots leading to perforation of the leaf blade, (C) Small blackish star-shaped oily lesions, (D) Increase in spots and development of a cracked appearance, accompanied by exudate.

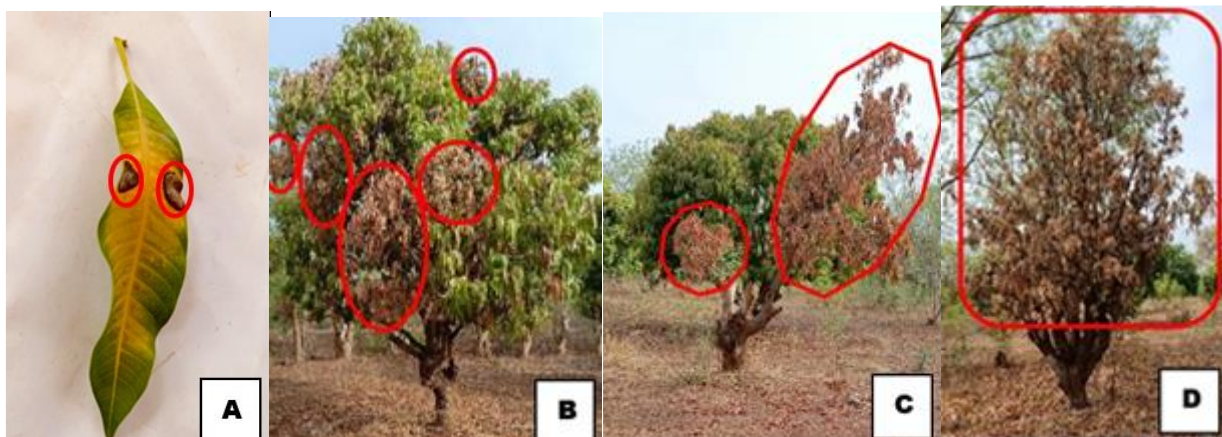


Figure 11. Symptoms of dieback in Kourinion, Kénédougou: (A) Browning and necrosis of leaves, (B) and (C) partial dieback, (D): total dieback.

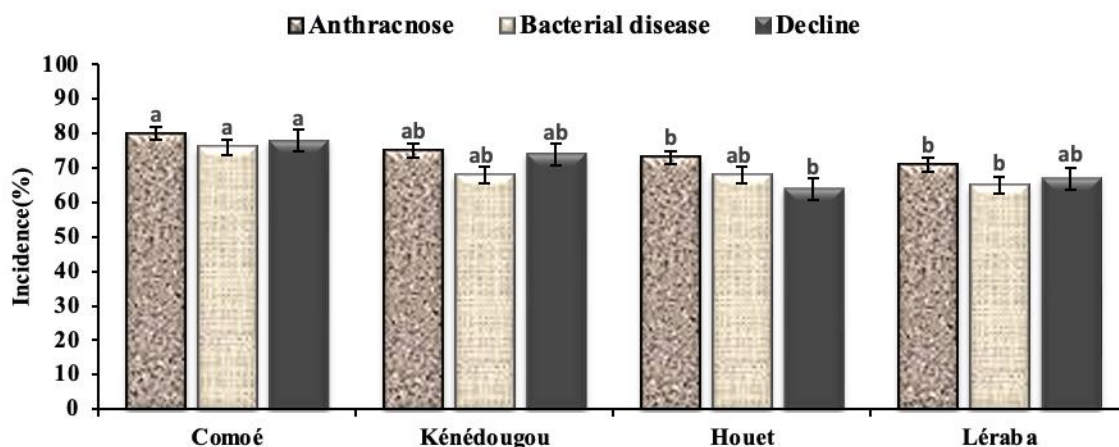


Figure 12. Average incidence rates of diseases by province.

partial dieback (10 to 90%) and total dieback (100%) (Figure 11). As for the fruits themselves, although they are less directly affected, they may abort or show reduced growth due to the deterioration of the nourishing tissues.

Incidence and severity of mango tree diseases by province

The incidence of the main mango tree diseases varies significantly between the provinces surveyed. In Comoé, the highest incidence rates are observed for anthracnose (80%), bacterial disease (78%) and dieback (78%), with no statistically significant difference between them ($p > 0.05$). In Kénédougou, incidence remains high for anthracnose (75%) and dieback (73%), slightly lower for bacterial disease (68%), but the differences are not

significant ($p > 0.05$). In contrast, in Houet and Léraba, incidence rates are lower overall, with anthracnose predominating (72 and 70% respectively) and lower values for dieback (63 and 67%) (Figure 12). The indicative letters show that the provinces of Comoé and Kénédougou have significantly higher incidence levels than Houet and Léraba for anthracnose, while for bacterial blight and dieback, the differences between provinces are less marked. These results suggest a heterogeneous distribution of diseases, probably linked to agroclimatic conditions and specific farming practices in each province (Dianda et al., 2023).

The severity of the main diseases affecting mango trees varies significantly between provinces and between types of disease (Figure 13). In Houet province, anthracnose has the highest severity (52%), followed by dieback (50%), while bacterial blight is significantly less severe (31%). In Comoé, bacterial disease reaches 44%,

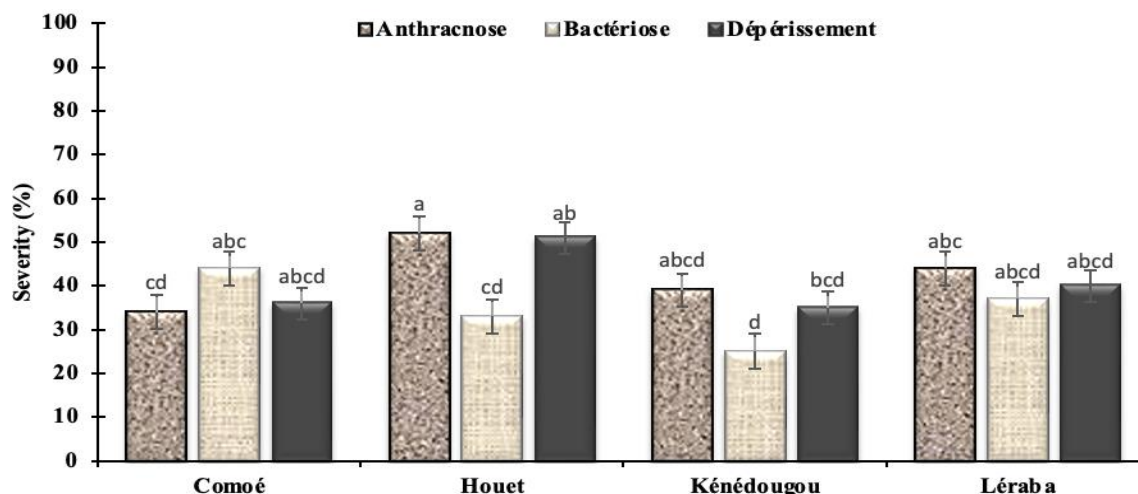


Figure 13. Average disease severity rates by province.

which is higher than dieback (36%) and anthracnose (34%), with no significant statistical difference between the latter two. In Kénédougou, severity levels are generally lower, with a maximum observed for anthracnose (39%) and a minimum for bacterial disease (26%). Finally, in Léraba, severity is at intermediate levels, with 44% for anthracnose, 38% for bacterial blight, and 40% for dieback. The indicative letters confirm that anthracnose in Houet is significantly more severe than bacterial disease in the same province and then bacterial disease in Kénédougou. These variations suggest that disease intensity is influenced by both the nature of the pathogen and the agroecological conditions specific to each province. Epidemiological results confirm a worrying health situation, with incidence rates above 50% and severity rates exceeding 30%.

Anthracnose is ubiquitous (71 to 80% incidence), with particularly high severity in Houet (52%) and Léraba (44%), corroborating the observations of Bougoum et al. (2023) and (Dembele et al., 2020). Bacterial disease has high incidence rates in Comoé (76%) and Léraba (65%), with maximum severity in areas with high humidity (Koffi et al., 2021; ANAM, 2024). The incidence of dieback is rising sharply, reaching 64 to 78% and severity levels of up to 51% in Houet, favored by hot and dry conditions (Dianda et al., 2018; ANAM, 2024). The combination of high incidence and severity underscores the urgent need to strengthen epidemiological surveillance, professionalize producer training, and promote rapid diagnostic technologies to limit losses and improve the competitiveness of the mango sector.

Conclusion

Mango production in Burkina Faso is significantly constrained by anthracnose, bacterial blight, and dieback,

while farmers' understanding of the epidemiology and management of these diseases remains limited. Enhancing the technical capacities of producers is crucial for effective phytosanitary management. Moreover, automatic disease detection models are currently being evaluated to identify the most effective ones. These models will be deployed on mobile applications or web platforms to facilitate the diagnosis of the main mango diseases in Burkina Faso.

CONFLICT OF INTERESTS

The authors have not declared any conflicts of interest.

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