Original Research Article

Role of Medicinal Herbs in Sustaining Begomovirus Populations in Burkina Faso: Therapeutic Implications and Ecological Insights

ABSTRACT

Medicinal herbs occupy an important place in the treatment of diseases in Burkina Faso. However, they live near crops which are strongly impacted by diseases with typical symptoms of begomovirus infection.These medicinal herbs may host these viruses, highlighting the need for further study. The purpose of this study was to inventory the medicinal herbs hosts of begomovirus. For this, a survey carried out among the elderly using semi-structured interviews based on a questionnaire. Thisallowed to inventory a wide diversity of herbs used in the treatment of diseases with *Heliotropium indicum* and *Euphorbia hirta* being the most cited with use values of 0.38 and 0.47, respectively. A complex network of sicknesses-herbs association was observed with some herbs used for the treatment of several sicknesses. A second survey was conducted in several localities in Burkina Faso and symptomatic plants were collected for analysis based on polymerization chain reaction to detect begomoviruses. In addition to the survey findings, our results indicate a significant diversity of medicinal herbs that hostbegomoviruses including the pepper yellow vein Mali virus, the tomato leaf curl Ghana virus and the cotton leaf curl Gezira virus. These results highlight the role of medicinal herbs in maintaining begomovirus populations in Burkina Faso and more largely in the word. It is therefore necessary to take medicinal plants into account in the epidemiological surveillance of plant infecting virus.

Keywords: Begomovirus, Plants host species, Virus epidemiology, Sickness.

1. INTRODUCTION

To defend against any parasitic attack, humans call on their internal defense systems daily, particularly their arsenal of immune cells. Most often, this arsenal needs to be supplemented with drugs from the pharmaceutical industry or medicinal herbs. Plant resources occupy a large place in human life with 50,000 to 70,000 plant species which are recognized worldwide for their medicinal properties. Indeed, since prehistoric times, plants have been one of the components of the environment most sought after by human beings to treat their sickness. Since then, interest in plants in medicine has continued to grow. A huge number of medicines are derived from plants which remain an inexhaustible medicinal source for humans [1]. According to the World Health Organization [2], more than 80% of the world's population uses medicinal plants for treatment. In Burkina Faso, statistics from the Ministry

of Public Health [3] indicate that nearly 70% of the population uses these practices and the very remarkable presence of traditional therapists in the cities and countryside is proof of this. The importance of medicinal plants in Burkina Faso is undeniable with a large diversity of plants used [4,5].

However, these plants are subject to uncontrolled destruction by anthropic activities. In addition, there is parasitic aggression including plants-infecting viruses. Increasingly, we are witnessing the emergence of new viral diseases on crops and wild plants, which pose a real threat to food security and human health. These emerging diseases include those induced by begomoviruses (Family: *Geminivirideae*) transmitted by invasive populations of their whitefly vector *Bemisiatabaci*. Losses in food crops can reach 100% when infection occurs early during plant development [6]. Begomovirus genomes consist of one (monopartite begomoviruses) or two (bipartite begomoviruses) single-stranded circular DNA (ssDNA) components of 2.7 kb that conjointly encode four to eight proteins involved in viral replication, movement, transmission and pathogenesis [7]. These viruses commonly infect plants belonging to the families Cucurbitaceae, Fabaceae, Malvaceae, Euphorbiaceae and Solanaceae causing symptoms of yellowing, yellow mosaic, stunted growth, dwarfism, chlorotic spots and leaf curl [8–10]. A complex of at least five begomovirus has been reported to be responsible for damage in vegetable crops. This includes the tomato leaf curl Mali virus (ToLCMLV), the tomato leaf curl Ghana virus (ToLCGHV), the cotton leaf curl Gezira virus (CLCuGeV) and the most prevalent virus called pepper yellow vein Mali virus (PepYVMLV) [10]. Weeds, especially medicinal herbs, that grow near host crops sometimes show similar symptoms [11]. However, the role of these weeds in maintaining and spreading begomoviruses remains poorly known [12]. Very few studies have been carried out on viruses infecting medicinal plants in Burkina Faso. This justifies the need to make an inventory of medicinal plants in maintaining the begomovirus population in Burkina Faso. The general objective of this study is to contribute to a better knowledge of medicinal plants that are part of the host range of begomoviruses in Burkina Faso.

2. MATERIAL AND METHODS

2.1. Surveys and medicinal herbs inventory

Surveys were conducted in June to December 2022 in the sub-humid Sudan-Sahel zone (annual rainfall between 600 and 900 mm) of Burkina Faso. Ninety women were randomly interviewed using semi-structured interviews based on a questionnaire [13]. They were all at least 45 years old and were from Bobo Dioulasso (11.18°N, 4,28°W), Ouagadougou (12.363°N, 1.518°W) and localities around Ouagadougou (Loumbila, 12.517°N, 1.385°W; Tabtenga, 12.575 N, 1,467 W). The interviews investigated the herbs used to cure sickness in Burkina Faso. The questions were asked mainly in the local language (Moore and Dioula).

2.2. Surveys and sample collection

A second survey was conducted around vegetable fields in 17 provinces (Figure 1) in the humid Sudan zone (annual rainfall between 900 and 1100 mm), the sub-humid Sudan-Sahel zone (annual rainfall between 600 and 900 mm) and the dry Sahel zone (annual rainfall between 400 and 600 mm)) of Burkina Faso [10]. These provinces are known to be hot spots for begomovirus. Herbs with typical symptoms of begomovirus infection were identified in the fields and then pictured and leaf samples were collected in envelopes with the name and the geographical coordinates (latitude, longitude) of the locality. All samples were dried in the oven at 50 °C for 72 h.

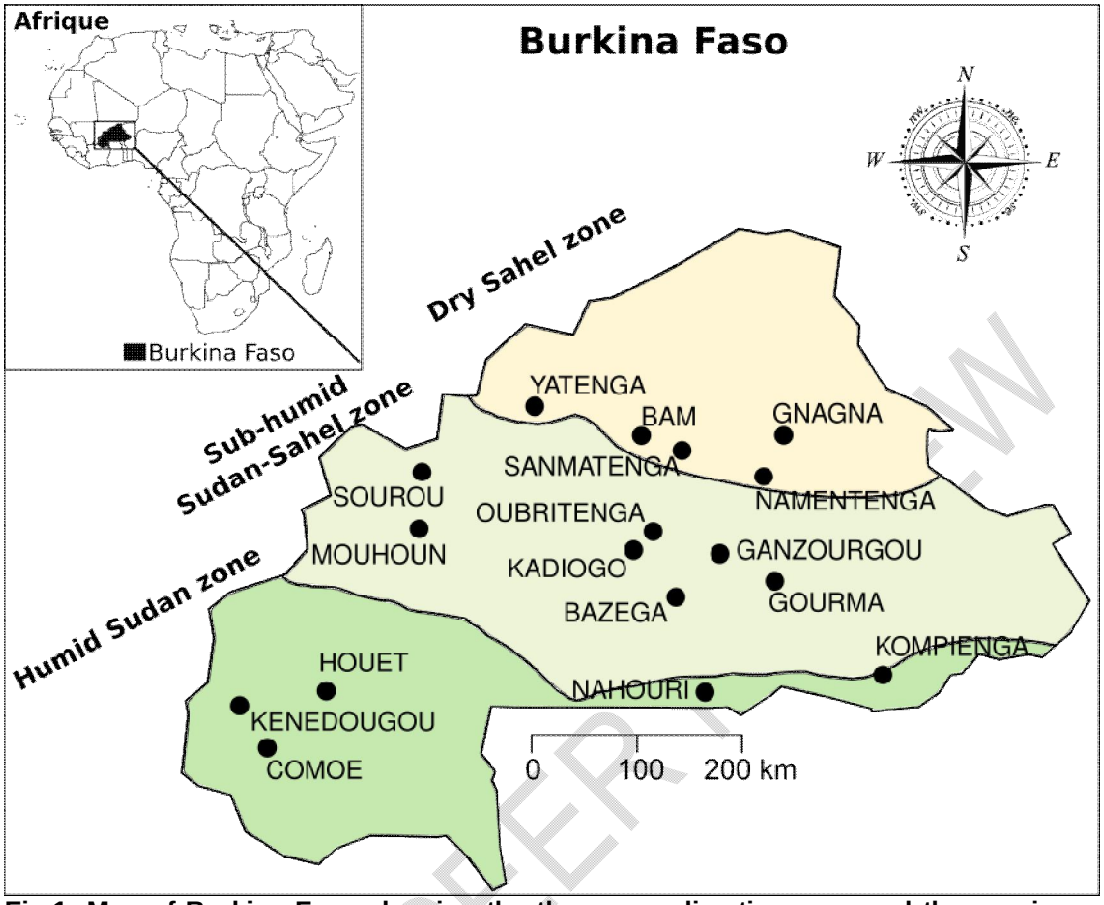

Fig.1: Map of Burkina Faso showing the three agroclimatic zones and the provinces from which leaf samples of medicinal herbs were taken.

2.3. Plant species identification

Herbaria were created for the identification of plant species; the specimens were compared to those in the herbarium of the Université Joseph KI-ZERBO (Ouagadougou). The scientific identification of the species recorded was carried out on the basis of the catalog of vascular plants of Burkina Faso [14] and the floristic lexicon proposed by [15]. The nomenclature adopted is that of the catalog of vascular plants of Burkina Faso [16] as described in earlier [4].

2.4. Virus detection using polymerase chain reaction

Total DNA was extracted from 20 mg of collected leaf samples using the adapted cetyl trimethylammonium bromide method as described elsewhere [11]. The resulting DNA was stored at -20°C before use. Sets of primer pairs were used for the specific detection of begomovirus DNA-A-like components (Table 1). PCR was carried out in 25 µL volumes containing 5 µL of 5× buffer, 2.5 µL of deoxynucleotide triphosphates (2 mM), 1.5 µL of MgCl2 (25 mM), 1 µL of forward and reverse primers (10 mM), and 1 U of GoTaq Flexi DNA polymerase (Promega). After an initial denaturation of 5 minutes at 94°C, 30 cycles consisting of 30 seconds at 94°C, 30 seconds at 50-62°C (according to primers used), and 1 minute at 72°C were conducted, followed by a final elongation step for 5 minutes at 72°C. Amplicons were checked by electrophoresis on 1% agarose gels as described elsewhere [17].

Table 1: Primers used to amplify begomoviruses

Primer	Primer sequence (5'– 3')	Amplicon size (bp)	Hybridation temperature (°C)	Targeted molecule
Cluter4 F342	TATMATCATTTCCACBCCVG	~690	50	Begomovirus
Cluster4 R1032	GCATGAGTACATGCCATATAC			DNA-A like
PepYVMLV-A-F	GCTCTTGAGTGCGTAATTC	559	55	PepYVMLV
PepYVMLV-A-R	ATGCAGATTCCGCTGAAG			DNA-A
PepYVMLV-B-F	GAGATCCAGACAGGTACTG	1290	57	PepYVMLV
PepYVMLV-B-R	GTCGACCTTCACTACTTCTC			DNA-B
ToLCGHV-F	CACTCTTGGTCACGATCTG	595	62	ToLCGHV
ToLCGHV-R	CACTTGATAACGGTCTCTG			DNA-A like
ToLCMLV-F	TGTCATGTTCTACTTGGTC	652	62	ToLCMLV
ToLCMLV-R	GAACCACGACATGATATCAG			DNA-A like

2.5. Data analysis

All statistical analyses were performed using the R v.4.6.2 [18] statistical software. Based on the local therapeutic importance of each herb species, the relative frequency of citation (RFC) was calculated as the percentage of species cited by an informant among all citations of species [4]. To interpret the ethnobotanical value of herbs, the Use Agreement Value index (UAV) combining the estimates of the medicinal Use Value index (UVs) of each species s and the Confirmation or Consensus index (CIs) was used. UAVs = UVs × CIs.

UVs were calculated as the ratio between the number of uses of a species mentioned by an informant and the number of people who cited this species. CIs were the ratio including the number of people who cited a given species and the total number of people interviewed [4,19–21].

The virus infection rates were calculated as the percentage of herbs with positive PCR results among all collected herbs per species. Citation frequency and virus infection rates differences between species were then examined using the chi-square test based on a contingency table containing the collected data.

Structure of herbs-disease association

Contingency matrices of numbers of positive samples to each viral species were used for community structure analysis. Bipartite networks were constructed and visualized using the igraph R package [22]. Interaction matrix featuring modules were generated using the R bipartite package [23].

3. RESULTS AND DISCUSSION

3.1. RESULTS

3.1.1. High participation rate and good knowledge of medicinal herbs

Out of a total of 90 people interviewed in the sub-humid Sudan-Sahel zone of Burkina Faso, 84 agreed to answer the questionnaire, representing a participation rate of 93%. A total of 25 medicinal herb species divided into 22 genera and 14 families have been cited by the informants. Amaranthaceae (four species) and Malvaceae (four species) were the families for which a greater diversity of species was reported by the informants (Table 2), while the great citation rates were obtained with the families Boraginaceae (10.63%) and Euphorbiaceae (13.29%). The Boraginaceae family included only one species

(*Heliotropiumindicum*) whereas the Euphorbiaceae family contained two Euphorbia species (*E. hirta* and *E. prostrata*). Comparison analysis showed that *Heliotropium indicum* and *Euphorbia hirta* were most used for sickness treatment than the other herb species with high significance ($p \leq 0{,}002$). The highest usage agreement values (UAVs) were also obtained with these two species (*Heliotropium indicum*, 0.38*; Euphorbia hirta* 0.47) (Table 2). In contrast, *Trianthemaportulacastrum* (UAVs = 0.04) and *Carallumaadscendens* (UAVs = 0.04) were less cited by informants as medicinal herbs than the others with significant difference ($p < 0.001$) excepted three (*Corchorus olitorius*, *Cleome gynandra* and *Eleusine indica*; $p \geq 0.289$) and two (*Sida acuta* and *Waltheria indica*; $p = 0.314$) species for which no significant difference were observed. Other analysis showed positive linear relationships between the RFC and UAVs ($y=0.001x+0.035$; $R=1$) (Figure 2). The preparation of phytotherapeutic recipes involves fruits, leaves, leafy stems, seeds bark, roots and/or whole plant. Leaves were the most used part of plant in this study while barks associated with roots were less used with citation rates of 33.89% (102/301) and 01.00% (03/301) (Figure 3A).

Table 2:Relative frequency of citation (RFC) and Use Agreement Value index (UAV) of medicinal herbs species

Plant family	Plant genera	Plant species	RFC [ncs/NCS]	UAVs [UV X CI]
Aizoaceae	*Trianthema*	*Trianthemaportulacastrum*	1% [3/301]	0.04 [1 X 0.04]
Amaranthaceae	*Alternanthera*	*Alternanthera caracasana*	1.99% [6/301]	0.07 [1 X 0.07]
Amaranthaceae	*Amaranthus*	*Amaranthus hybridis*	1.99% [6/301]	0.07 [1 X 0.07]
Amaranthaceae	*Amaranthus*	*Amaranthus spinosus*	3.32% [10/301]	0.12 [1.11 X 0.11]
Amaranthaceae	*Amaranthus*	*Amaranthus viridis*	3.99% [12/301]	0.14 [1 X 0.14]
Apocynaceae	*Caralluma*	*Carallumaadscendens*	1% [3/301]	0.04 [1 X 0.04]
Asteraceae	*Acanthospermum*	*Acanthospermumhispidum*	1.99% [6/301]	0.07 [1.2 X 0.06]
Asteraceae	*Ageratum*	*Ageratum conyzoides*	1.99% [6/301]	0.07 [1 X 0.07]
Boraginaceae	*Heliotropium*	*Heliotropium indicum*	10.63% [32/301]	0.38 [1 X 0.38]
Capparaceae	*Cleome*	*Cleome gynandra*	2.99% [9/301]	0.11 [1 X 0.11]
Convolvulaceae	*Merremia*	*Merremia tridentata*	1.99% [6/301]	0.07 [1 X 0.07]
Euphorbiaceae	*Euphorbia*	*Euphorbia hirta*	13.29% [40/301]	0.47 [1.21 X 0.39]
Euphorbiaceae	*Euphorbia*	*Euphorbia prostrata*	3.99% [12/301]	0.14 [1 X 0.14]
Lamiaceae	*Hyptis*	*Hyptisspicigera*	2.99% [9/301]	0.11 [1 X 0.11]
Lamiaceae	*Ocimum*	*Ocimum americanum*	6.64% [20/301]	0.23 [1.11 X 0.21]
Malvaceae	*Abelmoschus*	*Abelmoschus esculentus*	3.65% [11/301]	0.13 [1 X 0.13]
Malvaceae	*Corchorus*	*Corchorus olitorius*	2.99% [9/301]	0.11 [1 X 0.11]
Malvaceae	*Sida*	*Sida acuta*	1.99% [6/301]	0.07 [1 X 0.07]
Malvaceae	*Waltheria*	*Waltheria indica*	1.99% [6/301]	0.07 [1 X 0.07]
Nyctaginaceae	*Boerhavia*	*Boerhaviaerecta*	1.99% [6/301]	0.07 [1 X 0.07]
Poaceae	*Eleusine*	*Eleusine indica*	1.99% [6/301]	0.07 [1 X 0.07]
Rubiaceae	*Mitracarpus*	*Mitracarpusscaber*	7.31% [22/301]	0.26 [1 X 0.26]
Solanaceae	*Capsicum*	*Capsicum frutescens*	7.64% [23/301]	0.27 [1 X 0.27]
Solanaceae	*Nicotiana*	*Nicotiana tabacum*	4.65% [14/301]	0.17 [1 X 0.17]
Solanaceae	*Physalis*	*Physalis ixocarpa*	5.98% [18/301]	0.21 [1.06 X 0.2]

ncs/NCS = number of a species cited/ all citations of species
UV × CI = estimates of the medicinal Use Value index/ Confirmation or Consensus index

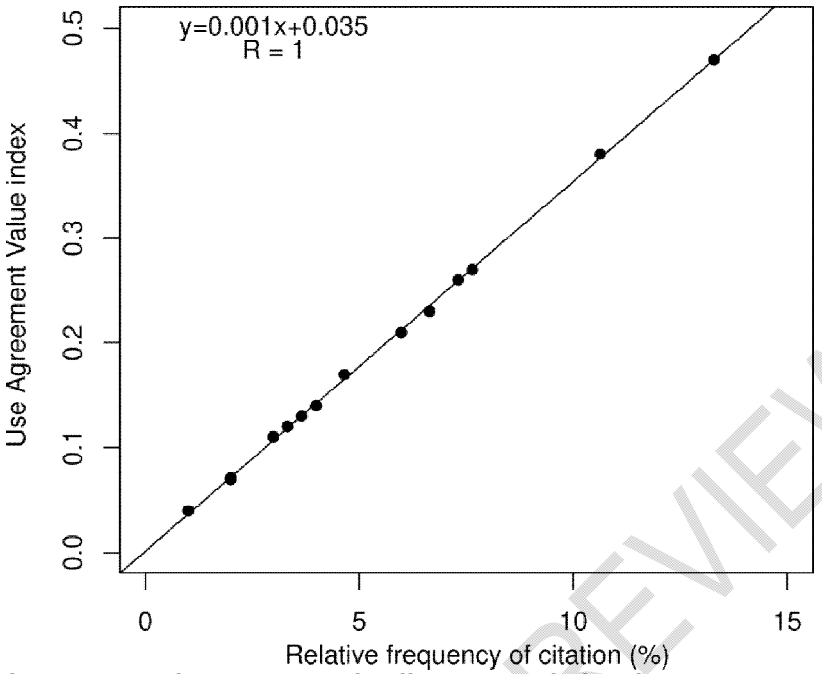

Fig.2: The bottom panels represent the linear correlation between Use Agreement Value index and Relative frequency of citations.

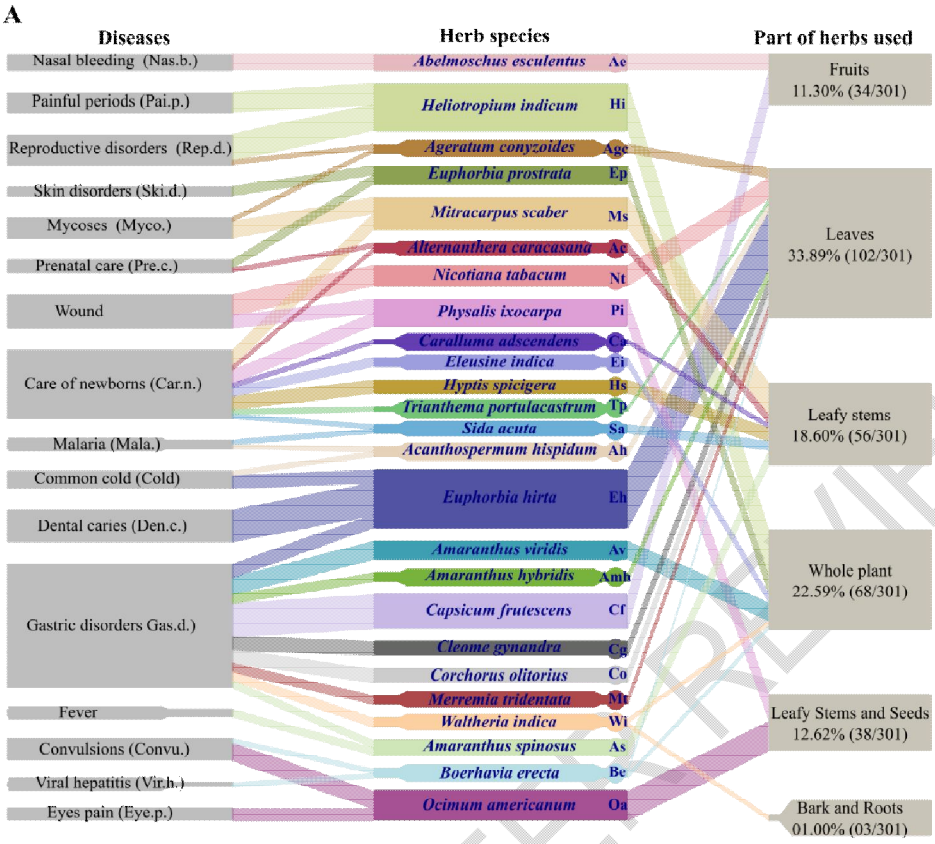

Fig.3: Multipartite graphs representing the interactions between medicinal herbs and illnesses in Burkina Faso. **(A)** Tripartite interaction graph representing the association between illnesses (left side of the diagram), herb species for the treatment of illnesses (middle side of the diagram) and the parts of herbs used for illnesses treatment (right side of the diagram) with the size of the boxes and links proportional to the number of citations by informants. Links are colored according to the herb species. **(B)** Bipartite graph representing the comity structure of herb species used in Burkina Faso for illnesses treatment. Square nodes represent human illnesses. Circular nodes represent herb species.

3.1.2. Various sicknesses treated with herbs and complex network of sicknesses-herbs association

The analysis of interview data showed that informants use herbs in the treatment of 16 sicknesses. Among these sicknesses, gastric disorders are the most cited, followed by maintenance care for newborns. Then come sicknesses like wounds, reproductive disorders, and tooth decay (Figure 3A).

Based on a matrix built using interview data, a network was constructed. In this network, each node represents a medicinal herb species and each link shows the connection between sicknesses treated with the same herb species (Figure 3B). The analysis revealed that the network appeared as extremely modular with an interconnection including most herbs (22/25). The network included an isolated group and a singleton. The isolated group involved *Boerhaviaerecta* and *Ocimum americanum* connecting viral hepatitis, convulsions and eye pain. The singleton was represented as nasal bleeding treated with *Abelmoschusesculentus*. Taken together, the cited sicknesses were treated with the largest diversity of plant. For example, gastric disorder was treated with nine species (*Amaranthus hybridis*, *Amaranthus spinosus*, *Amaranthus viridis*, *Capsicum frutescens*, *Cleome gynandra*, *Corchorus olitorius*, *Euphorbia hirta* ,*Merremia tridentata* and *Waltheria indica*).

3.1.3. Frequency of virus-like symptoms in medicinal herbs

During surveys conducted around vegetable fields in several localities in Burkina Faso, 56% (14/25) of herbs cited by informants were identified with geminivirus-like symptoms (Figure 4). Theses herb species belonged to twelve and nine out of the 22 genera (54.54%) and 14 families (64.29%) mentioned by informants, respectively (Figure 4). A total of 293 samples were collected from herbs with typical begomovirus-induced-symtpoms. Highest frequencies were obtained with *Capsicum frutescens* (21.16% [62/293]), *Sida acuta* (17.06% [50/293]), *Amaranthus viridis* (13.31% [39/293]), *Euphorbia hirta* (11.26% [33/293]) and *Boerhaviaerecta*(11.26% [33/293]) with disease rates higher than 10% (Figure 4). Symptoms were leaf curling, leaf yellowing, leaf distortion, leaf crumpling and stunting of leaves or whole plant (Figure 5).

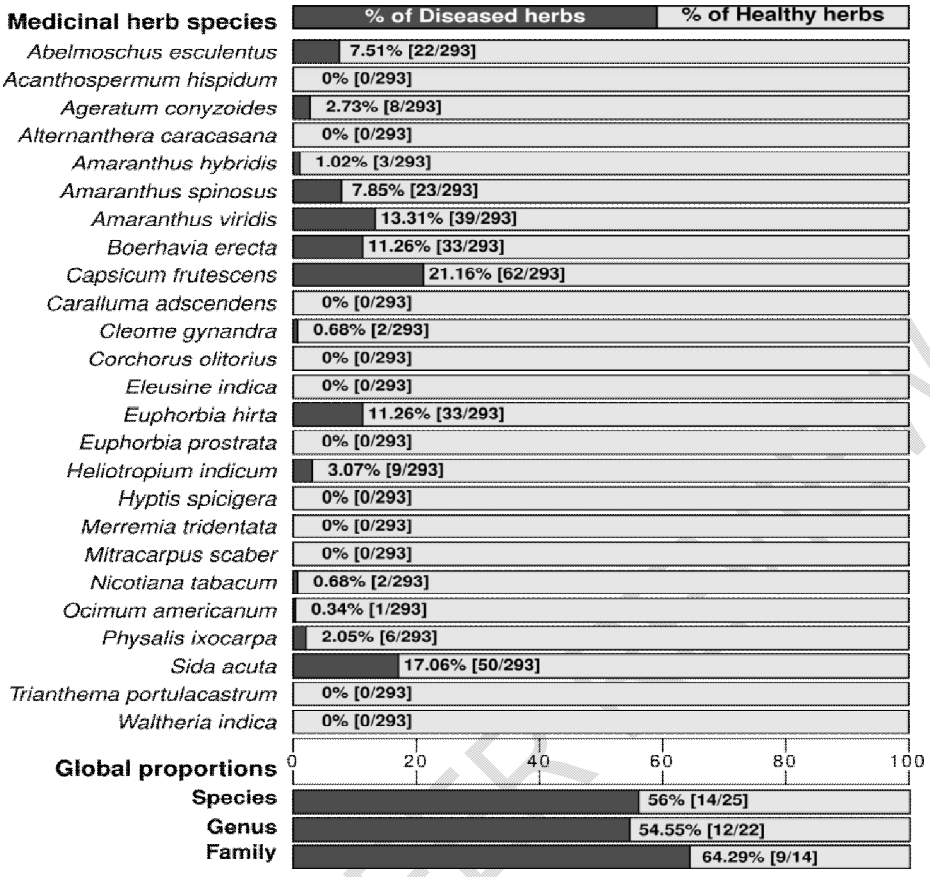

Fig.4: Proportions of diseases for each herb species and global proportions of diseased herbs species, genus and family. Histogram colors refer to the disease-like status such as positive (in dark grey) and negative (in grey). The frequencies of diseased samples for each species are indicated in the cell on the right with the number of diseased and non-diseased plants in the brackets.

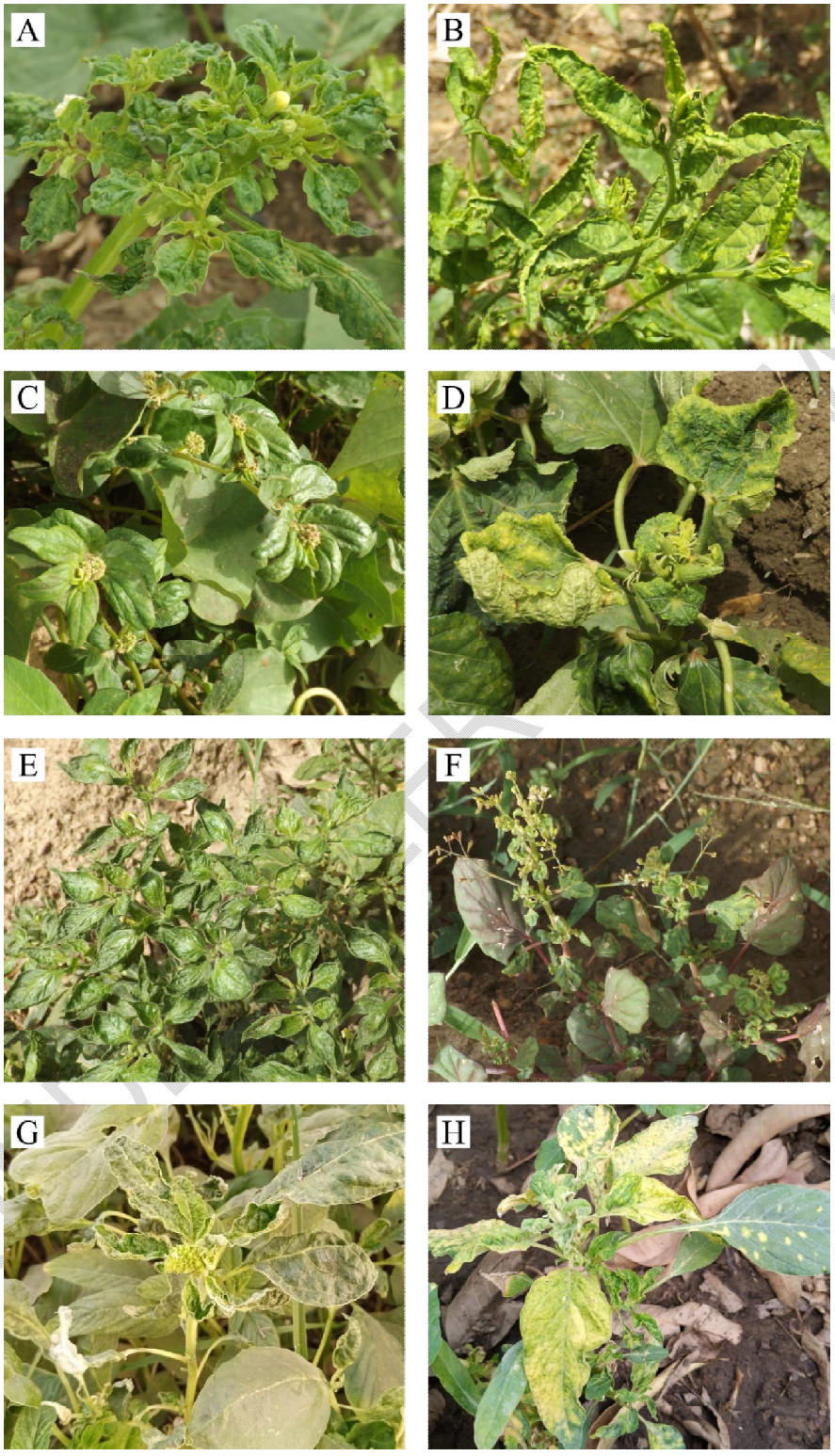

Fig.5: Typical begomoviruses induced-symptoms observed on medicinal herbs in Burkina Faso. (A) Symptoms of distortion and crumpling of *Physalis ixocarpa* leaves with

yellowing, **(B)** Typical symptoms of leaf up-curling of *Sida acuta*,**(C)** Typical symptoms of leaf down-curling of *Hephorbiahirta*,**(D)** Typical symptoms of leaf up-curling and yellowing of *Abelmoschus esculentus*,**(E)** Typical symptoms of leaf up-curling of *Capsicum frutescens*,**(F)** Typical symptoms of leaf curling and stunting of *Boerhaviaerecta*,**(G)** Symptoms of distortion, crumpling and up-curling of *Amaranthus hybridis* and **(H)** Symptoms of yellowing and leaf distortion of *Amaranthus viridis*.

3.1.4. Diversity of begomovirus

The molecular diagnosis using the 293 samples collected around vegetable crops made it possible to confirm the presence of the most prevalent begomoviruses infecting vegetable crops in Burkina Faso except for tomato leaf curl Mali virus. The global infection rate was 31.06% [91/293] and begomovirus detected were the cotton leaf curl Gezira virus (CLCuGeV, 16.04% [47/293]), the pepper yellow vein Mali virus (PepYVMLV, 13.65-14.33% [40-42/293]) and the tomato leaf curl Ghana virus (ToLCGHV, 0.68 [2/293]) (Table 3). Analyses showed that the highest rate of infection was obtained with *Nicotiana tabacum* (100% [2/2]) followed by *Sida acuta* (66% [33/50]), *Amaranthus hybridis* (66.67% [2/3]), *Abelmoschus esculentus* (59.09% [13/22]). The CLCuGeV and the PepYVMLV and the ToLCGHV were all detected from *Boerhaviaerecta* samples while the global rates of infection of this medicinal herb was 24.24% [8/33] (Table 3).

Table 3: Assessment of begomovirus content (%) of 293 symptomatic medicinal herb samples collected in 17 provinces in Burkina Faso.

Plant family	Plant genera	Plant species	Percentage of plants infected by:					Global infection rates (%)
			CLCuGeV	PepYMLVA	PepYMLVB	ToLCMLV	ToLCGHV	
Amaranthaceae	Amaranthus	*Amaranthushybridis*	0 [0/3]	33.33 [1/3]	66.67 [2/3]	0 [0/3]	0 [0/3]	66.67 [2/3]
Amaranthaceae	Amaranthus	*Amaranthusspinosus*	0 [0/23]	4.35 [1/23]	4.35 [1/23]	0 [0/23]	0 [0/23]	4.35 [1/23]
Amaranthaceae	Amaranthus	*Amaranthus viridis*	0 [0/39]	2.56 [1/39]	2.56 [1/39]	0 [0/39]	0 [0/39]	2.56 [1/39]
Asteraceae	Ageratum	*Ageratum conyzoides*	0 [0/8]	0 [0/8]	0 [0/8]	0 [0/8]	12.5 [1/8]	12.5 [1/8]
Boraginaceae	Heliotropium	*Heliotropiumindicum*	0 [0/9]	0 [0/9]	0 [0/9]	0 [0/9]	0 [0/9]	0 [0/9]
Capparaceae	Cleome	*Cleomegynandra*	0 [0/2]	0 [0/2]	50 [1/2]	0 [0/2]	0 [0/2]	50 [1/2]
Euphorbiaceae	Euphorbia	*Euphorbiahirta*	0 [0/33]	0 [0/33]	0 [0/33]	0 [0/33]	0 [0/33]	0 [0/33]
Lamiaceae	Ocimum	*Ocimumamericanum*	0 [0/1]	0 [0/1]	0 [0/1]	0 [0/1]	0 [0/1]	0 [0/1]
Malvaceae	Abelmoschus	*Abelmoschusesculentus*	59.09 [13/22]	0 [0/22]	0 [0/22]	0 [0/22]	0 [0/22]	59.09 [13/22]
Malvaceae	Sida	*Sida acuta*	66 [33/50]	0 [0/50]	0 [0/50]	0 [0/50]	0 [0/50]	66 [33/50]
Nyctaginaceae	Boerhavia	*Boerhaviaerecta*	3.03 [1/33]	18.18 [6/33]	18.18 [6/33]	0 [0/33]	3.03 [1/33]	24.24 [8/33]
Solanaceae	Capsicum	*Capsicum frutescens*	0 [0/62]	46.77 [29/62]	46.77 [29/62]	0 [0/62]	0 [0/62]	46.77 [29/62]
Solanaceae	Nicotiana	*Nicotiana tabacum*	0 [0/2]	100 [2/2]	100 [2/2]	0 [0/2]	0 [0/2]	100 [2/2]
Solanaceae	Physalis	*Physalis ixocarpa*	0 [0/6]	0 [0/6]	0 [0/6]	0 [0/6]	0 [0/6]	0 [0/6]
Total			**16.04 [47/293]**	**13.65 [40/293]**	**14.33 [42/293]**	**0 [0/293]**	**0.68 [2/293]**	**31.06 [91/293]**

3.2. Discussion

The diversity of plant species obtained in this study showed high level of knowledge and use of plants by the people. Other studies carried out in Burkina Faso highlighted that people use plants for treatment of sickness [4]. These plants are used in different forms with similar applications in certain regions of Burkina Faso and in neighboring countries [4]. For example, *Capsicum frutescens* is cited in Côte d'Ivoire [11] and in the present work for the treatment of gastric disorders. The highest UAV obtained with *Euphorbia hirta* and *Heliotropium indicum* can be due to the availability, the easy recognition and the easy application of these herbs. This would also be due to their ethnomedical application for the treatment of common illnesses such as gastric disorders, common cold, painful periods, etc. Several studies have reported these herbs as plant used in traditional system of medicine [24–27]. In addition, a high UAV for a species testifies to the repeated use of this species in the locality for the treatment of a sickness, to widespread knowledge about the uses of this plant and to an exchange of information between people [21]. This result shows that these plants would be among the best known species but above all, the most effective for the treatment of certain sicknesses in Burkina Faso. The high number of uses of a widely known species in a locality for the treatment of a sickness provides information on the confidence and security that this species provides [28].

The herb-sickness association network, obtained in this study, reveals that different plants can be used for the treatment of the same sickness. Indeed, plants allow the treatment of sickness thanks to the active molecule or the active principle that they contain. These plants probably have the same active molecules or the same active ingredients. Thus, these plants would have identical secondary metabolites with the same structures and would therefore be of the same family according to the chemical taxonomic classification. Phenolic compounds, terpenoids, steroids and alkaloids are examples of secondary metabolites; they have many pharmaceutical applications. They have antioxidant, antimicrobial, anti-inflammatory and anti-cancer properties [29].

The use of PCR diagnosis enabled the detection of begomoviruses in around ten species of medicinal plants. This highlights the existence of a large range of begomovirus host plants as observed through other studies [10]. This wide range of begomovirus hosts is associated with the invasive and polyphagous nature of the vector *B. tabaci* [30]. Furthermore, symptoms suggesting begomovirus infections were observed in some of plants from which no begomovirus was detected. This proves, once again, that even if symptom constitutes a good way to suspect the involvement of a pathogen in a given disease, it is not sufficient on its own to attribute the paternity of disease to a pathogen. The detection of CLCuGeV, ToLCGHV and PepYVMLV in this study confirms the existence and maintenance of begomovirus populations in Burkina Faso [10].

Finally, the detection of begomoviruses in plants with therapeutic virtues shows their involvement in the maintenance of begomovirus populations in Burkina Faso and more largely in Africa. This study is, of course, a first in Burkina Faso, but a similar study was conducted in Côte d'Ivoire [11].

4. CONCLUSION

The objective of the present study was to contribute to a better knowledge of medicinal plants that are part of the host range of begomoviruses. It emerges from this study that 25 herb species are known and used for various treatments of sicknesses by the population living in Burkina Faso. The diagnosis made it possible to identify the medicinal herbs which are part of the host range of begomoviruses in Burkina Faso. These results constitute useful sources of information for better understanding of begomovirusepidemiology. It would therefore be necessary to continue epidemiological surveillance work for better knowledge of viral diversity and the host range of these viruses.

CONSENT

Not applicable.

ETHICAL APPROVAL

Not applicable.

Disclaimer (Artificial intelligence)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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DEFINITIONS, ACRONYMS, ABBREVIATIONS

CIs: Confirmation or Consensus index
CLCuGeV: cotton leaf curl Gezira virus
PepYVMLV: pepper yellow vein Mali virus
ToLCGHV: tomato leaf curl Ghana virus
ToLCMLV: tomato leaf curl Mali virus
RFC: relative frequency of citation
UAV: Use Agreement Value index
UVs: estimates of the medicinal Use Value index of each species s