Incidence and Severity of Sooty Canker Disease on Date Palm in Northern State, Sudan

Muntasir, Adam M.* and Ahmed Baghdadi

Department of Plant Pathology, Faculty of Agriculture, Omdurman Islamic University, Sudan

Abstract

Surveys related to sooty canker disease (branch wilt disease) of date palm (*Phoenix dactylifera* L.) were conducted from June 4, 2017, to June 4, 2018, in the Northern State of Sudan. The objectives of the study were to identify the causal agent of the disease and to investigate its incidence, occurrence, severity, and symptoms on different hosts. Surveys covered 50 orchards across four localities: Halfa, Dongola, El Daba, and Marawi. Pathogens were isolated and identified based on morphological characteristics. Symptoms of the disease in date palms first appeared as chlorosis at the tips of the leaves, followed by necrosis and dryness. Eventually, the trees exhibited wilting and die-back. Black sooty canker layers of spores were observed when infected parts were removed from the affected areas. The distribution of sooty canker disease showed a high incidence in Halfa (31.7%) and Marawi (26.3%), compared to Dongola (20.7%) and El Daba (21.3%). Disease severity was also highest in Halfa (28%) and Marawi (22%), while it was lower in El Daba (18%) and Dongola (16%). Overall, the disease incidence across all surveyed regions ranged from 41% to 20%, with disease severity ranging from 28% to 16%. The mean infection level in date palms was notably high at 25%, compared to 13.5% in mango, citrus, and ficus trees. Among the pathogenic fungi isolated, *Nattrassia mangiferae* was identified as the major causal agent of sooty canker disease. This fungus was the most dominant species detected, accounting for 25% of all samples examined, followed by *Diplodia phonicum* (11.5%) and *Thielaviopsis paradox* (10.5%). Given the economic importance of date palm cultivation in the Northern State, future research should emphasize the management of *N. mangiferae*.

Keywords: (*Phoenix dactylifera* L.), fungal pathogen, sooty canker, *Nattrassia mangiferae.*

***Corresponding author:** muntasiradami@yahoo.com & muntasir923@gmail.com

Introduction

Date palm (*Phoenix dactylifera* L.) is widely cultivated in the arid regions of the Middle East, North Africa, and arid sub-Saharan areas such as Northern Sudan for its economic value (Purseglove, 1981). In Sudan, it is primarily grown along the Nile Valley in the Northern State, which extends from latitude 22ºN to latitude 15.5ºN in the south (Salih, 2003). Small numbers of date palm trees are also cultivated in Khartoum State, Nile State, and Darfur States (Ahmed, 2003). The date palm plays an important role in the local economy of Northern Sudan (Mahadi, 2001). In addition to marketing, produced dates are consumed as food due to their high carbohydrate content. The trunk of the date palm is used for house building or furniture, the fiber for ropes, the flower stalks for

weaving baskets, and pollen grains mixed with honey for human consumption. The stones of fresh fruits are used as animal feed or mixed with milk for medicinal purposes. Date palm trees are also grown for shade or prestige (Osman, 1979). Under local conditions, date palm trees are vulnerable to infection from several destructive diseases, which are responsible for significant declines and losses in the number of trees (Bliss & Djerbi, 1983). Several soil-borne fungi attack date palms, causing root rot, wilt, and decline diseases (Elarosi et al., 1983). The dominant fungi associated with date palm death and decline include *Fusarium oxysporum*, *Diplodia phoenicum*, *Ceratocystis radicicola*, and *Phonopsis phoenicola* (Ellis, 1976; Rottan & Al-Dboon, 1980; Mousiri et al., 2001). *Nattrassia mangiferae* causes wilt and sooty canker disease in date palms (Elshiekh, 2004). The sooty canker disease was first observed in date palms in Sudan during a survey conducted by Ahmed and Yassin (1992). The fungus *N. mangiferae* was identified as the causal organism of the sooty canker of date palms (Baghdadi et al., 2003). According to Elshiekh (2004), the symptoms of sooty canker disease caused by *N. mangiferae* in date palms include general wilt of the trees and maceration of offshoots, where the leaves turn almost white. Cross-sections of diseased offshoots reveal black layers of sooty masses of arthrospores, leading to blackening and destruction of the conductive system. Infected tree trunks become smaller, and the roots turn black. Leaf bases are easily detached, and the fibers take on a cottony texture. *Nattrassia* is a polymorphic fungus that has two spore stages: the pycnidial and the arthroconidial (Scytalidium state). Sutton and Dyko (1989) revised the genus *Hendersonula* and established the new monotypic genus *Nattrassia*, with *N. mangiferae* as the type species. Earlier synonymic names for this fungus include *Dothiorella mangiferae*, *Exosporina fawcettii*, *Fusicoccum eucalypti*, *Hendersonula cypria*, *H. agathidis*, and *H. toruloidea*. The arthric synanamorph is known as *Scytalidium dimidiatum*, also referred to as *Torula dimidiata* and *S. lignicola*. An asexual stage for *Nattrassia* has not been described (Elliott & Edmonds, 2004). The sooty canker disease of date palms results in a yield loss of 30-60%, as well as significant losses of mature trees and offshoots in the main growing areas of Northern State (Elshiekh, 2004). The symptoms and activity of *N. mangiferae* have been reported on various plants, including Persian walnut (Wilson, 1949; Ogawa, 1954), citrus (Calavan & Wallace, 1954), fig (Paxon et al., 1964), and grapevine (Wangikar, Raut & Gapalkrishna, 1975). Additional reports include *Ficus bengalensis* (Giha, 1975), *Gmelina orborea* (Nair, 2001), *Ficus nitida* (Nori, 1996), date palm (Elshiekh, 2004), acacia (Eltaher, 2004), and mango (Abed-Elkarim, 2004). The specific objectives of this study were to:

i) Survey the occurrences of the incidence and severity of sooty canker disease in date palm across different hosts in the Northern State of Sudan.

ii) Isolate and verify the identity of the main causal agents of sooty canker on date palm trees.

iii) Document symptoms of infected plants to verify and confirm the causal agents of sooty canker on date palm trees.

Materials and methods

Survey of Sooty Canker Disease

Occurrence, Incidence, and Severity of Disease

The survey was conducted from June 4, 2017, to June 4, 2018, covering different areas in five localities: Halfa (including Firage, Abri, Dalgo, Oshamato, Saadinfanti, Sabo, Saadeenkorta), Dongola (including E.Labab, Gordote, Dongola, Elborgig, Abufatma, Argo), Elgolid, Eldaba (including Elgaba, Hamoor, Elcarad, Bnganarti, Eldaba, Goshabi), and Marawi (including Elgorar, Marawi, Karima, Tangasi) in the Northern State of Sudan. The surveyed area is located between latitudes 16°N and 22°N and longitudes 20°E and 32°E. The distribution of infection and severity of the disease on date palm trees were assessed. Samples were collected based on the respective date palm cultivars. Each tree exhibiting foliage symptoms such as chlorosis, necrosis, wilting, drying, and white coloration, as well as the presence of a sooty black layer of spores on the leaf bases or offshoots, was recorded. The characteristics of *N. mangiferae* were documented by counting the number of infected parts showing sooty canker.

Disease incidence (%) was calculated using the following formula:

$$\textbf{Disease incidence (\%)} = \frac{\text{Number of diseased trees}}{\text{Total number of trees surveyed}} \times 100$$

The disease severity was estimated using a scale classified into five categories, based on the proportion of diseased parts included (Waller *et al*., 2002). These categories were as follows:

Guide of Deterioration	% of Diseased Part of The Tree
0	Healthy (no disease symptoms)
1	1-25%
2	26-50%
3	51-75%
4	76-100%

$$\textbf{Disease Severity (\%)} = \frac{\text{No. of trees} \times \text{Category (0)} + \ldots\ldots + \text{No. of trees} \times \text{Category (4)}}{\text{Total number of tested} \times \text{Top category index}}$$

Collective of infected plant samples

Random samples from infected trees and off-shoots were collected from the foliage, bark, basal part of the innermost leaves, terminal bud, and roots of infected date palm trees and off-shoots. Woody samples were taken using a borer inserted into the infected stem or root to a depth of 5 cm. Samples from each tree were kept in polythene bags, refrigerated for further analysis, and

transferred to the Plant Pathology Laboratory at the Plant Protection Directorate, Ministry of Agriculture.

Isolation of microorganisms

To isolate the causal agents from plant materials, samples from infected parts were cultured on Potato Dextrose Agar (PDA) medium in the laboratory. Small pieces (5 mm) of diseased tissue from roots, leaves, buds, and internal tissues were surface sterilized with 0.1% mercuric chloride for one minute, then thoroughly washed in three changes of sterile distilled water and dried on filter paper. Each sample was placed at the center of a Petri dish containing PDA medium using a needle that had been flamed to redness and then cooled. All cultures were incubated at room temperature (25-30°C), with fungal growth observed daily.

Identification of the fungus

Infected plant tissue was placed on PDA medium, and the causal organism was isolated from the diseased tissue. The vegetative mycelium of the isolate was grown in pure culture on PDA at room temperature (28±2°C). The fungus, *N. mangiferae,* was identified based on morphological and histological features as described by Ellis (1976). Other fungi such as *Diplodia phoenicum*, *Thielaviopsis paradoxa*, *Fusarium spp.*, *Rhizoctonia spp.*, and *Ceratocystis paradoxa* were also noted. After 1-3 days of culture inoculation, the microorganisms were examined under a light microscope.

Descriptions of symptoms

Symptoms from infected date palm trees were described to verify the causal agent of sooty canker disease.

Statistical analysis

Data collection from the survey was analyzed using a randomized complete block design, and the results were statistically analyzed using the SAS program at a probability level of 0.05.

Results

Occurrence of Incidence and Severity of Sooty Canker Disease

Following a reconnaissance survey in the Northern State of Sudan, a severe incidence of sooty canker disease caused by *N. mangiferae* was observed in areas cultivated with date palms. The surveyed localities included Halfa (Firage, Abri, Dalgo, Oshamato, Saadinfanti, Sabo, Saadeenkorta), Dongola (E.Labab, Gordote, Dongola, Elborgig, Abufatma, Argo), Eldaba (Elgaba, Elgolid, Hamoor, Elcarad, Bnganarti, Eldaba, Goshabi), and Marawi (Elgorar, Marawi, Karima, Tangasi). A total of 50 orchards were surveyed (Table 1). Among the orchard trees surveyed, date palms exhibited the highest infection rates due to sooty canker. The incidence of the disease was notably high in Halfa and Marawi, with rates of 31.7% and 26.3%, respectively, while lower rates were observed in Dongola (20.7%) and Eldaba (21.3%) (Table 1). Within these localities, the

highest disease incidences were recorded in Dalgo (41%), Argo (35%), and Elkarad (36%), whereas lower incidences were noted in Hamoor (21%), Elgaba (16%), and Benganarti (2%). Overall, the disease incidence across all surveyed regions was considered high, ranging from 2% to 41%, with disease severity between 16% and 28% (Table 2). Sooty canker disease was detected on date palm trees of various ages, from off-shoots to mature trees.

Distribution of isolated microorganisms

Nattrassia mangiferae showed a high distribution on date palms in the Northern State, alongside other fungi (Table 3). The data presented in Table 3 indicate the frequency of microorganisms isolated from date palms across various locations within the state. Among the fungi isolated, *N. mangiferae* was the most dominant species, accounting for 25% of all samples examined, followed by *Diplodia phonicum* (11.5%) and *Thielaviopsis paradoxa* (10%). The Barakawi variety of date palm was found to be highly susceptible to the disease, while the Jawa variety exhibited resistance based on observed disease symptoms (Table 4-A). Additionally, infestations were reported in other tree species, albeit with lesser distribution. These included *Citrus spp.*, *Psidium spp.*, mango, *Ficus spp.*, and eucalyptus (Table 4-B).

Confirmation and Verification of the Causal Agent of Sooty Canker
Morphological Identification of the Fungus Associated with Sooty Canker Disease on Date Palm Trees

The fungus *Nattrassia mangiferae* was consistently isolated from nearly all symptomatic tissues of date palm trees examined. It was initially identified based on its morphological characteristics. The mycelium (Plate 1) exhibited rapid growth, filling the entire Petri dishes within 5 to 7 days. The structure of the fungal culture was thick, and the color ranged from dark brown to black. The colony of *N. mangiferae* effused a dark blackish-brown to black hue (Plate 2). The fungal mycelia formed a chain structure, and fragmentation resulted in cylindrical or barrel-like structures, with brown arthroconidia that had 0-2 septa (Plate 3) (Pasha, 2007). Pycnidia were formed at canker lesions and beneath the bark of infected date palm trees; these were dark brown to black and contained cylindrical conidia that were also 0-2 septate, becoming brown at maturity. The verification of the causal agent of sooty canker disease aligns with the findings of Ellis (1976), Sigler *et al*. (1997), Farr et al. (2005), Crous *et al*. (2006), and Al-Saadoon *et al*. (2012). Other fungi were also verified and identified:

- ***Rhizoctonia spp.***: Characterized by distinctive irregular brown sclerotia formed on diseased plant tissues.
- ***Fusarium spp.***: Noted for colonies that produce violet to purple pigments in agar (Burgess *et al*., 2008).

- ***Diplodia phonicum***: Conidia are dark brown, ovoid, and obtuse at the apex, truncated or rounded at the base, with immature spores being aseptate and maturing to form darker brown, single-septate spores (Phillips *et al*., 2007).

- ***Thielaviopsis paradoxa***: Forms thick-walled resting spores (chlamydospores) and produces two types of infective asexual spores: hyaline, cylindrical microspores (8.5–12.7 × 2.5–4.7 µm) (Ellis, 1976).

Description of Symptoms

Based on the severity of infection, several symptoms of sooty canker disease were recorded according to Elshiekh (2004), Baghdadi *et al*. (2003), and Pasha (2007):

1. **Leaf Chlorosis**: Various shades of chlorosis (yellowing) are observed, characterized by the rolling of leaves starting from the upper part of the tree and progressing downward.
2. **General Wilt**: Infected trees exhibit wilting and maceration of the off-shoots, with leaves becoming almost white.
3. **Leaf Dryness and Dieback** (Fig. 1, 2).
4. **Leaf Base Peeling Off** (Fig.3).
5. **Black Layer of Sooty Masses**: Cross-sections of diseased off-shoots reveal a black layer of sooty masses of arthrospores.
6. **Trunk and Root Changes**: The trunks of infected trees become smaller, and the roots turn thin and black in color.
7. **Heart Leaf Removal**: The heart leaves are easily removable and turn black with a smooth sooty layer (Fig. 4).
8. **Death of Heart**: The heart of the trees may die, ending in black coloration.
9. **Leaf Base Texture**: Leaf bases can be easily cut, and the fibers turn to a cottony texture (Fig. 4).
10. **Destruction of the Conductive System**: The conductive plant system (xylem) becomes black in color and is destroyed.

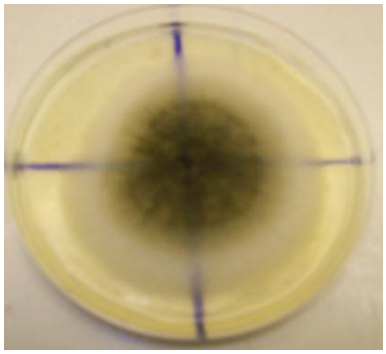

Plate (1): *Nattrassiamangiferae* on PDA; 3days old culture

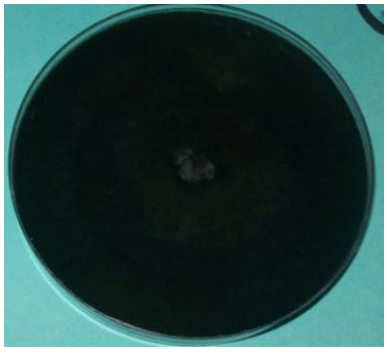

Plate (2): N*attrassiamangiferae* PDA; 7days old culture

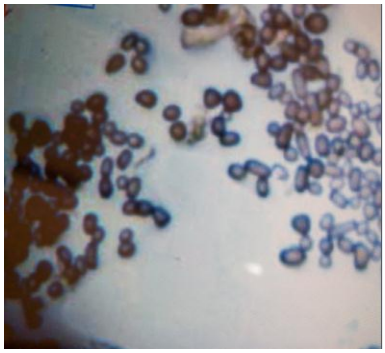

Plate (3): Arthrospores of the upper and downward

Fig. (1): Chlorosis of the tree from fungus *N.mangiferae*

Fig. (2): Chlorosis observed in the tree, starting from the upper leaves and progressing downward

Fig. (3): Infected leaf base, which can be easily detached from the tree

Fig. (4): Black sooty layers of arthrospores on date palm caused by *Nattrassia mangiferae.*

A) Inner part of leaf base, **B)** Leaf base, **C)** Heart of the date palm

Table (1): Disease incidence on date palm field in different Localities in Northern State.

Locality	Area	Infection %
ELdaba	ELkarad	36
	ELgaba	16
	ELdaba	24
	Benganarty	2
	Hamoor	21

	ELdaba	29
	Means	21.3
Dongola	ELbrgag	11
	Abu Fatima	13
	Argo	35
	Dongola	4
	East Labab	30
	Gordote	31
	Means	20.7
	Dalgo	41
	Oshamato	29
Halfa	Sabo	29
	Saadeenkorta	35
	Abri	25
	Abu Sari	31
	Means	31.7
	ELgorar	22
Marawi	Tangasi	29
	Karima	28
	Means	26.3

Table (2): The occurrence of sooty canker disease of date palm trees in different Localities in Northern State of Sudan

Locality	Disease incidence (%)	Disease severity (%)	No. field surveyed
ELdaba	21.3	18	15
Marawi	26.3	22	9
Dongola	20.7	16	12
Halfa	31.7	28	14
Means	25	22	Total=50

Table (3): Fungi and their distribution (%) isolated from naturally infected samples of date palm that exhibited typical symptoms of *N. mangiferae* frequency (%)

Fungi	Dongola	ELdaba	Marawi	Halfa	Mean
Nattrassia mangiferae	20.7	21.3	26.7	31.7	25
Theilaviopsis paradoxa	5	8	17	12	10.5
Diplodia phoenicum.	12	11	10	13	11.5
Ceratocystis paradoxa	10	3	5	7	6.25
Fusarium spp.	11	12	8	7	9.5
Rhizoctonia spp.	10	6	7	12	8.75

Table (4): A. Susceptibility of different date palm varieties to *N. mangiferae.*

Varieties	Jawa	Barakawi	Gundaila	Bentamoda	Meshregi
Susceptibility	-	++++	+++	++	+

- Resistant, ++++ High susceptibility, +++ Medium susceptibility, ++ Moderate susceptibility, + Low susceptibility.

Table (4): B. Disease incidence on other hosts in different areas in N.S. Infection (%)

Area	Citrus	Ficus	Eucalyptus	Mango	Guava
Argo	33	-	-	18	10
Dongola	-	20	5	-	-
Tangasi	7.5	-	-	-	-
ELgaba	15.4	-	-	23	-
ELkarad	28	-	-	-	-

Discussion

Sooty canker disease caused by *Nattrassia mangiferae* has been reported in Sudan by Ahmed and Yassin (1992), Baghdadi *et al*. (2003), and Elshiekh (2004). Microscopic examination has confirmed *N. mangiferae* as the primary causal agent of branch wilt, sooty canker, and die-back in date palms and other orchard trees in the Northern State of Sudan. The symptoms observed in this study align with those documented in the literature (Paxon *et al*., 1964; Davison, 1972; Pandey *et al*., 1981; Giha, 1996; Baghdadi *et al*., 2003; Elshiekh, 2004), indicating a serious threat to the future of these plants. Surveys conducted in 2013 and 2014 revealed severe damage to date palms, mangoes, and citrus trees in the Northern State. The findings of this study underscore the potential of *N. mangiferae* to inflict significant damage on a wide range of tree species. The survey confirmed the disease's epidemic occurrence in date palms and other fruit trees, including mangoes, citrus, and guava, within the Northern State. The frequency of infestation in date palms ranged from 20.7% to 31.7%, while in mangoes, citrus, and guava, it ranged from 5% to 22%. The development and spread of *N. mangiferae* sooty canker disease are influenced by a combination of cultural practices, soil conditions, and climatic factors. Temperature has been identified as a contributing factor to infection frequency in the Northern State (Elshiekh, 2004). Variations in infection rates may be linked to cultural practices; for example, close spacing between trees in Halfa and Marawi may facilitate pathogen transmission. Additionally, irrigation canals in contact with date palm trunks may enhance the spread of the fungus from the soil, as water can easily carry fungal spores from one tree to another, supporting the observations of Giha (1975) and Nori (1996). The present study documented various grades of symptoms, including chlorosis, necrosis, and yellowing of leaves, as well as black sooty canker on the basal part of leaves, leading to partial or total wilt and mortality. These symptoms are characteristic of *N. mangiferae* infection (Giha, 1975; Baghdadi *et al*., 2003; Elshiekh, 2004). The morphological characteristics of *N. mangiferae* described here are consistent with those

reported by Ellis (1976), Sigler *et al*. (1997), Farr *et al*. (2005), Crous *et al*. (2006), and Al-Saadoon *et al*. (2012).

Conclusion

The study of sooty canker disease caused by *Nattrassia mangiferae* in date palms in the Northern State of Sudan highlights the significant threat this pathogen poses to both economic and ecological systems in the region. The findings confirm that *N. mangiferae* is a major causal agent of severe symptoms, including chlorosis, necrosis, and die-back, affecting date palms and other fruit trees. The high incidence and severity of the disease across various localities indicate an urgent need for effective management strategies. Cultural practices, environmental conditions, and irrigation practices contribute to the spread of the pathogen, suggesting that integrated disease management approaches should be developed to mitigate the impact of sooty canker disease.

References

Abed-Elkarim, H. A. (2004). Personal communication. Ministry of Agriculture, River Nile State.

Ahmed, M. Y. (2003). Date palm problems in Nile State. Paper submitted at the Date Palm Workshop, Sudan University of Science and Technology, Khartoum, Sudan.

Ahmed, N. A., & Yassin, A. M. (1992). Technical Bulletin No. 5. Agricultural Research Corporation, Wad Medani, Sudan.

Al-Saadoon, A. H., Ameen, M. K., Hameed, M. A., AlBadran, A., & Z. Ali. (2012). First report of grapevine dieback caused by *Lasiodiplodia theobromae* and *Neoscytalidium dimidiatum* in Basrah, Southern Iraq. *African Journal of Biotechnology*, *11*(95), 16165-16171.

Baghdadi, A. M., Abulgasim, E. A., & Mokhtar, M. S. (2003). An epidemic wilt disease affecting date palm trees in Northern Sudan. Paper presented at the Date Palm Workshop, Sudan University of Science and Technology, Khartoum, Sudan.

Bllis, D. F., & Djerbi, M. (1983). Investigation on the causal agents of decline disease in date palm. *Date Growers Institute Annual Report*, *11*, 4-6.

Burgess, L. W., Knight, T. E., Tesoriero, L., & Phan, H. T. (2008). *Diagnostic manual for plant diseases in Vietnam*. ACIAR Monograph No. 129. ACIAR: Canberra.

Calavan, E. C., & Wallace, J. M. (1954). *Hendersonula toruloidae* Nattrass on citrus in California. *Phytopathology*, *44*, 635-639.

Davison, A. D. (1972). Factors affecting the development of madrone canker. *Plant Disease Reporter*, *56*, 50-52.

Elarosi, H., Elsaid, H., Nagiels, M. A., & Jaheen, N. (1983). Proceedings of the First Symposium on Date Palm in Saudi Arabia. Edirors and Publishers, 19-83.

Elliott, M., & Edmonds, R. L. (2004). Systematic study of *Nattrassia mangiferae*, the cause of madrone canker. In B. W. Geils (Ed.), *Proceedings of the 51st Western International Forest*

Disease Work Conference (pp. 59-62). U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Ellis, M. B. (1976). More Dematiaceous Hyphomycetes. Commonwealth Mycological Institute, Kew, England.

Elshiekh, A. M. E. (2004). Investigation on the causal agent of sooty canker disease of date palm trees in Northern State. M.Sc. Thesis, Sudan University of Science and Technology, Sudan.

Eltaher, & Khalifa, S. A. (2004). A new disease in Acacia trees in Northern Kordofan. *Akhbarelyom* (daily newspaper), April (2004), Saturday number 3422.

Farr, D. F., Elliott, M., Rossman, A. Y., & Edmonds, R. L. (2005). *Fusicoccum arbuti* sp. nov. causing cankers on Pacific madrone in western North America with notes on *Fusicoccum dimidiatum*, the correct name for *Scytalidium dimidiatum*, and *Nattrassia mangiferae*. *Mycologia*, *97*, 730–741.

Giha, O. H. (1975). *Hendersonula toruloidea* associated with serious wilt disease of shade trees (*Ficus benbhalensis*) in Sudan. *Plant Disease Reporter, 59*, 899-902.

Giha, O. H. (1996). Introduction to Principles of Plant Disease in Sudan. Dar Elasala, Wad Medani.

Mahadi, A. A. (2001). Sudan country study on biodiversity. Ministry of Tourism and Environment.

Mousiri, A., Lamari, L., & Saboon, N. (2001). Inventory of fungi rhizosphere of susceptible and resistant palm to the bayoud in the region of Adrar (Algeria). In *Seventh Arab Congress of Plant Protection* (Abstract book, 22-26 October, 2000, Amman, Jordan).

Nair, K. (2001). Pest outbreak in tropical forest plantations: Is a great risk for exotic species? Center for International Forestry Research (CIFOR), Jakarta, Indonesia.

Nori, W. S. (1996). Branch wilt and mortality of some shade trees in Khartoum State caused by *Nattrassia mangiferae*. M.Sc. Thesis, University of Khartoum, Sudan.

Ogawa, J. M. (1954). The occurrence of *Hendersonula toruloidea* Nattrass on populous species in California. *Plant Disease Reporter, 38*, 238.

Osman, A. M. A. (1979). Date palm production in the Sudan. Agricultural Research Corporation, Horticultural Research Center. (Arabic), Report page 15.

Pasha, A. A. (2007). Resistance of some woods to *Nattrassia mangiferae* fungus which causes decomposition in Nineveh. PhD Thesis, College of Agriculture and Forestry, University of Mosul, Iraq.

Paxton, J. D., Wilson, E. E., & Davis, J. R. (1964). Branch wilt disease of fig caused by *Hendersonula toruloidea*. *Plant Disease Reporter, 48*, 142.

Pandey, R. S., Bhargava, S. N., Shukla, D. N., & Khati, D. V. (1981). A new leaf disease of mango. *Plant Disease, 65*, 441-442.

Phillips, A. J. L., Crous, P. W., & Alves, A. (2007). *Diplodia seriata*, the anamorph of "Botryosphaeria" obtusa. *Fungal Diversity*, *25*, 141–155.

Purseglove, J. W. (1981). Date Palm (*Phoenix dactylifera* L.): *Tropical crops (Monocotyledons)*. Huntsmen Offset Printing Apt, Ltd.

Rottan, S. S., & Al-Dboon, A. H. (1980). Note on fungi associated with date palm. *Sydowia, 33*, 246-264.

Salih, A. A. (2003). Effect of soil and irrigation on the production of date palm. Paper submitted at the Date Palm Workshop Institute.

Sigler, L., Summerbell, R. C., Poole, L., Wieden, M., Sutton, D. A., Rinaldi, M. G., Flguirre, G. W., Estes, J. N., & Galgiani, J. N. (1997). Invasive *Nattrassia mangiferae* infections: Case report, literature review and therapeutic and taxonomic appraisal. *Journal of Clinical Microbiology*, *35*(20), 433-440.

Sutton, B. C., & Dyko, B. J. (1989). Revision of *Hendersonula toruloidea*. *Mycological Research*, *93*, 466-488.

Waller, J. M., Lenne, J. M., & Waller, S. J. (2002). Plant Pathologist's Pocketbook (3rd ed.). CABI Publishing.

Wangikar, P. D., Raut, J. G., & Gapalkrishna, N. (1975). Drying of grapevines caused by *Hendersonula toruloidea*. *Indian Phytopathology*, 22, 403-104.

Wilson, E. E. (1949). The pycnidial stages of the walnut branch wilt fungus, *Exosporina fawcetti*. *Phytopathology*, *39*, 340-346.

حدة وشدة الاصابة بمرض القرحة السخامية في نخيل البلح في الولاية الشمالية – السودان

منتصر أدم و أحمد بغدادي

قسم أمراض النبات، كلية الزراعة، جامعة أم درمان الإسلامية، السودان

الملخص العربي

تم إجراء مسح ميداني لمرض القرحة السخامية (ذبول الفروع) في نخيل التمر (*Phoenix dactylifera* L.) في الولاية الشمالية من السودان خلال الفترة من ٢٠١٧/٦/٤ إلى ٢٠١٨/٦/٤، بهدف التعرف على المسبب المرضي لهذا المرض ودراسة مدى حدوثه ونسبة الإصابة وشدة الإصابة وأعراضه المرضية في عوائل مختلفة. شمل المسح حوالي ٥٠ مزرعة نخيل في محليات حلفا، دنقلا، الدبة، ومروي. تم عزل المسبب الممرض والتعرف عليه بناءً على خصائصه المورفولوجية. تظهر أعراض المرض في نخيل التمر في البداية باصفرار قمة الأوراق، يعقبه جفاف وموت الأوراق، وذبول الأشجار، وموت الأطراف حتى تموت الشجرة بالكامل. تتقرح الأجزاء المصابة وتظهر طبقة سوداء ناعمة عند إزالة الأجزاء المصابة. نسبة حدوث وتوزيع مرض القرحة السخامية في نخيل البلح عالية في منطقتي حلفا ومروي (٣١.٧% و٢٦.٣% على التوالي) مقارنة بمنطقة دنقلا والدبة (٢٠.٧% و٢١.٣% على التوالي). بينما كانت حدة وشدة الإصابة عالية في منطقتي حلفا ومروي حيث بلغت (٢٨% و٢٢% على التوالي) مقارنة بمنطقة الدبة (١٨%) ودنقلا (١٦%). متوسط نسبة الإصابة بالمرض في جميع المناطق التي تم مسحها مرتفعة، حيث تتراوح بين ٢٠% و٤١%، بينما يتراوح متوسط شدة المرض بين ١٦% و٢٨%. وكان معدل الإصابة في نخيل التمر مرتفعًا حيث بلغ ٢٥% مقارنة بالأشجار الأخرى مثل المانجو والموالح واللبخ، التي بلغت ١٣.٥%. من خلال الفطريات الممرضة المعزولة، تم عزل الفطر *Nattrassia mangiferae* كمسبب مرض القرحة السخامية في النخيل. وهو الفطر السائد المعزول في معظم العينات حيث بلغت نسبته ٢٥%، بينما بلغت نسبة الفطريات الأخرى مثل (١١%) *Diplodia phonicum* و(١٠%) *Thielaviopsis paradoxa* يُعتبر نخيل البلح محصولًا اقتصاديًا في الولاية الشمالية، مما يستدعي مزيدًا من البحوث لمكافحة المرض وإدارته.

الكلمات الدالة: نخيل البلح، مسببات الأمراض الفطرية، القرحة السخامية، *Nattrassia mangiferae*