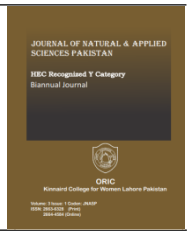
Contents list available http://www.kinnaird.edu.pk/

Journal of Natural and Applied Sciences Pakistan

Journal homepage: http://jnasp.kinnaird.edu.pk/



WILD PINK (*DIANTHUS THUNBERGII* S.S.HOOPER): ITS CURRENT MEDICINAL APPLICATIONS AND FUTURE THERAPEUTIC POTENTIAL

Alfred Maroyi[1*]
Department of Biotechnology and Biological Sciences, University of Fort Hare

Article Info

*Corresponding Author
Email: amaroyi@ufh.ac.za

Abstract

Dianthus thunbergii S.S.Hooper (Caryophyllaceae) which is commonly known as wild pink is a perennial herb that plays an important role in traditional medicine in South Africa. The present review of D. thunbergii compiles information on its medicinal uses, phytochemical and pharmacological properties, and further use potential. The aim is to prepare a comprehensive scientific review of the existing knowledge of D. thunbergii and provide baseline information that can enhance further research and use of the species. Therefore, information on medicinal uses, phytochemical and pharmacological properties of D. thunbergii was derived from online databases as well as pre-electronic literature sources such as books, book chapters, journal articles, dissertations, and theses which were obtained from the University library. The following keywords were applied during the literature search: "ethnobotany", "biological activities", "medicinal uses", "phytochemistry", "pharmacological properties" and "traditional uses of D. thunbergii". The research findings showed that the leaves or roots of D. thunbergii are used as charm, for body cleansing or purification, removing body odour, and traditional medicine against diabetes mellitus, stomach complaints and chest problems. Chemical compounds identified from D. thunbergii include alkanes, alkaloids, amino acids, coumaric acid, fatty acid esters, flavonoids, ketones, lipids, phenolics, tannin and terpenoids. The aqueous and ethanol extracts of D. thunbergii roots demonstrated antioxidant and anti-proliferative activities in in vitro experiments. This interdisciplinary review emphasizing the ethnopharmacological properties and therapeutic potential of D. thunbergii highlights the traditional ecological and cultural knowledge, broad and deep economic and socio-cultural significance of the species.

Keywords

Caryophyllaceae, *Dianthus Thunbergii*, Ethnopharmacology, *Materia Medica*, Wild Pink

1. Introduction

Many countries in sub-Saharan Africa continue to face the burden of obesity, overweight and diet-related non-communicable diseases (Modjadji *et al.*, 2025; Tareke et al., 2025; Agboyibor et al., 2026). Current research indicates that there is an unprecedented rising burden of obesity, overweight, cancer, cardiovascular diseases, hypertension, respiratory infections and type 2 diabetes mainly due to complex behavioural and metabolic risk factors (Melaku *et al.*, 2018; Tapkigen *et al.*, 2024; Modjadji *et al.*, 2025). There are several behavioural risk and metabolic factors associated with these diseases in the region, and they are a major public health concern in sub-Saharan Africa leading to shifts in dietary and lifestyle patterns characterized by increased energy intake, physical inactivity, significant nutrition transition, that is, from traditional, fibre and nutrient-rich diets to ultra-processed foods (Nnyepi *et al.*, 2015; Owino, 2019; Popkin & Ng, 2022). Tapkigen *et al.* (2024) argued that the burden of obesity, overweight and diet-related non-communicable diseases in sub-Saharan Africa can be addressed through understanding how food systems function, their drivers and roles in shaping diets in terms of quality, quantity, adequacy and safety. *Dianthus thunbergii* S.S.Hooper (Figure 1) is one of the medicinal plant species widely used against some non-communicable diseases in South Africa (Oyedemi, Bradley & Afolayan, 2009; Odeyemi & Bradley, 2018; Nyakudya *et al.*, 2020; Sagbo & Hussein, 2022). The root decoction of *D. thunbergii* is also used as traditional medicines against cancer (Akinrinde *et al.*, 2018a), respiratory infections such as chest complaints (Moffett, 2010; Akinrinde *et al.*, 2018b; Moteetee, Moffett & Seleteng-Kose, 2019) and diabetes mellitus (Oyedemi *et al.*, 2009; Akinrinde *et al.*, 2018a,b; Odeyemi & Bradley, 2018; Nyakudya *et al.*, 2020; Sagbo & Hussein, 2022). Despite growing interest in medicinal applications of *D. thunbergii* against non-communicable diseases, documentation of ethnomedicinal applications and ethnopharmacological properties of the species are limited. This article provides a comprehensive review of the traditional and present medicinal uses of *D. thunbergii*, as well as the future potential therapeutic applications of the species. Understanding of the traditional ecological knowledge and ethnopharmacological properties of *D. thunbergii* are important, as well as its social and economic importance in enhancing the well-being of local communities.

Figure 1: *Dianthus thunbergii* S.S.Hooper: Mature plant with pinkish flowers (Manning, 2009)

2. Materials and Methods

2.1 Study area

Dianthus thunbergii is endemic to South Africa, the species has been recorded in Swellendam in the Western Cape and the Eastern Cape provinces (Figure 2). Swellendam is a historical town in South Africa, established in 1745 and it is the third oldest town in the country after Cape Town and Stellenbosch, and renowned for its rich Cape Dutch history with over 50 provincial heritage sites (Viljoen, 2001; Hulley & Van Wyk, 2019). The name Swellendam is in honour of the former governor of the Dutch Cape colony, Hendrik Swellengrebel (1700-1760 and his wife Helena Wilhemina Van Damme (1706-1746). *Dianthus thunbergii* occurs on sandstone rocky slopes, sandy soils in grassland, closed shrubland in the renosterveld and the Fynbos biome from Swellendam to the Eastern Cape province (Goldblatt & Manning, 2000; Manning & Goldblatt, 2012; Bredenkamp, 2019), see Figure 2. Majority of the population of Swellendam Municipality are of Khoi descent and have Afrikaans as their first language (Hulley & Van Wyk, 2019) while the amaXhosa people are predominantly located in the Eastern Cape province (Mokhoathi 2021; Ndude & Memela, 2024).

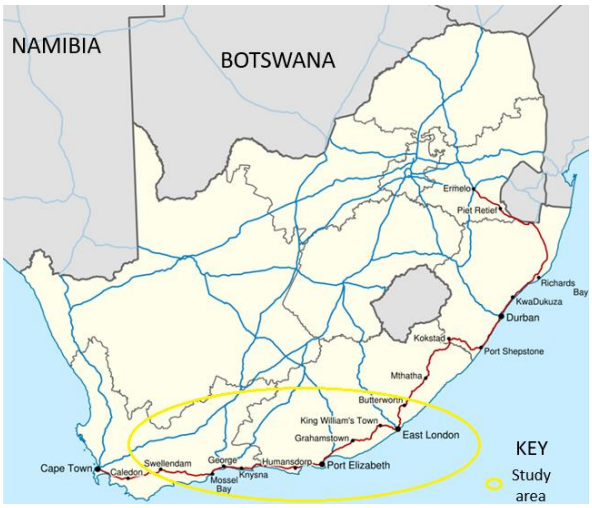


Figure 2: Study area showing Swellendam in the Western Cape and other areas in the Eastern Cape province

2.2 Data collection

A review of ethnobotanical literature on the botany, phytochemical, pharmacological properties and how *D. thunbergii* is used by local communities in the Eastern and Western Cape provinces was conducted. The literature search for medicinal uses, phytochemistry and pharmacological properties of *D. thunbergii* was conducted from June to December 2025 using online search databases. The pre-electronic sources used in this study included books, book chapters, journal articles, dissertations, and theses which were obtained from the University library. The keywords used in the search included "*Dianthus thunbergii*" and English common names "Thunberg's carnation", "Thunberg's dianthus", "Thunberg's wild pink" and "wild pink". An additional search was also conducted using the keywords "biological activities of *Dianthus thunbergii*", "ethnobotany of *Dianthus thunbergii*", "pharmacological properties of

Dianthus thunbergii", "medicinal uses of *Dianthus thunbergii*", "traditional uses of *Dianthus thunbergii" and* "phytochemistry of *Dianthus thunbergii*". The search covered publications from 1959 to 2025, a long period to capture literature on the medicinal uses, phytochemical and pharmacological properties of *D. thunbergii*. The literature sources excluded from this review were those articles which were partially accessed, that is, accessed as abstracts only, and also published or unpublished articles lacking information on botanical, ecological, ethnobotanical and ethnopharmacological properties of *D. thunbergii*. The botanical, ecological, ethnobotanical and ethnopharmacological literature studies focusing on *D. thunbergii* that were used as the main sources of data for all the analyses in this study are listed in Table 1.

Table 1: Overview of literature sources documenting botanical, ecological, ethnobotanical and ethnopharmacological literature studies focusing on *Dianthus thunbergii*

Author(s) and year of publication	**Region**	**Data collection methods**
Hooper, 1959	Swellendam and the Eastern Cape	Field work and herbarium studies
Van den Bergh, 1995	Eastern Cape	Field work and ethnobotanical studies
Dold & Cocks, 1999	Eastern Cape	Field work and ethnobotanical studies
Goldblatt & Manning, 2000	Swellendam and the Eastern Cape	Field work and herbarium studies
Leistner, 2000	Swellendam and the Eastern Cape	Field work and herbarium studies
Dold & Cocks, 2002	Eastern Cape	Field work and ethnobotanical studies
Cocks & Wiersum, 2003	Eastern Cape	Field work and ethnobotanical studies
Germishuizen & Meyer, 2003	Swellendam and the Eastern Cape	Field work and herbarium studies
Cocks, 2006	Eastern Cape	Field work and ethnobotanical studies
Cocks & Dold, 2006	Eastern Cape	Field work and ethnobotanical studies
Manning, 2009	Eastern Cape	Field work and herbarium studies
Nzue, 2009	Swellendam	Field work and ethnobotanical studies
Oyedemi *et al.*, 2009	Eastern Cape	Field work and ethnobotanical studies
Raimondo *et al.*, 2009	Swellendam and the Eastern Cape	Field work and herbarium studies
Moffett, 2010	Eastern Cape	Field work and ethnobotanical studies
Vlok & Schutte-Vlok, 2010	Swellendam and the Eastern Cape	Field work and herbarium studies
Manning & Goldblatt, 2012	Swellendam and the Eastern Cape	Field work and herbarium studies
Snijman, 2013	Swellendam and the Eastern Cape	Field work and herbarium studies
Afolayan *et al.*, 2014	Eastern Cape	Field work and ethnobotanical studies
Chigor, 2014	Eastern Cape	Field work and ethnobotanical studies
Retief & Meyer, 2017	Swellendam and the Eastern Cape	Field work and herbarium studies

Akinrinde *et al.*, 2018a	Eastern Cape	Field work, ethnobotanical studies and laboratory evaluations
Akinrinde *et al.*, 2018b	Eastern Cape	Field work, ethnobotanical studies and laboratory evaluations
Odeyemi & Bradley, 2018	Eastern Cape	Field work, ethnobotanical studies and laboratory evaluations
Bredenkamp, 2019	Swellendam and the Eastern Cape	Field work and herbarium studies
Hulley & Van Wyk, 2019	Swellendam	Field work and ethnobotanical studies
Moteetee *et al.*, 2019	Eastern Cape	Field work and ethnobotanical studies
Nyakudya *et al.*, 2020	Swellendam and the Eastern Cape	Ethnobotanical studies
Aremu & Pendota, 2021	Swellendam and the Eastern Cape	Ethnobotanical studies
Kambizi & Bvenura, 2021	Swellendam and the Eastern Cape	Ethnobotanical studies
Sagbo & Hussein, 2022	Eastern Cape	Ethnobotanical studies
Akinrinde *et al.*, 2024	Eastern Cape	Ethnobotanical studies
Mnxati, 2024	Swellendam and the Eastern Cape	Field work and herbarium studies
Mnxati & Mankga, 2025	Swellendam and the Eastern Cape	Field work and herbarium studies

3. Results and discussion

3.1 Taxonomy and botanical description of Dianthus thunbergii

Dianthus thunbergii is a member of the eudicot family Caryophyllaceae, which is commonly known as pink or carnation family (Manning, 2009). The family Caryophyllaceae consists of annual or perennial herbs or subshrubs and rarely shrubs (Leistner, 2000; Retief & Meyer, 2017) distributed in about 105 genera and 2625 species (Christenhusz & Byng, 2016). Members of this family are rarely monoecious, gynodioecious or dioecious. The stems are often swollen at the nodes and usually dichotomously branched (Retief & Meyer, 2017) and the leaves are opposite, decussate or whorled, often united at the base. The leaf blade of the species belonging to this family is simple, with entire margins, with or without stipules (Leistner, 2000; Retief & Meyer, 2017). When stipules are present, they are scarious and sometimes connate at the base. The flowers occur in dichasial inflorescences, which are solitary, bisexual and regular while the fruit is a capsule splitting from apex or a nutlet (Leistner, 2000; Retief & Meyer, 2017). The genus name *Dianthus* is derived from the Greek words "*dios*" meaning "divine" and "*anthos*" meaning "flower" probably referring to the heavenly scent (Manning, 2009). The species name "*thunbergii*" is in honour of Karl Peter von Thunberg (11 November 1743 to 8 August 1928) a Swedish botanist and pupil of Carl Linnaeus who travelled in southern Africa and Asia, collecting and describing many plants and animals (Nordenstam, 1994; Glen, 2004). The synonyms of *D. thunbergii* include *D. hirtus* Vill., *D.*

prostratus Eckl. & Zeyh., *D. ramentaceus* Fenzl ex Sond., *D. scaber* Chaix and *D. scaber* Thunb. (Fassou *et al.,* 2022). English common names of *D. thunbergii* include Thunberg's carnation, Thunberg's dianthus, Thunberg's wild pink and wild pink (Manning, 2009). Eleven vernacular names of *D. thunbergii* have been reported and these include aandblommetjie, grashout, grashoutjie and wilde-angelier (Afrikaans) (Hulley & Van Wyk, 2019), hlokoana-la-tsela and tlokofiloane (Sesotho) (Moffett, 2010; Moteetee *et al.,* 2019) and indlela zimhlope, inkomoyentaba, ubulawu, ubulawu obumhlophe and ungcana (isiXhosa) (Dold & Cocks, 1999, 2002; Cocks & Dold, 2006). *Dianthus thunbergii* is a loosely caespitose or spreading herb, growing to about 10 cm to 40 cm in height (Bredenkamp, 2019). The leaves of flowering shoots of *D. thunbergii* are linear and glaucous with white membranous sheath (Figure 1). The inflorescences have erect or curved peduncles which are usually simple or sparingly branched with two to five flowers. The calyx usually has two to four pairs of bracts which are membranous with minutely ciliolate margins. *Dianthus thunbergii* has toothed petals while the sepals are cylindrical and united, while the petals are pink in colour, limb oblong-ovate or obovate in colour, glabrous, dentate to shortly fimbricate (Figure 1). *Dianthus thunbergii* usually flowers between September and February, and produces a fruit capsule (Goldblatt & Manning, 2000; Manning & Goldblatt, 2012). Two infraspecific taxa of *D. thunbergii* are recognized and these are *D. thunbergii* Hooper forma *maritimus* Hooper and *D. thunbergii* Hooper forma *thunbergii* (Germishuizen & Meyer, 2003; Fassou *et al.,* 2022). These two infraspecific taxa are distinguished on the basis of height and geographical distribution with *D. thunbergii* forma *maritimus* characterized with height ranging from 10 cm to 20 cm and recorded in the Eastern Cape province at an altitude ranging from 15 m to 671 m above sea level. On the contrary, *D. thunbergii* forma *thunbergii* reaches a height of 10 cm to 40 cm and has been recorded in both the Eastern Cape and Western Cape provinces at an altitude ranging from 15 m to 2100 m above sea level. A phylogenetic analysis of three plastids (trnH-psbA, trnK-psbA and trnK-matK) and a nuclear region revealed that *D. thunbergii* is closely related two *Dianthus* species, that is, *D. albens* Aiton and *D. bolusii* Burt Davy (Mnxati & Mankga, 2025). All three species have height reaching 40 cm, linear leaves and flowers ranging in colour from white, pink to purple (Goldblatt & Manning, 2000; Manning & Goldblatt, 2012; Bredenkamp, 2019). Both *D. thunbergii*, *D. albens* and *D. bolusii* have been recorded in nutrient poor and acidic soils but a distinguishing feature of *D. thunbergii* is its petal-lamina, which is devoid of hairs (Hooper, 1959; Mnxati, 2024; Mnxati & Mankga, 2025). *Dianthus thunbergii* has been recorded in stony soil in grassland, closed shrubland in the Eastern Fynbos-Renosterveld biome from Port Elizabeth east to Grahamstown and to Humansdorp (Bredenkamp, 2019). *Dianthus thunbergii* and *D. albens* have

been recorded in overlapping geographical areas in the Eastern Cape province but differ in calyx size and also have entire or toothed petal margins (Goldblatt & Manning, 2000; Manning & Goldblatt, 2012).

3.2 Traditional Uses of Dianthus Thunbergii

Dianthus thunbergii is an important medicinal plant in the Eastern Cape province in South Africa (Dold & Cocks, 1999; Cocks & Wiersum, 2003; Cocks, 2006) and the roots of the species are sold in informal herbal medicine markets in the province as sources of traditional medicines (Dold & Cocks, 2002). *Dianthus thunbergii* is also a popular ornamental plant used in flower beds, as a cut flower and dried flower arrangements (Dold & Cock, 2012). Similarly, some *Dianthus* species are regarded as important sources of cut flowers and such taxa include *D. caryophyllus* L., commonly known as carnation, and is widely used in cut flower trade in the Middle East, Europe and South America (Chandra *et al.*, 2016). *Dianthus chinensis* L. is also cultivated on a large scale as an ornamental plant (Bredenkamp, 2019). The roots and other plant parts of *D. thunbergii* are harvested from plants growing in the wild and widely utilized by local communities. But research conducted by Raimondo *et al.* (2009) and Vlok & Schutte-Vlok (2010) showed that *D. thunbergii* is not under any threats and its conservation status based on the IUCN Categories of Threat has categorized the species as of Least Concern as its population is stable. Several researchers listed medicinal uses of *D. thunbergii* in the Eastern and Western Cape provinces of South Africa, including recipes to treat and manage body cleansing or purification, cancer, charm, chest complaints, colic, diabetes mellitus, good luck charm, relieve one's fears and emotions, remove body odour, stomach complaints and wounds (Table 2). Major ailments or diseases treated or managed by leaf or root decoctions or infusions of *D. thunbergii* that are supported by at least two references include (in their order of importance) diabetes mellitus, charm, stomach complaints, chest complaints, body cleansing or purification and remove body odour (Figure 3). These medicinal applications of *D. thunbergii* had historical influence on culture in the Eastern and Western Cape provinces, particularly the use of root infusion of the species as a ritual wash against evil spirits or bad luck attributed to sorcery and to facilitate communication with ancestral spirits through dreams (Cocks & Dold, 2006; Hulley & Van Wyk, 2019). *Dianthus thunbergii* is an important medicinal plant species in South Africa, including other related *Dianthus* species such as *D. albens*, *D. basuticus* Burtt Davy, *D. caespitosus* Thunb., *D. crenatus* Thunb., *D. micropetalus* Ser., *D. mooiensis* F.N.Williams and *D. zeyheri* (Watt & Breyer-Brandwijk, 1962; Jacot Guillarmod, 1971; Hutchings *et al.*, 1996; Arnold *et al.*, 2002; Van Wyk & Gericke, 2018). Today, *D. thunbergii* remains popular as traditional medicine against diabetes mellitus (Oyedemi *et al.*, 2009; Akinrinde *et al.*, 2018a,b; Odeyemi & Bradley, 2018; Nyakudya *et al.*, 2020; Sagbo & Hussein, 2022).

Table 2: Medicinal applications of *Dianthus thunbergii*

Medicinal use	Plant parts used	References
Body cleansing or purification	Root decoction taken orally	Nzue, 2009; Chigor, 2014
Cancer	Root decoction taken orally or applied topically	Akinrinde *et al.*, 2018a
Charm	An infusion of the root is used as a ritual wash against evil spirits or bad luck attributed to sorcery and taken orally to facilitate communication with ancestral spirits through dreams	Cocks & Dold, 2006; Hulley & Van Wyk, 2019
Chest complaints	Root decoction taken orally	Moffett, 2010; Akinrinde *et al.*, 2018a; Moteetee *et al.*, 2019
Colic	Root decoction taken orally	Akinrinde et al., 2018a
Diabetes mellitus	Root decoction taken orally	Oyedemi *et al.*, 2009; Akinrinde *et al.*, 2018a,b; Odeyemi & Bradley, 2018; Nyakudya *et al.*, 2020; Sagbo & Hussein, 2022
Good luck charm	Roots burnt	Van den Bergh, 1995
Relieve one's fears and emotions	Root decoction taken orally	Moffett, 2010; Moteetee *et al.*, 2019
Remove body odour	Leaf infusion applied topically	Afolayan *et al.*, 2014; Kambizi & Bvenura, 2021
Stomach complaints	Root decoction taken orally	Nzue, 2009; Chigor, 2014; Hulley & Van Wyk, 2019; Aremu & Pendota, 2021
Wounds	Root decoction applied topically	Akinrinde *et al.*, 2018a

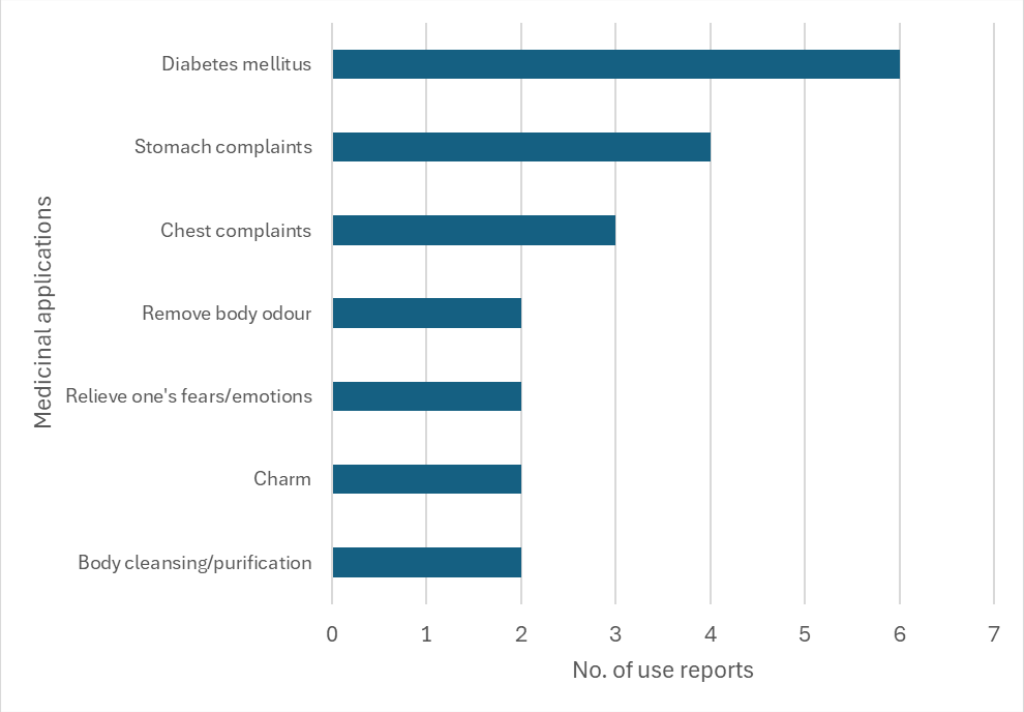


Figure 3: Main uses of *Dianthus thunbergii*

3.3 Phytochemical and pharmacological properties of Dianthus thunbergii

Dianthus thunbergii contains several phytochemicals (Table 3), and some of these secondary metabolites identified from the species have definite potential pharmacological and medicinal value. The roots of *D. thunbergii* are rich in different biological molecules such as coumaric acid derivatives, flavonoid derivatives, lignans, lipids and lipid-like molecules, oligosaccharides, organo-heterocyclic compounds, phenolic glycosides, tannin and terpenoids (Akinrinde *et al.*, 2018a, 2024). Other phytochemical compounds identified from the roots of the species include aldehydes, alkanes, alkaloids, amides, amines, amino acids, fatty acid esters, flavonols, ketones and proanthocyanidins (Akinrinde *et al.*, 2018b, 2024). Some of these phytochemical compounds are associated with multiple beneficial biochemical effects and therefore, characterized with potential phytotherapeutic applications. The aqueous and ethanol extracts of *D. thunbergii* roots also demonstrated antioxidant (Akinrinde *et al.*, 2018b) and anti-proliferative (Akinrinde *et al.*, 2018a) in *in vitro* experiments.

Table 3: Phytochemical compounds putatively identified from roots of *Dianthus thunbergii*

Chemical compound	Formula	Reference
Coumaric acid derivatives		
Isoacteoside	$C_{29}H_{36}O_{15}$	Akinrinde *et al.*, 2018a
Flavonoid derivatives		
Albanin H	$C_{50}H_{48}O_{12}$	Akinrinde *et al.*, 2018a
6"-Caffeoylastragalin	$C_{30}H_{26}O_{14}$	Akinrinde *et al.*, 2018a
7-chloro-3,3',4',5,6,8-hexamethoxyflavone	$C_{21}H_{21}ClO_8$	Akinrinde *et al.*, 2018a
Hyperoside	$C_{21}H_{20}O_{12}$	Akinrinde *et al.*, 2018a
Irilone 4´-glucoside	$C_{22}H_{20}O_{11}$	Akinrinde *et al.*, 2018a
Kaempferol 3-gentiobioside	$C_{27}H_{30}O_{16}$	Akinrinde *et al.*, 2018a
Myricetin 3-acetyl rhamnoside)	$C_{23}H_{22}O_{13}$	Akinrinde *et al.*, 2018a
Pelargonidin 3-arabinoside	$C_{20}H_{19}O_9^+$	Akinrinde *et al.*, 2018a
Peonidin 3-sophoroside 5-glucoside	$C_{34}H_{43}O_{21}^+$	Akinrinde *et al.*, 2018a
Pinotin A aglycone	$C_{25}H_{19}O_9$	Akinrinde *et al.*, 2018a
α-Viniferin	$C_{42}H_{30}O_9$	Akinrinde *et al.*, 2018a
Lignans		
Lappaol H	$C_{40}H_{46}O_{14}$	Akinrinde *et al.*, 2018a
Lipids and lipid-like molecules		

Endomorphin-2	$C_{32}H_{37}N_5O_5$	Akinrinde *et al.*, 2018a
22-Deoxocurcubitacin D	$C_{30}H_{46}O_6$	Akinrinde *et al.*, 2018a
Lactodifucotetraose	$C_{24}H_{42}O_{19}$	Akinrinde *et al.*, 2018a
Lactosamine	$C_{12}H_{23}NO_{10}$	Akinrinde *et al.*, 2018a
Lyciumin B	$C_{44}H_{52}N_{10}O_{11}$	Akinrinde *et al.*, 2018a
Maltobionic acid	$C_{12}H_{22}O_{12}$	Akinrinde *et al.*, 2018a
β-vulganoside 1	$C_{47}H_{70}O_{20}$	Akinrinde *et al.*, 2018a
Oligosaccharides		
Inulin	$(C_6H_{10}O_5)_n$	Akinrinde *et al.*, 2018a
Maltohexaose	$C_{36}H_{62}O_{31}$	Akinrinde *et al.*, 2018a
Organo-heterocyclic compounds		
Norrubrofusarin 6-gentiobioside	$C_{26}H_{30}O_{15}$	Akinrinde *et al.*, 2018a
3'-N-acetyl-4'-O-(9-octadecenoyl) fusaro chromanone	$C_{35}H_{54}N_2O_6$	Akinrinde *et al.*, 2018a
Thiamine monophosphate	$C_{12}H_{17}N_4O_4PS$	Akinrinde *et al.*, 2018a
1,3,5-Trihydroxy-10-methyl acridone	$C_{14}H_{11}NO_4$	Akinrinde *et al.*, 2018a
Phenolic glycosides		
Nb-trans-Feruloylserotonin glucoside	$C_{26}H_{30}N_2O_9$	Akinrinde *et al.*, 2018a
Zeanoside C	$C_{16}H_{19}NO_{10}$	Akinrinde *et al.*, 2018a
Tannin		
6-Cinnamoyl-1,6-digalloyl-beta-D-glucopyranose	$C_{29}H_{26}O_{15}$	Akinrinde *et al.*, 2018a
Terpenoids		
α-Amyrin tetratriacontanoate	$C_{64}H_{116}O_2$	Akinrinde *et al.*, 2018a
Centellasaponin B	$C_{42}H_{68}O_{16}$	Akinrinde *et al.*, 2018a
β-Citraurin epoxide	$C_{30}H_{40}O_3$	Akinrinde *et al.*, 2018a
Licorice saponin C2	$C_{42}H_{62}O_{15}$	Akinrinde *et al.*, 2018a
3-keto-isosteviol	$C_{20}H_{28}O_4$	Akinrinde *et al.*, 2024
γ-Muurolene	$C_{15}H_{24}$	Akinrinde *et al.*, 2024
α and β-pinene	$C_{10}H_{16}$	Akinrinde *et al.*, 2024
L-pinocarveol	$C_{10}H_{16}O$	Akinrinde *et al.*, 2024
Sanguisorbin E	$C_{43}H_{68}O_{13}$	Akinrinde *et al.*, 2018a
β-selinene	$C_{15}H_{24}$	Akinrinde *et al.*, 2024

Soyasaponin γ-G	$C_{48}H_{74}O_{17}$	Akinrinde *et al.*, 2018a
Spathulenol	$C_{15}H_{24}O$	Akinrinde *et al.*, 2024
Cis-2-Thujen-4-ol	$C_{10}H_{16}O$	Akinrinde *et al.*, 2024
Cis-Verbenol	$C_{10}H_{16}O$	Akinrinde *et al.*, 2024
Verbenone	$C_{10}H_{14}O$	Akinrinde *et al.*, 2024

3.3.1 Antioxidant activities

Akinrinde *et al.* (2018b) evaluated the antioxidant activities of ethanol and aqueous extracts of *D. thunbergii* roots using the 2'-azino-bis (3-ethylbenthiazoline-6-sulfonic acid (ABTS), 1,1 diphenyl-2-picrylhydrazyl (DPPH), nitric oxide (NO), ferric-reducing antioxidant potential (FRAP) and hydrogen peroxide (H_2O_2) assays with butylated hydroxytoluene, vitamin C and rutin as positive controls. The extracts demonstrated activities against DPPH, H2O2, ABTS and NO exhibiting half maximal inhibitory concentration (IC_{50}) values ranging from 0.005 mg/ml to 0.1 mg/ml (Akinrinde *et al.*, 2018b).

3.3.2 Anti-proliferative activities

Akinrinde *et al.* (2018a) evaluated the anti-proliferative activities of ethanol and aqueous extracts of *D. thunbergii* roots on murine insulinoma (INS-1) and human hepato-cellular carcinoma (HepG2) cell lines using the 3-(4,5-dimethylthiazol-2-yl) 2,5-diphenyltetrazolium bromide (MTT) and crystal violet cell viability assays. The aqueous extract exhibited the best activities against both INS-1 and HepG2 with IC_{50} values ranging from 36.0 µg/ml to 50.0 µg/ml (Akinrinde *et al.*, 2018a).

4. Conclusion

The current review provides a summary of the medicinal uses, phytochemical and pharmacological properties of *D. thunbergii*. Such documentation is particularly important in tropical Africa where the majority of the population rely on medicinal plants for primary health care needs. Knowledge gaps in the scholarly literature on *D. thunbergii* that have been identified, which require additional research in a variety of experiments include the need for detailed phytochemical and pharmacological studies aimed at evaluating the toxicological properties, *in vivo*, pre-clinical and clinical studies involving the species. This comprehensive documentation of the ethnopharmacological properties and therapeutic potential of *D. thunbergii* contributes essential insights to traditional ecological and cultural knowledge associated with the species. The documented information about medicinal applications and ethnopharmacological properties of *D. thunbergii* could be useful in bio-prospecting for new health-promoting and pharmaceutical products. The present study with detailed information about medicinal uses, plant parts used, dose, route of administration, phytochemical and pharmacological properties of *D. thunbergii* is an important and essential step towards correlating the medicinal uses of the

species with its ethnopharmaceutical properties. The growing interest in medicinal plants such as *D. thunbergii* as sources of traditional medicines underscores the importance of ethnopharmacological research.

References

Afolayan, A.J., Grierson, D.S., Mbeng, W.O. (2014). Ethnobotanical survey of medicinal plants used in the management of skin disorders among the Xhosa communities of the Amathole District, Eastern Cape, South Africa. *Journal of Ethnopharmacology*, 153, 220–232.

Agboyibor, K.M., Nambiema, A., Golestani, A., *et al.* (2026). Prevalence, time trends and associated factors of adult overweight and obesity in 36 countries in the WHO African region from 2003 to 2022: A study of 54 WHO STEPS surveys representing 156 million adults. *BMJ Global Health*, 11, e019988.

Akinrinde, A., Van de Venter, M., Koekemoer, T., Bradley, G. (2018a). Anti-proliferative activities of the aqueous root extract of *Dianthus thunbergii* SS Hooper (Caryophyllaceae). *African Journal of Traditional Complementary and Alternative Medicine*, 15(4): 32-44.

Akinrinde, A.S., Afolayan, A.J., Bradley, G. (2018b). Phytochemical composition and antioxidant activities of *Dianthus Thunbergii* Hooper and *Hypoxis Argentea* Harv ex Baker: Plants used for the management of diabetes mellitus in Eastern Cape, South Africa. *Pharmacognosy Magazine*, 14, 195-202.

Akinrinde, A.S., Afolayan, A.J., Bradley, G. (2024). Terpenoid profiles of the essential oils from the underground parts of *Dianthus thunbergii* S.S. Hooper and *Hypoxis argentea* Harv ex Baker as affected by pre-distillation drying. *Ornamental and Medicinal Plants*, 7(1), 21-31.

Aremu, A.O., Pendota, S.C. (2021). Medicinal plants for mitigating pain and inflammatory-related conditions: An appraisal of ethnobotanical uses and patterns in South Africa. *Frontiers in Pharmacology*, 12, 758583.

Arnold, T.H., Prentice, C.A., Hawker, L.C., Snyman, E.E., Tomalin, M., Crouch, N.R., Pottas-Bircher, C. (2002). *Medicinal and magical plants of southern Africa: An annotated checklist*. National Botanical Institute, Strelitzia 13, Pretoria, South Africa.

Bredenkamp, C.L. (2019). *A flora of the Eastern Cape province: Volume 1*. Strelitzia 41, South African National Biodiversity Institute, Pretoria, South Africa.

Chandra, S., Rawat, D.S., Chandra, D., Rastogi, J. (2016). Nativity, phytochemistry, ethnobotany and pharmacology of *Dianthus caryophyllus. Research Journal of Medicinal Plant*, 10(1), 1-9.

Chigor, C.B. (2014). Development of conservation methods for *Gunnera perpensa* L.: An overexploited medicinal

plant in the Eastern Cape, South Africa. Unpublished PhD Thesis, University of Fort Hare, Alice, South Africa.

Christenhusz, M.J.M., Byng, J.W. (2016). The number of known plants species in the world and its annual increase. *Phytotaxa*, 261(3), 201–217.

Cocks, M. (2006). Wild plant resources and cultural practices in rural and urban households in South Africa: Implications for bio-cultural diversity conservation. Unpublished PhD Thesis, Wageningen University, Wageningen, The Netherlands.

Cocks, M.L., Dold, A.P. (2006). Cultural significance of biodiversity: The role of medicinal plants in urban African cultural practices in the Eastern Cape, South Africa. *Journal of Ethnobiology*, 26(1), 60-82.

Dold, T., Cocks, M.L. (2012). *Voices from the Forest: Celebrating Nature and Culture in Xhosaland.* Jacan Media, Johannesburg, South Africa.

Dold, A.P., Cocks, M.L. (2002). The trade in medicinal plants in the Eastern Cape, South Africa. *South African Journal of Science*, 98, 589–597.

Dold, A.P., Cocks, M.L. (1999). Preliminary list of Xhosa plant names from the Eastern Cape, South Africa. *Bothalia*, 29, 267–292.

Fassou, G., Korotkova, N., Nersesyan, A., Koch, M.A., Dimopoulos, P., Borsch, T. (2022). Taxonomy of *Dianthus* (Caryophyllaceae): Overall phylogenetic relationships and assessment of species diversity based on a first comprehensive checklist of the genus. *PhytoKeys*, 196, 91-214.

Germishuizen, G., Meyer, N.L. (2003). *Plants of southern Africa: An annotated checklist*. National Botanical Institute, Pretoria, South Africa.

Glen, H. (2004). *Sappi: What's in a name? The meanings of the botanical names of trees*. Jacana Media (Pvt) Ltd, Johannesburg, South Africa.

Goldblatt, P., Manning, J. (2000). *Cape plants: A conspectus of the Cape flora of South Africa*. National Botanical Institute of South Africa, Pretoria, South Africa.

Hooper, S.S. (1959). The genus *Dianthus* in Central and South Africa. *Hooker's Icones Plantarum*, 37, 1-58.

Hulley, I.M., Van Wyk, B.E. (2019). Quantitative medicinal ethnobotany of Kannaland (western Little Karoo, South Africa): Non-homogeneity amongst villages. *South African Journal of Botany*, 122, 225-265.

Hutchings, A., Scott, A.H., Lewis, G., Cunningham, A. (1996). *Zulu medicinal plants: An inventory*. Natal University Press, Pietermaritzburg, South Africa.

Jacot Guillarmod, A. (1971). *Flora of Lesotho*. J. Cramer, Lehre, Germany.

Kambizi, L., Bvenura, C. (2021). Medicinal plants for strong immune system and traditional skin therapy in South Africa:

An overview. In *Medicinal Plants and the Human Immune System* (pp. 123-172), Husen, A., editor. CRC/Taylor & Francis, Boca Raton, FL, USA.

Leistner, O.A. (2000). *Seed plants of southern Africa: Families and genera*. Strelitzia 10, National Botanical Institute, Pretoria, South Africa.

Manning, J. (2009). *Field guide to wild flowers of South Africa, Lesotho and Swaziland*. Struik Nature, Cape Town, South Africa.

Manning, J., Goldblatt, P. (2012). *Plants of the Greater Cape Floristic region 1: The Core Cape Flora.* South African National Biodiversity Institute, Pretoria, South Africa.

Melaku, Y.A., Gill, T.K., Taylor, A.W., Appleton, S.L., Gonzalez-Chica, D., Adams, R., Achoki, T., Shi, Z., Renzaho, A. (2018). Trends of mortality attributable to child and maternal undernutrition, overweight/obesity and dietary risk factors of non-communicable diseases in sub-Saharan Africa, 1990–2015: Findings from the Global Burden of Disease Study 2015. *Public Health Nutrition*, 22(5), 827–840.

Mnxati, E.S. (2024). A phylogenetic study of the genus *Dianthus* L. (Caryophyllaceae) in South Africa. Unpublished MSc Dissertation, University of South Africa, Pretoria, South Africa.

Mnxati, S., Mankga, L. (2025). Phylogenetic relationships of *Dianthus* (Caryophyllaceae) species found in South Africa. *Diversity*, 17, 202.

Modjadji, P., Thovhogi, N., Sekgala, M.D., Monyeki, K.D. (2025). Non-communicable disease burden and dietary determinants in women of reproductive age in Sub-Saharan Africa: A scoping review. *Diseases*, 13, 313.

Moffett, R.O. (2010). *Sesotho plant and animal names and plants used by the Basotho*. Sun Press, Stellenbosch, South Africa.

Mokhoathi, J. (2021). Christianity in transformation: The rise of African Christianity among the AmaXhosa of the Eastern Cape. *Acta Theologica*, 41(32), 149–164.

Moteetee, A., Moffett, R.O., Seleteng-Kose, L. (2019). A review of the ethnobotany of the Basotho of Lesotho and the free state Province of South Africa (South Sotho). *South African Journal of Botany*, 122, 21-56.

Ndude, A., Memela, S. (2024). Utilisation of rondavel space by amaXhosa people: A case of Mbhashe Local Municipality, Eastern Cape Province, South Africa. *Humanities and Social Sciences Communications*, 11, 1122.

Nnyepi, M.S., Gwisai, N., Lekgoa, M., Seru, T. (2015). Evidence of nutrition transition in Southern Africa. *Proceedings of the Nutrition Society*, *74*, 478–486.

Nordenstam, B. (1994). Carl Peter Thunberg (1743–1828): "The father of South African Botany", his contribution and

legacy. *Transactions of the Royal Society of South Africa*, *49*(2), 161–174.

Nyakudya, T.T., Tshabalala, T., Dangarembizi, R., Erlwanger, K.H., Ndhlala, A.R. (2020). The potential therapeutic value of medicinal plants in the management of metabolic disorders. *Molecules*, 25, 2669.

Nzue, A.P.M.M. (2009). Use and conservation status of medicinal plants in the Cape Peninsula, Western Cape Province of South Africa. Unpublished MSc dissertation, University of Stellenbosch, Stellenbosch, South Africa.

Odeyemi, S., Bradley, G. (2018). Medicinal plants used for the traditional management of diabetes in the Eastern Cape, South Africa: Pharmacology and toxicology. *Molecules*, *23*, 2759.

Owino, V.O. (2019). Challenges and opportunities to tackle the rising prevalence of diet-related non-communicable diseases in Africa. *Proceedings of the Nutrition Society*, 78, 506–512.

Oyedemi, S.O., Bradley, G., Afolayan, A.J. (2009). Ethnobotanical survey of medicinal plants used for the management of diabetes mellitus in the Nkonkobe Municipality of South Africa. *Journal of Medicinal Plants Research*, 3(12), 1040-1044.

Popkin, B.M., Ng, S.W. (2022). The nutrition transition to a stage of high obesity and noncommunicable disease prevalence dominated by ultra-processed foods is not inevitable. *Obes. Rev.*, *23*, e13366.

Raimondo, D., von Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A., Manyama, P.A. (2009). *Red List of South African Plants.* Strelitzia 25. South African National Biodiversity Institute, Pretoria, South Africa.

Retief, E., Meyer, N.L. (2017). *Plants of the Free State: Inventory and identification guide*. Strelitzia 38, South African National Biodiversity Institute, Pretoria, South Africa.

Sagbo, I.J., Hussein, A.A. (2022). Antidiabetic medicinal plants used in the Eastern Cape Province of South Africa: An updated review. *Processes*, 10(9), 1817.

Snijman, D.A. (2013). *Plants of the Greater Cape Floristic Region, volume 2: The extra Cape flora.* Strelitzia 30, South African National Biodiversity Institute, Pretoria, South Africa.

Tapkigen, J., Harding, S., Pulkki, J., *et al*. (2024). Climate change-induced shifts in the food systems and diet-related non-communicable diseases in sub-Saharan Africa: A scoping review and a conceptual framework. *BMJ Open*, 14, e080241.

Tareke, A.A., Mohammed, A., Ali, Y., Muche, A. (2025). Trends in overweight and obesity among reproductive-age women in sub-Saharan African countries from 1990 to 2030: Progress towards 2030 SDG

nutrition targets. *Clinical Epidemiology and Global Health*, 33, 102044.

Van den Bergh, C.K. (1995). The healing practices of Bishop Joseph Matuwane. *Navorsinge van die Nasionale Museum: Researches of the National Museum*, 11(12), 377-396.

Van Wyk, B.-E., Gericke, N. (2018). People's plants: A guide to useful plants of southern Africa. Briza Publications, Pretoria, South Africa.

Viljoen, R. (2001). Aboriginal Khoikhoi servants and their masters in colonial Swellendam, South Africa, 1745-1795. *Agricultural History*, 75(1), 28-51.

Vlok, J., Schutte-Vlok, A.L. (2010). *Plants of the Klein Karoo*. Umdaus Press, Hatfield, South Africa.

Watt, J.M., Breyer-Brandwijk, M.G. (1962). *The medicinal and poisonous plants of southern and eastern Africa: Being an account of their medicinal and other uses, chemical composition, pharmacological effects and toxicology in man and animal.* E & S Livingstone Ltd, London, UK.