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Review

Traditional Uses, Phytochemistry, and Pharmacology of *Elegia* Species: A Review

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Abstract: In South Africa, plants belonging to the Restionaceae family possess an ecological dominance. As a result, they have been the subject of numerous morphological, anatomical, and evolutionary studies. However, few studies have focused on their phytochemical profile and their potential pharmacological activities. The genus *Elegia* L. is the second largest of this family comprising 52 species, which are mainly used as materials for thatching. Limited studies on the chemical constituents of *Elegia* species and their importance as medicinal plants have been undertaken. This review provides constructive and extensive information about the botanical characterization, distribution, traditional uses, phytochemistry and pharmacology of the genus *Elegia*. A comprehensive search of previously published literature was performed for studies on this genus, using databases with different key search words. This survey documented 52 *Elegia* species summarizing their previous taxonomic classification. In addition, 14 species were found to be studied for their phytochemical profile, revealing 14 chemical compounds. Concerning their biological activities, only one species (*E. tectorum* (L.f.) Moline and H.P.Linder) is reported for its anti-wrinkle activity. Moreover, two species are locally used for thatching and as materials for brooms. The present review highlights the *Elegia* genus as an important source of bioactive phytochemicals with flavonol glycosides being the main metabolites and reveals the uncharted territory of this genus for new research studies.

Keywords: genus *Elegia*; Restionaceae; restios; flora of South Africa; flavonoids; proanthocyanidins; anti-wrinkle activity

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1. Introduction

Restionaceae is an ancient family, related to grasses and sedges, which includes 60 genera and over 500 species [1–3]. It is distributed throughout the southern hemisphere with the majority of its populations occurring in Africa (approximately 360 species) and in Australia (approximately 150 species) [1,3]. Plants of this family are known as restios and possess a dominant ecological role in the Cape Floristic Region of South Africa. Fynbos is the main vegetation of this biodiversity hotspot and restios are considered its characteristic component [1,4].

In general, the taxonomy of this family is challenging and is constantly modified due to new genetic data [5]. The African species belong to Restionoidae Mast. subfamily, which consists of approximately 16 genera and 360 species. The Restionoidae subfamily is further divided into 2 tribes, Restioneae Bartl. and Willdenowieae Masters [1,6]. The Willdenowieae tribe contains 8 genera, while the rest belong to the Restioneae tribe. Within the Restioneae tribe, there are several groups, one of which is the *Elegia* group including two genera, *Elegia* L. and *Askidiosperma* Steud. [1]. The name Elegia has Greek origin and derives from the ancient Greek word "elegeia" which means ode and the root word "elegos" which translates as lament, mourning or mourning song accompanied by a flute. The word was later used by Plinius in the Latinized form to describe a kind of reed [5].

The Restionaceae family shows an intriguing ecological dominance in South Africa [1]. Consequently, plants of this well-known family have been the subject of numerous morphological, anatomical and evolutionary studies [4,6]. However, the absence of reports on potential pharmacological activities and the lack of up-to-date scientific studies of the phytochemistry are enthralling facts that led us to thoroughly study the restios and especially the genus *Elegia*. Recently, *E. tectorum* revealed promising anti-wrinkle activity. Thus, the aim of this review was to provide constructive and extensive information about the botanic characterization, distribution, traditional uses, phytochemistry and pharmacology of the genus *Elegia* with the hope of further exploration of the scientific potential of these plants.

2. Materials and Methods

A comprehensive literature search was conducted on scientific databases including Google Scholar, PubMed and Reaxys. The keywords "Elegia", "Restionaceae", "Restios", "Elegia compounds", "Elegia phytochemicals", "Elegia pharmacological" and "Elegia traditional uses" were used for data collection. The number of searches/hits for each keyword is presented in Table 1. The criteria for the selection of the used articles were studies on the traditional uses, phytochemistry and pharmacological properties of this genus. Searches were performed for other potential studies by manual screening references in the used research articles. Moreover, books with rigorous quality of taxonomic information and ethnobotany were selected for the review. The latest date for searching the literature was 15 October 2021. The time range of data collection was from 1969 to 2021. The taxonomy of the African Restionaceae available in IntKey format as a free download from the website of the University of Zurich was used to validate the scientific names, provide information about the distribution, botanical characterization and traditional uses of the African species [7]. The *Elegia* species with their botanical synonyms (previous botanical names) are displayed in Table 2, the specialized natural products reported in the genus *Elegia* are categorized by species in Table 3 and the chemical structures of the identified compounds are illustrated in Table 4.

Table 1. The number of searches/hits for each keyword.

Keywords	Number of Searches/Hits		
	Google Scholar	**PubMed**	**Reaxys**
Elegia	88,300	7	38
Restionaceae	8550	50	238
Restios	1200	4	47
Elegia compounds	1180	1845	11
Elegia phytochemicals	32	61	0
Elegia pharmacological	191	5841	0
Elegia traditional uses	5750	30	2

3. Botanical Characterization and Distribution

The plants of the Restionaceae family are found all over the southern hemisphere with approximately 360 species in Africa, 150 in Australia, 4 in New Zealand, 1 in Southwest Asia and 1 in South America. All the species of the genus *Elegia* are endemic to the Western and Eastern Cape Province of South Africa [1,3]. The genus *Elegia* L. is the second largest of the family with 52 species (Table 2) [5,7].

Plants of the Restionaceae family are evergreen, grass-like plants, caespitose, rhizomatous or stoloniferous, growing to a maximum height of 3.5 m (depending on the species) [1,3]. Species belonging to the *Elegia* L. are either caespitose or rhizomatous [3]. The stems of the restios are called culms and they are the only green part of the plant and are, therefore, considered as the main photosynthetic organ [1,3]. The culms of the *Elegia* species could be simple or branched. The leaves of the restios are reduced to sheaths in adult plants, they can also be persistent, but usually the plants lose these sheaths. Male and female inflorescences are usually similar, much branched with numerous small, often dark-coloured spikelets or solitary flowers [1,3]. Spikelets consist of flowers and large bracts (a modified leaf) that are called spathes. Spathes are prominent and often obscure the flowers [1]. Restios' flowers have three petals and three sepals forming a perianth of six tepals whose color, shape, size and texture vary for each species [1]. Each flower is minute (<10 mm long) and is situated on a central axis above a bract. The fruit can be either a 1–3 locular capsule or a 1-locular nut [1,3]. The seeds have an elliptical shape and are between 1–2 mm long [1].

The entire family is wind-pollinated and all genera apart from *Coleocarya* S.T. Blake and *Lepyrodia* R. Br. are dioecious. The enlarged bracts and spathes of the *Elegia* genus appear to work as air scoops, that guide the wind to pass through the styles. Alternatively, they are able to cause local eddies that help the pollen drop down onto the styles. These mechanisms have a high efficacy, since very little pollen of other species has been detected on the styles of the *Elegia* species [1].

Table 2. All species of the genus *Elegia* L. and their previous botanical names.

Botanical Name	Synonyms (Previous Botanical Name)
E. acockii (Pillans) Moline and H.P.Linder	*Chondropetalum acockii* Pillans
E. aggregata (Mast.) Moline and H.P.Linder	*C. aggregatum* (Mast) Pillans *Dovea aggregata* Mast.
E. altigena Pillans	-
E. amoena Pillans	-
E. asperiflora (Nees) Kunth	*E. ciliata* Mast. *E. glauca* Mast. *E. lacerata* Pillans *Restio asperiflorus* Nees
E. atratiflora Esterh.	-
E. caespitosa Esterh.	-
E. capensis (Burm.f.) Schelpe	*E. verticillaris* (L.f.) Kunth *Equisetum capense* Burm. f. *Restio verticillaris* L.f.
E. coleura Nees ex Mast.	*E. exilis* Mast.
E. cuspidata Mast.	-
E. decipiens (Esterhuysen) Moline and H.P.Linder	*Chondropetalum decipiens* Esterhuysen
E. deustum (Rottb.) Kunth	*Chondropetalum deustum* Rottb. *Elegia deusta* (Rottb.) Kunth *Restio chondropetalum* Nees
E. dregeana Kunth	-
E. ebracteata (Kunth) Moline and H.P.Linder	*Chondropetalum ebracteatum* (Kunth) Pillans *Dovea ebracteata* Kunth
E. elephantina H.P.Linder	-
E. equisetacea Mast.	*E. equisetacea* (Mast.) Mast. *E. propinqua* (Nees) Kunth var. *equisetacea* Mast
E. esterhuyseniae Pillans	-
E. extensa Pillans	-
E. fastigiata Mast.	-

Table 2. *Cont.*

Botanical Name	Synonyms (Previous Botanical Name)
E. fenestrata Pillans	-
E. filacea Mast.	*E. gracilis* N.E.Br. *E. parviflora* Pillans *E. parviflora* (Thunb.) Kunth *E. parviflora* Pillans var. *filacea* (Mast.) Pillans *E. rehmanni* Mast
E. fistulosa Kunth	-
E. fucata Esterhuysen	-
E. galpinii N.E.Br.	-
E. grandis (Nees) Kunth	*Lamprocaulis grandis* (Nees) Mast. *Restio grandis* Spreng. Ex Nees
E. grandispicata H.P.Linder	-
E. hookeriana (Mast.) Moline and H.P.Linder	*Chondropetalum hookerianum* (Mast.) Pillans *Dovea bolusii* Mast. *D. hookeriana* Mast.
E. hutchinsonii Pillans	-
E. intermedia (Steud.) Pillans	*E. membranacea* (Nees) Kunth. *E. membranaceus* Nees *Restio intermedius* Steud. *R. membranaceus* Nees
E. juncea L.	*E. junacea* L. *E. propinqua* (Nees) Kunth *Elegia juncea* L. var. *geniculate* Pillans *Elegia propinqua* (Nees) Kunth var. *minor* Mast. *Restio elegia* Murray *Restio junceus (L.)* Nees *R. propinquus* Nees
E. macrocarpa (Kunth) Moline and H.P.Linder	*Chondropetalum macrocarpum* (Kunth) Kunth *Dovea macrocarpa* Kunth
E. marlothii (Pillans) Moline and H.P.Linder	*Chondropetalum marlothii* (Pillans) Pillans *Dovea marlothii* Pillans
E. microcarpa (Kunth) Moline and H.P.Linder	*Chondropetalum microcarpum* (Kunth) Pillans *Dovea rigens* Mast. *D. microcarpa* Kunth
E. mucronata (Nees) Kunth	*Chondropetalum mucronatum* (Nees) Pillans *Dovea mucronata* (Nees) Mast. *E. panicoides* Kunth *Restio mucronatus* Nees
E. muirii Pillans	-
E. namaquense H.P.Linder and Helme	-
E. neesii Mast.	*Lamprocaulis neesii* (Mast.) Mast. *L. schlechteri* Gilg-Ben.
E. nuda (Rottb.) Kunth	*Chondropetalum nudum* Rottb. *Cuculifera dura* Nees *Dovea nuda* (Rottb.) Pillans *E. elongata* Mast. *Restio acuminatus* Thunb. *R. nudus* (Rottb.) Nees

Table 2. *Cont.*

Botanical Name	Synonyms (Previous Botanical Name)
E. persistens Mast.	-
E. prominens Pillans	-
E. racemosa (Poir.) Pers.	*Dovea racemosa* (Poir.) Mast. *E. bella* Pillans *E. fusca* N.E. Br. *E. racemosa* (Poir.) Pers. *Restio racemosa* Poir.
E. recta (Mast.) Moline and H.P.Linder	*Chondropetalum rectum* (Mast.) Pillans *Dovea recta* Mast.
E. rigida Mast.	*E. obtusiflora* Mast. *E. parviflora* Pillans var. *rigida* (Mast.) *E. spathacea* Mast. var. *attenuata* Pillans
E. spathacea Mast.	-
E. squamosa Mast.	*E. pectinata* Pillans
E. stipularis Mast.	-
E. stokoei Pillans	-
E. tectorum (L.f.) Moline and H.P.Linder	*Chondropetalum tectorum* (L.f) Raf. *Dovea cylindrostachya* Mast. *D. tectorum* (L.f.) Mast. *E. tectorumi* (Mast.) Moline and H.P. Linder *Restio tectorum* L.f.
E. thyrsifera (Rotth.) Pers.	*E. acuminata* Mast. *Restio thyrsifer* Rottb.
E. thyrsoidea (Mast.) Pillans	*Dovea thyrsoidea* Mast.
E. vaginulata Mast.	-
E. verreauxii Mast.	-

(-): No synonyms exist.

4. Traditional Uses

The traditional use of herbs is an integral part of the culture and religious practices/rituals of African people. It is estimated that over 80% of the South African population has consulted local therapists who employ traditional methods and treatments, using various parts of native plants at least once in their lives [8]. To date, numerous cultural communities of the region depend on traditional medicine, called "muthi", instead of the modern western medicine [9]. South Africa has a multitude of tribes, each of which uses its own remedies [8,10]. It is estimated that more than 3400 medicinal species exist in southern Africa of which 2062 taxa have been identified as being used and/or sold in this region [9]. These taxa belong to 171 families with the 5 most popular medicinal plant families being the Asteraceae (2236 species; 257 medicinal species), Fabaceae (1638 species; 159 medicinal species), Apocynaceae (689 species; 104 medicinal species), Asphodelaceae (558 species; 83 medicinal species) and Lamiaceae (264 species; 68 medicinal species) [9]. Despite the large contribution of restios to the local flora (over 360 spp. in Africa), Williams et al. (2013) reported that only one species is documented as a medicinal plant, but its common or botanical name was not mentioned [9]. However, some species of the family have been recorded in ethnobotany, still they are all only used as materials for the manufacture of tools such as brushes and dusters [10]. Among them, two *Elegia* species (*E. equisetacea* and *E. tectorum*) are used for thatching and as materials for brooms [1,10].

Plants of Restionaceae family are widely used by the local populations with their main purpose being as a building material for roof thatching [1,3]. Several of them were used as building materials in many areas of South Africa long before the first European colonies arrived. These constructions can still be seen in locations where traditional "reed" houses continue to be built and maintained in a similar way. The culms in particular are used for the construction of various parts of the houses such as roofs and walls [1]. During the Dutch East India Company's presence in the Western Cape, *E. tectorum* (L.f.) Moline and H.P. Linder was one of the most used species for thatching [1,5]. Due to its strong presence in the flora of the surrounding area, it is was probably the main plant employed to build the roofs of what is now modern Cape Town several centuries ago [7]. Nowadays, thatching is prepared mostly from *Thamnochortus insignis* Mast. Apart from thatching, some species are locally used as materials for brooms. In current years, there is an increasing use of restios for ornamental purposes since they are ideal for areas with water shortages [1].

5. Phytochemistry

Although the Restionaceae family has been in existence for over 200 years, few phytochemical studies of this family have previously been conducted. Studies, which have investigated the phytochemical composition of species in this family, have highlighted the flavonoid compounds. The flavonoid patterns of the Restionaceae family present differences compared to those of the related families, Juncaceae and Poaceae. In addition, various flavonoids derivatives were reported among the taxa of the restios, which could be attributed to the geographical origin [3,11,12]. In particular, the African species are rich in common 3-hydroxyflavones (flavonols) and flavones as aglycons or/and with their glycosides. In the genera *Elegia* and *Chondropetalum,* the presence of glycosides of myricetin, laricitrin and syringetin and the absence of glycosides of flavones distinguishes them from the rest of the African taxa [3,11]. The rest of the African genera contain glycosides of quercetin and glycosides of various flavones. Specifically, the flavones are luteolin, apigenin, chrysoeriol, cyanidin, orientin, iso-orientin and lucenin [11]. In contrast, the Australian species are characterized by the existence of the flavonol, gossypetin, and the absence of proanthocyanidins which can be found in almost all of the African species [3,11]. Interestingly, from the 42 African species that were examined, 88% of them contained proanthocyanidins, while only 4% of the 115 Australian species contained them [13]. Moreover, the presence of gossypetin instead of quercetagetin is considered as a characteristic of a more "ancient" family since the latter is found in families that are more chemically advanced. This hypothesis is supported by the phylogenetic theory that Restionaceae is a relatively unspecialized family and is ancestral to the Poaceae and the Eriocaulaceae [14].

A study by Harborne et al. (1985) investigated 11 species of the genus *Chondropetalum*, showing that even within the genus there are differences in the chemical profile of the flavonoids. In contrast, many of these species revealed numerous similarities with species of the genus *Elegia*. In fact, most of the examined *Chondropetalum* species were eventually reclassified and now belong to the genus *Elegia* and the rest are classified in the genus *Askidiosperma* [2,7]. According to Harborne et al. (1985) the species were divided into two groups based on their 3-hydroxyflavone (flavonol) aglycons. The first group included most species re-classified to the genus *Elegia* and contained glycosides of myricetin, laricitrin and syringetin. Whereas the second group consisted of mainly *Askidiosperma* species, which contain quercetin, kaempferol, gossypetin, 7′-methyl-ether of gossypetin and herbacetin 4′-methyl ether. It is important to note that the different flavonoid quantity of *E. macrocarpa* resulted in the classification of this species into the second group. With regards to the presence of proanthocyanidins, both procyanidin and prodelphinidin were identified in species of the first group (*Elegia* species), while only procyanidin was present in the second group [12]. The chemical structures of the reported natural products from the genus *Elegia* are presented in Tables 3 and 4.

Table 3. Specialized natural products present in species of genus *Elegia* L.

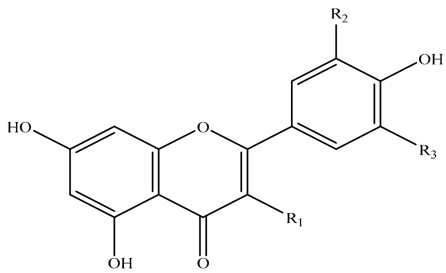
Species	Compounds	Plant Part	References
E. capensis (Burm. F.) Schelpe	Myricetin 3-galactoside (**5**) Myricetin 3-arabinoside (**6**) Myricetin 3-rhamnoside (**7**) Quercetin 3-galactoside (**4**) Procyanidin *	stem, inflorescences	[11]
E. cuspidata Mast.	Syringetin 3-galactoside (**12**) Procyanidin *	stem, inflorescences	[11]
E. deustum (Rottb.) Kunth	Myricetin 3-galactoside (**5**) Myricetin 3-rhamnoside (**6**) Laricitrin 3-galactoside (**9**) Laricitrin 3-rhamnoside (**10**) Syringetin 3-galactoside (**12**) Syringetin 3-rhamnoside (**14**) Procyanidin * Prodelphinidin *	aerial culm #	[12]
E. filacea Mast.	Laricitrin 3-galactoside (**9**) Syringetin 3-galactoside (**12**) Procyanidin * Sulphated flavonoids *	stem, inflorescences	[11]
E. galpinii N.E.Br.	Myricetin 3-galactoside (**5**) Laricitrin 3-galactoside (**9**) Laricitrin 3-diglycoside * Syringetin 3-galactoside (**12**) Procyanidin *	stem, inflorescences	[11]
E. hookeriana (Mast.) Moline and H.P.Linder	Myricetin 3-galactoside (**5**) Myricetin 3-rhamnoside (**7**) Laricitrin 3-galactoside (**9**) Laricitrin 3-rhamnoside (**10**) Syringetin 3-galactoside (**12**) Syringetin 3-arabinoside (**13**) Cyanidin 3-glycoside (anthocyanin) *	stem, inflorescences; aerial culm #	[11,12]
E. macrocarpa (Kunth) Moline and H.P.Linder	Kaempferol (**1**) Quercetin (**2**)	aerial culm #	[12]
E. microcarpa (Kunth.) Moline and H.P.Linder	Myricetin 3-galactoside (**5**) Laricitrin 3-galactoside (**9**) Laricitrin 3-rhamnoside (**10**) Syringetin 3-galactoside (**12**) Syringetin 3-arabinoside (**13**) Procyanidin * Prodelphinidin *	aerial culm #	[12]
E. mucronata (Nees) Kunth	Myricetin 3-galactoside (**5**) Procyanidin * Prodelphinidin *	stem, inflorescences; aerial culm #	[11,12]
E. nuda (Rottb.) Kunth	Myricetin 3-galactoside (**5**) Myricetin 3-rhamnoside (**7**) Laricitrin 3-galactoside (**9**) Laricitrin 3-rhamnoside (**10**) Syringetin 3-galactoside (**12**) Procyanidin * Prodelphinidin *	aerial culm #	[12]

Table 3. *Cont.*

Species	Compounds	Plant Part	References
E. persistens Mast.	Myricetin 3-galactoside (**5**) Laricitrin 3-galactoside (**9**) Laricitrin 3-diglycoside * Syringetin 3-galactoside (**12**) Procyanidin *	stem, inflorescences	[11]
E. recta (Mast.) Moline and H.P.Linder	Myricetin 3-galactoside (**5**) Myricetin 3-rhamnoside (**7**) Laricitrin 3-galactoside (**9**) Laricitrin 3-rhamnoside (**10**) Syringetin 3-galactoside (**12**) Syringetin 3-arabinoside (**13**) Procyanidin * Prodelphinidin *	aerial culm #	[12]
E. spathacea Mast.	Syringetin 3-galactoside (**12**)	stem, inflorescences	[11]
E. tectorum (L.f.) Moline and H.P.Linder	Laricitrin 3-galactoside (**9**) Syringetin 3-galactoside (**12**) Procyanidin * Prodelphinidin *	stem, inflorescences; aerial culm #	[11,12]

(-): no synonyms exist; *: not determined; #: aerial culm (or stem) tissues, after separation from the inflorescences.

Table 4. Chemical Structures of the 3-hydroxyflavone (flavonol) derivatives of *Elegia* species.



Chemical Name	R_1	R_2	R_3
Kaempferol (**1**)	OH	H	H
Quercetin (**2**)	OH	OH	H
Quercetin 3-galactoside (**3**)	O-gal	OH	H
Myricetin (**4**)	OH	OH	OH
Myricetin 3-galactoside (**5**)	O-gal	OH	OH
Myricetin 3-arabinoside (**6**)	O-ara	OH	OH
Myricetin 3-rhamnoside (**7**)	O-rha	OH	OH
Laricitrin (**8**)	OH	OMe	OH
Laricitrin 3-galactoside (**9**)	O-gal	OMe	OH
Laricitrin 3-rhamnoside (**10**)	O-rha	OMe	OH
Syringetin (**11**)	OH	OMe	OMe
Syringetin 3-galactoside (**12**)	O-gal	OMe	OMe
Syringetin 3-arabinoside (**13**)	O-ara	OMe	OMe
Syringetin 3-rhamnoside (**14**)	O-rha	OMe	OMe

Gal: galactoside; Ara: Arabinoside; Rha: Rhamnoside.

6. Potential Pharmacological Activities and Clinical Studies

Even though the phytochemistry of the genus *Elegia* has been studied in some degree, there are no research for the potential biological activities of its compounds. This fact is very puzzling, since many *Elegia* species contain flavonols and some contain proanthocyanidins [12,13]. 3-Hydroxyflavones (flavonols) are one of the most abundant classes of flavonoids that possess many important pharmacological activities [15,16]. In general, flavonols display a significant antioxidant activity. Specifically, kaempferol (**1**) and quercetin (**2**), as well as their glycosides possess antioxidant activity [16–18]. Furthermore, many flavonols such as kaempferol (**1**), quercetin (**2**), and myricetin (**4**) are known to inhibit numerous enzymes [16]. In addition, kaempferol (**1**) and quercetin (**2**) have shown antineoplastic and anti-ulcer activity [16]. Many studies have reported the anti-microbial and the anti-inflammatory activities of several flavonols [16–19]. Myricetin (**4**) could be found in many diets and it has demonstrated antioxidant, anti-inflammatory, anti-cancer and neuroprotective activity [20]. Moreover, myricetin (**4**) has exerted antidiabetic, anti-cancer, immunomodulatory, cardiovascular, analgesic and antihypertensive activity [20,21]. Myricetin 3-galactoside (**5**) and myricetin 3-rhamnoside (**7**) have shown in vitro antioxidant and antigenotoxic activity [22,23]. In addition, myricetin 3-galactoside (**5**) has demonstrated antinociceptive, anticatabolic and anti-inflammatory activities [24,25]. Recently, this compound has exhibited anti-osteoporotic properties [26]. Laricitrin (**8**) and syringetin (**11**) are less common flavonols and they have not been thoroughly studied compared to kaempferol or quercetin. Syringetin 3-galactoside (**12**) has shown antioxidant potential through DPPH method, which was higher than α-tocopherol [27]. Likewise, laricitrin (**8**) has indicated strong antioxidant activity in DPPH test [28].

Proanthocyanidins have been mentioned to possess various and promising pharmacological properties [29]. In particular, they have shown antioxidant, anticancer, antidiabetic, neuroprotective, and antimicrobial activities. Thus, their presence reinforces the already pharmaceutically interesting phytochemical profile of *Elegia* species.

The species *E. tectorum* was included in a recently conducted research project that investigated the potential of twenty-seven indigenous South African plants. They were tested for the treatment of acne, skin hyperpigmentation, wrinkles (elastase inhibition), periodontal diseases, tuberculosis and cancer [30]. The ethanolic extract of *E. tectorum* was studied for its antibacterial activity against *Cutibacterium acnes*, *Prevotella intermedia*, *Streptococcus mutans*, *Mycobacterium tuberculosis* and *M. smegmatis*. The method used was the serial microtiter dilution assay in which the minimum inhibitory concentration (MIC) values for plant extract were measured. Furthermore, the ethanolic extract was explored for inhibition activity against elastase and tyrosinase, which are enzymes associated with wrinkle formation and pigmentation, respectively. Moreover, the cytotoxicity were tested against human keratinocytes (HaCat), melanoma cells (MEL-1), breast cancer cells (MCF-7) and cervical cancer cells (HeLa) [30]. The results showed that *E. tectorum* exhibited no antibacterial or cytotoxic activity. However, it displayed a moderate anti-tyrosinase activity with an IC_{50} value of 65.26 ± 8.38 μg/mL and potent anti-elastase activity with an IC_{50} value of 13.5 ± 1.5 μg/mL. The inhibitory activity against elastase of *E. tectorum* was comparable to ursolic acid, a known inhibitor of elastase. It is worth noting that after consecutive liquid/liquid partitions with ethyl acetate and saturated butanol three fractions were obtained. Of these fractions, the remaining aqueous fraction had the highest anti-elastase activity, but its IC_{50} value was lower compared to the initial ethanol extract. Furthermore, the aqueous fraction was submitted to further chromatographic techniques and gave six subfractions, of which none anti-elastase activity. Thus, the author assumed that this activity was possibly correlated to synergistic effects with the compounds presented in the ethanol extract.

In a clinical study, *E. tectorum* was tested for irritancy in twenty subjects. The results indicated that this plant had a mild irritant activity. Nevertheless, when tested in cream formulation it showed no skin irritation [30]. Another clinical study examined the anti-wrinkle effects of *E. tectorum* in twenty-six Caucasian females with Fitzpatrick skin phototypes I-III. It was concluded that the test product, compared to a placebo control, was effective in decreasing the wrinkle depth after 28 days of use with an application rate of two times per day [30].

7. Conclusions

The present review described thoroughly all the existing knowledge and research advances of the genus *Elegia* L. It focused on highlighting the importance of this genus as a major component of the fynbos biome, as well as its integral role in the cultural practices and everyday life of locals. Furthermore, taking also in consideration the recent results on the anti-wrinkle effects of *E. tectorum*, this overview unveiled the promising role of *Elegia* spp. as potential medicinal plants of South Africa with rich bioactive phytochemical content.

As a result, this study could be a stimulus for further research of the *Elegia* genus or even the entire Restionaceae family. In addition, it could be used as a guide for scientists in need of uncharted species that have not yet been fully explored. The fact that no *Elegia* species has been used traditionally as a medicinal plant should not be a prohibitive factor since scientists today have the necessary tools to unveil the hidden treasure of novel specialized metabolites of species that may have eluded human curiosity and history up until today. The research that has been conducted for the *Elegia* genus is very limited. Though, the results which are summarized herein clearly indicate that these plants could be a promising source and very beneficial for the local population and economy. Further studies should be carried out to acquire a better understanding on the phytochemistry and the pharmacological properties of the *Elegia* species.

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References

1. Dorrat-Haaksma, E.; Linder, H.P. *Restios of the Fynbos*, 2nd ed.; Struik Nature: Cape Town, South Africa, 2012.
2. Moline, P.M.; Linder, H.P. Molecular Phylogeny and Generic Delimitation in the Elegia Group (Restionaceae, South Africa) Based on a Complete Taxon Sampling and Four Chloroplast DNA Regions. *Syst. Bot.* **2005**, *30*, 759–772. [CrossRef]
3. Linder, H.P.; Briggs, B.G.; Johnson, L.A.S. *The Families and Genera of Vascular Plants*, 1st ed.; Kubitzki, K., Ed.; Springer: New York, NY, USA, 1998; Volume 4.
4. Hardy, C.R.; Moline, P.; Linder, H.P. A Phylogeny for the African Restionaceae and New Perspectives on Morphology's Role in Generating Complete Species Phylogenies for Large Clades. *Int. J. Plant Sci.* **2008**, *169*, 377–390. [CrossRef]
5. Linder, H.P.; Hardy, C.R. A Generic Classification of the Restioneae (Restionaceae), Southern Africa. *Bothalia* **2010**, *40*, 1–36. [CrossRef]
6. Briggs, B.; Linder, P. A New Subfamilial and Tribal Classification of Restionaceae (Poales). *Telopea* **2009**, *12*, 333–345. [CrossRef]
7. Linder, H.P. The Taxonomy of the African Restionaceae Available in Intkey Format. Available online: http://www.systbot.uzh.ch/en/Bestimmungsschluessel/Restionaceae (accessed on 13 October 2021).
8. Steenkamp, V. Traditional Herbal Remedies Used by South African Women for Gynaecological Complaints. *J. Ethnopharmacol.* **2003**, *86*, 97–108. [CrossRef]
9. Williams, V.L.; Victor, J.E.; Crouch, N.R. Red Listed Medicinal Plants of South Africa: Status, Trends, and Assessment Challenges. *S. Afr. J. Bot.* **2013**, *86*, 23–35. [CrossRef]
10. Aston Philander, L. An Ethnobotany of Western Cape Rasta Bush Medicine. *J. Ethnopharmacol.* **2011**, *138*, 578–594. [CrossRef] [PubMed]
11. Harborne, J.B. Correlations between Flavonoid Chemistry, Anatomy and Geography in the Restionaceae. *Phytochemistry* **1979**, *18*, 1323–1327. [CrossRef]
12. Harborne, J.B.; Boardley, M.; Linder, P. Variations in Flavonoid Patterns within the Genus *Chondropetalum* (Restionaceae). *Phytochemistry* **1985**, *24*, 6. [CrossRef]
13. Harborne, J.B. Arsenal for Survival: Secondary Plant Products. *Taxon* **2000**, *49*, 435–449. [CrossRef]
14. Harborne, J.B.; Clifford, H.T. Flavonoid Patterns of the Restionaceae. Gossypetin in Restio and a New Flavone in Hypolaena. *Phytochemistry* **1969**, *8*, 2071–2075. [CrossRef]
15. Agrawal, A.D. Pharmacological Activities of Flavonoids: A Review. *Int. J. Pharm. Sci. Nanotechnol.* **2011**, *4*, 1394–1398. [CrossRef]
16. Brahmachari, G.; Gorai, D. Progress in the Research on Naturally Occurring Flavones and Flavonols: An Overview. *COC* **2006**, *10*, 873–898. [CrossRef]
17. Lesjak, M.; Beara, I.; Simin, N.; Pintać, D.; Majkić, T.; Bekvalac, K.; Orčić, D.; Mimica-Dukić, N. Antioxidant and Anti-Inflammatory Activities of Quercetin and Its Derivatives. *J. Funct. Foods* **2018**, *40*, 68–75. [CrossRef]
18. Tatsimo, S.J.N.; de Tamokou, J.D.; Havyarimana, L.; Csupor, D.; Forgo, P.; Hohmann, J.; Kuiate, J.-R.; Tane, P. Antimicrobial and Antioxidant Activity of Kaempferol Rhamnoside Derivatives from *Bryophyllum pinnatum*. *BMC Res. Notes* **2012**, *5*, 158. [CrossRef]

19. Rho, H.S.; Ghimeray, A.K.; Yoo, D.S.; Ahn, S.M.; Kwon, S.S.; Lee, K.H.; Cho, D.H.; Cho, J.Y. Kaempferol and Kaempferol Rhamnosides with Depigmenting and Anti-Inflammatory Properties. *Molecules* **2011**, *16*, 3338–3344. [CrossRef] [PubMed]
20. Semwal, D.; Semwal, R.; Combrinck, S.; Viljoen, A. Myricetin: A Dietary Molecule with Diverse Biological Activities. *Nutrients* **2016**, *8*, 90. [CrossRef]
21. Taheri, Y.; Suleria, H.A.R.; Martins, N.; Sytar, O.; Beyatli, A.; Yeskaliyeva, B.; Seitimova, G.; Salehi, B.; Semwal, P.; Painuli, S.; et al. Myricetin Bioactive Effects: Moving from Preclinical Evidence to Potential Clinical Applications. *BMC Complement. Med.* **2020**, *20*, 241. [CrossRef] [PubMed]
22. Hayder, N.; Bouhlel, I.; Skandrani, I.; Kadri, M.; Steiman, R.; Guiraud, P.; Mariotte, A.-M.; Ghedira, K.; Dijoux-Franca, M.-G.; Chekir-Ghedira, L. In Vitro Antioxidant and Antigenotoxic Potentials of Myricetin-3-O-Galactoside and Myricetin-3-O-Rhamnoside from *Myrtus communis*: Modulation of Expression of Genes Involved in Cell Defence System Using CDNA Microarray. *Toxicol. Vitr.* **2008**, *22*, 567–581. [CrossRef]
23. Xu, Z.; He, W.; Liu, C.; Kong, J. Enzymatic Synthesis of Myricetin 3-O-Galactoside through a Whole-Cell Biocatalyst. *Chin. Herb. Med.* **2020**, *12*, 384–389. [CrossRef]
24. de Oliveira Azevedo, A.; Campos, J.J.; de Souza, G.G.; de Carvalho Veloso, C.; Duarte, I.D.G.; Braga, F.C.; de Castro Perez, A. Antinociceptive and Anti-Inflammatory Effects of Myricetin 3-O-β-Galactoside Isolated from *Davilla elliptica*: Involvement of the Nitrergic System. *J. Nat. Med.* **2015**, *69*, 487–493. [CrossRef] [PubMed]
25. Oh, J.H.; Karadeniz, F.; Lee, J.I.; Park, S.Y.; Seo, Y.; Kong, C.-S. Anticatabolic and Anti-Inflammatory Effects of Myricetin 3-O-β-D-Galactopyranoside in UVA-Irradiated Dermal Cells via Repression of MAPK/AP-1 and Activation of TGFβ/Smad. *Molecules* **2020**, *25*, 1331. [CrossRef] [PubMed]
26. Karadeniz, F.; Oh, J.H.; Jo, H.J.; Seo, Y.; Kong, C.-S. Myricetin 3-O-β-D-Galactopyranoside Exhibits Potential Anti-Osteoporotic Properties in Human Bone Marrow-Derived Mesenchymal Stromal Cells via Stimulation of Osteoblastogenesis and Suppression of Adipogenesis. *Cells* **2021**, *10*, 2690. [CrossRef]
27. Masuoka, C.; Yokoi, K.; Komatsu, H.; Kinjo, J.; Nohara, T.; Ono, M. Two Novel Antioxidant Ortho-Benzoyloxyphenyl Acetic Acid Derivatives from the Fruit of *Vaccinium uliginosum*. *FSTR* **2007**, *13*, 215–220. [CrossRef]
28. do Vale, A.E.; David, J.M.; Brandão, H.N.; David, J.P. A New Flavonol Glycoside Derivative from Leaves of *Moldenhawera* Nutans. *Z. Nat. C* **2005**, *60*, 45–49. [CrossRef] [PubMed]
29. Rauf, A.; Imran, M.; Abu-Izneid, T.; Iahtisham-Ul-Haq; Patel, S.; Pan, X.; Naz, S.; Sanches Silva, A.; Saeed, F.; Rasul Suleria, H.A. Proanthocyanidins: A Comprehensive Review. *Biomed. Pharmacother.* **2019**, *116*, 108999. [CrossRef]
30. Lall, N. *Natural Cosmetics from South African Wetland Plants*; TT 817/20; Water Research Commission: Pretoria, South Africa, 2020.