UNIVERSIDAD DE SANTIAGO DE CHILE

BOLETÍN LATINOAMERICANO Y DEL CARIBE DE PLANTAS MEDICINALES Y AROMÁTICAS
17 (6): 583 - 603 (2018)
© / ISSN 0717 7917 / www.blacpma.usach.cl

Blacpma

**Artículo Original | Original Article**

# Therapeutic plants used by traditional health practitioners to treat pneumonia in the Limpopo Province, South Africa

[Plantas terapéuticas utilizadas por profesionales de la salud tradicionales para tratar la neumonía en la provincia de Limpopo, Sudáfrica]

**Sebua Silas Semenya[1,2] & Alfred Maroyi[2]**

[1]*Technology Transfer Office, Research Administration and Development Department, University of Limpopo, Sovenga, South Africa*
[2]*Medicinal Plants and Economic Development Research Centre, Department of Botany, University of Fort Hare, Alice, South Africa*
***Contactos | Contacts:*** **Sebua Silas SEMENYA** - ***E-mail address:*** **sebuasemenya@gmail.com / sebua.semenya@ul.ac.za**

**Abstract:** Ethnobotanical studies focusing on the documentation of folk therapies employed for pneumonia are almost non-existence in Africa and elsewhere. Data on plants used to treat this ailments was obtained through informed consent semi-structured face-to-face interview and field observations with 128 conveniently selected Bapedi traditional healers (THs) residing in the Limpopo Province, South Africa. A total of 57 plant species distributed across 54 genera and 32 botanical families, mostly the Asteraceae (21.8%) and Fabaceae (18.7%) were used by THs to treat pneumonia and related symptoms. Therapeutic uses of larger number of the documented species are not recorded elsewhere in literature as treatments of these ailments. Overall, the most widely used species by all interviewed THs were *Acacia erioloba*, *Clerodendrum ternatum*, *Cryptocarya transvaalensis*, *Enicostema axillare*, *Lasiosiphon caffer* and *Stylochaeton natalensis*. Ethnopharmacological studies validating the reported therapeutic claims of the species by Bapedi THs should be a subject of future investigation.

**Keywords:** Bapedi; Ethnobotany; Medicinal plants; Traditional healing practices; Pneumonia..

**Resumen:** Los estudios etnobotánicos que se centran en la documentación de las terapias populares empleadas para la neumonía son casi inexistentes en África y en otros lugares. Los datos sobre plantas utilizadas para tratar estas dolencias se obtuvieron a través de entrevistas personales semiestructuradas con consentimiento informado y observaciones de campo a 128 curanderos tradicionales (TH) convenientemente seleccionados que residen en la provincia de Limpopo, Sudáfrica. Las TH utilizaron un total de 57 especies de plantas distribuidas en 54 géneros y 32 familias botánicas, en su mayoría Asteraceae (21.8%) y Fabaceae (18.7%) para tratar la neumonía y los síntomas relacionados. Los usos terapéuticos de un gran número de las especies documentadas no se registran en ninguna otra parte de la literatura como tratamientos para estas dolencias. En general, las especies más utilizadas por todos los TH entrevistados fueron *Acacia erioloba*, *Clerodendrum ternatum*, *Cryptocarya transvaalensis*, *Enicostema axillare*, *Lasiosiphon caffer* y *Stylochaeton natalensis*. Los estudios etnofarmacológicos que validan las afirmaciones terapéuticas informadas de las especies por parte de Bapedi TH deben ser un tema de investigación futura.

**Palabras clave**: Bapedi; Etnobotánica; Plantas medicinales; Prácticas curativas tradicionales; Neumonía.

**Recibido | Received:** April 27, 2016
**Aceptado | Accepted:** June 22, 2018
**Aceptado en versión corregida | Accepted in revised form**: October 2, 2018
**Publicado en línea | Published online:** November 30, 2018
**Este artículo puede ser citado como / This article must be cited as:** SS Semenya, A Maroyi. 2018. Therapeutic plants used by traditional health practitioners to treat pneumonia in the Limpopo Province, South Africa. **Bol Latinoam Caribe Plant Med Aromat** 17 (6): 583 – 603.

## INTRODUCTION

Pneumonia is a form of an acute respiratory infection that causes lung inflammation, making breathing painful and limiting oxygen intake (World Health Organisation, 2015). Major pathogenic causes of pneumonia include amongst the other *Streptococcus pneumoniae* and *Heamophilus influenzae* Type-B (Hib) (Levine *et al*., 2000). This illness affects people of all ages, but is particularly common in older adults and young children (PKIDs, 2018). However, there is little reliable information on its specific incidence and mortality in adults across the globe (Buzzo *et al*., 2013). Amongst the children worldwide, pneumonia accounts for an estimated 15% of all mortality of those under the age of five years per annum (World Health Organisation, 2015). However, sub-Saharan Africa is disproportionately affected, accounting for more than half of these pneumonia cases per year. This therefore, suggests that the affliction is widespread and significant health care issue in many African countries.

Indeed, recent available literature from African countries has shown that pneumonia is a leading killer of children. For instance, in Nigeria more than 120,000 children under the age of five years were reported to have died from this infection in 2010 (Olowu *et al*., 2015). Pneumonia was ranked second as the leading cause of death among children of this age bracket in Kenya, accounting for 16% (Onyango *et al*., 2012). In Ethiopia at least 8% of children die because of pneumonia infections per annum (Shibre, 2015). South Africa is not excluded and literatures revealed that this infection is the leading cause of childhood mortality, and a major contributor to their morbidity. For instance, in 2011 pneumonia was placed second as the leading cause of fatality, accounting for 11.5% of deaths in children <5 years of age (Statistics South Africa, 2011a). Furthermore, of 0.22 most recent global estimate of pneumonia incidence per annum in children of this age from low and middle income countries, 0.14 episodes was for South Africa, with 11.1% of cases defined as severe (Rudan *et al*., 2010).

Preventive interventions as well as early and appropriate treatment of pneumonia can reduce morbidity and mortality (Sazawal & Black, 2003). One of the prevention and management strategies of this affliction that has been shown to be highly successful in developing countries including Africa, is routine child or adult hoods inoculation with Hib and pneumococcal conjugate vaccines in the modern health care facilities (Peny *et al*., 2005). However, same authors reported that the routine utilization of these vaccines in most African countries is hampered by their high price in the short to medium term. Additionally, in these countries most of people especially who reside in sparsely isolated and mountainous rural areas do not have access to modern health care facilities, or cannot afford the cost of repeatedly travelling to these facilities for treatments (Choonara, 2014). Subsequently, they utilize locally available traditional healers (THs) for management and treatment of diseases (Schwitters *et al*., 2015). Evidence exist in most African countries to name few Gambia (Usuf *et al*., 2016), Nigeria (Bedford, 2012), and South Africa (Ayibor, 2008), that THs do treat pneumonia using plant resources. However, ethnobotanical studies focusing on the documentation of the forest therapies employed by THs or even lay people for this ailment are almost non-existence. For instance, in Africa there is currently one study (Nelwamondo, 2013) carried out amongst Vhavenda THs in the Vhembe district of Limpopo Province (South Africa). This study however, is extremely limited both in terms of spatial coverage and sample size. The purpose of the present study is therefore, to exclusively and comprehensively document the plants used medicinally to treat pneumonia by larger number of THs practicing in the Limpopo Province. This study will contribute towards establishing data bases of this plants in South Africa and Africa as a continent.

## MATERIALS AND METHODS

### *Study area and population*

The present investigation was conducted in the municipalities of Capricorn, Sekhukhune and Waterberg districts of the Limpopo Province (Figure No.1), South Africa. Within each municipality, five representative villages were selected as study sites.

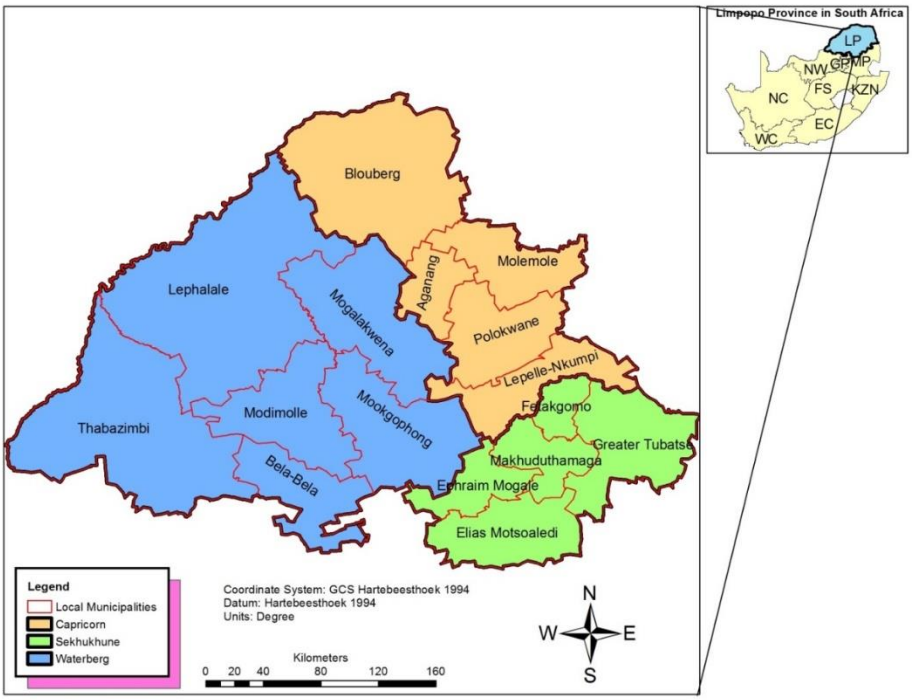


**Figure No. 1**
**Map of Limpopo Province indicating the studied areas (districts and municipalities).**

Vast majority of people inhabiting the studied areas speak Sepedi language (Statistics South Africa, 2011b), and they belong to the Bapedi ethnic, which is one of the prominent and recognised South African tribe, tracing its descent from the Basotho kinfolks (Thema, 2006). Economic development in the studied areas is generally marginalised and unemployment is rife, with a larger proportion of population living in poverty (Statistics South Africa, 2014). Furthermore, infrastructure and services are poor, particularly the healthcare. For instance, a single community health centre is shared by population from numerous villagers.

***Ethnobotanical survey and data collection***

A pilot survey was conducted within each selected village to request approval from local traditional leaders to execute the study, and also to invite THs to share their ethnobotanical medical practices associated with pneumonia. Traditional healers (58 males and 70 females) were randomly selected with the help of local traditional leaders, and only THs who belong to the Bapedi ethnic group were included as participants in this study. Healers were informed about the aim of the project in their local language of Sepedi, and subsequently those who agreed to participate in the study were requested to sign a consent form.

Data were collected from May 2017 to October 2017 using a semi-structured questionnaire through a combination of face-to-face interviews and direct observations with 128 conveniently selected (e.i., with recommendations from fellow healers and leaders) THs. The questionnaire was structured to obtain information on the Pedi name/s of medicinal plants used for pneumonia and related symptoms, ailments treated, parts used for herbal medicine, condition of plant part used (e.i., fresh/dried), and route/s of remedy preparation, administration and dosage strength. Each healer was interviewed in isolation, in his/her consultation room, in order to maintain data independence, and also to keep the practices of healers confident.

The semi-structured interviews schedule was followed by field trip with each healer for species identification, and personal observation (e.i., on the morphological features of each medicinal plant species). Species were initially identified by THs through Pedi vernacular name/s and afterwards researchers collected and prepared voucher

specimens for botanical identification. All the specimens were deposited at the Larry Leach Herbarium (University of Limpopo) and plant identification was done by taxonomic expert at the same Herbarium.

***Data analysis***

***Micro Soft Excel and Statistical Package for the Social Sciences (SPSS)***

Facilities in Microsoft Excel 2000 and SPSS version 14.0 were utilized to analyse data. Descriptive statistical methods such as cross-tabulation, percentage and frequency were employed to summarize ethnobotanical information collected during semi-structured interviews and field observation with Bapedi THs.

***Fidelity level (FL)***

The fidelity level as described by Al-Quran (2009) was used to determine uniformity of plant utilisation amongst the interviewed THs, as a treatment of pneumonia and related symptoms. This was calculated using the following formula:

$$FL\ (\%) = \frac{NP}{N} \times 100$$

Where:

*Np* was the number of THs who independently used of a particular plant species to treat pneumonia and/or related symptom, *N* the total number of THs who reported the plant as a medicine to treat any given disease (pneumonia or related symptom).

The fidelity level shows the percentage of informants claiming the use of a certain plant for the same major purpose (Friedman *et al*., 1986), thus can be used to pinpoint the most favoured medicinal plant species in treatment of particular ailment.

***Use value (UV)***

Use value is determined to provide a good measure to estimate all the possible uses of an individual plant species, and was calculated using the following standard protocol as described by Phillips and Gentry (1993):

$$UV = \Sigma \frac{U}{N}$$

Where:

*U* was the number of citations per species,
*N* the total number of questioned THs.

Generally, plant with broad therapeutic uses and those highly mentioned as cure of a particular ailment will score a high UV.

## RESULTS AND DISCUSSION

***Diversity of used plant species***

Ethnobotanical surveys focusing on the utilisation of plants as treatment of pneumonia are almost non-existent in Africa. To the best of our knowledge with the exclusion of our study, there is currently one study that focused on this subject (Nelwamondo *et al*., 2013), therefore indicating a need for more similar studies. The current survey permitted inventory of 57 species (52 indigenous and 5 exotics) distributed across 54 genera and 32 botanical families that are used by 128 interviewed Bapedi THs (58 males and 70 females) to treat pneumonia and related symptoms. One plant species; *Aloe* spp. (Asphodelaceae) could not be identified scientifically up to species level due lack of diagnostic features. Amongst the 32 families recorded, Asteraceae (21.8%, n=7) and Fabaceae (18.7%, n=6) were represented by higher number of medicinal plant species, probably due to the fact that they both comprise most taxa that dominate the local flora across the studied areas. Carrió and Valles (2012) observed that there is a correlation between medicinal plant utilisations and their local availability, that the more common a plant is in an area, the greater is the probability of its medicinal use. In addition, both Asteraceae (Leonti *et al*., 2003) and Fabaceae (Achika *et al*., 2014) have been reported to have a larger number of bioactive compounds, which could contribute to the utilisation rates of their members by Bapedi THs. The reminder of the botanical families encountered in our study had less than three taxa (Table No. 1A & B).

## Table No. 1A
## Medicinal plants used by Bapedi traditional healers to treat pneumonia and related symptoms in the Limpopo Province

| Species name | Voucher numbers | Vernacular name | Habit | Used plant part | State of use |
|---|---|---|---|---|---|
| | | | | | |
| **Anacardiaceae** | | | | | |
| **Schinus molle* L. | SSS60 | Thoba/Mokwepere | Tree | Leaf | Dry |
| | | | | | |
| *Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) | SSS201 | Morula/Mokano | Tree | Bark | Dry |
| | | | | | |
| **Apiaceae** | | | | | |
| *Alepidea amatymbica* Eckl. & Zeyh. var. *amatymbica* | SSS66 | Lešokwane | Herb | Rhizome | Dry |
| | | | | | |
| **Apocynaceae** | | | | | |
| *Carissa bispinosa* (L.) Desf. ex Brenan | SSS09 | Leputlo/Mothokolo/ Mošhukudu/Motholo | Tree | Root | Dry |
| | | | | | |
| *Pergularia daemia* (Forssk.) Chiov. subsp. *daemia* | SSS1130 | Modutlamaswi | Herb | Root | Dry |
| | | | | | |
| *Strophanthus speciosus* (Ward & Harv.) Reber | SSS01 | Morarwane | Shrub | Root | Dry |
| | | | | | |
| **Araceae** | | | | | |
| Stylochaeton natalensis Schott | SSS222 | Mokunya/Mokušhete | Herb | Root | Dry |
| | | | | | |
| **Asparagaceae** | | | | | |
| *Asparagus angusticladus* (Jessop) J.-P.Lebrun & Stork | SSS1128 | Makgolela | Herb | Root | Dry |
| | | | | | |
| **Asphodelaceae** | | | | | |
| *Aloe* spp. | SSS16 | Thogo/Marobadibogale | Shrub | Leaf | Fresh |
| | | | | | |
| **Asteraceae** | | | | | |
| *Artemisia afra* Jacq. ex Willd. var. *afra* | SSS69 | Legana/Moilanši | Herb | Leaf | Dry |
| | | | | | |
| *Callilepis laureola* DC. | SSS1127 | Phela/Hlonya/Makuru/ Pedipekanto | Herb | Root | Dry |
| | | | | | |
| *Helichrysum caespititium* (DC.) Harv. | SSS1126 | Bokgatha | Herb | Whole plant | Dry |
| | | | | | |
| *Kleinia longiflora* DC. | SSS824 | Mmale | Shrub | Twig | Dry |
| | | | | | |
| *Psiadia punctulata* (DC.) Vatke | SSS707 | Lesotlane/Monotletšane/ lesodi | Shrub | Root | Dry |
| | | | | | |
| *Senecio serratuloides* DC. | SSS88 | Legatuludi | Shrub | Leaf | Dry |
| | | | | | |
| *Vernonia wollastonii* S. Moore | SSS1124 | Lešokwane | Shrub | Root | Dry |
| | | | | | |
| **Canellaceae** | | | | | |
| *Warburgia salutaris* (G. Bertol.) Chiov. | SSS607 | Molaka | Tree | Bark | Dry |
| | | | | | |
| **Cannabaceae** | | | | | |
| **Cannabis sativa* L. var. *indica* (Lam.) Wehmer | SSS55 | Lebake/Patše | Herb | Leaf | Dry |
| | | | | | |
| **Celastraceae** | | | | | |
| *Catha edulis* (Vahl) Forssk. ex Endl. | SSS74 | Lehlatse/Lewang/ Molomomonate | Tree | Root | Dry |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| *Pleurostylia capensis* (Turcz.) Loes | SSS806 | Sekgakga | Tree | Root | Fresh |
| | | | | | |
| **Cyperaceae** | | | | | |
| *Cyperus sexangularis* Nees | SSS602 | Mohlahla | Herb | Root | Dry |
| | | | | | |
| **Dioscoreaceae** | | | | | |
| *Dioscorea dregeana* (Kunth) T.Durand & Schinz | SSS83 | Mabele-apoo | Herb | Tuber | Dry |
| | | | | | |
| **Ebenaceae** | | | | | |
| *Euclea crispa* (Thunb.) Garke subsp. *crispa* | SSS1122 | Mokwerekwere | Tree | Root | Dry |
| | | | | | |
| **Euphorbiaceae** | | | | | |
| *Euphorbia inaequilatera* Sond. var. *inaequilatera* | SSS13 | Kgamaswana/Mmatelaface | Herb | Whole plant | Dry |
| | | | | | |
| *Jatropha zeyheri* Sond. | SSS333 | Sephapabadiya | Herb | Root | Dry |
| | | | | | |
| **Ricinus communis* L. var. *communis* | SSS33 | Mokhure | Shrub | Leaf | Fresh |
| | | | | | |
| **Fabaceae** | | | | | |
| *Acacia erioloba* E.Mey. | SSS22 | Mogohlo/Mošu | Tree | Root | Dry |
| | | | | | |
| *Cassia abbreviata* Oliv. subsp. *beareana* (Holmes) Brenan | SSS57 | Monepenepe | Tree | Bark | Dry |
| | | | | | |
| *Peltophorum africanum* Sond. | SSS47 | Mosehla | Tree | Bark | Dry |
| | | | | | |
| *Philenoptera violacea* (Klotzsch) Schrire | SSS44 | Mphata | Tree | Bark | Dry |
| | | | | | |
| *Senna italica* Mill. subsp. arachoides (Burch.) Lock | SSS515 | Moroteladitšhoši | Herb | Root | Dry |
| | | | | | |
| *Schotia brachypetala* Sond. | SSS520 | Molope | Tree | Root | Dry |
| | | | | | |
| **Gentianaceae** | | | | | |
| *Enicostema axillare* (Lam.) A.Raynal subsp. axillare | SSS517 | Makgonotšohle/ Mphedu-ya-thaba | Herb | Whole plant | Dry |
| | | | | | |
| **Hyacinthaceae** | | | | | |
| *Drimia elata* Jacq. | SSS521 | Sekanama | Herb | Bulb | Fresh |
| | | | | | |
| *Drimia sanguinea* (Schinz) Jessop | SSS90 | Sekanama | Herb | Bulb | Fresh |
| | | | | | |
| **Lamiaceae** | | | | | |
| *Clerodendrum glabrum* E.Mey. var. angustifolium E.Mey. | SSS712 | Mohlokohloko | Tree | Leaf | Fresh |
| | | | | | |
| *Clerodendrum ternatum* Schinz | SSS825 | Sebokane | Herb | Whole plant | Dry |
| | | | | | |
| **Lauraceae** | | | | | |
| *Cryptocarya transvaalensis* Burtt Davy | SSS526 | Kgosupsa | Tree | Bark | Dry |
| | | | | | |
| **Malvaceae** | | | | | |
| *Adansonia digitata* S | SSS509 | Mogoo | Tree | Root | Dry |
| | | | | | |
| *Dombeya rotundifolia* (Hochst.) Planch. var. rotundifolia | SSS504 | Mokgoba | Tree | Root | Dry |
| | | | | | |
| *Gossypium herbaceum* L. subsp. africanum (Watt) Vollesen | SSS815 | Katluni/Leokodi/ Mohlare-wa-mawisi | Shrub | Root | Dry |
| | | | | | |
| **Mesembryanthemaceae** | | | | | |
| *Carpobrotus edulis* (L.) L.Bolus subsp. edulis | SSS804 | Moshipse | Herb | Leaf | Fresh |
| | | | | | |
| **Passifloraceae** | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| *Adenia spinosa* Burtt Davy | SSS12 | Monna-apare/ Pisayabatšumi/Mothema | Shrub | Stem | Dry |
| | | | | | |
| **Polygalaceae** | | | | | |
| *Securidaca longepedunculata* Fresen. var. *longepedunculata* | SSS409 | Mphesu/Mpitlamarago | Tree | Root | Dry |
| | | | | | |
| **Proteaceae** | | | | | |
| *Protea caffra* Meisn. subsp. caffra | SSS35 | Modumela | Tree | Root | Dry |
| | | | | | |
| **Rubiaceae** | | | | | |
| *Vangueria infausta* Burch. subsp. infausta | SSS1120 | Mmilo | Tree | Root | Dry |
| | | | | | |
| **Rutaceae** | | | | | |
| **Citrus limon* (L.) Burm.f. | SSS808 | Moswiri | Tree | Bark | Dry |
| | | | | | |
| *Zanthoxylum capense* (Thunb.) Harv. | SSS31 | Monokwane/ Moregakgaka | Tree | Root | Dry |
| | | | | | |
| *Zanthoxylum humile* (E.A.Bruce) P.G.Waterman | SSS900 | Senokomaropa | Tree | Root | Dry |
| | | | | | |
| **Santalaceae** | | | | | |
| *Osyris lanceolata* Hochst. & Steud. | SSS909 | Mphera | Tree | Root | Dry |
| | | | | | |
| **Solanaceae** | | | | | |
| **Datura ferox* L. | SSS997 | Mohlabane | Herb | Whole plant | Fresh |
| | | | | | |
| *Solanum catombelense* Peyr. | SSS1000 | Mothola-o-momokhwibidu | Herb | Whole plant | Dry |
| | | | | | |
| **Thymelaeacea** | | | | | |
| *Lasiosiphon caffer* Meisn. | SSS997 | Nkekologe | Shrub | Root | Dry |
| | | | | | |
| **Verbenaceae** | | | | | |
| *Lippia javanica* (Burm.f.) Spreng. | SSS992 | Mošunkwane/motlaba-dipoo | Shrub | Leaf | Fresh |
| | | | | | |
| **Vitaceae** | | | | | |
| *Cyphostemma humile* (N. E. Br.) Desc. ex Wild & R. B. Drumm. subsp. *humile* | SSS999 | Sekgalaka | Herb | Root | Dry |
| | | | | | |
| *Rhoicissus tomentosa* (Lam.) Wild & R. B. Drumm. | SSS1138 | Terebe-ya-nageng | Herb | Root | Dry |
| | | | | | |
| **Zamiaceae** | | | | | |
| *Encephalartos transvenosus* Stapf & Burtt Davy | SSS991 | Mofaka | Tree | Root | Dry |
| | | | | | |

## Table No. 1B

| Species name | Methods of herbal preparation and administration | Aliment/s treated | Frequency of use; N = THs (128) | | FL | UV |
|---|---|---|---|---|---|---|
| | | | UM | % | | |
| **Anacardiaceae** | | | | | | |
| **Schinus molle* L. | Mixed with dried root of *J. zeyheri*. Boiled for 7 minutes. Steam is inhaled (nasally). Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Sclerocarya birrea* (A.Rich.) Hochst. subsp. *caffra* (Sond.) | Pounded and mixed with dried powdered roots of *C. laureola*, entire plant of *E. axillare* and *H. caespititium*. Taken orally with warm water. Thrice a day | Pneumonia | 1 | 2.3 | 100 | 0.02 |
| | Pounded and mixed with dried powdered bark of *C. abbreviata* and fresh bulb of *D. sanguinea*. Boiled for 6 | Pneumonia | 1 | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | minutes. Extract is taken orally. Thrice a day | | | | | |
| | Pounded and mixed with dried powdered roots of *S. brachypetala* and *V. infausta* Taken orally with warm water. Thrice a day | Pneumonia | 1 | | | |
| | | | | | | |
| **Apiaceae** | | | | | | |
| *Alepidea amatymbica* Eckl. & Zeyh. var. *amatymbica* | Pounded and taken orally with warm water. Thrice a day | Fever | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Apocynaceae** | | | | | | |
| *Carissa bispinosa* (L.) Desf. ex Brenan | Pounded and taken orally with warm water. Thrice a day | Lack of appetite | 4 | 3.1 | 100 | 0.03 |
| | | | | | | |
| *Pergularia daemia* (Forssk.) Chiov. subsp. *daemia* | Boiled for 6 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Strophanthus speciosus* (Ward & Harv.) Reber | Boiled for 6–12 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Araceae** | | | | | | |
| Stylochaeton natalensis Schott | Boiled for 5 minutes. Extract is taken orally. Thrice a day | Pneumonia | 128 | 100 | 100 | 1.00 |
| | | | | | | |
| **Asparagaceae** | | | | | | |
| *Asparagus angusticladus* (Jessop) J.-P.Lebrun & Stork | Boiled 5–8 minutes. Extract is taken orally. Thrice a day | Lack of appetite | 2 | 1.5 | 100 | 0.01 |
| | | | | | | |
| **Asphodelaceae** | | | | | | |
| *Aloe* spp. | Macerated in warm water for 24 hrs. Decoction is taken orally. Thrice a day | Pneumonia | 5 | 3.9 | 100 | 0.03 |
| | | | | | | |
| **Asteraceae** | | | | | | |
| *Artemisia afra* Jacq. ex Willd. var. *afra* | Boiled for 4–5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day | Fever | 67 | 52.3 | 100 | 0.52 |
| | | | | | | |
| *Callilepis laureola* DC. | Pounded and taken orally with warm water. Thrice a day | Fever | 3 | 2.1 | 30 | 0.07 |
| | | Tight chest | 6 | 4.2 | 60 | |
| | Pounded and mixed with dried powered bark of *S. birrea*, entire plant of *E. axillare* and *H. caespititium*. Taken orally with warm water. Thrice a day | Pneumonia | 1 | 0.7 | 10 | |
| | | | | | | |
| *Helichrysum caespititium* (DC.) Harv. | Pounded and mixed with dried powdered bark of *S. birrea*, entire plant of *E. axillare* and root of *C. laureola*. Taken orally with warm water. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Kleinia longiflora* DC. | Mixed with fresh bulb of *D. sanguinea* and dried whole plant of *E. axillare*. Boiled for 3 minutes. Stream is inhaled (nasally) under blanket. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Psiadia punctulata* (DC.) Vatke | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Senecio serratuloides* DC. | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 20 | 15.6 | 100 | 0.15 |
| | | | | | | |
| *Vernonia wollastonii* S. Moore | Boiled for 7 minutes. Extract is taken orally. Thrice a day | Pneumonia | 19 | 14.8 | 100 | 0.14 |
| | | | | | | |
| **Canellaceae** | | | | | | |
| *Warburgia salutaris* (G. Bertol.) Chiov. | Boiled for 4 minutes. Extract is taken orally. Thrice a day | Chest pain | 4 | 3.1 | 80 | 0.03 |
| | Mixed with fresh leaf of *L. javanica*. Boiled for 5 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | 0.7 | 20 | 0.00 |
| | | | | | | |
| **Cannabaceae** | | | | | | |
| **Cannabis sativa* L. var. *indica* (Lam.) | Pounded and taken orally with warm water. Thrice a | Fever | 5 | 3.9 | 100 | 0.03 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Wehmer | day | | | | | |
| | | | | | | |
| **Celastraceae** | | | | | | |
| *Catha edulis* (Vahl) Forssk. ex Endl. | Pounded and powder is sucked (orally). Thrice a day | Lack of appetite | 8 | 6.2 | 100 | 0.06 |
| | | | | | | |
| *Pleurostylia capensis* (Turcz.) Loes | Boiled for 5 minutes. Steam is inhaled (nasally) under blanket. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Cyperaceae** | | | | | | |
| *Cyperus sexangularis* Nees | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 8 | 6.2 | 100 | 0.06 |
| | | | | | | |
| **Dioscoreaceae** | | | | | | |
| *Dioscorea dregeana* (Kunth) T.Durand & Schinz | Pounded and mixed with dried powdered root of *S. longepedunculata*. Boiled for 4 minutes. Steam inhaled under (nasally) blanket. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Ebenaceae** | | | | | | |
| *Euclea crispa* (Thunb.) Garke subsp. *crispa* | Pounded and taken orally with warm water. Thrice a day | Fatigue | 10 | 7.8 | 100 | 0.07 |
| | | | | | | |
| **Euphorbiaceae** | | | | | | |
| *Euphorbia inaequilatera* Sond. var. *inaequilatera* | Boiled for 5 minutes. Extract is used topically as bath. Thrice a day | Pneumonia | 4 | 3.1 | 100 | 0.03 |
| | | | | | | |
| *Jatropha zeyheri* Sond. | Mixed with dried leaf of S. molle. Boiled for 7 minutes. Steam is inhaled (nasally). Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Ricinus communis* L. var. *communis* | Boiled for 5–8 minutes. Warm extract is used topically to wash body. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Fabaceae** | | | | | | |
| *Acacia erioloba* E.Mey. | Pounded and taken orally with warm water. Thrice day. | Pneumonia | 128 | 100 | 100 | 1.00 |
| | | | | | | |
| *Cassia abbreviata* Oliv. subsp. *beareana* (Holmes) Brenan | Pounded and mixed dried powered bark of *S. birrea* and fresh bulb of *D. sanguinea*. Boiled for 6 minutes. Extract taken orally. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Peltophorum africanum* Sond. | Boiled for 5–11 minutes. Extracts taken orally. Thrice a day | Pneumonia | 2 | 1.4 | 25 | 0.06 |
| | | Tight chest | 6 | 4.2 | 75 | |
| | | | | | | |
| *Philenoptera violacea* (Klotzsch) Schrire | Boiled 5–10 minutes. Extract is taken orally. Thrice a day | Pneumonia | 4 | 3.1 | 100 | 0.03 |
| | | | | | | |
| *Senna italica* Mill. subsp. *arachoides* (Burch.) Lock | Pounded and mixed with dried powdered root of *C. humile*. Power is poured in the warm water, and used topically as a bath. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Schotia brachypetala* Sond. | Pounded and mixed with dried powdered bark of S. birrea and root of *V. infausta*. Taken orally with warm water. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Gentianaceae** | | | | | | |
| *Enicostema axillare* (Lam.) A.Raynal subsp. axillare | Pounded and mixed with dried powdered bark of *S. birrea*, root of *C. laureola* and whole plant of *H. caespititium*. Taken orally with warm water. Thrice a day | Pneumonia | 1 | 100 | 100 | 1.00 |
| | Mixed with fresh bulb of *D. sanguinea* and dried twigs of *K. longiflora*. Boiled for 3 minutes. Stream is inhaled (nasally) under blanket. Thrice a day | Pneumonia | 1 | | | |
| | Mixed with fresh bulb of *D. elata*. Boiled for 5 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | | | |
| | Boiled for 5–9 minutes. Extract is taken orally. Thrice a day | Pneumonia | 125 | | | |
| | | | | | | |
| **Hyacinthaceae** | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Drimia elata* Jacq. | Mixed with dried whole plant of *E. axillare*. Boiled for 5 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Drimia sanguinea* (Schinz) Jessop | Mixed with dried whole plant of E. axillare and twigs of *K. longiflora*. Boiled for 3 minutes. Stream is inhaled (nasally) under blanket. Thrice a day | Pneumonia | 1 | 1.5 | 100 | 0.01 |
| | Mixed with dried powered bark of *C. abbreviata* and *S. birrea*. Boiled for 6 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | | | |
| | | | | | | |
| **Lamiaceae** | | | | | | |
| *Clerodendrum glabrum* E.Mey. var. angustifolium E.Mey. | Boiled for 5–8 minutes. Extract is taken orally. Thrice a day | Aphonia | 2 | 1.5 | 100 | 0.01 |
| | | | | | | |
| *Clerodendrum ternatum* Schinz | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 128 | 100 | 100 | 1.00 |
| | | | | | | |
| **Lauraceae** | | | | | | |
| *Cryptocarya transvaalensis* Burtt Davy | Boiled for 5–9 minutes. Extract is taken orally. Thrice a day | Pneumonia | 128 | 100 | 100 | 1.00 |
| | | | | | | |
| **Malvaceae** | | | | | | |
| *Adansonia digitata* S | Boiled for 6–10 minutes. Extract is taken orally. Thrice a day | Fatigue | 103 | 73.5 | 92.7 | 0.86 |
| | | Lack of appetite | 8 | 5.7 | 7.2 | |
| | | | | | | |
| *Dombeya rotundifolia* (Hochst.) Planch. var. rotundifolia | Pounded and extract is taken orally with warm water. Thrice a day | Lack of appetite | 5 | 3.5 | 71.4 | 0.05 |
| | | Pneumonia | 2 | 1.5 | 28.5 | |
| | | | | | | |
| *Gossypium herbaceum* L. subsp. africanum (Watt) Vollesen | Pounded and extract is taken orally with warm water. Thrice a day | Pneumonia | 6 | 4.6 | 100 | 0.04 |
| | | | | | | |
| **Mesembryanthemaceae** | | | | | | |
| *Carpobrotus edulis* (L.) L.Bolus subsp. edulis | Chewed (orally) as raw and juice is swallowed. Thrice a day | Lack appetite | 2 | 1.5 | 100 | 0.01 |
| | | | | | | |
| **Passifloraceae** | | | | | | |
| *Adenia spinosa* Burtt Davy | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 34 | 26.5 | 100 | 0.26 |
| | | | | | | |
| **Polygalaceae** | | | | | | |
| *Securidaca longepedunculata* Fresen. var. *longepedunculata* | Pounded and mixed with dried powdered tuber of *D. dregeana*. Boiled for 4 minutes. Steam is inhaled (nasally) under blanket. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Proteaceae** | | | | | | |
| *Protea caffra* Meisn. subsp. caffra | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 9 | 7 | 100 | 0.07 |
| | | | | | | |
| **Rubiaceae** | | | | | | |
| *Vangueria infausta* Burch. subsp. infausta | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 1 | 1.5 | 100 | 0.01 |
| | Pounded and mixed with dried powdered bark of *S. birrea* and root of *S. brachypetala*. Taken orally warm water. Thrice a day | Pneumonia | 1 | | | |
| | | | | | | |
| **Rutaceae** | | | | | | |
| **Citrus limon* (L.) Burm.f. | Pounded and taken orally with warm water. Thrice a day | Fever | 34 | 26.5 | 100 | 0.26 |
| | | | | | | |
| *Zanthoxylum capense* (Thunb.) Harv. | Pounded and taken orally with warm water. Thrice a day | Aphonia | 2 | 1.5 | 100 | 0.01 |
| | | | | | | |
| *Zanthoxylum humile* (E.A.Bruce) P.G.Waterman | Pounded and poured in the warm water, and used topically as a bath. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Santalaceae** | | | | | | |
| *Osyris lanceolata* Hochst. & Steud. | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Solanaceae** | | | | | | |
| **Datura ferox* L. | Boiled for 5–9 minutes. Steam is inhaled (nasally) under blanket. Thrice a day | Pneumonia | 2 | 1.5 | 100 | 0.01 |
| | | | | | | |
| *Solanum catombelense* Peyr. | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 88 | 69.5 | 100 | 0.69 |
| | Boiled for 4 minutes. Steam is inhaled (nasally) under. Thrice a day | Pneumonia | 1 | | | |
| | | | | | | |
| **Thymelaeacea** | | | | | | |
| *Lasiosiphon caffer* Meisn. | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 128 | 100 | 100 | 1 |
| | | | | | | |
| **Verbenaceae** | | | | | | |
| *Lippia javanica* (Burm.f.) Spreng. | Mixed with fresh leaf of *W. salutaris*. Boiled for 5 minutes. Extract is taken orally. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| **Vitaceae** | | | | | | |
| *Cyphostemma humile* (N. E. Br.) Desc. ex Wild & R. B. Drumm. subsp. *humile* | Pounded and mixed with dried powdered root of *S. italica*. Power is poured in the warm water, and used topically as a bath. Thrice a day | Pneumonia | 1 | 0.7 | 100 | 0.00 |
| | | | | | | |
| *Rhoicissus tomentosa* (Lam.) Wild & R. B. Drumm. | Pounded and taken orally with warm water. Thrice a day | Pneumonia | 6 | 4.6 | 100 | 0.04 |
| | | | | | | |
| **Zamiaceae** | | | | | | |
| *Encephalartos transvenosus* Stapf & Burtt Davy | Boiled for 5 minutes. Extract is taken orally. Thrice a day | Fatigue | 42 | 30 | 97.6 | 0.33 |
| | | Pneumonia | 1 | 0.7 | 2.3 | |
| | | | | | | |

## Plant habit

Trees made-up the highest proportion (42.1%, n=24) of growth forms in this survey, followed by herbs (38.5%, n=22) and shrubs (19.2%, n=11). In addition to their local availability, preferences of these habits by interviewed THs might be attributed to other factors. For instance, most of the harvested parts (e.g. bark and roots) from trees are not affected by seasonal variations (Mohammed *et al*., 2015), thus are available through the year. This in turn obviously ensures the constant availability of remedies treating pneumonia and related symptoms. On the other hand, herbs might be highly favoured in this study due to their ease of collection, and assumed efficacy as noted by some THs. Overall, the utilisation of the aforesaid habits could possibly be an indication of an old transmission of healing knowledge amongst THs pertinent to pneumonia and related symptoms.

### *Distribution of used plants within the municipalities and districts*

The most species widely utilised by THs (100%, n=128) across the studied sites were *Acacia erioloba*, *Clerodendrum ternatum*, *Cryptocarya transvaalensis*, *Enicostema axillare*, *Lasiosiphon caffer* and *Stylochaeton natalensis*. This finding not only shows the popularity of these species amongst Bapedi THs and their reliability as pneumonia medicine, but to some extent suggest that the various environmental factors favouring their growth and survival are common across the three studied districts. Street & Prinsloo (2012) observed that the species that are widely used are more likely to be over-harvested to extinction. Therefore, studies assessing the sustainability in the harvesting of the afore-said species are critical.

Other species widely distributed in this study were *Adansonia digitata*, *Adenia spinosa*, *Cannabis sativa*, *Citrus limon* and *Solanum catombelense*. These species were utilised by THs in certain municipalities across the three studied districts. Widespread use of *A. digitata*, *C. sativa* and *C. limon* came as no surprise since they are commonly cultivated in home gardens for other uses apart from medicine. For instance, *A. digitata* and *C. limon* were disclosed by THs as part of their diet, and *C. sativa* is

smoked for pleasure. Therefore, most THs across the three studied districts might have ensured that these species are always available as both pneumonia medicine and for the provision the above said uses. *Artemisia afra*, *Callilepis laureola*, *Datura ferox*, *Dombeya rotundifolia*, *Drimia sanguinea*, *Encephalartos transvenosus*, *Euclea crispa*, *Peltophorum africanum*, *Protea caffra*, *Sclerocarya birrea*, *Senecio serratuloides* and *Warburgia salutaris* was also rampant, used by THs in some municipalities but situated within two of three studied districts (Table No. 2). Hence the degree of their utilisation in these areas might coincide with the THs' level of knowledge pertinent to their applications as treatment of pneumonia and related symptoms. The same can be said for *Asparagus angusticladus*, *Carissa bispinosa*, *Carpobrotus edulis*, *Cassia abbreviata*, *Catha edulis*, *Cyperus sexangularis*, *Cyphostemma humile* and *Vernonia wollastonii* which were recorded amongst THs practicing in certain municipalities belonging to a single district. The rest (n=26) of the species were used in a single municipality within one of the three studied districts, thus suggesting that their application as pneumonia and related symptoms therapies are currently restricted to certain THs localised in the selected areas.

***Species utilisation and literature comparison***

Higher number (71.3%, n=40) of plant species documented in the present study were wholly used by THs to treat pneumonia. Only five species (8.7%) were implicated as treatment of this ailment and the following conditions fatigue, lack of appetite, tight chest and fever. The rest (21%, n=12) of the plant were exclusively used to treat aphonia, fatigue, fever, lack of appetite, fatigue and lack of appetite.

***Pneumonia therapies***

Analysis of the results from this study further showed that an overwhelming majority (71.3%, n=40) of species comprising of *A. erioloba*, *Adenia spinosa*, *Aloe spp.*, *Cassia abbreviata*, *C. ternatum*, *C. transvaalensis*, *C. sexangularis*, *C. humile*, *D. ferox*, *Dioscorea dregeana*, *Drimia elata*, *D. sanguinea*, *E. axillare*, *Euphorbia inaequilatera*, *Gossypium herbaceum*, *Helichrysum caespititium*, *Jatropha zeyheri*, *Kleinia longiflora*, *L. caffer*, *Lippia javanica*, *Osyris lanceolata*, *Pergularia daemia*, *Philenoptera violacea*, *Pleurostylia capensis*, *P. caffra*, *Psiadia punctulata*, *Rhoicissus tomentosa*, *Ricinus communis*, *Schinus molle*, *Schotia brachypetala*, *S. birrea*, *Securidaca longepedunculata*, *S. serratuloides*, *Senna italica*, *S. catombelense*, *Strophanthus speciosus*, *S. natalensis*, *Vangueria infausta*, *V. wollastonii* and *Zanthoxylum humile* were exclusively used by Bapedi THs to heal pneumonia (Table No. 1B). Amongst these species 15% (n=6), namely *A. erioloba*, *C. ternatum*, *C. transvaalensis*, *E. axillare*, *L. caffer* and *S. natalensis* was used by all THs (n=128, for each) who treated this disorder across the three studied districts and municipalities. To the best of our knowledge the present study is the first to comprehensively report on the use of these species as medicine to treat pneumonia. Therefore, their restricted uses to Bapedi THs as medicine to treat this condition might be a reflection of an ethnic discovery of their bioactivity, which is not yet known or shared amongst other cultures. The above six listed species should therefore, be targeted for further studies to determine and identify their bio-active compounds. Same studies are also significant for other widely used taxon such as *S. catombelense* (69.5%, n=89), *A. spinosa* (26.5%, n=34), *S. serratuloides* and *V. wollastonii* (14.8%, n=19, for each), which their application as pneumonia treatment is so far also restricted to the Bapedi THs.

Overall, higher numbers of species used by Bapedi THs to treat pneumonia are recorded in South Africa for the first time in this study, as medicine for this affliction. Amongst the 40 recorded species implicated as pneumonia cure, only 12.5% (n=5) viz. *C. abbreviata* (Orwa *et al*., 2009; Dangarembizi *et al*., 2015), *O. lanceolata* (Patel *et al.*, 2014**)**, *R. tomentosa* (Burkill 1985), *S. longepedunculata* (Mustapha, 2013) and *V. infausta* (Plantzafrica, 2016a) was previously reported in literature as medicine for this respiratory. It should be highlighted that with the exception of *V. infausta*, which its use for pneumonia was previously emphasized in South Africa (Plantzafrica, 2016b), use of the aforesaid remaining species as cure for this condition are recorded for the first time in this country as pneumonia cure. Generally, new record of commonly known medicinal plants documented in the current study as remedies for pneumonia might at least partially be ascribed to the dearth of ethnobotanical surveys focusing on pneumonia in Africa as a continent. This posit perhaps is true especially since these plants are widely distributed across Africa. However, it is also probable that knowledge of utilisation of such species might remain localised

amongst Bapedi THs even if more surveys are conducted, attributed to the fact that indigenous curative knowledge may vary according to both geographic location and cultures (Menendez-Baceta *et al*., 2015).

***Pneumonia and related symptoms therapies***

About 8.7% (n=5) of the entirety (n=57) of plants documented in this study comprising of *D. rotundifolia* (lack of appetite), *E. transvenosus* (fatigue), *C. laureola* (fever and tight chest), *P. africanum* (tight chest) as well as *W. salutaris* (tight chest) were reported by Bapedi THs as cure for pneumonia and the mentioned conditions, thus reflecting the confidence healers have in these species as multiple therapies. Nevertheless, many of such plants namely *D. rotundifolia*, *E. transvenosus*, *C. laureola* and *P. africanum* are recorded for the first time in our study as being used for pneumonia and the aforesaid disease/s. Only use of *W. salutaris* for pneumonia and tight chest was previously reported amongst the Zulu THs practicing in South Africa (Felhaber, 1997), and Shona people of Zimbabwe (Colfer, 2012), respectively. This is finding was however, not surprising based on the fact that *W. salutaris* is an important folk remedies for various ailments including respiratory infection and related symptoms both in South Africa and Zimbabwe (Maroyi, 2013). Overall, applications of all the afore-listed species should be scientifically investigated for their bioactivity against the recorded aliments, as they might hold the potential in the management of both pneumonia and its opportunistic infections. Indeed, a single plant can be vested with many metabolites or same molecules can be active against various pathogens (Tugume *et al*., 2016).

The remainder (21%, n=12) of the species; *A. digitata* (fatigue and lack of appetite), *Alepidea amatymbica* (fever), A. afra (fever), *Asparagus angusticladus* (lack of appetite), *Carissa bispinosa* (lack of appetite), *Cannabis sativa* (fever), *Carpobrotus edulis* (lack of appetite), *Catha edulis* (lack of appetite), *Citrus limon* (fever), *Clerodendrum glabrum* (aphonia), *Euclea crispa* (fatigue) and *Zanthoxylum capense* (aphonia) documented in the present study was exclusively used medicinally to treat the mentioned ailments reported by Bapedi THs as common in pneumonia infected patients. Amongst these species only the use of *A. digitata* as fatigue therapy (Wickens, 1979), and *C. sativa* (Augustino *et al*., 2011), *A. afra* (Thring & Weitz, 2005) as well as *A. amatymbica* (Louvel *et al*., 2013) for the aforesaid ailments were previously reported in literature. Applications of the rest of the above-listed species are documented in the present study for the first time.

**Table No. 2**
**Use of species to treat pneumonia (PN) and related symptoms according to districts and municipality**

**Capricorn District**

| Species name | **Municipalities** | | | | | |
|---|---|---|---|---|---|---|
| | **Aganang** | **Blouberg** | **Lepelle-Nkumpi** | **Molemole** | **Polokwane** | **Sum of ailments (FC)** |
| *Acacia erioloba* | PN:12 | PN:15 | PN: 12 | PN:12 | PN:15 | **66** |
| *Adansonia digitata* | FA: 12 | FA: 15 | FA:12 | FA: 12 | FA: 15 | **66** |
| | LA:1 | LA:4 | LA:1 | LA:1 | LA:1 | **8** |
| *Adenia spinosa* | PN:12 | - | - | - | PN:9 | **21** |
| *Alepidea amatymbica* | - | - | - | - | - | **0** |
| *Aloe spp.* | - | - | - | PN:5 | - | **5** |
| *Artemisia afra* | FE:12 | FE:15 | FE:12 | FE:12 | FE:15 | **66** |
| *Asparagus angusticladus* | - | - | LA:1 | - | LA:1 | **2** |
| *Callilepis laureola* | - | - | - | - | FE:3 | **3** |
| | PN:1” | - | - | - | - | **1** |
| | - | TC:2 | - | - | - | **2** |
| *Cannabis sativa* | FE:1 | FE:1 | FE:1 | - | - | **3** |
| *Carissa bispinosa* | - | LA: 4 | - | - | - | **4** |
| *Carpobrotus edulis* | LA:2 | - | - | - | - | **2** |
| *Cassia abbreviata* | PN:1” | - | - | - | - | **1** |
| *Catha edulis* | LA:1 | LA:4 | LA:1 | LA:1 | LA:1 | **8** |
| *Citrus limon* | FE:2 | FE:6 | FE:2 | FE:3 | FE:1 | **14** |
| *Clerodendrum glabrum* | - | - | AP:2 | - | - | **2** |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Clerodendrum ternatum* | PN:12 | PN:15 | PN:12 | PN:12 | PN:15 | **66** |
| *Cryptocarya transvaalensis* | PN:12 | PN:15 | PN:12 | PN:12 | PN:1 | **66** |
| *Cyperus sexangularis* | - | PN:2 | - | PN:4 | PN:2 | **8** |
| *Cyphostemma humile* | - | - | - | - | PN:1” | **1** |
| *Datura ferox* | - | PN:1 | - | - | - | **1** |
| *Dioscorea dregeana* | PN:1” | - | - | - | - | **1** |
| *Dombeya rotundifolia* | LA:1 | LA:1 | LA:1 | LA:1 | LA:1 | **5** |
| | - | - | - | - | PN:1 | **1** |
| *Drimia elata* | - | - | - | - | PN:1” | **1** |
| *Drimia sanguinea* | PN:1” | - | - | - | - | **1** |
| *Encephalartos transvenosus* | FA: 10 | FA: 8 | FA: 2 | FA: 8 | FA: 4 | **32** |
| | - | - | - | - | - | **0** |
| *Enicostema axillare* | PN:1”:11 | PN:15 | PN:12 | PN:12 | PN:1”:14 | **66** |
| *Euclea crispa* | FA:1 | - | - | - | - | **1** |
| *Euphorbia inaequilatera* | - | - | - | - | - | **0** |
| *Gossypium herbaceum* | - | - | - | - | - | **0** |
| *Helichrysum caespititium* | PN:1” | - | - | - | - | **1** |
| *Jatropha zeyheri* | PN:1” | - | - | - | - | **1** |
| *Kleinia longiflora* | - | - | - | - | - | **1** |
| *Lippia javanica* | PN:1” | - | - | - | - | **1** |
| *Lasiosiphon caffer* | PN:12 | PN:15 | PN:12 | PN:12 | PN:15 | **66** |
| *Osyris lanceolata* | - | - | - | PN:1 | - | **1** |
| *Peltophorum africanum* | - | - | - | PN:1 | PN:1 | **2** |
| | - | - | - | - | - | **0** |
| *Pergularia daemia* | PN:1 | - | - | - | - | **1** |
| *Philenoptera violacea* | PN:4 | - | - | - | - | **4** |
| *Pleurostylia capensis* | - | - | - | - | - | **0** |
| *Protea caffra* | - | - | - | PN:1 | - | **1** |
| *Psiadia punctulata* | - | - | - | - | - | **0** |
| *Rhoicissus tomentosa* | - | - | - | - | - | **0** |
| *Ricinus communis* | - | PN:1 | - | - | - | **1** |
| *Schinus molle* | PN:1” | - | - | - | - | **1** |
| *Schotia brachypetala* | - | - | - | - | - | **0** |
| *Sclerocarya birrea* | PN:2” | - | - | - | - | **2** |
| *Securidaca longepedunculata* | PN:1” | - | - | - | - | **1** |
| *Senecio serratuloides* | - | - | - | - | - | **0** |
| *Senna italica* | - | - | - | - | PN:1” | **1** |
| *Solanum catombelense* | PN:10 | PN:5 | PN:5 | - | PN:7 | **27** |
| *Strophanthus speciosus* | - | - | - | - | - | **0** |
| *Stylochaeton natalensis* | PN:12 | PN:15 | PN:12 | PN:12 | PN:15 | **66** |
| *Vangueria infausta* | - | - | - | - | - | **0** |
| *Vernonia wollastonii* | - | - | - | - | - | **0** |
| *Warburgia salutaris* | PN:1” | - | - | - | - | **1** |
| | - | - | - | - | - | **0** |
| *Zanthoxylum capense* | - | - | AP:2 | - | - | **2** |
| *Zanthoxylum humile* | - | - | - | - | PN:1 | **1** |

**Key:** Aphonia, AP; Fatigue, FA; Fever, FE; lack of Appetite, LA. Plain indicate numer of healer/s who use a species to treat an ailments whilst numeric with a quotation mark indicate number of healer/s who use a species in combination to treat an aiment/s

## Sekhukhune District

| **Species name** | **Municipalities** | | | | | |
|---|---|---|---|---|---|---|
| | **Elias Motsoaledi** | **Ephrime Mogale** | **Fetakgomo** | **Makhudumathamaga** | **Tubatse** | **Sum of ailment (FC)** |
| *Acacia erioloba* | PN:13 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Adansonia digitata* | FA:13 | - | - | FA:8 | - | **21** |
| | - | - | - | - | - | **0** |
| *Adenia spinosa* | - | - | PN:9 | - | - | **9** |
| *Alepidea amatymbica* | - | - | - | - | FE:1 | **1** |
| *Aloe spp.* | - | - | - | - | - | **0** |
| *Artemisia afra* | - | - | - | - | - | **0** |
| *Asparagus angusticladus* | - | - | - | - | - | **0** |
| *Callilepis laureola* | - | - | - | - | - | **0** |
| | - | - | - | - | - | **0** |

| | | | | | | |
|---|---|---|---|---|---|---|
| | - | - | - | - | - | **0** |
| *Cannabis sativa* | - | - | - | - | FE:1 | **1** |
| *Carissa bispinosa* | - | - | - | - | - | **0** |
| *Carpobrotus edulis* | - | - | - | - | - | **0** |
| *Cassia abbreviata* | - | - | - | - | - | **0** |
| *Catha edulis* | - | - | - | - | - | **0** |
| *Citrus limon* | - | - | - | FE:1 | - | **1** |
| *Clerodendrum glabrum* | - | - | - | - | - | **0** |
| *Clerodendrum ternatum* | PN:13 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Cryptocarya transvaalensis* | PN:13 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Cyperus sexangularis* | - | - | - | - | - | **0** |
| *Cyphostemma humile* | - | - | - | - | - | **0** |
| *Datura ferox* | - | - | - | - | PN:1 | **1** |
| *Dioscorea dregeana* | - | - | - | - | - | **0** |
| *Dombeya rotundifolia* | - | - | - | - | - | **0** |
| | - | PN:1 | - | - | - | **1** |
| *Drimia elata* | - | - | - | - | - | **0** |
| *Drimia sanguinea* | PN:1” | - | - | - | - | **1** |
| *Encephalartos transvenosus* | - | - | - | FA: 8 | FA: 2 | **10** |
| | - | - | - | PN:1 | - | **1** |
| *Enicostema axillare* | PN:1”:12 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Euclea crispa* | - | - | - | - | - | **0** |
| *Euphorbia inaequilatera* | - | - | - | - | - | **0** |
| *Gossypium herbaceum* | - | - | - | - | PN:6 | **6** |
| *Helichrysum caespititium* | - | - | - | - | - | **0** |
| *Jatropha zeyheri* | - | - | - | - | - | **0** |
| *Kleinia longiflora* | PN:1” | - | - | - | - | **0** |
| *Lippia javanica* | - | - | - | - | - | **0** |
| *Lasiosiphon caffer* | PN:13 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Osyris lanceolata* | - | - | - | - | - | **0** |
| *Peltophorum africanum* | - | - | - | - | - | **0** |
| | - | - | - | - | - | **0** |
| *Pergularia daemia* | - | - | - | - | - | **0** |
| *Philenoptera violacea* | - | - | - | - | - | **0** |
| *Pleurostylia capensis* | PN :1 | - | - | - | - | **1** |
| *Protea caffra* | - | - | PN:4 | PN:1 | PN:3 | **8** |
| *Psiadia punctulata* | - | - | - | - | - | **0** |
| *Rhoicissus tomentosa* | - | - | - | - | PN:6 | **6** |
| *Ricinus communis* | - | - | - | - | - | **0** |
| *Schinus molle* | - | - | - | - | - | **0** |
| *Schotia brachypetala* | - | - | PN:1” | - | - | **1** |
| *Sclerocarya birrea* | - | - | PN:1” | - | - | **1** |
| *Securidaca longepedunculata* | - | - | - | - | - | **0** |
| *Senecio serratuloides* | - | PN:7 | PN:9 | - | - | **16** |
| *Senna italica* | - | - | - | - | - | **0** |
| *Solanum catombelense* | PN:13 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Strophanthus speciosus* | - | - | - | - | - | **0** |
| *Stylochaeton natalensis* | PN:13 | PN:7 | PN:9 | PN:8 | PN:6 | **43** |
| *Vangueria infausta* | - | - | PN:1”:1 | - | - | **2** |
| *Vernonia wollastonii* | - | - | - | - | - | **0** |
| *Warburgia salutaris* | - | - | - | - | - | **0** |
| | - | - | - | - | - | **0** |
| *Zanthoxylum capense* | - | - | - | - | - | **0** |
| *Zanthoxylum humile* | - | - | - | - | - | **0** |

**Key:** Aphonia, AP; Fatigue, FA; Fever, FE; lack of Appetite, LA. Plain indicate numer of healer/s who use a species to treat an ailments whilst numeric with a quotation mark indicate number of healer/s who use a species in combination to treat an aiment/s

## Waterberg Distric

| Species name | Municipalities | | | | | | |
|---|---|---|---|---|---|---|---|
| | Bela-Bela | Lephalale | Modimolle | Mogalakwena | Mookgophong | Thabazimbi | Sum ofailment (FC) |
| *Acacia erioloba* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Adansonia digitata* | FA:2 | FA:1 | FA:1 | FA:4 | FA:4 | FA:4 | **16** |
| | - | - | - | - | - | - | **0** |
| *Adenia spinosa* | - | - | - | - | - | PN:4 | **4** |
| *Alepidea amatymbica* | - | - | - | - | - | - | **0** |
| *Aloe spp.* | - | - | - | - | | | **0** |
| *Artemisia afra* | FE:1 | - | - | - | - | - | **1** |
| *Asparagus angusticladus* | - | - | - | - | - | - | **0** |
| *Callilepis laureola* | - | - | - | - | - | - | **0** |
| | - | - | - | - | - | - | **0** |
| | TC:3 | - | - | TC:1 | - | - | **4** |
| *Cannabis sativa* | | | | FE:1 | | | **1** |
| *Carissa bispinosa* | - | - | - | - | - | - | **0** |
| *Carpobrotus edulis* | - | - | - | - | - | - | **0** |
| *Cassia abbreviata* | - | - | - | - | - | - | **0** |
| *Catha edulis* | - | - | - | - | - | - | **0** |
| *Citrus limon* | FE:4 | FE:1 | FE:2 | FE:4 | FE:4 | FE:4 | **19** |
| *Clerodendrum glabrum* | - | - | - | - | - | - | **0** |
| *Clerodendrum ternatum* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Cryptocarya transvaalensis* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Cyperus sexangularis* | - | - | - | - | - | - | **0** |
| *Cyphostemma humile* | - | - | - | - | - | - | **0** |
| *Datura ferox* | - | - | - | - | - | - | **0** |
| *Dioscorea dregeana* | - | - | - | - | - | - | **0** |
| *Dombeya rotundifolia* | - | - | - | - | - | - | **0** |
| | - | - | - | - | - | - | **0** |
| *Drimia elata* | - | - | - | - | - | - | **0** |
| *Drimia sanguinea* | - | - | - | - | - | - | **0** |
| *Encephalartos transvenosus* | - | - | - | - | - | - | **0** |
| | - | - | - | - | - | - | **0** |
| *Enicostema axillare* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Euclea crispa* | - | FA:2 | FA:1 | FA:3 | - | FA 3 | **9** |
| *Euphorbia inaequilatera* | PN:4 | - | - | - | - | - | **0** |
| *Gossypium herbaceum* | - | - | - | - | - | - | **0** |
| *Helichrysum caespititium* | - | - | - | - | - | - | **0** |
| *Jatropha zeyheri* | - | - | - | - | - | - | **0** |
| *Kleinia longiflora* | - | - | - | - | - | - | **0** |
| *Lippia javanica* | - | | - | - | - | - | **0** |
| *Lasiosiphon caffer* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Osyris lanceolata* | - | - | - | - | - | - | **0** |
| *Peltophorum africanum* | - | - | - | - | - | - | **0** |
| | TC:4 | - | - | TC:1 | - | TC:1 | **6** |
| *Pergularia daemia* | - | - | - | - | - | - | **0** |
| *Philenoptera violacea* | | | - | - | - | - | **0** |
| *Pleurostylia capensis* | - | - | - | - | - | - | **0** |
| *Protea caffra* | - | - | | - | - | - | **0** |
| *Psiadia punctulata* | - | - | - | - | - | PN:1 | **1** |
| *Rhoicissus tomentosa* | - | - | - | - | - | - | **0** |
| *Ricinus communis* | - | - | - | - | - | - | **0** |
| *Schinus molle* | - | - | - | - | - | - | **0** |
| *Schotia brachypetala* | - | - | - | - | - | - | **0** |
| *Sclerocarya birrea* | - | - | - | - | - | - | **0** |
| *Securidaca longepedunculata* | - | - | - | - | - | - | **0** |
| *Senecio serratuloides* | - | PN:4 | - | - | - | - | **4** |
| *Senna italica* | - | - | - | - | - | - | **0** |
| *Solanum catombelense* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| *Strophanthus speciosus* | - | - | - | - | PN:1 | - | **1** |
| *Stylochaeton natalensis* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Vangueria infausta* | - | - | - | - | - | - | **0** |
| *Vernonia wollastonii* | PN:4 | PN:1 | PN:2 | PN:4 | PN:4 | PN:4 | **19** |
| *Warburgia salutaris* | - | - | - | - | - | - | **0** |
| | CP:4 | - | - | - | - | - | **4** |
| *Zanthoxylum capense* | - | - | - | - | - | - | **0** |
| *Zanthoxylum humile* | - | - | - | - | - | - | **0** |
| **Key:** Aphonia, AP; Fatigue, FA; Fever, FE; lack of Appetite, LA. Plain indicate numer of healer/s who use a species to treat an ailments whilst numeric with a quotation mark indicate number of healer/s who use a species in combination to treat an aiment/s | | | | | | | |

### *Fidelity level (FL) and use value (UV)*

The most preferred plants for the treatment of pneumonia and related symptoms in this study according to FL were *C. ternatum*, *C. transvaalensis*, *E. axillare*, *L. caffer* and *S. natalensis* (UM (use mention)=128 and FL=100; pneumonia, for each), *A. digitata* (UM=103 and FL=92.7; fatique), *S. catombelense* (UM=88 and 100 FL; pneumonia), *E. transvenosus* (UM=42 and FL= 97.6; fatigue), *A. afra* (UM=67 and FL=100; fever), *A. spinosa* (UM=34 and FL=100), *C. limon* (UM=34 and FL=100; pneumonia), *S. serratuloides* (UM=20 and FL=100; pneumonia), *A. erioloba* (UM=19 and FL=100; pneumonia) and *V. wollastonii* (UM=19 and FL=100; pneumonia). This finding indicates that THs are knowledgeable about the medical applications of these species in the management of the mentioned health condition/s. Also, it reflects their therapeutic potential as cure for conditions.

Amongst the recorded species in this study, *A. erioloba*, *C. ternatum*, *C. transvaalensis*, *E. axillare*, *L. caffer* and *S. natalensis*, each received highest UV scores of one (n=1) against pneumonia, thus indicating that they might be equally valued by THs within the Bapedi traditional healing sector as pneumonia treatments. Furthermore, it also shows good precision in information exchange regarding their therapeutic applications amongst Bapedi THs. However, from the conservation point of view the referred species might be under pressure of exploitation.

### *Plant parts used, mode of preparations, dosages and administrations*

Different plant parts such as bark, bulb, leaf, rhizome, root, stem, tuber, twig and whole plant were used by Bapedi THs to prepare herbal remedies. Amongst these parts root and leaf were found to be the most frequently favoured accounting for 50% (n=29) and 17.2% (n=10), respectively. The remaining plant parts namely bark (12%, n=7), whole plant (10.3%, n=6), bulb (3.4%, n=2), stem, tuber, twig and rhizome (1.7%, n=1, for each) were less often utilised during remedy preparation. *Warburgia salutaris* was the only species harvested for both leaf and bark. Leaf and root also constituted the major plant part used in a similar study conducted amongst the Vhavenda THs residing in the Vhembe district of Limpopo Province (Nelwamondo *et al*., 2013). Most of the plant parts used by Bapedi THs were processed in their dried state (82.7%, n=48), and only 17.2% (n=10) were prepared while still fresh. The above-mentioned species was the only one processed in both dry and fresh forms. For instance, its leaf was used while still fresh, probably due the fact that they are evergreen, thus available for remedy preparation all year round. On the other hand, *W. salutaris* bark was processed in dried state. Generally, 67 recipes deriving mainly (65.6%, n=44) from a single species as opposed to poly (34.3%, n=23) species were documented in this study. This finding is contrary to that reported by Nelwamondo *et al*. (2013) who found that all recipes in their study were made from a single species. Bapedi THs might have preferred monotherapy due to its simplicity of preparation in order to ensure a better compliance by patients. In addition to this, they might have favoured it as it safe time of searching and harvesting larger number of species for polytherapy preparation. However, utilisation of this therapy by some THs in the present study also has merits as it reduces development of drug resistance. This is particularly true since major pathogens such as *H. influenzae* causing pneumonia and related symptoms are less likely to have resistance to multiple drugs simultaneously (Gessner *et al*., 2010–2014).

**Sum of THs who treat ailment per district using documented species (as presented in Table No. 2)**

| | Districts | | | Sum of THs who use species to treat ailment |
|---|---|---|---|---|
| **Species name** | **Capricorn** | **Sekhukhune** | **Waterberg** | |
| | | | | |
| *Acacia erioloba* | **66** | **43** | **19** | **128** |
| *Adansonia digitata* | **66** | **21** | **16** | **103** |
| | **8** | **0** | **0** | **8** |
| *Adenia spinosa* | **21** | **9** | **4** | **34** |
| *Alepidea amatymbica* | **0** | **1** | **0** | **1** |
| *Aloe spp.* | **5** | **0** | **0** | **5** |
| *Artemisia afra* | **66** | **0** | **1** | **67** |
| *Asparagus angusticladus* | **2** | **0** | **0** | **2** |
| *Callilepis laureola* | **3** | **0** | **0** | **3** |
| | **1** | **0** | **0** | **1** |
| | **2** | **0** | **4** | **6** |
| *Cannabis sativa* | **3** | **1** | **1** | **5** |
| *Carissa bispinosa* | **4** | **0** | **0** | **4** |
| *Carpobrotus edulis* | **2** | **0** | **0** | **2** |
| *Cassia abbreviata* | **1** | **0** | **0** | **1** |
| *Catha edulis* | **8** | **0** | **0** | **8** |
| *Citrus limon* | **14** | **1** | **19** | **34** |
| *Clerodendrum glabrum* | **2** | **0** | **0** | **2** |
| *Clerodendrum ternatum* | **66** | **43** | **19** | **128** |
| *Cryptocarya transvaalensis* | **66** | **43** | **19** | **128** |
| *Cyperus sexangularis* | **8** | **0** | **0** | **8** |
| *Cyphostemma humile* | **1** | **0** | **0** | **1** |
| *Datura ferox* | **1** | **1** | **0** | **2** |
| *Dioscorea dregeana* | **1** | **0** | **0** | **1** |
| *Dombeya rotundifolia* | **5** | **0** | **0** | **5** |
| | **1** | **1** | **0** | **2** |
| *Drimia elata* | **1** | **0** | **0** | **1** |
| *Drimia sanguinea* | **1** | **1** | **0** | **2** |
| *Encephalartos transvenosus* | **32** | **10** | **0** | **42** |
| | **0** | **1** | **0** | **1** |
| *Enicostema axillare* | **66** | **43** | **19** | **128** |
| *Euclea crispa* | **1** | **0** | **9** | **10** |
| *Euphorbia inaequilatera* | **0** | **0** | **0** | **4** |
| *Gossypium herbaceum* | **0** | **6** | **0** | **6** |
| *Helichrysum caespititium* | **1** | **0** | **0** | **1** |
| *Jatropha zeyheri* | **1** | **0** | **0** | **1** |
| *Kleinia longiflora* | **1** | **0** | **0** | **1** |
| *Lippia javanica* | **1** | **0** | **0** | **1** |
| *Lasiosiphon caffer* | **66** | **43** | **19** | **128** |
| *Osyris lanceolata* | **1** | **0** | **0** | **1** |
| *Peltophorum africanum* | **2** | **0** | **0** | **2** |
| | **0** | **0** | **6** | **6** |
| *Pergularia daemia* | **1** | **0** | **0** | **1** |
| *Philenoptera violacea* | **4** | **0** | **0** | **4** |
| *Pleurostylia capensis* | **0** | **1** | **0** | **1** |
| *Protea caffra* | **1** | **8** | **0** | **9** |
| *Psiadia punctulata* | **0** | **0** | **1** | **1** |
| *Rhoicissus tomentosa* | **0** | **6** | **0** | **6** |
| *Ricinus communis* | **1** | **0** | **0** | **1** |
| *Schinus molle* | **1** | **0** | **0** | **1** |
| *Schotia brachypetala* | **0** | **1** | **0** | **1** |
| *Sclerocarya birrea* | **2** | **1** | **0** | **3** |
| *Securidaca longepedunculata* | **1** | **0** | **0** | **1** |
| *Senecio serratuloides* | **0** | **16** | **4** | **20** |
| *Senna italica* | **1** | **0** | **0** | **1** |
| *Solanum catombelense* | **27** | **43** | **19** | **89** |

| | | | | |
|---|---|---|---|---|
| *Strophanthus speciosus* | **0** | **0** | **1** | **1** |
| *Stylochaeton natalensis* | **66** | **43** | **19** | **128** |
| *Vangueria infausta* | **0** | **2** | **0** | **2** |
| *Vernonia wollastonii* | **0** | **0** | **19** | **19** |
| *Warburgia salutaris* | **1** | **0** | **0** | **1** |
| | **0** | **0** | **4** | **4** |
| *Zanthoxylum capense* | **2** | **0** | **0** | **2** |
| *Zanthoxylum humile* | **1** | **0** | **0** | **1** |

The commonest technique of plant preparation in this study was via pounding (47.7%, n=32) and boiling (43.2%, n=29). About 5.9% (n=4) of medicine prepared by THs using both these techniques. Maceration and chew (prescribed as harvested) were the less frequently (1.4%, n=1, for each) preferred routes of herbal preparation in this study. Powdering might be highly favoured by Bapedi THs since it allows the preservation of gathered plant materials that are only available during a specific season. On the other hand, boiling was the only versatile method of herbal preparation used for both desiccated and fresh materials in this study, which might explain its preferences by most interviewed Bapedi THs. Overall, there was no consistency with regards to the duration of boiling these materials amongst THs. For instance, boiling duration of plant parts obtained from same species varied according to THs; a minimum of three to a maximum of 12 minutes, depending on an individual healer was utilised to boil these parts. Preparation of harvested plant parts via maceration (precisely fresh pilled leaf of *Aloe* spp.) was done overnight (24 hrs). Healer who utilised this method reported it as both effective and best for the complete extraction of the potential content of the plant, but also complained about its long preparation duration. However, this claim warrants further investigation.

Prepared medicines/recipes (n=67) were exclusively taken orally (77.6%, n=51), nasally (16.4%, n=11) and topically (7.4%, n=5) respectively. Nelwamondo *et al*. (2013) also reported similar finding amongst Vhavenda THs. With respect to the dosage strength consistency was only observed amongst THs for medicine administered orally where three cups (500 ml) full of extracts was prescribed thrice a day. Similarly, two fresh leaves of raw material were prescribed (orally) three times a day by all THs (Table No. 1A & B). However, on the converse, dosage strength of the remainder of the remedies depended on both an individual healer's preferences and experience. For instance, a minimum of four to five tablespoons of pulverized medicine was prescribed.

## CONCLUSION

There are tremendously few African studies that investigated the use of plant resources by indigenous people as treatment of pneumonia and related conditions. Thus ethnobotanical knowledge pertinent to these disorders remains untapped amid diverse African cultures sited across the various countries. As far as the medicinal use of plant resources to heal pneumonia and related symptoms is concerned, the present study will remain standard reference of work for decades. Overall, larger number of new therapeutic uses of plant species inventoried in this survey that were not recorded elsewhere in literature, emphasises the significance of conducting similar studies amongst other African cultures. Ethnopharmacological studies validating the reported claims of these species should also be a subject of future studies.

## REFERENCES

Achika JI, Arthur DE, Gerald I, Adedayo A. 2014. A review on the phytoconstituents and related medicinal properties of plants in the Asteraceae family. **J Appl Chem** 7: 2278 - 5736.

Al-Quran S. 2009. Ethnopharmacological survey of wild medicinal plants in Showbak, Jordan. **J Ethnopharmacol** 123: 45 - 50.

Augustino S, Hall JB, Makonda FBS, Ishengoma RC. 2011. Medicinal resources of the Miombo woodlands of Urumwa, Tanzania: Plants and its uses. **J Med Plants Res** 5: 6352 - 6372.

Ayibor PK. 2008. **Treatment received by children who visit traditional healers. M.Sc. Dissertation**. University of the Witwatersrand, Johannesburg, South Africa.

Bedford J. 2012. **Qualitative studies to identify solutions to local barriers to care seeking and treatment for diarrhoea, malaria and**

**pneumonia in selected high burden countries: Report on finding from Nigeria**. United Nations Children's Funds (UNICEF), New York, USA.

Burkill HM. 1985. **The useful plants of west tropical Africa: *Ricinus communis* Linn. (Euphorbiaceae)**. Royal Botanic Gardens, Kew (K), UK.

Buzzo AR, Roberts C, Mollinedo LG, Ouevedo JM, Casas GL, Soldevilla JMS. 2013. Morbidity and mortality of pneumonia in adults in six Latin American countries. **Int J Infect Dis** 17: 673 - 677.

Carrió E, Valles J. 2012. Ethnobotany of medicinal plants used in Eastern Mallorca (Balearic Islands, Mediterranean Sea). **J Ethnopharmacol** 141: 1021 - 1040.

Choonara I. 2014. Why children do not receive treatment. **Arch. Dis. Child** 99: 605 - 606.

Colfer CJP. 2012. **Human Health and Forests: A Global Overview of Issues, Practice and Policy**. Routledge, London, UK.

Dangarembizi R, Chivandi E, Dawood S, Erlwanger KH, Gundidza M, Magwa ML, Muredzi P, Samie A. 2015. The fatty acid composition and physicochemical properties of the underutilised *Cassia abbreviata* seed oil. **Pak J Pharm Sci** 28: 1005 - 1008.

Felhaber T (Ed.). 1997. **South African traditional healers. Primary health care handbook**. Kagiso Publishers. Cape Town, South Africa.

Friedman J, Yaniva Z, Dafnib A, Palewitch D. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. **J Ethnopharmacol** 16: 275 - 287.

Gessner BD, Njanpopo-Lafourcade BM, Herbert MA. 2010–2014. ***Haemophilus influenza*. http://www.antimicrobe.org/new/b67.asp**

Leonti MM, Pamirez F, Sticher O, Heinrich M. 2003. Medicinal flora of the Populuca: A botanical systematical perspective. **Econ Bot** 57: 218 - 230.

Levine OS, Liu G, Garman RL, Dowell SF, Yu S, Yang YH. 2000. *Haemophilus influenzae* Type b and *Streptococcus pneumonia* as causes of pneumonia among Children in Beijing, China**. Emerg Infect Diseases** 6: 165 - 170.

Louvel S, Moodley N, Seibert I. 2013. Identification of compounds from the plant species *Alepidea amatymbica* active against HIV. **South Afr J Bot** 86: 9 - 14.

Maroyi A. 2013. *Warburgia salutaris* (Bertol. f.) Chiov.: A multi-use ethnomedicinal plant species. **J Med Plants Res** 7: 53 - 60.

Menendez-Baceta G, Aceituno-Mata L, Reyes-Carcia V, Tardio J, Salpeteur M, Pardo-de-Santayana M. 2015. The importance of cultuiral factors in the distribution of medicinal plant knowledge: A case study in four Basque regions. **J Ethnopharmacol** 161: 116 - 127.

Mohammed S, Danjuma MN, Abdulkarim AI. 2015. Ethnobotanical survey of medicinal plants in Metropolitan Kano, Nigeria. **Int J Environ Res Public Health** 3: 345 - 351.

Mustapha AA. 2013. Ethno-medico-botanical uses of *Securidaca longepedunculata* Fresen (Family-Polygalaceae) from Keffi Local Government, Nasarawa State, Nigeria. **J Nat Remedies** 13: 134 - 137.

Nelwamondo K. 2013. **Ethnobotanical survey of medicinal plants used by traditional healers to treat pneumonia in Vhembe district**. B.Sc. mini-dissertation. University of Venda, Thohoyandou, South Africa.

Nelwamondo MC, Masevhe NA, Mulaudzi TM. 2013. An ethnobotanical survey of medicinal plants used in the treatment of pneumonia in Vhembe District Municipality, Limpopo Province, South Africa. **South Afr J Bot** 86: 179

Olowu A, Elusiyan JBE, Esangbedo D, Ekure EN, Esezobor C, Falade AG, Osinusi K, Mukhtar-Yola M, Meremikwu M, Ibe B, Johnson WBR, Oviawe O, Bastos I. 2015. Management of community acquired pneumonia (CAP) in children: Clinical practice guidelines by the Paediatrics Association of Nigeria (PAN). **Nigerian J Pediatr** 42: 283 - 292.

Onyango D, Kikuvi G, Amukoye E, Omolo J. 2012. Risk factors of severe pneumonia among children aged 2–59 months in western Kenya: A case control study. **Pan Afr Med J** 13: 45.

Orwa C, Mutua A, Kindt R, Jamnadass R, Anthony S. 2009. Agroforestree database: A tree reference and selection guide version 4.0. **http://www.worldagroforestry.org**

Patel S, Mwamhanga M, Mwamhanga J. 2014. The Importance of ethno-medicinal plants amongst the Iraqw in the Karatu District: Cultural and conservation implications. **Under Res J Hum Sci** 13: 1 - 5.

Peny J, Gleizes O, Covilard J. 2005. Financial requirements of immunisation programmes in developing countries: A 2004–2014 perspective. **Vaccine** 23: 4610 - 4618.

Phillips OL, Gentry AH. 1993. The useful plants of Tambopata, Peru: II additional hypotheses testing in quantitative ethnobotany. **Econ Bot** 47: 33 - 43.

PKIDs. 2018. **Pneumonia**. **http://www.pkids.org/diseases/pneumonia.html**

Plantzafrica. 2018a. ***Vangueria infausta* Burch. subsp. *infausta***. **www.plantzafrica.com**

Plantzafrica. 2018b. ***Vangueria infausta* Burch. subsp. *infausta***. **www.plantzafrica.com**

Rudan I, O'Brien KL, Nair H. 2010. Epidemiology and etiology of childhood pneumonia in 2010: Estimates of incidence, severe morbidity, mortality, underlying risk factors and causative pathogens for 192 countries**. J Glob Health** 3: 10 - 40.

Sazawal S, Black RE. 2003. Pneumonia case management trials group. Effect of pneumonia case management on mortality in neonates, infants, and preschool children: A meta-analysis of community-based trials. **Lancet Infect Dis** 3: 547 - 556.

Schwitters A, Lederer P, Zilversmit L, Gudo PS, Ramiro I, Cumba L. 2015. Barriers to health care in rural Mozambique: A rapid ethnographic assessment of planned mobile health clinics for ART. **Glob Health Sci Pract** 3: 109 - 116.

Shibre GS. 2015. **Assessment of the prevalence and associated factors of pneumonia in children 2 to 59 months old, Debreberhan district, North East Ethiopia**. M.Sc. Dissertation. Addis Ababa University, Ethiopia.

Statistics South Africa. 2011a. **Mortality and causes of death in South Africa: Findings from death notification**. **http://www.statssa.gov.za/**

Statistics South Africa. 2011b. **Census 2011 Census in brief**. Statistics South Africa, Pretoria, South Africa.

Statistics South Africa. 2014. **Poverty trends in South Africa: An examination of absolute poverty between 2006 and 2011**. Statistics South Africa, Pretoria, South Africa.

Street RA, Prinsloo G. 2012. Commercially important medicinal plants of South Africa: A review. **J Chem** Vol 2013, Article ID 205048, 16 pages.

Thema KM. 2006. ***Sekgapa:* a culture-based study of a musical tradition of BaPedi women of Mailula, Mmamabolo district, Limpopo Province-South Africa**. Dissertation, University of Cape Town, Cape Town, South Africa.

Thring TSA, Weitz FM. 2005. Medicinal plant use in the Bredasdorp/Elim region of the Southern Overberg in the Western Cape Province of South Africa. **J Ethnopharmacol** 103: 261 - 275.

Tugume P, Kakudidi EK, Buyinza M, Namaalwa J, Kamatenesi M, Mucunguzi P, Kalema J. 2016. Ethnobotanical survey of medicinal plant species used by communities around Mabira Central Forest Reserve, Uganda. **J Ethnobiol Ethnomed** 12: 5.

Usuf E, Mackenzie G, Sambou S, Atherly D, Suraratdecha C. 2016. The economic burden of childhood pneumococcal diseases in The Gambia. **Cost Effectiveness and Resource Allocation** 14: 4.

Wickens GE. 1979. **The uses of the baobab (*Adansonia digitata* L.) in Africa. In: Taxonomic aspects of African economic botany (Kunkel, G. Ed.),** A.E.T.F.A.T. Las Palmas de Gran Canaria, Spain.

World Health Organisation. 2015. **Pneumonia: Fact sheet N°331**. Geneva, Switzerland.