The cultivation of wild food and medicinal plants for improving community livelihood: The case of the Buhozi site, DR Congo

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Abstract

This study aims to demonstrate the effect of farming technology on introducing medicinal plants (MP) and wild food plants (WFP) into a traditional agricultural system within peri-urban zones. Field investigations and semi-structured focus group interviews conducted in the Buhozi community showed that 27 health and nutrition problems dominated in the community, and could be treated with 86 domestic plant species. The selected domestic MP and WFP species were collected in the broad neighboring areas of the Buhozi site, and introduced to the experimental field of beans and maize crops in Buhozi. Among the 86 plants introduced, 37 species are confirmed as having both medicinal and nutritional properties, 47 species with medicinal, and 2 species with nutritional properties. The field is arranged in a way that living hedges made from Tithonia diversifolia provide bio-fertilizers to the plants growing along the hedges. The harvest of farming crops does not disturb the MP or WFP, and vice-versa. After harvesting the integrated plants, the community could gain about 40 times higher income, than from harvesting farming crops only. This kind of field may be used throughout the year, to provide both natural medicines and foods. It may therefore contribute to increasing small-scale crop producers’ livelihood, while promoting biodiversity conservation. This model needs to be deeply documented, for further pharmaceutical and nutritional use.

Key Words: Integrated agriculture, peri-urban zone, medicinal plants, wild food plants, community building

Introduction

During the last decades, agriculture in numerous African countries has been confronted with decreases of production yield, and less competitiveness for market access [1,2]. Subsequently, food and nutritional insecurity has been increasing gradually at household levels, especially in the rural areas that are occupied by more than 70% of the population. The situation is catastrophic within the African Great Lakes Region [3], and especially in DR Congo [4,5] where the Human Development Index is critical [6].

In the eastern part of DR Congo, rural food assets are limited in quality, and lead to several scenarios of malnutrition, affecting children of different ages, and women in post-conflict areas [4-6]. In such conditions, community access to better health care services is lacking, and governmental institutions are not able to support even the common illnesses. Due to this situation, local villagers rely on the traditional knowledge of medicinal plants (MP) and wild food plants (WFP), as a way of self-reliance in health and nutrition. The first preliminary survey showed 277 traditional medicine practitioners, who are active in both urban and peri-urban areas, collect MP material from the wild, using unsustainable methods [7]. Since crop production on poor and eroded soils does not help to ensure food security, cultivating WFP and MP could become an option for improving livelihoods in the households of small-scale farmers.

Buhozi is selected as a study site since Buhozi village is a typical farming zone, directly linked to the City of Bukavu from the Panzi urban district. Buhozi has predominant banana plantations, mixed with bean, maize and cassava farms. The majority of people are small-scale farmers who produce beans, cassava and corns just for household consumption. The peri-urban zones around Bukavu City are not taken into account for support from Humanitarian Development agencies, while people suffer from extreme poverty and hunger, as well as from various chronic

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It is recognized that 80% of poor people rely on local medicinal plants to heal their illness. Plants are collected from bushes and fallows, which are perpetually deteriorated by overpopulation and poor environmental policies [8]. About 60% of Buhozi households are led by women who are poor, jobless and illiterate, and who at the same time, manage about 6 children below 15 years old. Seventy percent of youngsters are less educated, and work in Bukavu and surroundings as domestic servants, heavy carriers, millers or house builders/repairers, with poor monthly salaries. There is only one health center, with poor infrastructure, which serves about 3,750 inhabitants. Malaria, sexually transmitted diseases, water-borne diseases and malnutrition are major health problems in Buhozi.

This study aims to introduce innovative agricultural techniques, to integrate WFP and MP into the existing agricultural system at the Buhozi experimental site. Consequently, after conducting this study, and utilizing the cultivated WFP and MP, people in the community can eventually improve their income, health and nutrition status.

**Subjects and Methods**

This study was commenced with a focus group interview, to find out the willingness of Buhozi villagers to cultivate WFP and MP, followed by identifying the health problems of the community. Then, the researchers found traditional WFP or MP that corresponded to the identified problems. Once the listings of the plants were completed, we integrated these plants into the existing farming system for cultivating. After the harvest of some plants, the economic effects and the nutritional values of the selected plants were analyzed.

**Subjects**

Study subjects were recruited from members of the OBWOLOLOKE organization during June 2011. OBWOLOLOKE, meaning “Woman raise up and take care of yourself”, is a community-based development group, organized by women in Bukavu from 2008, which aims to overcome poverty in the post-conflict region, through sound initiatives in agriculture and peace-making. The focus group interview was conducted with 35 participants, to assess community needs concerning health, nutrition and motivation, for bringing WFP and MP into existing agricultural cultivation [9]. We used the baseline study protocol tailored by NGOs, Diobass and PPLM [10], with a direct orientation towards health and sickness aspects, local knowledge, and practices based on botanics and the environment [10,11]. Additionally, through a semi-structured interview, we tried to identify the major incentives for WFP and MP cultivation, and collection sites of seeds or plant materials. For all questions, the subjects were allowed multiple answers.

**Study site and planting**

The land for experimentation and technical facilities were provided by the ULPGL (Université Libre des pays des Grands Lacs) administration, through international cooperation. The management scheme (mapping) of the garden has been drawn at community levels, and the collecting agenda of WFP and MP has been defined by OBWOLOLOKE members, by regrouping 42 Buhozi households. Based on the results of needs assessment, 37 WFP & MP, 2 WFP and 47 MP were selected, and then planted on prepared land in Buhozi, according to the mapping. The cultivation started from September, 2011. Germoplasmes of those plants containing cuttings, seedlings, or seeds [12-16], have been collected from the territory of Kabare (Fig. 1). Plant identification has been done from available facilities of the Economic Botany Unit at the CERUKI (Centre de Recherches Universitaire du Kivu, ISP Bukavu, DR Congo), from useful floras [17-22].

The field is arranged in a way that living hedges made from *Tithonia diversifolia* provide bio-fertilizers to WFP and MP growing along the hedges. Cultivation was conducted by 40 OBWOLOLOKE members, along with their existing agricultural plants.

**Monitoring and analyses of nutritional values of WFP and MP**

The follow-up to cultivation was done by weekly field visit, based on the growth status of plants. Photographs were taken at different growth stages. The frequencies of use of the cultivated plants (WFP or MP) were counted, at a regularly scheduled meeting with 40 people of the OBWOLOLOKE team.
The harvest was done all year around, whenever the plants were ready, after one year of seeding. The prices of the harvested plants were surveyed at the local markets in Bukavu City, and the additional income from the integrated plants was estimated with the market price.

Nutrients analyses of selected plants were conducted. At this preliminary stage, five plants of *Amaranth cruentus*, *Harunagana madagascariensis*, *Harunagana montana*, *Moringa stenopetala* and *Tremena orientalis* were selected for nutritional analyses. The Harunagana family was selected, due to its abundance in the area, and the rest were selected, due to their well-known traditional usages. Thiamin, ascorbic acid, niacin and pyridoxine were analyzed simultaneously using HPLC. Vitamin E was analyzed using GC-FID. Mineral contents of the Harunagana family were also analyzed using ICP-MS.

**Results**

**Results of needs assessment**

Investigation, driven by 35 members of OBWOLOLOKE of Buhozi, interviewed separately, showed seven motivations for bringing wild food and medicinal plants into cultivation (Table 1). Twenty-seven types of existing illnesses or malnutrition, which affect household members in Buhozi, were found through focus group interview (Table 2). Illnesses that are predominant in children of less than 15 years also exist. Out of 27 illnesses, eight types of illnesses were chronic tendency (+++), including malaria, alcoholism, dermatitis, verminosis, food poisoning, sexually transmitted disease and acute gastritis, which affect all household members (men, women and children). Periodic illnesses (++) were recorded as flu and cough. Illnesses, observable in only isolated cases (+), were HIV/AIDS, uterine prolapse and sexual asthenia.

**Selection of plants and integration into the existing agriculture**

According to the results of the survey, a total of 86 plants were selected, in order to ameliorate the major health problems of Buhozi (Table 3). The plant species were collected from varied agro-eco systems, such as bushes, managed medicinal gardens, fallows, riparian zones of Kahuzi Biega National Park, and the Ruzizi valley. The table shows 37 plants with both food and medicinal effects, which are already cultivated in Buhozi. Among them, 16 can be used as vegetables (source of minerals and vitamins), 3 species can be eaten as fruit (source of minerals and vitamins), 2 different species can be eaten as tubers (source...
| No. | Scientific names                  | Vernacular name | Usage                                                                 | Remedies and mode of usages                                                                 |
|-----|-----------------------------------|-----------------|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| 1   | Abrus precatorius                 | Abrus           | MP (1) Aphrodisiac, myorelaxant, antidiabetic                       |
| 2   | Achillea millefolium              | Achillee        | MP Antibacterial, parasiticide, insecticide                          |
|     |                                   |                 | anti-cancer, myo-relaxant, expectorant, strengthening the immune system |
| 3   | Ageratum conyzoides               | Kahyole         | MP Cough, antibacterial, wound dressing, insecticide,               |
| 4   | Agrochus incognitus               | Celeri ya pori  | MP Antimalarial, intestinal worms                                    |
| 5   | Alchemilla kivensis               | Alchemilla      | MP Antibacterial, fungicide, parasiticide,                          |
| 6   | Allium sativum                    | Garlic          | WFP (2) Food poisoning, intestinal worms,                            |
| 7   | Aloe barbadensis                  | Cigaka           | MP Parasiticide, fungicide, antibacterial, wound dressings,         |
|     |                                   |                 | strengthening the immune system                                      |
| 8   | Amaranthus cruentus               | Amarante inca   | WFP Vegetable                                                         |
| 9   | Amaranthus viridis                | Local Amarante  | WFP Vegetable                                                         |
| 10  | Annona squamosa                   | Mustafère        | WFP Vegetable                                                         |
| 11  | Artemisia annua                   | Armoise chinoise| WFP Antimarial, menstruation disorders, strengthening the immune system, gastric tonic |
| 12  | Blumea alata                      | Chirhabirhabi    | MP Cough, snake bite                                                  |
| 13  | Bombacopsis glabra                | Kalanga ya wazungu | WFP MP Cough, aphrodisiac, furuncle                                |
| 14  | Borago officinalis                | Bourrache       | WFP MP Cough, antibacterial, wound dressing,                        |
| 15  | Brilliantaisa cicatrascosa        | Namadwi         | MP Antidote, parasiticide, wound dressing, kwashikork                |
| 16  | Calendula officinalis             | Souci           | MP Dysmenorrhea, vaginal candidosis, wound dressing                 |
| 17  | Canavalia gladiata                | Cikubwekubwe    | MP Parasiticide, antibacterial, wound dressing, antidelote          |
| 18  | Cannabis sativa                   | Ibangi          | MP Abdominal disorders, anxiolytic                                   |
| 19  | Celosia trigyna                   | Kabalala nkwaile | MP Intestinal worms, snake bites, strengthening the immune system,   |
| 20  | Chenocephalum ambrosioiodes       | Kivunjohoma     | MP Parasiticide, fungicide, antibacterial, wound dressings, fungicide |
| 21  | Chenocephalum proucerum           | Mugunduzimu     | MP Antibacterial, parasiticide, insecticide, antiviral, bronchite    |
| 22  | Clerodendrum myricoides           | Mukuza nyera    | MP Intestinal worms, snake bites                                      |
| 23  | Cassiocephalum bumbense           | Mufulubwindi    | WFP MP Wound dressing, hemorrhagia, placenta expellent              |
| 24  | Cassiocephalum vitellinum         | Nshungululu     | MP Hepato-protector, wound dressing, parasiticide, antioxidant       |
| 25  | Cucurbita maxima                  | Pumpkin         | WFP MP Vegetable                                                     |
| 26  | Cucurbita pepo                     | Pumpkin         | WFP MP Vegetable                                                     |
| 27  | Cymbopogon citratus               | Lemon grass     | WFP MP Hypoglycemic effect, febrifuge, diuretic, insecticide, aphrodisiac, tea |
| 28  | Datura metel                      | Chamuwale       | MP Myo-relaxant, neuro-stimulant, wound dressing                     |
| 29  | Datura striamonium                | Nyamugunga      | MP                                                                      |
| 30  | Dicliptera colorata               | Mpindula        | MP Strengthening the immune system, parasiticide, antiviral, antibacterial, anti-anemic |
| 31  | Dioscorea bulbifera               | Yam             | WFP MP Tubers                                                         |
| 32  | Dioscorea dumetorum               | Yam             | WFP MP Tubers                                                         |
| 33  | Embelia schimperi                 | Kashulula       | WFP MP Vegetable                                                     |
| 34  | Equisetum ramosissimum            | Prèle de champs  | MP Osteoporosis, parasiticide, fungicide                             |
| 35  | Erythrina abyssinica              | Cigohwa         | MP Hepatitis, sexual asthenia, furuncles                            |
| 36  | Eucalyptus maidenii               | Eucalyptus      | MP Insecticides, flu, female frigidity                               |
| 37  | Gladiolus peltacirius             | Glaielul        | MP Antibacterial, parasiticide, insecticide, antiviral, intestinal worms, food poisonings |
| 38  | Guzotia scabra                    | Cimbe          | MP Skin and mental disorders                                         |
| 39  | Gynandropsis gynandra             | Muhole          | WFP MP Parasiticide, fungicide, antibacterial, wound dressings, insecticides |
| 40  | Harungana madagascariensis        | Ndwanuko        | MP Food poisoning, intestinal worms, hepatitis, snake bites           |
| 41  | Hibiscus noldei                   | Mukera nshungu  | MP Myomes, dermatosis, abdominal disorders                           |
| 42  | Hygrophila auriculata             | Buganga bukali  | MP Uterine prolapse, antimalarial, dermatosis                        |
| 43  | Hypoxxis subspicata var. esculenta | Wild tomato    | WFP MP Hormonal stimulant, wound dressing, parasiticide              |
| 44  | Lantana camara                    | Maviyakiku      | MP Myo-relaxant, neuro-sedative, expectorant, snake bite             |
| 45  | Laportea alatipes                 | Ortie           | WFP MP Strengthening the immune system, parasiticide, antiviral, antibacterial, fractures, hepatitis |
| 46  | Lavandula officinalis             | Lavande         | WFP MP Antibacterial, parasiticide, insecticide, myo-relaxant, neuro-toric, strengthening the immune system |
| 47  | Leucas martinicensis              | Kanyamafundwe   | MP                                                                      |
| 48  | Maticaria camomilla               | Camomille       | MP Internal inflammation, parasiticide, anti oxydants                |
| 49  | Melia azedarach                   | Lilas de Perses | MP Parasiticide, fungicide, antibacterial, wound dressings, insecticides, strengthening the immune system, insecticide, antimalarial |
| 50  | Melissa officinale                | Melisse         | WFP MP Aantibacterial, parasiticide, insecticide myorelaxant, expectorant, somniferous, gastritis |

Table 3. List of wild food and medicinal plant species and the usages
of polysaccharides), and 7 types of herbs can be grown and served as spices and refreshing teas. Additionally, 2 species can be used as food sources only. Table 3 also shows utilization profiles of the 47 MP cultivated in Buhozi. Out of 84 species recorded as MP, 70% are indigenous (afrotropical), whilst 30% are described as exotic.

A basic knowledge of MP usages was derived from workshops undertaken at community level. It was completed and validated through literature reviews [13,23-27].

Fig. 2 shows the disposition of the experimental field (0.25 ha = 2,500 m²), with mixed crops alternating between living hedges of *Tithonia diversifolia*, spaced from 3 m. WFP and MP are mixed in with crops (bush beans, maize and sweet potato).

### Economic opportunities from cultivated plants

Table 4 shows the differences of generated incomes between traditional income crops (beans and maize) of the Buhozi community, and selected MP cultivated together on the same plots, but harvested at different periods. The comparison is enforced by the price found on the Bukavu market. The estimated gain of the community by cultivating the special MP during
Table 4. Income through cultivating medicinal and wild food plants from local market

| Products | Market price per 1 kg (US dollar) | Harvested quantity and area | Estimated gain (US dollar) |
|----------|----------------------------------|----------------------------|---------------------------|
| Traditional crops |                                  |                            |                           |
| Beans    | 2                                | 35 kg\(^{1)}\) from 2,500 m\(^2\) | 70                        |
| Maize    | 0.8                              | 10 kg\(^{1)}\) from 2,500 m\(^2\) | 8                         |
| Integrated plants |                                  |                            |                           |
| Artemisia annua | 125                           | 20 kg from 200 m\(^2\)       | 2,500                     |
| Calendula officinale | 200                        | 0.5 kg from 100 m\(^2\)      | 100                       |
| Laportea alatipes | 50                             | 1 kg from 100 m\(^2\)        | 50                        |
| Mentha piperita | 20                             | 0.5 kg from 100 m\(^2\)      | 10                        |
| Vernonia amygdalina | 100                           | 3 kg from 100 m\(^2\)        | 300                       |

\(^{1)}\) Available amount for sale after domestic consumptions

Table 5. Individual frequencies for the uses of growing medicinal plants on the site

| Plants                | Main reason for plant collection | Number of collectors from January to June 2013 |
|-----------------------|----------------------------------|-----------------------------------------------|
| Artemisia annua       | Malaria                          | 20                                            |
| Guizotia scabra       | Intestinal worms                 | 5                                             |
| Guizotia scabra       | Abdominal pains                  | 5                                             |
| Plantago palmata      | Wounds                           | 7                                             |
| Plantago palmata      | Tonsilitis                       | 10                                            |
| Aloe barbadensis      | Diarrhoea                        | 8                                             |
| Aloe barbadensis      | Burr                             | 7                                             |
| Tithonia diversifolia | Intestinal worms in goat         | 25                                            |
| Tetradenia riparia    | Cough                            | 10                                            |
| Cymbopogon citratus   | Fever                            | 15                                            |
| Guizotia scabra       | Gastroenteritis in infants       | 5                                             |
| Laportea alatipes     | Rats traps                       | 9                                             |
| Vernonia amygdalina   | Malaria                          | 9                                             |
| Rosmarinus officinalae | Exhaustion                     | 8                                             |
| Rosmarinus officinalae | Food spice                      | 4                                             |
| Physalis peruviana    | Abdominal pain in infants        | 10                                            |
| Dicliptera colorata   | Anaemia                          | 7                                             |
| Achillea millefolium  | Dysmenorhea                      | 15                                            |
| Symphitum officinale  | Vegetable                        | 12                                            |
| Symphitum officinale  | Gastritis                        | 4                                             |
| Harungana madagascariensis | Food poisoning               | 3                                             |
| Harungana madagascariensis | Hepatitis                  | 2                                             |

2012-2013 is 3,060 US dollars, which is about 40 times higher than the income from traditional cash crops only (78 US dollars). Table 5 shows the frequencies of collecting and sporadic uses of medicinal plants from Buhozi garden according to individual circumstances. These results demonstrate that 16 species of the plants are often exploited as phyto-medicine. Among them, two are used as food.

Table 6 shows the results of the micro nutrients analyses of the selected plants. Amaranth, moringa and trema were rich in vitamin E and vitamin B\(_6\). Amaranth also showed high vitamin B\(_1\) content. Harungana showed high mineral values, although it did not show any vitamin contents.

Discussion

Oxfam Novib [28] reported that during the last two decades, millions of people have succeeded in escaping poverty. At the same time, one out of five still lives in poverty, while one out of seven suffers from chronic hunger. According to the 2008 World Bank report, one billion in the world live on less than one dollar per day, and 2.7 billion live on less than 2 dollars per day. The majority of them are women. Promoting food security with community-based adaptation for alleviating poverty should be tried. Action research provides broader initiatives and
experiences, which can lead to changes of community, where efforts of humanitarian agencies are lacking, as in the peri-urban zones of Bukavu city. Katwanyi et al. [8] reported that these zones appear as passage-ways of human movements toward rural areas, in the territories of Walungu and Kabare. The results of the action research of our study improved the economic status of the community, as well as the nutrition and health status.

The health problems found in the study area (Table 2) seem to be related to environmental damage, or to extreme poverty [6]. In general, among 27 illnesses recorded, 24 are related to female, 19 to male and 13 to children. Since HIV/AIDS is found in Buhozi, one can imagine that the combined effects of alcoholism, poverty and general illiteracy propagate this pandemic at large scale, in the peri-urban and urban areas. Peri-urban zones have complex social features that must be monitored, in the movement towards sustainable development. People in these areas work as home workers, bikers, sentries, or home servants in the city. On the other hand, because of poverty, these villages often become potential refuges for informal armed groups or rebels. However, at the same time, the same villages provide vegetables, bananas, hens and rabbits, as well as honey for the city. By introducing an integrated agriculture, these villages can provide medicines and vegetables, which can reinforce the farming savings. The seven different expectations from Buhozi people towards developing WFP and MP (Table 1) are summarized as 1) developing self-reliance in health care at the community level, 2) producing and processing home medicines, 3) providing raw materials to traditional medicine clinics available in the city of Bukavu, and 4) conserving and protecting local knowledge on medicinal plants uses.

The incentives evoked by these farmers meet the aims of ANAMED International [29], and those of Neema [30], which are to promote natural medicine, and at the same time, to integrate environmental management and cultural diversity. Although small-scale farming activities show little profitability to ensure the food security of the producers, previous studies reported that intercropping aromatic and medicinal plants on farmland provided economic and social opportunities that support biodiversity conservation [31-35]. In the present study, we attempted to introduce MP and WFP that meet the needs of the Buhozi community. All the plant species we listed for WFP and MP (Table 1) are summarized as 1) developing self-reliance in health care at the community level, 2) producing and processing home medicines, 3) providing raw materials to traditional medicine clinics available in the city of Bukavu, and 4) conserving and protecting local knowledge on medicinal plants uses.

The market prices of the cultivated plants (Table 5) clearly demonstrate that conventional crops (e.g. beans or maize) grown in a 0.25 ha (2,500 m²) plot size are less profitable than medicinal plants, in the Buhozi context. It is clear that cultivating crops under a complex agricultural system leads to more attractive market access. Planting certain medicinal plants, of *Artemisia annua*, *Calendula officinalis*, *Thymus vulgaris* and *Vernonia amygdalina*, is more profitable than planting beans. Literature
from India shows similar results [31-32,45]. By successfully introducing WFP and MP into the existing farming system, the community can improve its health and ameliorate nutrition insecurity, as well as its economic status.

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References

1. Timberlake L. Africa in Crisis: the Causes, the Cures of Environmental Bankruptcy. Washington, D.C.: International Institute for Environment and Development; 1985. p.232.
2. Jayne TS, Mather D, Mghenyi E. Principal challenges confronting smallholder agriculture in sub-Saharan Africa. World Dev 2010;38:1384-98.
3. Isimbisho M, Balagizi K, Mapatano M, Niyonkuru D. Gouvernance des Ressources Naturelles Collectives des Ecosystèmes Fragiles dans la Région des Grands Lacs Africains. Bukavu: Centre de Recherches Universitaires du Kivu; 2013. p.461.
4. Martini M. République Démocratique du Congo: Analyse de la Sécurité Alimentaire et de la Vulnérabilité - Collecte et Analyse des Informations Secondaires (CFSVA). Rome: Programme Alimentaire Mondial; 2005. p.66.
5. Gaye D. Pauvreté Rurale et insécurité Alimentaire au Sud-Kivu: Situation de Milieux Précarisés à l’Est de la République Démocratique du Congo. Louvain-la-Neuve: Louvain Développement; 2005. p.128.
6. Programme des Nations Unies pour le Développement, Unité de lutte contre la pauvreté (CD). Province du Sud Kivu Profil Resume: Pauvreté et Conditions de vie des Menages. Kinshasa: Programme des Nations Unies pour le Développement; 2009. p.20.
7. Bashirurishindi K. L’impact socio-économique du métier des tradipraticiens dans le district sanitaire de Bukavu. Mémoire de licence [master's thesis]. Goma: Université Libre des Pays des Grands Lacs; 2012.
8. Katwanyi K, Adhama M, Balagizi K, Limbuko M, Murhula G, Guhanika B, Kasaza D. Etude de base de la Sécurité Alim en Milieu Pérurbain des Territoires de Kabare et Walungu, Rapport Technique. Berlin: Pain pour le Monde; 2013. p.67.
9. Reed MS, Graves A, Dandy N, Posthumus H, Hubacek K, Morris J, Prell C, Quinn CH, Stringer LC. Who's in and why? A typology of stakeholder analysis methods for natural resource management. J Environ Manage 2009; 90:1933-49.
10. Balagizi K, Mapatano M, Polepole P, Cizungu M, Cihyoka MA. Recueil des Pratiques et Savoirs Locaux. Document Technique. Bukavu: DIOBASS; 2010. p.265.
11. Scoones I, Thompson J. La Reconnaissance du Savoir Rural: Savoir des Populations, Recherche Agricole et Vulgarisation. Paris: Karthala; 1999. p.474.
12. Letouzey R. Manuel de Botanique Forestière: Afrique Tropicale. Vol. I. Botanique Générale. Paris: Centre Technique Forestier Tropical; 1982. p.460.
13. Joy PP, Thomas J, Mathew S, Skaria BP. Medicinal Plants. Kerala: Kerala Agricultural University; 1998. p.211.
14. Maundu P, Katende K, Tegnas B. Wildfood Plants of Uganda. Nairobi: World Agroforestry Centre; 1997. p.345.
15. Centre de Coopération Internationale en Recherche Agronomique pour le Développement, Groupe de Recherche et d'Échanges Technologiques (FR). Memento de l'Agronome. Paris: Centre de Coopération Internationale en Recherche Agronomique pour le Développement; 2002.
16. Amponsah K, Crensil OR, Odamtten GT, Ofusohene-Djan W. Manual for the Propagation and Cultivation of Medicinal Plants of Ghana. Aburi: Darwin Initiative; 2002. p.32.
17. Troupin G, Flore du Rwanda: Spermatophytes. Vol. II. Tervuren: Musée royal de l'Afrique centrale; 1983. p.603.
18. Troupin G, Ayoabangira FX, Bridson D, Champluvier D, Lawrelwe A, Malaise P, Maquet P, Reekmans M, Schotsmans H, Verdcourt B. Flore du Rwanda: Spermatophytes. Vol. III Tervuren: Musée royal de l'Afrique centrale; 1985. p.744.
19. Troupin G, Champluvier D, Geerinck D, Malaise P, Maquet P. Flore du Rwanda: Spermatophytes. Vol. IV. Tervuren: Musée royal de l'Afrique centrale; 1988. p.662.
20. Lisowski S. Flore d’Afrique centrale (Zaire-Rwanda-Burundi): Spermatophytes. Compositae (Part 2): Tribe Inuleae. Meise: National Botanic Garden of Belgium; 1989. p.239.
21. Agnew AD, Agnew S. Upland Kenya Wild Flowers: a Flora of the Ferns and Herbaceous Flowering Plants of Upland Kenya. 2nd ed. Nairobi: East Africa Natural History society; 1994. p.374.
22. Fischer E, Killmann D. Illustrated field guide to the Plants of Nyungwe National Park Rwanda. Koblenz: University of Koblenz-Landau; 2009. p.771.
23. Defour G. Éléments d'Identification de 400 Plantes Médicinales et Vétérinaires du Bushi. Bukavu: Editions Bandari; 1995. p.125.
24. Co LL. Common Medicinal Plants of the Cordillera Region (Northern Luzon, Philippines): a Trainor's Manual for Community Based Health Programs. Baguio: Community Health Education, Services and Training in the Cordillera Region; 1989. p.487.
25. Balagizi K, Halisombe K. Plantes du Kivu à Usage Alimentaires et Médicinales. Quezon: Council for Extension, Research and Development in Agriculture and Fisheries; 2000.
26. Neuwinger HD. African Traditional Medicine. A Dictionary of Plant Use and Applications with Supplement: Search System for Diseases. Stuttgart: Medpharm Scientific Publishers; 2000. p.600.
27. Balagizi KI, Kamble VE, Ratti E. Les Plantes Médicinales du Bushi. Genova: Auslieferungsstelle des Buches Emiliani-Rapallo; 2006. p.315.
28. Oxfam Novib (NL). Organigramme. In: Un Avenir Équitable et durable à la Médecine traditionnelle dans la ville de Bukavu. Mémoire de licence [master's thesis]. Goma: Université Libre des Pays des Grands Lacs; 2002.
29. Hirt HM, M'Pia B. La Médecine Naturelle Tropicale: Livre de Poche Pratique pour les Médecins, Tradipraticiens et Infirmiers: Comment se Soigner Avec les Plantes Tropicale?: Comment Fabriquer Soi-Même des Médicaments et des Produits Cosmétiques? Winnenden: Anamed; 2004. p.128.
30. Neema B. Etude des facteurs favorisant au recours des patients à la Médecine traditionnelle dans la ville de Bukavu. Mémoire de Licence [master's thesis]. Goma: Université Libre des Pays des Grands Lacs; 2013.
31. Wiersum KF, Dold AP, Hasselman M, Cocks M. Cultivation of medicinal plants as a tool for biodiversity conservation and poverty alleviation in the Amatola Region, South Africa. In:
Bogers RJ, Craker LE, Lange D, editors. Medicinal and Aromatic Plants: Agricultural, Commercial, Ecological, Legal, Pharmacological and Social Aspects. Dordrecht: Springer; 2006. p.43-57.

32. Biswas BC. Cultivation of medicinal plant. Success stories of two farmers. Fertili Mark News 2010;41:1-4, 20.

33. Phondani PC, Negi VS, Bhatt ID, Maikhuri RK, Kothyari BP. Promotion of medicinal and aromatic plants cultivation for improving livelihood security: a case study from West Himalaya, India. Int J Med Aromat Plants 2011;1:245-52.

34. Rajeswara Rao BR, Syamasundar KV, Nagaraju G, Adinarayana G. Biodiversity, conservation and cultivation of medicinal plants. J Pharmacogn 2012;3:59-62.

35. Amujoyegbe BJ, Agbedahunsi JM, Amujoyegbe OO. Cultivation of medicinal plants in developing nations: means of conservation and poverty alleviation. Int J Med Aromat Plants 2012;2:345-53.

36. Garza E. Guide to natural Remedies for Health and well-being. Mexico: Orvit Publishing; 1998. p.426.

37. Duke JA, Bogenschutz-Godwin MJ, duCellier J, Duke PA. Handbook of medicinal Herbs, 2nd edition. Boca Raton (FL): CRC Press; 2002. p.870.

38. Pamplona-Roger GD. Santé par les Plantes Médicinales. Madrid: Editorial Safeliz; 2009. p.383.

39. Koh K, Kim S, Balagizi K, Park EH, Kim B, Kim HS. Screening African ethnic plants for possible medicinal or nutritional values. Singapore: Proceedings of 11th Asian Congress of Nutrition; 2011 July 13-16; Singapore. Singapore: Federation of Asian Nutrition Societies; 2011.

40. Kim HS, Koh K, Park EH, Balagizi K, Kim HJ. Evaluation of Antioxidant Properties of the Stem Bark of Harungana Madagascariensis Lam. Ex. Poir (Clusiaceae) from Eastern DR Congo. San Diego (CA): Federation of American Societies for Experimental Biology; 2012.

41. Adhama M, Balagizi K, Mushagalusa BT. Rapport Technique sur la Recherche sur les Plantes Médicinales et Alimentaires de l'ULPGL. Texte Présenté à l'Exposition de la Francophonie. Goma: Université Libre des Pays des Grands Lacs; 2013. p.25.

42. Plant Resources of Tropical Africa (NL). Liste de Base des Espèces et de Leurs Groupes d'Usages. Wageningen: Plant Resources of Tropical Africa; 2012. p.341.

43. Isumbisho M, Balagizi K, Mapatano M, Niyonkuru D. Gouvernance des Ressources Naturelles Collectives des Écosystèmes Fragiles dans la Région des Grands Lacs Africains. Bukavu: Centre de Recherches Universitaires du Kivu; 2013. p.421.

44. Koho F, Yemefack M, Feujjo-Teguefouet P, Tchantchaouang JC. Effet combiné des feuilles de Tithonia diversifolia et des engrais inorganiques sur les rendements du maïs et les propriétés d'un sol ferrallitique au Centre Cameroun. Tropicultura 2011;29:39-45.

45. Shabidullah AKM, Haque CE. Linking medicinal plant production with livelihood enhancement in Bangladesh: implications of a vertically integrated value chain. J Transdiscipl Environ Stud 2010;9:1-18.