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Exploring Alternative Use of Medicinal Plants for Sustainable Weed Management

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Abstract: This paper presents the first application of ethnobotanical studies to screen for allelopathic species among medicinal plants for sustainable weed management. This study assesses the possible relationship between ethnobotanical indices and allelopathy of medicinal plants. Ethnobotanical data were collected in 2016 by using semi-structured interviews with 140 informants in the Ejisu-Juaben Municipality, Ghana. Data were analysed using statistical tool and ethnobotanical indices including use value (UV), Fidelity Level (FL), Relative Frequency of Citation (RFC). The Sandwich and Dish pack methods were respectively used to evaluate allelopathy through leachates and volatiles of collected samples. Ninety-five species belonging to 43 families are reported in this study, with leaves (52%) cited the most utilised plant part. *Cleistopholis patens* (UV = 0.54; FL = 90.7%; RFC = 0.37) and *Ocimum gratissimum* (UV = 0.37; FL = 38.4%; RFC = 0.35) were among the most cited species. Thirty-two species showed inhibition (≥49.3%) by leachates, while twenty-four species were found with potential volatile inhibitory compounds against lettuce radicle growth. There was a significant positive correlation (Pearson) between the UV and RFC of medicinal plants and allelopathy by leaf leachates ($r = 0.639$ **; $p = 0.01$ and $r = 0.653$ **; $p = 0.01$ respectively). This systematic documentation of medicinal plants in Ejisu-Juaben Municipality shows medicinal plants with ethnomedicinal values and potential allelopathy that can be utilised in sustainable weed control.

Keywords: medicinal plants; use value (UV); Fidelity Level (FL); Relative Frequency of Citation (RFC); ethnomedicine; allelopathy; sustainable weed control; Ejisu-Juaben Municipality

1. Introduction

Medicinal plants have been an important part of human health care and most of these plants contain a number of secondary metabolites that may function as repellents, poisons, hormones, and as attractants in some cases [1–4]. Many of these secondary metabolites contained in medicinal plants have pharmacological properties that are reported to be responsible for the curative effects of medicinal plants [5,6]. Approximately 52,000 of the estimated 422,000 flowering plants worldwide are used for medicinal purposes [7]. Of these, the biological activity of only about 6% has been screened, with 15% having been phytochemically evaluated [8,9]. There, however, exist several novel sources of bioactive compounds in medicinal plants that remain untapped [10]. Plants, especially those with ethnopharmacological uses, have been the primary sources of bioactive substances in the early days of drug discovery [11,12]. The success of natural products in drug discovery has been explained by the structural similarities of protein targets and high chemical diversity [13]. Currently, about 25% of prescribed drugs worldwide are derived from plants and/or their derived synthetic analogues [9,14–16]. Interestingly, some of these bioactive substances with pharmacological properties have been reported with allelopathic activities [17–19].

Likewise, natural products can be explored as sources of bioherbicides in sustainable agriculture with the possibility of finding novel molecular sites of action (SOA). The indiscriminate use of synthetic herbicides and other factors have resulted in many weeds developing resistance to most of the known herbicide SOAs [20,21]. Consequently, herbicides with new SOA as well as new weed control strategies are required to mitigate the increasing numbers of herbicide-resistant/tolerant weeds that threaten the environment [22,23]. Natural products or their derivatives have contributed enormously to the development of pesticide SOAs especially that of herbicides, insecticides, and fungicides [24]. Furthermore, many allelochemicals operate by mechanisms not possessed by synthetic herbicides and can be further explored to develop potentially new SOA [24,25]. Allelopathy, which is defined as the natural interaction involving secondary metabolites (allelochemicals) produced by plants, bacteria, fungi, and algae that influence (positive or negative effects) the growth and development of agricultural and biological systems, can be explored in sustainable weed control [26–29]. These allelochemicals are largely secondary metabolites and are present in plant tissues including leaves, fruits, stems, flowers, rhizomes, roots, pollen, and seeds [30–32]. The phytotoxicity of allelochemicals released through root exudation, leaching, volatilization, and residue decomposition of certain plants on germination and seedling growth of the associated plants have been widely studied [33–36]. Currently, researchers have focused on the isolation and identification of novel products from higher plants (medicinal plants especially) that are allelopathic [37]. Mesotrione (a selective herbicide) is a synthetic analog of leptospermone, an allelochemical isolated from *Callistemon citrinus* [38]. This is probably the most successful development of a commercial herbicide of plant origin. Cinmethylin (1,4-cineole derivative) is a pre-emergence herbicide that inhibits tyrosine aminotransferase and is used selectively to control annual grass weeds in rice and broadleaf crops [39].

The two main approaches that have aided the identification of natural product as potential herbicides are to perform bioassay-guided isolation using promising species or to test compounds isolated for purposes such as pharmaceutical use [40]. The initial search for candidate species for biological activity screening is of major significance for the isolation and identification of potent bioactive compounds [9]. The use of ethnobiological and/or chemical ecology clues to select potential organisms have provided valuable information for the discovery of compounds of pharmaceutical, rodenticidal, and insecticidal leads [9,15,40]. The approach of isolating allelochemicals from medicinal plants could begin with field observation [38,41] or screen a large number of plants for potential allelopathic species [35,42–44]. In recent times, many potent allelochemicals have been isolated from medicinal plants for sustainable weed control measures in modern agriculture [32,45–47]. However, there is no established relationship between medicinal species and their related allelopathic potentials.

Consequently, it is essential to know how ethnobotanical indices of medicinal species relate to their potential allelopathy. We believe knowledge on such relationship would assist the selection of highly potential allelopathic species for bioassay-guided isolation to improve the odds of finding allelochemical(s) for sustainable weed management. In this study, we focused on assessing the association between quantitative ethnobotanical indicators or indices and potential allelopathic activities of medicinal plants. We hypothesised that highly utilised medicinal species could be potentially allelopathic.

2. Materials and Methods

2.1. Study Area

The study area covers a total land area of 582.5 km^2 comprising about 10% of the entire Ashanti Region of Ghana. The Ejisu-Juaben Municipality lies within Latitudes 1°15′ N and 1°45′ N and Longitude 6°15′ W and 7°00′ W (Figure 1). The Municipality experiences a bimodal rainfall pattern with wet semi-equatorial climate. The major rainfall period (1200–1500 mm/year) begins from March to July and the minor rainfall period (900–1120 mm/year) begins in September until November. Relative humidity is usually fairly moderate but high during the rainy season and early mornings. The annual temperatures range from 25 °C in August to 32 °C in March. The topography of the Municipality is generally undulating, dissected by plains and slopes with an elevation of 240–300 m above sea level. The population of the Municipality is estimated to be 143,762 with most people engaging in agricultural activities (62.5%), commerce and services (31.7%), and industry (6.8%). The majority of the farmers (94.1%) are food crop farmers with the remaining 5.9% engaging in mixed farming [48]. The Municipality is ethnically homogenous with Akans′ as the overwhelming majority (82%) and Christianity (84.1%) being the predominant religion [48]. Although the modern health care in the municipality has seen some improvements, some of the inhabitants still depend on traditional healers and herbal medicines for their health issues. As a result, traditional healers still continue to play a significant role in their local communities [49]. Malaria, acute respiratory tract infections, rheumatism, skin diseases and ulcers, diarrhoea and anaemia were among the top ten outpatient department cases in both 2012 and 2013 in the municipality [50].

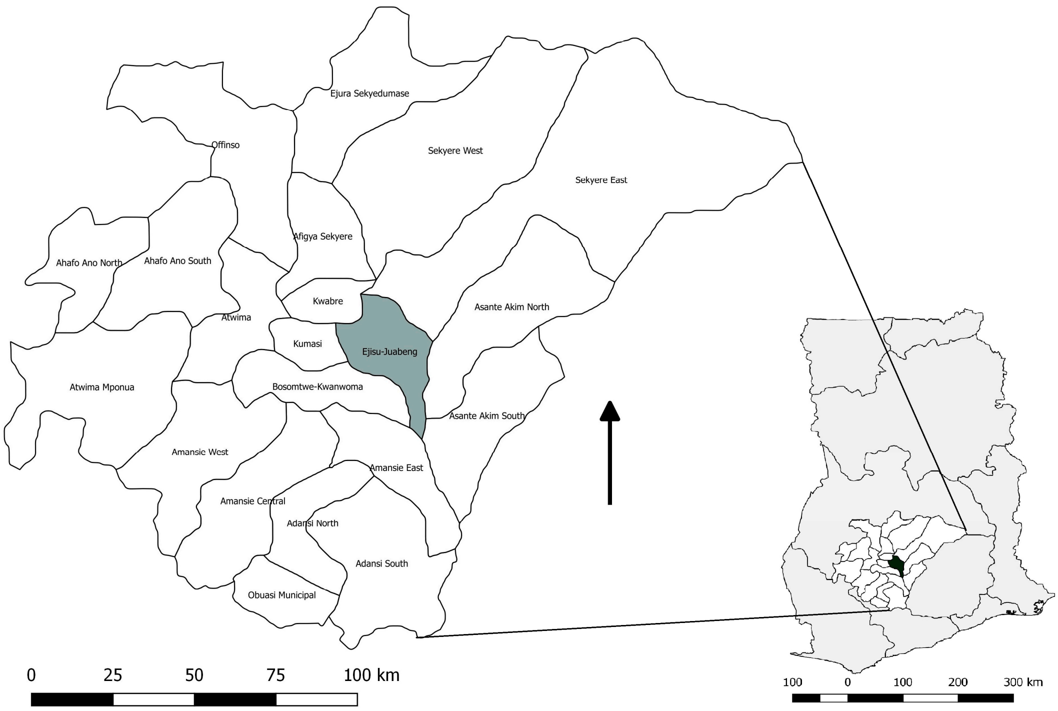

Figure 1. Map of Ghana showing Ejisu-Juaben Municipality.

2.2. Ethnobotanical Survey and Plants Collection

An ethnobotanical survey was conducted between January and September 2016 to collect and document the various traditional medicinal uses of plants in the Ejisu-Juaben Municipality. This survey was carried out using field tour, semi-structured interviews, and personal interviews with 140 respondents based on standard ethnobotanical methods [51–53]. These respondents included traditional healers and local people who use medicinal plants in their households. Voluntary verbal prior informed consent of each of the informant was obtained before the interviews commenced. Since this knowledge is a natural wealth of the local people, they were assured that the data would be used only for academic purposes. Some of the information that was recorded during the survey included the bio data of the informants, local name(s) of utilised plants, sources of plants, plant parts used, preparation and administration procedures, ailments treated, and among others. The interview usually lasted between 1 and 4 h including a field-walk to collect plant species mentioned in the interview. The interview sessions usually involved 2–3 members of each household including the informant.

2.3. Botanical Identification

Plant samples for laboratory screening for allelopathic species and voucher specimens were collected with the kind aid of informants as shown in Figure 2. Voucher specimen for all the plant species were collected following plant taxonomic method [54], identified, and deposited at the herbarium of the Centre for Plant Medicine Research, Mampong-Akropong, Eastern Region, Ghana. The identities of the voucher specimen were confirmed by comparing with already identified specimens at the Herbarium.

Figure 2. Interview with local informants and (**A**); collection of 95 medicinal plants including: *Mussaenda erythrophylla* (**B**); and *Helleria latifolia* (**C**) at the localities of Ejisu-Juaben Municipality.

2.4. Data Analysis Using Ethnobotanical Indices

2.4.1. Use Value (UV)

The relative importance of a plant species as a medicinal plant known locally in the traditional medicinal system of the study area was demonstrated using a quantitative method termed use value [55]. The use value (UV) was calculated as;

$$UV = \sum Ui/N \quad (1)$$

where UV is use value of a particular species, U is the number of use reports for a specific plant species, and N is the number of informants interviewed. High use value for a species indicates that these plants are the most highly used, recommended, and known by the informants, which implies the importance of these plants. On the other hand, and low use value can be explained by the fact that the informants possess limited knowledge on the therapeutic uses of these plants [56]. This use value (UV) index is used for the analysis of the use of a single species and to compare plants among the same sample.

2.4.2. Fidelity Level (FL)

Fidelity Level [57] was calculated for each of the preferred species to quantify the importance of a species for a given purpose based on key informants who cited them in the treatment of particular ailments. This index is very useful for the identification of the most preferred species by the key informants for treating a specific ailment.

The following formula was used:

$$FL = I_P/I_U \times 100\% \quad (2)$$

where I_P is the number of informants who suggested the use of a species to a particular disease and, I_U is the total number of informants who mentioned the species for any use. The FL values range $0\% < FL \leq 100\%$. The high FL values for a plant indicate its high frequency of use or efficacy to treat a specific ailment. On the other hand, it can be inferred that low FL values indicate the low frequency of use or less effectiveness of the species in treating the specific ailment.

2.4.3. Relative Frequency of Citation (RFC)

The relative frequency of citation reveals the local importance of each medicinal plant species as used by the indigenous people to the area. This index can also give an indication of the medicinal species best known or long used by the majority of the informants and represent a source of reliability [56]. Knowledge on the medicinal uses of plants is easily preserved for future generation when maximum number of informants knows the species. The relative frequency of citation (RFC) of species was calculated by dividing the frequency of citation (FC) (the number of informants mentioning a useful species) by the total number of informants in the survey (N). This RFC index ranges from 0 (when a species is not referred by any user as useful) and 1 (when all respondents mentioned the species as useful).

The following formula [58] was used to calculate the RFC index;

$$RFC = FC/N \quad (3)$$

Medicinal species with high RFC should be further evaluated for phytochemically and pharmaceutically important substances, which could potentially lead to identifying active constituents for drug discovery [59,60].

2.5. Bioassay for Potential Allelopathic Medicinal Species

2.5.1. Preparation of Plant Material

The experimental sample(s) of each of the 95 medicinal plant species were freshly collected, placed separately in a paper bag, and oven-dried at 60 °C for approximately 24 h in a drying chamber. The oven-dried plant materials were kept in a plastic bag and subsequently in an airtight box until further use. The potential allelopathic activities of all the species were determined using the Sandwich and Dish pack bioassay methods under laboratory conditions. Agar (0.7% w/v) was used as a growth medium in the sandwich method.

2.5.2. Sandwich Bioassay

The sandwich bioassay adopted from Fujii et al. [61] was used to screen for the potential allelopathic activity of leachates from leaves, stem bark, roots, and fruits of the collected medicinal plants. The sandwich bioassay has been used [33,35,44,61–63] to screen a lot of plants and is effective in determining allelopathic activities by plant litter under laboratory conditions. The sandwich bioassay is widely used, reliable, and less time-consuming method for screening allelopathic activity from leaf litter [61]. Using this bioassay method, the medicinal plants collected during field survey were screened for their potential allelopathic activities. Using multi-well plastic dish, the sandwich method was set up following the protocol of [61] with minor modifications.

Six-well multi-dish plastic plates were filled with 10 or 50 mg oven-dried samples in each well. Five mL of agar was added in two successions to form layers above and below the plant samples. Five lettuce seeds (*Lactuca sativa* var. Great Lakes 366) were vertically placed on the solidified agar. The multi-well dishes were labelled and covered with plastic tape and incubated (NTS Model MI-25S) at 22 °C for 3 days. The radicle and hypocotyl lengths of lettuce were measured and expressed as a percentage of the control after the 3-day incubation. Treatments were replicated three times and data presented as the mean of the three replicates. Agar with no plant material was set as the untreated control.

2.5.3. Dish Pack Bioassay

Fujii et al. [64] adopted this approach to screen for the presence of volatile allelochemicals from plant species. This method is widely used [35,43,44,65] due to the rapid and efficient way it determines the presence of volatile allelochemicals in plants. The Dish-pack bioassay was used to evaluate the potential volatile allelopathy of the collected medicinal plants. Multi-well plastic dishes with six wells (36 mm × 18 mm) were used in this experiment. The distances from the point where plant sample was placed (source well) to the centre of other wells were 41, 58, 82, and 92 mm. The source well was filled with 200 mg of oven-dried plant material, while filter papers were laid in the other wells and 0.75 mL of distilled water was added to each of the wells containing filter paper. The control treatment did not contain any plant sample at the source well. Seven lettuce seeds were placed on the filter paper in each well. The multi-well dishes were tightly sealed to avoid desiccation and loss of volatile compounds. The dishes were wrapped with aluminium foils and placed in an incubator (NTS Model MI-25S) at 22 °C for three days. The radicle and hypocotyl lengths were measured and recorded after 3 days of incubation and expressed as a percentage of the control. The degree of inhibition was calculated as a percentage of the control.

2.6. Statistical Analysis

The Standard Deviation Variance (SDV) concept was adopted to categorise the allelopathic activity [61,66]. For the statistical analysis, the mean and standard deviation were calculated and the criterion of the SDV was evaluated. Again, we used Pearson correlations to check the relationship between the ethnobotanical indices (FL, UV, and RFC) and allelopathic activity (through plant leachates and volatiles) of the mentioned medicinal plants using Statistical Package for the Social Sciences (SPSS ver. 21.0).

3. Results and Discussion

3.1. Profile of Informants, Medicinal Plant Diversity, and Distribution

In total, 140 informants with ages between 28 and 85 years were interviewed, of which 35.7% were males and 64.3% were females. Primary or basic education (49.3%) was the most acquired educational level, whilst informants with no formal education were 38.6% (Table 1). Only 0.7% of the informants had a tertiary education with the remaining (10.8%) having acquired secondary education. The majority of the informants (89.2%) were Christians while Muslims were 6.4%. Most of the informants (89%) acquired their knowledge on medicinal plants through the experience of other people who are mostly close relatives. This finding is supported by the report that traditional medicinal knowledge on plants has been passed from generation to generation verbally [67]. A similar mode of transfer of knowledge on medicinal plants was reported among traditional healers in Sisala, Northwest Ghana [68] and in Rodrigues Island, Mauritius [69]. Very few had their knowledge from traditional healers (9%) and spiritual intuitions (2%).

The present study documented 95 species belonging to 43 families used for treating 62 different types of human ailments in the study area.

Table 1. Demographic profile of the informants in Ejisu-Juabeng Municipality.

Category	Description	Frequency (%)
Age (years)	20–30	14 (10)
	31–40	31 (22.1)
	41–50	23 (16.4)
	51–60	32 (22.9)
	61+	40 (28.6)
Gender	Male	50 (35.7)
	Female	90 (64.3)
Education	None	54 (38.6)
	Primary	69 (49.3)
	Secondary	16 (11.4)
	Tertiary	1 (0.7)
Religion	Christian	125 (89.2)
	Muslim	9 (6.4)
	No religious affiliation	6 (4.3)
Ethnicity	Akan	132 (94.3)
	Mamprusi	4 (2.9)
	Krobo	1 (0.7)
	Wangala	2 (1.4)
	Grusi	1 (0.7)
Occupation	Farming	78 (54.5)
	Trading	35 (24.5)
	Teaching	4 (2.8)
	Kente weaving	3 (2.1)
	Traditional healer	15 (10.5)
	Hairdressing	4 (2.8)
	Student	1 (0.7)

The families with most species were Fabaceae (11 species), Euphorbiaceae (8 species), Asteraceae (6 species), Poaceae (6 species), Bignoniaceae (5 species), and Rutaceae (4 species). The families of Amaranthaceae, Apocynaceae, Combretaceae, Malvaceae, Meliaceae (3 species each) and Anacardiaceae, Arecaceae, Asclepiadaceae, Lamiaceae, Rubiaceae, Solanaceae, Verbenaceae, Zingiberaceae (2 species each) also had high representation. The remaining 23 families were represented with one species each. The high representation of Fabaceae among medicinal plants in Ghana had also been reported in other studies [68,70,71]. Fabaceae was also the dominant family among medicinal plants documented in other countries including Western Ghat, India [72], Djibouti [73], Burkina Faso [74], and Uganda [75]. The majority of the species (47%) used in the Ejisu-Juaben Municipality by our informants were collected from the wild, others from croplands (21%) and about 18% could be collected from virtually everywhere.

3.2. Plant Parts Used in Medicinal Remedies Preparation in the Study Area

A high number of herbal preparations were made using leaves (52%), stem barks (17%), and root/root barks (12%) of medicinal (Figure 3). The high preference for leaves in herbal remedy/remedies preparations is a common herbal practice in other parts of Ghana as reported in the Dangme West District [76], some communities around the Bobiri Forest Reserve [77], Sisala East and West districts [68], and Kpando Municipality [78]. Studies in other countries have also reported the high usage of the above-mentioned plant parts [74,79,80]. This high preference for leaves in herbal medicine preparation could be due to abundance and/or the ease with which they can be collected [81,82]. However, seeds (7%), fruits (5%), whole plant (3%), flowers (3%), and others (2%) such as rhizome, cob, and cloves are used to a lesser extent. Moreover, the leaves are the most active plant parts involved in photosynthesis and production of most pharmacologically active phytochemicals which may be involved in curative effects of these medicinal plants [6]. On the contrary, roots have been reported as the most utilised plant part in Eastern Nepal [83] and the Oshikoto Region in Namibia [84]. This disparity could be due to culture, plant diversity, and active compounds present in the plant parts found in the respective study areas [85]. The use of other plant parts such as root/root barks and stems bark (29%) in our study areas makes those species vulnerable to overexploitation. Some informants mentioned the use of more than one plant part during herbal preparations. For example, various parts of *Cleistopholis patens* (leaves, stem barks, flowers, roots, and seeds), *Rauwolfia vomitoria* (Leaves, roots, and stem barks), and *Musa paradisiaca* (leaves, roots, and flowers) were used to prepare remedies for various ailments and this practice could make such species extremely vulnerable to overexploitation.

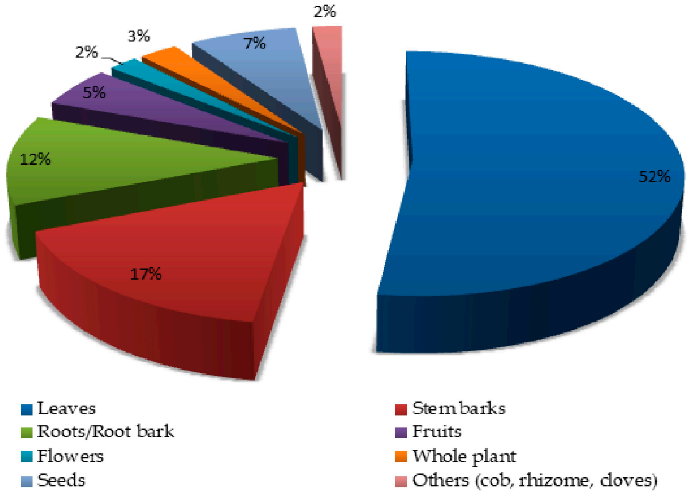

Figure 3. Plant parts used in herbal remedy preparation.

3.3. Mode of Medicinal Recipe Preparation and Administration

The most cited methods used in herbal remedy preparation in the study area were decoction (40%) crushing/shredding (18%), paste (12%), powder (8%), rubbing and squeezing (7%), and eating raw (6%) (Figure 4). Other preparation methods such as cooking, poultice, alcohol and infusions were cited less. Most of the herbal preparations were taken orally (58%), followed by topical applications methods such as body massage, tying on wound, bath, or smearing as a body lotion (35%). Oral intakes of herbal remedies as a major route of administration have also been reported in recent ethnobotanical surveys in Ghana [68,70,76,77,86] and in other countries [75,87–89]. In addition, the use of herbal preparations as injections (as enema 7%) was also a common prescription among the traditional healers and other plant users in the municipality. The frequent use of enemas in Ghana is a cultural practice in traditional healthcare delivery, mostly for pregnancy care, stimulation of early child walk, constipation and other stomach related complications [90]. Some of the informants (traditional healers especially) claimed the potency of their herbal medicines would reduce if they revealed some specific adjuvants (not mentioned in this report) added to their herbal formulations. In order to reveal some of these adjuvants, eggs, schnapps, cola, and some amount of money (paid in coins) were offered for rituals under the promise of not revealing to other people. Some herbal practitioners protect their indigenous knowledge by generating an air of secrecy on herbal formulations and dosage given to patients [91,92]. Secrecy is viewed as a major challenge facing the transmission of traditional knowledge and the perceived lack of cooperation between healers and orthodox medicinal system [93].

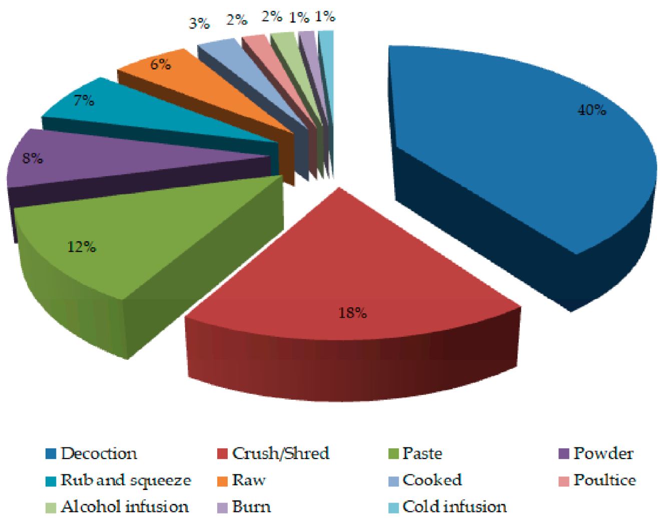

Figure 4. Mode of preparation of herbal remedies by the inhabitants of Ejisu-Juaben Municipality.

3.4. Ailments Treated by Medicinal Species

The traditional knowledge of the local people of the Ejisu-Juaben Municipality provided information on the treatment of 62 different types of human ailments and diseases. The most frequently reported ailment in this study area was malaria, which accounted for more than 24% of all use records while stomach-aches (7%), fever (6.5%), wounds (5.1%) and headache (3.7%) were also common. Malaria, ulcers, and diarrhoea are among the top ten outpatient department cases in both 2012 and 2013 in the municipality [49]. A wide range of ailments was treated by species documented in this study, varying from one to seven per plant. The species that was mentioned in the treatment of the highest number of ailments was *Momordica charantia* (7 health conditions), followed by *Cleistopholis patens*, *Newbouldia laevis*, *Ocimum gratissimum*, and *Alchornea cordifolia* (six health conditions each). In addition, *Mangifera indica*, *Alstonia boonei*, *Cocos nucifera*, and *Kalanchoe integra* were each used in the management of five health conditions. The details on the medicinal plants, ailments treated, preparation and administration methods, and other ethnobotanical values are provided in Table S1. The use of a single plant in the treatment of multiple health conditions (at least 5 diseases) was also reported among traditional healers and plant users in Ethiopia [87], Algeria [56], and Uganda [75]. *Ocimum gratissimum* was used in the treatment of Diabetes mellitus in Nigeria [94] and *Mangifera indica* was used in the treatment of coughs, infertility, and convulsions in Uganda [75].

3.5. Comparison of Documented Data on Medicinal Plants with Previous Literature

A literature study was conducted to determine whether the medicinal plants used by the people in the Ejisu-Juaben Municipality were also used for similar purposes in other areas. *Azadirachta indica* and *Tectona grandis* had FL value of 100% for the treatment of malaria in this study. These species were also used in the treatment of malaria as reported in other parts of Ghana [76,77,95]. *Azadirachta indica* is used in other countries such as Uganda [96], Nigeria [97], and Kenya [98] for the treatment of malaria. Similarly, *Tectona grandis* (FL = 100%) is utilised in other parts of Ghana [77,99], Nigeria [100], and Cote d'Ivoire [101] for the treatment of malaria. In addition, *Cleistopholis patens* is used to treat malaria in other areas of Ghana [77,102] and Cameroon [103]. *Vernonia amygdalina* (FL = 65%) is highly preferred in Uganda for the treatment of malaria, stomach ache, and convulsions [75] and for managing impotence, dandruff and bloating in Ethiopia [87]. *Alstonia boonei* is used in treating malaria in Uganda [75], haemorrhoids and malaria in Nigeria [97,104,105]. *Senna alata* is also utilised in the treatment of skin diseases in Nigeria [106] and Bangladesh [107]. In Trinidad and Tobago, *Phyllanthus urinaria* was reported to be effective in the treatment of diarrhoea [108], and malaria in Thailand [109], and ulcer in China [110]. *Newbouldia laevis* was used in our study area to treat stomach upset and cough was also used to treat earache and cough in Cameroon [111] and in Nigeria [112] for cough and stomach-aches. The roots of *Cocos nucifera* is an aphrodisiac [113] and was used by the local people in Ejisu-Juaben Municipality to treat erectile dysfunction.

3.6. Quantitative Ethnobotanical Indices

3.6.1. Use Value (UV)

The reported high UV (0.02–0.54) indicates high numbers of use reports by the informants for a particular plant. The most rarely used medicinal species were *Solanum lycopersicum*, *Elaeis guineensis*, *Lantana camara*, *Petersianthus macrocarpus*, *Sesamum indicum*, *Eleusine indica*, and 12 other species with UV of 0.02. The overview of 15 most cited medicinal plants in the Ejisu-Juaben Municipality is provided in Table 2. Medicinal plants with high UV could suggest the presence of bioactive compounds and which require further evaluation for their essential phytochemicals [114]. Nonetheless, the use value cannot specifically distinguish whether a plant species was used for a single or multiple purposes [115]. The UV has also been associated with issues of conservation and sustainability of species with high UV [116]. Such species as *C. patens* and *O. gratissimum* are most likely to suffer the greatest harvesting pressure. These important species could be identified through such studies to ensure their sustained availability in the environment.

Table 2. Overview of fifteen of the most cited medicinal plants for the treatment of various ailments in the Ejisu-Juaben Municipality.

Scientific Name, Voucher No. (Family)	Local Names	Part(s) Used	Key Ailment(s) Treated	Preparation and Administration	FL	UV	RFC
Cleistopholis patens (Benth.) Engl. & Diels CPMR 4070 (Annonaceae)	Ngone nkyene	L/SB, F R/SB, Se	**Malaria**, Hernia	Decoction (oral) Paste (enema)	90.7	0.54	0.37
Ocimum gratissimum L. CPMR 4131 (Lamiaceae)	Nunum	L, Se	**Diarrhoea**, malaria Convulsion	Decoction (oral) Rub (topical)	38.5	0.37	0.35
Carica papaya L. CPMR 4112 (Caricaceae)	Brɔferɛ	L R, Se	**Malaria** Anthelmintic	Cook (oral) Raw (oral)	30.6	0.26	0.25
Azadirachta indica A. Juss. CPMR 4067 (Meliaceae)	Neem tree	L, SB	**Malaria**	Decoction (oral)	100	0.33	0.25
Vernonia amygdalina Delile CPMR 4088 (Asteraceae)	Awɔnwono	L	Diarrhoea, **malaria**	Decoction (oral)	65.2	0.16	0.24
Alstonia boonei De Wild. CPMR 4096 (Apocynaceae)	Nyamedua	SB	**Measles**, shingles Malaria	Crush (Topical) Decoction (oral)	70	0.36	0.22
Senna occidentalis (L.) Link CPMR 4082 (Fabaceae)	Nkwadaa brodeɛ	L R	**Diarrhoea**, malaria cough	Decoction (oral) Raw (oral)	79.6	0.35	0.21
Senna alata (L.) Roxb. CPMR 4083 (Fabaceae)	Sempe	L	**Eczema**, **rashes** Stomach-aches	Poultice (topical) Decoction (oral)	33.3	0.28	0.16
Alchornea cordifolia (Schumach. & Thonn.) Müll.Arg. CPMR 4065 (Euphorbiaceae)	Ogyama	L, SB SB	Constipation Fever, **malaria** Wounds, **piles**	Paste (enema) Decoction (oral) Rub (topical)	31.0	0.21	0.16
Phyllanthus muellerianus (Kuntze.) Exell. CPMR 4121 (Euphorbiaceae)	Awobɛ	L	**Wounds**	Squeeze (topical)	100	0.03	0.01
Eclipta alba Hassk. CPMR 4106 (Asteraceae)	Ntum	L	**Eye diseases** Constipation	Juice (topical) Paste (enema)	50.0	0.04	0.11
Spathodea campanulata P. Beauv. CPMR 4084 (Bignoniaceae)	Kuakuaninsuo	L, SB	Typhoid, **malaria** Wounds	Decoction (oral) Paste (topical)	66.7	0.15	0.11
Mangifera indica L. CPMR 4095 (Anacardiaceae)	Amango	SB L	**Diarrhoea** Cough, **fever**	Paste (Enema) Decoction (oral)	50.0	0.09	0.1
Musa paradisiaca L. CPMR 4146 (Musaceae)	Brɔdeɛ	L, R, Fl L, R	**Wounds** Fever, headache	Paste (topical) Decoction (oral)	40.0	0.11	0.10
Newbouldia laevis (P.Beauv.) Seem. CPMR 4109 (Bignoniaceae)	Sɛsɛmasa	L SB	Stomach upset **Cough**	Paste (enema) Raw (oral)	26.7	0.11	0.09

Ethnobotanical indices: UV: use value; FC: frequency of citation; FL: Fidelity Level (The ailments in bold were used to calculate the fidelity level); Parts used: R; Roots, L; Leaves, Fl; Flower, SB; Stem bark, Se; Seed, Rh; Rhizome, Wp; Whole plant, Co; Cob, Cv; Cloves, RB; Root bark, F; Fruit, CPMR; Centre for Plant Medicine Research.

3.6.2. Relative Frequency of Citation (RFC)

The relative frequency of citation (RFC) was also calculated during this survey to determine the most common occurring medicinal plants used in the study area for various ailments. Regarding the individual species *Cleistopholis patens*, *Ocimum gratissimum*, and *Carica papaya* had the highest RFC values of 0.36, 0.34, and 0.24 respectively. These different species were each cited by at least 35 informants indicating they were common and utilised medicinal plants among the population across the study area. Medicinal species with high RFC should be further evaluated for phytochemically and pharmaceutically important substances, which could potentially lead to identifying active constituents for drug discovery [59,117].

3.6.3. Fidelity Level (FL)

In this study, the FL values ranged from 26.7% to 100%. *Azadirachta indica* and *Tectona grandis* and thirty-two other species also had FL value of 100%. *Azadirachta indica* and *Tectona grandis* were ranked high in the treatment of malaria as reported in other parts of Ghana [76,77,95]. Medicinal species with high fidelity level values could be potential candidates for further pharmacological investigations to confirm theirs in vitro activity [81]. The lowest FL values were recorded for *Newbouldia laevis* (26.7%), *Carica papaya* (30.6%), *Jatropha curcas* (30.8%), *Alchornea cordifolia* (31%), and *Senna alata* (33.3%). The low FL values for these species could be the results of the limited sharing of knowledge about their control in the study area.

3.7. Allelopathy of the Medicinal Plants Collected

3.7.1. Potential Allelopathic Activity by Leachates of Medicinal Plant

In this study, the radicle inhibition percentages of lettuce seedlings were in the range of 3.6–86.2% based on 10 mg oven-dried samples (Table S1). With respect to 10 mg oven-dried samples treatment, 32 species caused significant inhibition on lettuce radicle as evaluated using standard deviation variance (SDV). Our results indicated six species with more than 70% inhibition of lettuce radicle growth, while the number of species with inhibition of lettuce radicle between 60% and 70% were 15 species, and those between 49% and 59% were 11 species. Only five species, *Carica papaya*, *Kalanchoe integra*, *Eclipta alba*, *Amaranthus spinosus*, and *Zanthoxylum leprieurii*, inhibited lettuce hypocotyl growth more than 50%. All these 32 species out of the total number of species tested inhibited lettuce radicle growth by more than 50%. The overview of the top inhibiting species is shown in Table 3.

The families with the highest number of species causing >50% included Euphorbiaceae and Asteraceae (3 species each), and Amaranthaceae, Bignoniaceae, Fabaceae, and Rutaceae (2 species each). The rest of the species belonged to the families of Anacardiaceae, Annonaceae, Apocynaceae, Boraginaceae, Caricaceae, Combretaceae, Crassulaceae, Cucurbitaceae, Lamiaceae, Loganiaceae, Loranthaceae, Malvaceae, Meliaceae, Menispermaceae, Poaceae, Sapindaceae, Verbenaceae, and Zingiberaceae (1 species each). The hypocotyl of lettuce, however, showed less inhibition of growth than was observed in radicle. The relatively higher sensitivity of radicle in comparison with hypocotyl could be explained by the absorption and the higher concentration of growth inhibitory substances in root tissues due to the direct contact with the substrate [118]. In this study, the species with strong inhibitory activities (more than 70% radicle inhibition) belonged to six families: Caricaceae (*C. papaya*), Cucurbitaceae (*M. charantia*), Meliaceae (*A. indica*), Apocynaceae (*A. boonei*), Bignoniaceae (*S. campanulata*) and Menispermaceae (*F. exasperata*). In this section, we discuss the chemical information of the six species that showed strong allelopathic activities.

C. papaya showed the strongest inhibitory activity of the radicle and hypocotyl of lettuce seedling (86% and 62% respectively). In this study, we reported the use of *C. papaya* as mainly as anthelmintic and also to treat malaria. The ovicidal and larvicidal activities of aqueous and ethanolic extracts of *C. papaya* seeds on *Heligmosomoides bakeri* have been confirmed [119]. Some useful secondary metabolites such as protocatechuic acid, *p*-coumaric acid, caffeic acid, kaempferol, quercetin, and chlorogenic acid have identified in different parts of *C. papaya* [120,121]. Most of these phenolics have been reported as allelochemicals in other plant species.

Momordica charantia also showed a high level of inhibition on lettuce radicle and hypocotyl by 79% and 30% respectively. The fruit of *Momordica charantia* is eaten as a salad in Rodrigues Island, Mauritius and is reported to be effective against diabetes mellitus and hypercholesterolemia [69]. However, *M. charantia* in this study was reported as being used against abdominal pains, fever, measles, gonorrhoea, and snakebite. Quercetin-3-*O*-pentosylhexoside, 4-*O*-Feruoylquinic acid, 5-*O*-Feruoylquinic acid, Kaempferol-*O*-acetyl hexoside, and Isorhamnetin-*O*-acetyl hexoside are some of the active phenolic compounds and flavonol derivatives in *M. charantia* [122].

Table 3. Overview of the allelopathic potential of top 30 most inhibitory medicinal plants used traditionally in the Ejisu-Juaben Municipality.

Family	Scientific Names	Part Used	Allelopathy (% Growth Inhibition)					
			SW (10 mg/10 mL Agar)			Dish Pack (200 mg/DP)		
			R%	H%	Criteria *	R%	H%	Criteria *
Caricaceae	*Carica papaya*	L	86.2	62.4	****	37.7	24.8	**
Cucurbitaceae	*Momordica charantia*	L	78.7	30.1	***	−1.0	−4.0	
Meliaceae	*Azadirachta indica*	L	74.7	25.9	***	13.6	−1.0	
Apocynaceae	*Alstonia boonei*	SB	71.5	35.8	***	14.4	8.2	
Bignoniaceae	*Spathodea campanulata*	L	71.3	16.0	***	10.6	21.5	
Menispermaceae	*Ficus exasperata*	L,	70.0	19.5	***	9.9	2.9	
Euphorbiaceae	*Phyllanthus urinaria*	L	68.5	47.7	**	61.7	43.1	****
Asteraceae	*Eclipta alba*	L	68.0	57.7	**	61.8	47.7	****
Annonaceae	*Cleistopholis patens*	L	67.6	12.7	**	16.7	1.6	
Crassulaceae	*Kalanchoe integra*	L	66.8	59.8	**	43.7	14.7	***
Amaranthaceae	*Amaranthus spinosus*	Wp	66.4	57.3	**	36.8	1.70	**
Asteraceae	*Chromolaena odorata*	L	66.2	14.2	**	11.1	1.60	
Sapindaceae	*Paullinia pinnata*	R	66.2	29.6	**	−6.0	−8.0	
Poaceae	*Cymbopogon citratus*	L	65.9	47.7	**	34.7	1.30	**
Bignoniaceae	*Heliotropium indicum*	L	65.6	−5.0	**	9.0	4.70	
Fabaceae	*Senna alata*	L	62.9	22.6	**	14.6	13.8	
Lamiaceae	*Ocimum gratissimum*	L	62.3	−24.0	**	4.3	18.2	
Bignoniaceae	*Newbouldia laevis*	L	61.9	49.0	**	31.7	21.1	*
Rutaceae	*Zanthoxylum leprieurii*	SB	61.8	53.8	**	13.7	1.70	
Rutaceae	*Citrus aurantiifolia*	F	60.2	46.7	**	1.70	−30.0	
Combretaceae	*Terminalia catappa*	L	59.9	37.8	**	28.1	2.20	*
Fabaceae	*Senna occidentalis*	L	58.4	−10.0	*	7.40	10.3	
Loranthaceae	*Tapinanthus bangwenis*	Wp	57.7	34.8	*	39.2	21.1	**
Euphorbiaceae	*Manihot esculenta*	L	57.7	24.7	*	16.9	9.20	
Amaranthaceae	*Alternanthera pungens*	L	57.4	19.1	*:	84.0	63.0	****
Malvaceae	*Sida acuta*	L	56.8	4.40	*	4.20	9.0	
Asteraceae	*Ageratum conyzoides*	L	56.8	−2.0	*	17.7	1.80	
Anacardiaceae	*Mangifera indica* L.	L	55.7	21.1	*	19.3	17.5	
Euphorbiaceae	*Alchornea cordifolia*	L	51.7	21.8	*	6.30	7.50	
Verbanaceae	*Tectona grandis*	L	52.2	11.1	*	37.7	15.7	**

M-Average, δ-Standard deviation. Criteria: Stronger inhibitory activity in the radicle:* M + 0.5 (δ); ** M + 1(δ); *** M + 1.5(δ); and **** M + 2.5(δ); SW: Sandwich Bioassay Method; DP: Dish pack Bioassay Method.

Azadirachta indica is used in other countries such as Uganda [96] and Kenya [98] for the treatment of malaria as reported in this study. *A. indica* showed the inhibitory activity of 75% and 26% respectively on lettuce radicle and hypocotyl. The allelochemical azadirachtin isolated from *A. indica* is an antifeedant that results in feeding deterrence, moulting aberrations, and mortality within some insect orders [123].

Alstonia boonei showed 72% inhibition of radicle and 36% inhibition of the lettuce seedlings. In this study, the local people used *A. boonei* to treat malaria and other several skin diseases such as measles, chicken pox, boils, and shingles. *Alstonia boonei* is used in treating malaria in Uganda [75] and haemorrhoids in Nigeria [104]. α-amyrin and β-amyrin acetate are active anti-inflammatory substances isolated from the bark of *A. boonei* [124]. In addition, echitamine, lupenol, and ursolic acid have all been isolated from leaves and stem bark of *A. boonei* [125].

Spathodea campanulata also caused an inhibition of lettuce radicle and hypocotyl by 72% and 16% respectively. Local healers in the study area used *S. campanulata* to treat typhoid, malaria, and wounds. Ursolic acid and its derivatives have been isolated from the bark of *S. campanulata* as anti-malarial compounds [126]. Other active compounds such as iridoid ajugol, p-hydroxy-benzoic acid and methyl p-hydroxybenzoate have also been isolated from this medicinal plant [127].

The radicle and hypocotyl of lettuce were also inhibited by the leachates of *Ficus exasperata* (70% and 20% respectively). *F. exasperata* was mentioned for the treatment of malaria, wound, shingles, and abnormal foetus position in the study area. Ficusamide and bergapten were isolated from the stem bark of *F. exasperata* and reported to be antimicrobial [128].

3.7.2. Potential Allelopathic Effects of Volatile Constituents from Medicinal Plant

Our results indicate (Table S1) that among the plant species tested, lettuce radicle growth was inhibited by significantly the volatiles constituents of 24 species based on standard deviation variance (SDV). The species that caused inhibition of lettuce radicle growth above 50% belonged to the five families of Amaranthaceae (*Alternanthera pungens*), Asteraceae (*Eclipta alba*), Euphorbiaceae (*Phyllanthus urinaria*), Solanaceae (*Solanum lycopersicum* and *Solanum torvum*), and Fabaceae (*Tetrapleura tetraptera*).

Similar to inhibition by leachates, the radicle of lettuce was inhibited more than hypocotyl growth. The volatile compounds from plants are usually difficult to be concentrated highly enough to cause significant inhibitory under field conditions [64]. However, high concentrations of volatile allelochemicals accumulated from cover plants or thick fallen leaves can effect plant–plant interaction to inhibit the germination and growth of other plants. Although lettuce inhibition by volatile constituents of the reported medicinal species did not correlate with the ethnobotanical indices, the medicinal uses and bioactive information of the top inhibiting species are described. An overview of 30 of the most inhibitory medicinal species against lettuce radicle is shown in Table 3.

The leaves of *Alternanthera pungens* were reported in this study for the treatment of constipation and headache. Other studies have reported the use of *Alternanthera pungens* to treat jaundice and had shown strong hypoglycemic and antidyslipidemic effects [129,130]. The leaves of *A. pungens* caused the most inhibition of lettuce radicle and hypocotyl by 84% and 64%, respectively. Vitexin, isovitexin, and orientin with antioxidant potentials were isolated from the aerial parts of *A. pungens* [131].

The volatile constituents of the leaves of *Eclipta alba* inhibited the radicle (62%) and hypocotyl (48%). The leaves of *Eclipta alba* were used in the study area to treat catarrh and malaria. Bakht et al. [132] showed the antimicrobial potentials of *Eclipta alba*. The main volatiles of *Eclipta alba* includes heptadecane, n-hexadecanoic acid, and pentadecane [133]. The aerial parts of *E. alba* also contain lanosteroid, ursolic acid, apigenin, and β-amyrin [134,135].

Phyllanthus urinaria also caused 62% inhibition of lettuce radicle growth and 43% inhibition on the hypocotyl. *Phyllanthus urinaria* was mentioned in this study as being used to manage and treat high blood pressure, malaria, sore throat, and ulcer. The antiplasmodial activity of *Phyllanthus urinaria* has been well known [136,137]. Hippomanin A and corilagin isolated from *P. urinaria* were found with in vitro antiviral activity [138].

Solanum lycopersicum and *Solanum torvum* (both Solanaceae) caused lettuce radicle inhibition by 58% and 52% respectively. However, the inhibitory activity on lettuce hypocotyl was low as in the case of other species (27% and 36% respectively for *S. lycopersicum* and *S. torvum*). *S. lycopersicum* was reported for treating convulsion while *S. torvum* was used as a blood tonic and also to treat a cough, typhoid, and headache. Zingiberene, curcumene, *p*-cymene, α-terpinene, isovaleronitrile, 3-methylbutanal, tran-2-hexenal, and α-phellandrene are some of the active volatile constituents from *S. lycopersicum* [139,140]. *Solanum torvum* contains some phenolic compounds as stearic acid, linolenyl alcohol, and linoleic acid [141]. *Tetrapleura tetraptera*, an important spice in the study area, was used as a blood tonic and also to treat typhoid and asthma. The fruits of *T. tetraptera* inhibited the lettuce radicle and hypocotyl by 51% and 31%, respectively. Ojewole and Adewunmi [142] reported the anti-inflammatory and hypoglycaemic effects of *T. tetraptera* aqueous extracts. 2-methyl butanoic acid, acetic acid, 2-methyl butanoic acid, 2-hydroxy-3-butanone, 2-methyl butanol, and butanoic acid are some of the dominant essential oils in the fruits of *T. tetraptera* [143]. The results hereby presented in this study provide benchmark information for future research on potential natural herbicides.

3.7.3. Correlation between Ethnobotanical Indices and Allelopathic Activity

As shown in Table 4, we present Pearson correlations between the ethnobotanical indices (FL, UV, and RFC) and allelopathic activity (through plant leachates and volatiles) of the 95 medicinal plants reported in this study. There was no significant correlation between all the ethnobotanical indices and plant allelopathy exhibited through volatile constituents. This could be because the volatile constituents causing inhibition were not involved in the healing effects of the respective medicinal plants. It was noticed during the survey that only the volatiles of *Ocimum gratissimum* and *Hoslundia opposita* were used in treating ailments. On the contrary, inhibition by leachates from plants correlated with all the ethnobotanical species. There was a significant positive correlation between inhibition by plant leachates and RFC and UV (r = 0.653 **; p = 0.01 and r = 0.639 **; p = 0.01 respectively). In this study, the leachates of *Carica papaya*, *Momordica charantia*, *Azadirachta indica*, *Alstonia boonei*, *Spathodea campanulata*, *Ficus exasperata*, *Phyllanthus urinaria*, *Eclipta alba*, *Cleistopholis patens*, and *Kalanchoe integra* showed inhibitory effects on lettuce radicle (67–86%).

Table 4. Relationship between ethnobotanical indices and allelopathic activities of collected species.

	Correlations	Inhibition-SW	Inhibition-DP	UV	FL	RFC
Inhibition-SW	Pearson Correlation	1.0	0.186	0.639 **	−0.462 **	0.653 **
	Sig. (2-tailed)		0.071	0.000	0.000	0.000
	N	95.0	95.0	95.0	95.0	95.0
Inhibition-DP	Pearson Correlation	0.186	1.0	0.128	−0.161	0.183
	Sig. (2-tailed)	0.071		0.215	0.119	0.075
	N	95.0	95.0	95.0	95.0	95.0
UV	Pearson Correlation	0.639 **	0.128	1.0	−0.242 *	0.941 **
	Sig. (2-tailed)	0.000	0.215		0.018	0.000
	N	95.0	95.0	95.0	95.0	95.0
FL	Pearson Correlation	−0.462 **	−0.161	−0.242 *	1	−0.284 **
	Sig. (2-tailed)	0.000	0.119	0.018		0.005
	N	95.0	95.0	95.0	95.0	95.0
RFC	Pearson Correlation	0.653 **	0.183	0.941 **	−0.284 **	1.0
	Sig. (2-tailed)	0.000	0.075	0.000	0.005	
	N	95.0	95.0	95.0	95.0	95.0

** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed); SW: Sandwich bioassay method; DP: Dish pack bioassay method.

These medicinal species were also of high importance based on their reported ethnobotanical indices reported in this study area and also in other studies [69,75,76,99,102,108,119,126]. It can be inferred from these highly significant positive correlations that the bioactive substances associated with curative effects of the understudied medicinal plants may play a role in the allelopathy of such species. In effect, medicinal species with high ethnobotanical indices can be specifically targeted in the search for allelopathic species for weed control. Such species would offer higher chances for the successful isolation of bioactive compounds with allelopathic leads. Nonetheless, the utilisation of such analysis to identify candidate allelopathic species depends on the quality of the ethnobotanical survey and the analysis of the ethnobotanical indices. The reported Pearson correlation coefficient between UV and RFC was 0.941 that reflects a significant and positive correlation between the proportion of plant uses within the interviewed population and the frequency that the informant mentions a particular use of a species. This relationship indicates that an increase in the number of informants increases the knowledge of the uses of a particular species [144]. The scattergram showing the relationship between ethnobotanical indices and allelopathic potentials of medicinal plants are shown in Figure 5. On the contrary, the correlation between FL and growth inhibitions through leachates was rather negative ($r = -0.462$ **; $p = 0.01$).

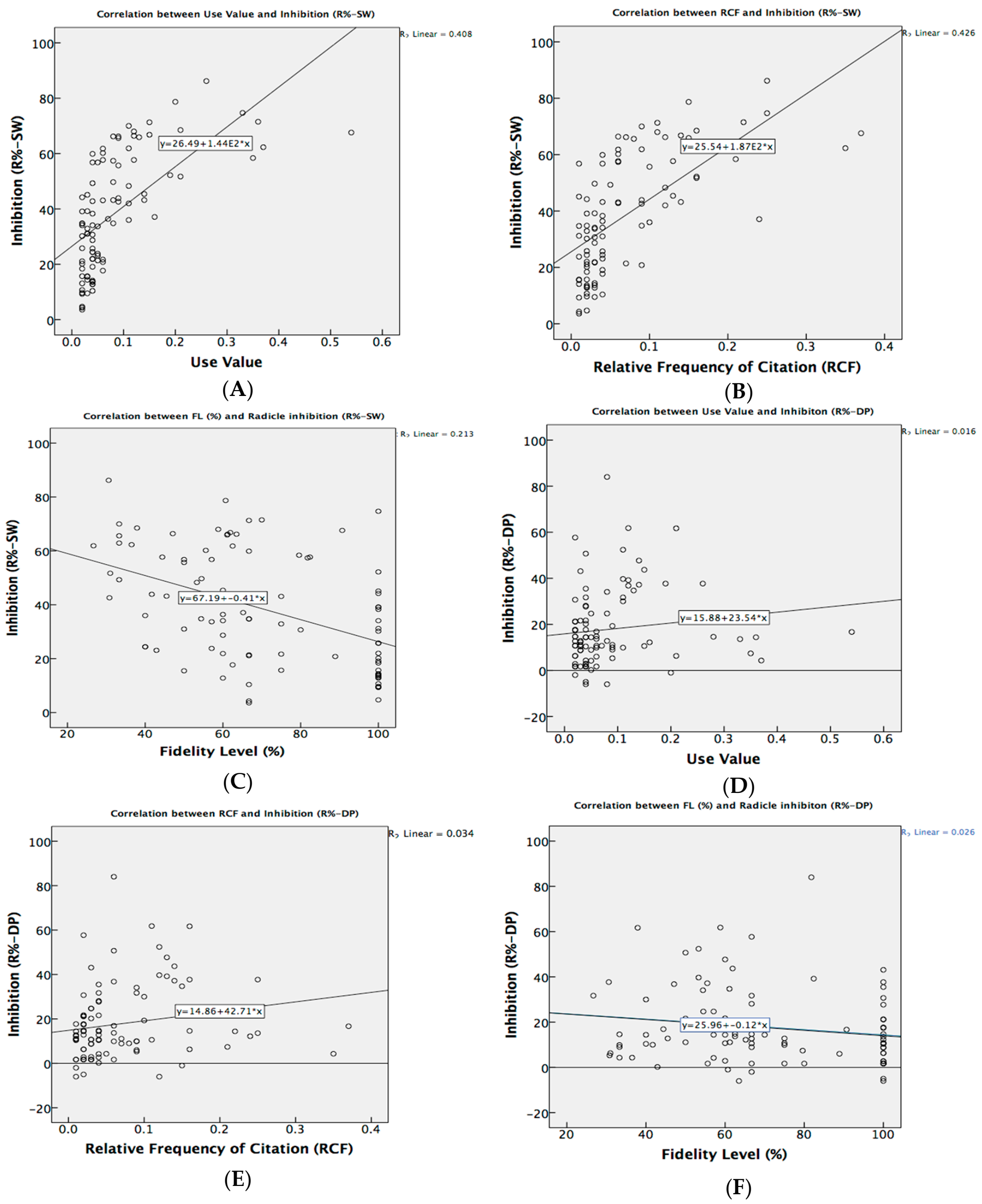

Figure 5. Pearson correlation between ethnobotanical indices and allelopathy (lettuce radicle inhibition) of medicinal plants. Pearson correlation was conducted to find any association between some ethnobotanical indices (use value, fidelity level, and relative frequency of citation) of medicinal plants and their corresponding allelopathy (effects of leachates and volatiles constituents on lettuce radicle). Correlations between inhibition of lettuce radicle growth by plant leachates and: (**A**) use value; (**B**) relative frequency of citation; and (**C**) fidelity level. Correlations between inhibition of lettuce radicle growth by plant volatile constituents and: (**D**) use value; (**E**) relative frequency of citation; and (**F**) fidelity level.

Most of the already reported allelochemicals from medicinal plants also have reported therapeutics properties. For example, the allelochemical artemisinin is used in an anti-malarial drug [17], safranal; anticonvulsant [18], L-3,4-dihydroxyphenylalanine (L-DOPA); anti-Parkinson's disease [145], kaempferol; and anti-cancer [19], among a tall list of others. Although some of the species showed significant inhibition by both leachates and volatile constituents, there was no significant correlation between them. This could indicate that the bioactive substances responsible each kind of inhibition activity are different. Angelicin was reported as the principal allelochemical of *Heracleum sosnowskyi* fruit leachate, but the allelochemical responsible for volatile inhibition was identified to be octanal [33,34]. Similarly, the volatile monoterpene 1,8-cineole has been identified as the main volatile allelochemical of *Artemisia* spp. [146]. However, artemisinin was identified at the main selective allelochemical of *Artemisia annua* [147].

3.7.4. Future Influence of the Present Study

This study could provide a rationale for the conservation and sustainable harvesting of the local flora as a medicinal plant among the residents. The species that are reported with high ethnobotanical values can be subjected to further phytochemical and biological activity screening to confirm their in vitro activities. Sustainable weed management has become critically important in modern agriculture largely due to the profuse usage agrochemicals especially herbicide. Species that showed allelopathic potentials can be further explored in the management of weeds. Candidate species can be utilised as mulching materials or ground cover crops to minimise the indiscriminate use of synthetic herbicides. The information on the potential allelopathy of some of the medicinal plants presented in this study could be useful for researchers working to find new lead compounds for bioherbicides. The species identified with allelopathic potentials can be candidate species for future isolation and identification of allelochemicals for sustainable weed control.

4. Conclusions

This study of medicinal plants used by the local people of Ejisu-Juaben Municipality has reported 95 species for the treatment of 62 human ailments. The ethnobotanical importance of the mentioned medicinal plants in the study area is shown by the reported use value (UV), fidelity level (FL), and relative frequency of citation (RFC). The most common medicinal plants in the study area with high ethnobotanical values included *Cleistopholis patens*, *Ocimum gratissimum*, *Alstonia boonei*, *Senna occidentalis*, *Azadirachta indica*, *Senna alata*, *Carica papaya*, *Phyllanthus urinaria*, *Alchornea cordifolia*, and *Momordica charantia*. In addition, most of these reported medicinal plants showed allelopathic activities through plant leachates and volatile compounds. The UV and RFC significantly correlated with lettuce radicle inhibition through plant leachates. These significant associations indicate that medicinal plants with high ethnobotanical indices are potentially allelopathic. Based on this relationship, we can improve the odds of finding bioactive compounds of pharmaceutical and allelopathic lead during a large-scale screening of medicinal plants. Moreover, some of the medicinal plants reported with high RFC, UV, and FL values should be subjected to further pharmacological research for the potential discovery of new compounds and biological activities. In addition, some of the species that showed high allelopathic potentials can be further explored in sustainable weed control practices. Consequently, the ethnobotanical survey can form the basis for screening medicinal plants to increase the odd of finding allelopathic species for sustainable weed management. To the best of our knowledge, this is the first report relating ethnobotanical indices of medicinal plants to their corresponding potential allelopathy.

Supplementary Materials: The following are available online at www.mdpi.com/2071-1050/9/8/1468/s1, Table S1: Ethnobotanical values and allelopathic activities of medicinal plants cited by local informants in the Ejisu-Juaben Municipality.

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Conflicts of Interest: The authors declare no conflict of interest.

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