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Detection of Alkaloid for 26 Plants Used in Ethnoveterinary Medicine in Sudan

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Abstract

The present study was detected of alkaloid compounds in 26 plants used in Ethnoveterinary medicine in Sudan. Crude extracts for the plant samples were obtained using Five solvents (ethanol, petroleum ether, chloroform, ethyl acetate and aqueous). Phytochemical screening method on the ethanolic and aqueous extracts. Revealed that alkaloids were abundant in most candidate plant except only five, namely; *Maerva crassifolia* (stem park), *Pennisetum orientale* (seeds), *Balanites aegyptiaca* (fruit), *Cucurbita moschata* (seeds) and *Conocarpus erectus* (leaves). Thin layer chromatography (TLC) used to detection of alkaloids in those plants extracts have shown good results.

Keywords: Ethnoveterinary medicin; Ethanol; Petroleum ether; Chloroform; Phytochemical screening; Alkaloids.

1. Introduction

The secondary metabolites produced by plants have a wide spectrum of activity; they affect insects at the cellular, tissue and organismal level. In general, their action disturbs the cellular and physiological processes responsible for maintaining homeostasis, and they can provoke sublethal changes within various tissues and organs, which can ultimately lead to death. However, secondary metabolites also have sublethal implications, such as reduced fecundity, reduced viability or deformities in parental and filial generations. In addition, these compounds reduce the number of individuals in populations both directly (as a result of death) but also, or even primarily, indirectly. Secondary plant metabolites can disturb development, lead to malformations or malfunctions, extend the duration of developmental stages [1, 2] or act as repellents [3, 4] The alkaloids are one of the most diverse groups of secondary metabolites found in living organisms and have an array of structure types, biosynthetic pathways, and pharmacological activities. Although alkaloids have been traditionally isolated from plant, an increasing number are to be found in animals, insects, and marine invertebrates and microorganisms [5]. Ethnoveterinary medicine (EVM) deals with people's knowledge, skills, methods, practices and beliefs about the care of their animals. Ethnoveterinary knowledge is acquired through practical experience and has traditionally been passed down orally from generation to generation [6]. The aim of this study is to detected of alkaloid compounds in 26 plants used in Ethnoveterinary medicine in Sudan

2. Materials and Methods

2.1. Plant Material

The samples of the candidate plants were purchased from Omdurman market and some were collected from Omdurman Islamic University field. plant used identified and authenticated by prof: Hatil Alkamali/ Herbarium botany department.

2.2. Preparation of Plant Extraction

Different extracts were prepared by a modification of the method according to Robinson [7]. The steps are graphically presented as a flow chart in Figure (1)

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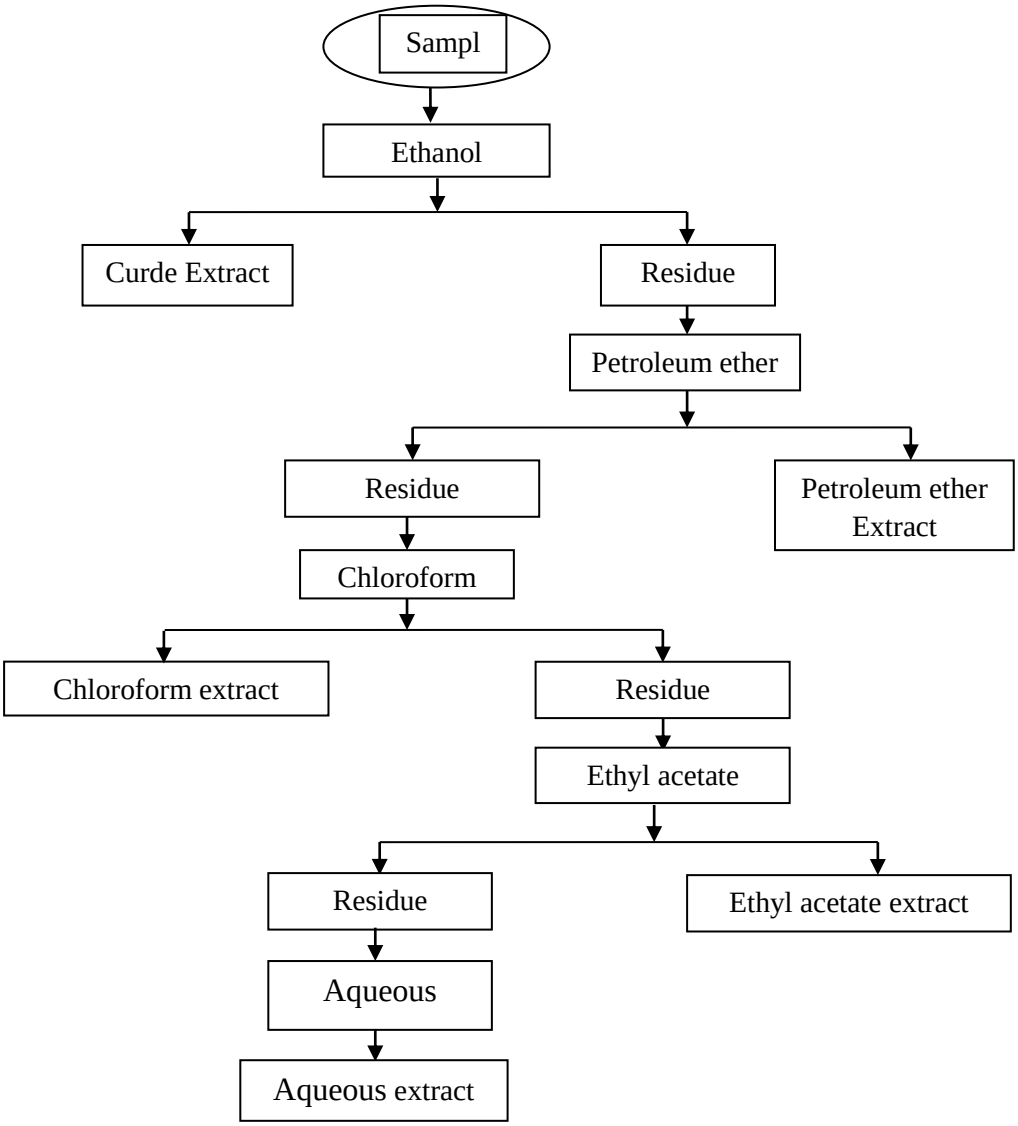
Figer-1. Steps Of Extracts Method



2.2. Qualitative Phytochemical Evaluation of Alkaloids

The ethanol and aqueous extracts of candidate plants were used for the detection of Alkaloids according to standard method described by Trease and Evans [8].

2.3. Mayer's Test

To 0.5ml of the extract 2ml of Mayer's reagent (K_2HgI_4) was added and the reaction mixture was observed for the formation of creamy white precipitate.

2.4. Thin Layer Chromatography of Alkaloids

Precoated TLC plates were used for the chromatographic analysis of the crude extract (Silica gel 60 F254). The following solvent system were used:

Chloroform: Methanol: Water (6: 3: 0.65) for detection of alkaloids [9].

2.5. Detection

Dragendoroff's reagent

3. Results and Discussion

3.1. Phytochemical Evaluation of Candidate Plants Table (1)

phytochemical evaluation showed the presence of Alkaloids compounds in each of the *Acacia mellifera* (Stem bark), *Acacia nilotica* (Fruits), *Acacia nubica* (Stem bark), *Allium cepa*(Bulb), *Calotropis procera* (Aerial parts), *Camellia sinensis* (Leaves), *Capsicum frutescens* (Fruits), *Coffea arabica* (Seed), *Coriandrum sativum* (Fruits), *Cymbopogon schoenanthus* (Aerial part), *Foeniculum vulgare* (Fruits), *Medicago sativa* (Aerial part), *Nigella sativa* (Seed), *Panicum turgidum* (Aerial part), *Sorghum bicolor* (Seed) and *Trigonella foenum-graecum* (Seed) in all extracts (ethanol, aqueous). Alkloid compounds also appeared in the aqueous extract of *Abelmoschus esculentus* (Fruits), *Hibiscus sabdariffa* L (Fruits), *Nicotiana rustica* (Aerial parts), *Solennostemma argel* (Aerial part), *Ziziphus*

spina-christi (Leaves). Also it does not appear in each of extracts in five plants *Balanites roxburghii* (Fruits), *Conocarpus erectus* (Leaves), *Cucurbita peop* (Seeds), *Maerua crassifolia* (Stem bark), *Pennisetum americanum* (Grain).

3.2. Thin Layer Chromatographic Technique

Petroleum ether extract of *Abelmoschus esculentus* for detection of alkaloids revealed the presence of five compounds having R_f values of 0.04, 0.09, 0.18, 0.27 and 0.51 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Chloroform extract revealed the presence of five compounds having R_f values of 0.07, 0.11, 0.02, 0.44 and 0.06 respectively. Ethanolic extract revealed the presence of four compounds having R_f values of 0.07, 0.09, 0.13and 0.33 respectively. Ethyl acetate extract revealed the presence of two compounds having R_f values of 0.11and 0.31 respectively. Aqueous extract revealed the presence of two compounds having R_f values of 0.09 and 0.31 respectively. Ethanolic extract of *Acacia mellifera* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.10, 0.35 and 0.92 respectively, when a solvent system of Chloroform: Methanol: Water (6 : 3 : 0.65) was used. Chlorofom extract revealed the presence of three compounds having R_f values of 0.08, 0.37 and 0.96 respectively. Ethyl acetate extract revealed the presence of three compounds having R_f values of 0.12, 0.29 and 0.94 respectively. Aqueous extract revealed the presence of two compounds having R_f values of 0.13 and 0.90 respectively. Petroleum ether extract revealed the presence of one compound having R_f values of 0.92 respectively. Ethanolic extract of *Acacia nilotica* for detection of alkaloids revealed the presence of two compounds having R_f values of 0.87 and 0.88 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Aqueous extract revealed the presence of tow compounds having R_f values of 0.92 and 0.9 respectively. Petroleum ether, chloroform and ethyl acetate revealed the presence of one compound for each having R_f value of 0.9, 0.82 and 0.75 respectively. Ethyl acetate extract of *Acacia nubica* for detection of alkaloid revealed the presence of three compounds having R_f values of 0.77, 0.82 and 0.87 respectively when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Aqueous extract revealed the presence of two compounds having R_f values of 0.8 and 0.9 respectively. Ethanolic, petroleum ether and chloroform extracts revealed the presence of one compound for each having R_f value of 0.87, 0.87 and 0.8 respectively. Chloroform and aqueous extracts of *Allium cepa* for detection of alkaloids revealed the presence of one compounds for each having R_f values of 0.87 and 0.76 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. No compound were detect in ethanolic, petroleum ether and ethyl acetate extracts. Ethanolic extract of *Balanites roxburghii* for detection of alkaloids revealed the presence of two compounds having R_f values of 0.13 and 0.73 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Petroleum ether, chloroform, ethyl acetate, aqueous extracts revealed the presence of one compound for each having R_f values of 0.56, 42, 0.29 and 0.67 respectively. TLC of ethanolic extract of *Calotropis procera* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.8, 0.84 and 0.87 respectively when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Petroleum ether extract revealed the presence of three compounds having R_f values of 0.84, 0.85 and 0.91 respectively. Petroleum ether extract of *Camellia sinensis* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.68, 0.78 and 0.88 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. TLC of chloroform extract revealed the presence of three compounds having R_f values of 0.17, 0.7 and 0.82 respectively. Ethyl acetate extract revealed the presence of three compounds having R_f values of 0.17 , 0.68 and 0.83 respectively. Ethanolic extract revealed the presence of two compounds having R_f values of 0.25 and 0.92 respectively. Aqueous extract revealed the presence of two compounds having R_f values of 0.67 and 0.8 respectively. TLC of ethanolic extract of *Capsicum frutescens* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.13, 0.58 and 0.73 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Chloroform and ethyl acetate extracts revealed the presence of one compound for each having R_f values of 0.58 and 0.56 respectively. No compound were detect in petroleum ether and aqueous extracts. TLC of ethanolic extract of *Coffea arabica* for detection of alkaloids revealed the presence of two compounds for each having R_f value of 0.75 and 0.95 respectively when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Petroleum ether extracts revealed the presence of two compounds for each having R_f value 0.5 and 0.77 respectively. Chloroform, ethyl acetate and aqueous extract revealed the presence of one compound for each having R_f value of 0.83, 0.83 and 0.88 respectively. TLC of ethanolic, petroleum ether, chloroform, ethyl acetate and aqueous extracts of *Conocarpus erectus* for detection of alkaloids revealed the presence of one compound for each having R_f values of 0.39, 0.07, 0.15, 0.13 and 0.46 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. TLC of aqueous extract of *Coriandrum sativum* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.88, 0.92 and 0.96 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Ethyl acetate extract revealed the presence of two compounds having R_f values of 0.72 and 0.9 respectively. Ethanolic, chloroform, ethyl acetate and aqueous extracts revealed the presence of one compound for each having R_f value of 0.74, 0.76 and 0.74 respectively. TLC of petroleum ether extract of *Cucurbita pepo* for detection of alkaloids revealed the presence of four compounds having R_f values of 0.11, 0.34, 0.60 and 0.85 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Petroleum ether extract revealed the presence of four compounds having R_f values of 0.06, 0.34, 0.66 and 0.85 respectively. Ethanolic extract revealed the presence of two compounds having R_f values of 0.17 and 0. 58 respectively. Chloroform extract revealed the presence of two compounds having R_f values of 0.13 and 0. 26 respectively. Aqueous extract revealed the presence of two compounds having R_f values of 0.08 and 0. 23 respectively. Petroleum ether extract of *Cymbopogon schoenanthus* for detection of alkaloids revealed the presence

of two compounds having R_f values 0.86 and 0.96 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. TLC of ethanolic , chloroform, ethyl acetate and aqueous extracts revealed the presence of one compound for each having R_f value of 0.95, 0.95, 0.98 and 0.20 respectively. TLC of ethanolic extract of *Foeniculum vulgare* for detection of alkaloids revealed the presence of five compounds having R_f values 0.58 , 0.69, 0.78, 0.82 and 0.96 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Chloroform extract revealed the presence of three compounds having R_f values of 0.8, 0.85 and 0.98 respectively. Ethyl acetate extract revealed the presence of three compounds having R_f values of 0.84, 0.87 and 0.98 respectively. Aqueous extract revealed the presence of three compounds having R_f values of 0.76, 0.84 and 0.95 respectively. Petroleum ether extract revealed the presence of two compounds having R_f values of 0.29 and 0.96 respectively. Ethanolic extract of *Hibiscus sabdariffa* for detection of alkaloids revealed the presence of two compounds having R_f values of 0.8 and 0.88 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Aqueous extract revealed the presence of two compounds having R_f values of 0.53 and 0.7 respectively. Petroleum ether, chloroform and ethyl acetate extract revealed the presence of one compound for each having R_f values of 0.85, 0.77 and 0.85 respectively. Ethanolic and chloroform extracts of *Maerva crassifolia* for detection of alkaloids revealed the presence of one compound for each having R_f values of 0.86 and 0.86 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. No compound were detect in petroleum ether, ethyl acetate and aqueous extracts. TLC of chloroform extract of *Medicago sativa* for detection of alkaloid revealed the presence of four compounds having R_f values of 0.1, 0.24, 0.76 and 0.96 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Ethanolic extract revealed the presence of two compounds having R_f values of 0.16 and 0.82 respectively. Petroleum ether extract revealed the presence of two compounds having R_f values of 0.24 and 0.96 respectively. Aqueous extract revealed the presence of one compound having R_f values of 0.14 respectively. No compound were detect in ethyl acetate extracts. Chloroform extract of *Nicotiana rustica* for detection of alkaloids revealed the presence of four compounds having R_f values of 0.12, 0.28, 0.44 and 0.88 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Ethanolic extract revealed the presence of three compounds having R_f values of 0.01, 0.03 and 0.44 respectively. Petroleum ether extract revealed the presence of three compounds having R_f values of 0.01, 0.03 and 0.44 respectively. Ethyl acetate and aqueous extracts did not appear compounds. Petroleum ether extract of *Nigella sativa* for detection of alkaloids revealed the presence of four compounds having R_f values of 0.06, 0.09, 0.15 and 0.26 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Ethanolic extract revealed the presence of three compounds having R_f values of 0.09, 0.19 and 0.30 respectively. Chloroform extract revealed the presence of three compounds having R_f values of 0.09, 0.19 and 0.32 respectively. Ethyl acetate extract revealed the presence of two compounds having R_f values of 0.30 and 0.47 respectively. No compound were detect in aqueous extracts. Aqueous extract of *Panicum turgidum* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.13, 0.37 and 0.58 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Chloroform extract revealed the presence of two compounds having R_f values of 0.60 and 0.83 respectively. Ethyl acetate extract revealed the presence of two compounds having R_f values of 0.15 and 0.52 respectively. Ethanolic extract revealed the presence of one compounds having R_f values of 0.58 respectively. No compound were detect in petroleum ether extract. TLC of ethanolic extract of *Pennisetum americanum* for detection of flavones revealed the presence of four compounds having R_f values of 0.1, 0.26, 0.4 and 0.7 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Petroleum ether extract revealed the presence of two compounds having R_f values of 0.1and 0.24 respectively. Chloroform extract revealed the presence of two compounds having R_f values of 0.1and 0.28 respectively. No compound were detect in ethyl acetate and aqueous extracts. Petroleum ether extract of *Solennostemma argel* for detection of alkaloids revealed the presence of four compounds having R_f values of 0.6 , 0.72 , 0.83 and 0.9 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Chloroform extract revealed the presence of four compounds having R_f values of 0.71 , 0.82 , 0.9 and 0.83 respectively. TLC of ethanolic extract revealed the presence of two compounds having R_f values of 0.75 and 0.8 respectively. Ethyl acetate extract revealed the presence of two compounds having R_f values of 0.63 and 0.82 respectively. No compound were detect in aqueous extract. TLC of petroleum ether extract of *Sorghum bicolor* for detection of alkaloids revealed the presence of three compounds having R_f values of 0.72, 0.82 and 0.96 respectively when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Ethyl acetate extract revealed the presence of three compounds having R_f values of 0.84, 0.92 and 0.98 respectively. Ethanolic and aqueous extracts revealed the presence of one compound for each having R_f value of 0.9 and 0.8 respectively. TLC of ethanolic extract of *Trigonella foenum – graecum* of alkaloids revealed the presence of three compounds having R_f values of 0.39, 0.56 and 0.79 respectively when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Petroleum ether , chloroform, ethyl acetate and aqueous extracts revealed the presence of one compound for each having R_f value of 0.79, 0.33, 0.81 and 0.81 respectively. TLC of chloroform extract of *Ziziphus spina-christi* for detection of flavones revealed the presence of three compounds having R_f values of 0.51, 0.66 and 0.87 respectively, when a solvent system of Chloroform : Methanol : Water (6 : 3 : 0.65) was used. Ethyl acetate extract revealed the presence of three compounds having R_f values of 0.57, 0.92 and 0.94 respectively. Ethanolic extract revealed the presence of two compounds having R_f values of 0.70 and 0.91 respectively. Petroleum ether extract revealed the presence of two compounds having R_f values of 0.38 and 0.60 respectively. Aqueous extract revealed the presence of one compound having R_f values 0.87.

4. Conclusion

The present study was detected of alkaloid compounds in 26 plants used in Ethnoveterinary medicine in Sudan, where it was the work of extracts of different plant. Phytochemical screening method on the ethanolic and aqueous extracts, alkaloids were abundant in most candidate plant except only five, namely; *Maerva crassifolia* (stem park), *Pennisetum orientale* (seeds), *Balanites aegyptiaca* (fruit), *Cucurbita moschata* (seeds) and *Conocarpus erectus* (leaves). Thin layer chromatography (TLC) used to detection of alkaloids in those plants extracts have shown good results.

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Table-1. phytochemical screening of Alkaloid

Plants	Extration	Alkaloids
Abelmoschus esculentus (Fruits)	Ethanol Aqueous	- +
Acacia mellifera (Stem bark)	Ethanol Aqueous	+ +
Acacia nilotica (Fruits)	Ethanol Aqueous	+ +
Acacia nubica (Stem bark)	Ethanol Aqueous	+ +
Allium cepa (Bulb)	Ethanol Aqueous	+ +
Balanites roxburghii (Fruits)	Ethanol Aqueous	- -
Calotropis procera (Aerial parts)	Ethanol Aqueous	+ +
Camellia sinensis (Leaves)	Ethanol Aqueous	+ +
Capsicum frutescens (Fruits)	Ethanol Aqueous	+ +
Coffea arabica (Seed)	Ethanol Aqueous	+ +
Conocarpus erectus (Leaves)	Ethanol Aqueous	- -
Coriandrum sativum (Fruits)	Ethanol Aqueous	+ +
Cucurbita peop (Seeds)	Ethanol Aqueous	- -
Cymbopogon	Ethanol	+

schoenanthus (Aerial part)	Aqueous	+
Foeniculum vulgare (Fruits)	Ethanol Aqueous	+ +
Hibiscus sabdariffa L (Fruits)	Ethanol Aqueous	- +
Maerua crassifolia (Stem bark)	Ethanol Aqueous	- -
Medicago sativa (Aerial part)	Ethanol Aqueous	+ +
Nicotiana rustica (Aerial parts)	Ethanol Aqueous	- +
Nigella sativa (Seed)	Ethanol Aqueous	+ +
Panicum turgidum (Aerial part)	Ethanol Aqueous	+ +
Pennisetum americanum (Grain)	Ethanol Aqueous	- -
Solennostemma argel (Aerial part)	Ethanol Aqueous	- +
Sorghum bicolor (Seed)	Ethanol Aqueous	+ +
Trigonella foenum-graecum (Seed)	Ethanol Aqueous	+ +
Ziziphus spina-christi (Leaves)	Ethanol Aqueous	- +

Table-2. Retardation Factor of alkaloid compounds by thin layer chromatography from some plants under study

Abelmoschus esculentus:	
Extraction	**R_f value**
Ethanol	0.07, 0.09, 0.13, 0.33
Petroleum ether	0.04, 0.09, 0.18, 0.27, 0.51
Chloroform	0.07, 0.11, 0.2, 0.44, 0.6
Ethyl acetate	0.11, 0.31
Aqueous	0.09, 0.31
Acacia mellifera	
Ethanol	0.10, 0.35, 0.92
Petroleum ether	0.92
Chloroform	0.08, 0.37, 0.96
Ethyl acetate	0.12, 0.29, 0.94
Aqueous	0.13, 0.90
Acacia nilotica	
Ethanol	0.87, 0.88
Petroleum ether	0.9
Chloroform	0.82
Ethyl acetate	0.75
Aqueous	0.92, 0.9
Acacia nubica	
Ethanol	0.87
Petroleum ether	0.87
Chloroform	0.8
Ethyl acetate	0.77, 0.82, 0.87
Aqueous	0.8, 0.9
Allium cepa	
Ethanol	------
Petroleum ether	------
Chloroform	0.87
Ethyl acetate	------
Aqueous	0.76
Balanites roxburghii	
Ethanol	0.13, 0.73
Petroleum ether	0.56

Chloroform	0.42
Ethyl acetate	0.29
Aqueous	0.67
Calotropis procera	
Ethanol	0.8, 0.84, 0.87
Petroleum ether	0.84, 0.85, 0.91
Chloroform	0.82, 0.85, 0.91
Ethyl acetate	0.82, 0.87, 0.93
Aqueous	0.8, 0.92
Camellia sinensis	
Ethanol	0.25, 0.92
Petroleum ether	0.68, 0.78, 0.88
Chloroform	0.17, 0.7, 0.82
Ethyl acetate	0.17, 0.68, 0.83
Aqueous	0.67, 0.8
Capsicum frutescens	
Ethanol	0.13, 0.58, 0.73
Petroleum ether	-----
Chloroform	0.58
Ethyl acetate	0.56
Aqueous	-----
Coffea arabica	
Ethanol	0.75, 0.95
Petroleum ether	0.5, 0.77
Chloroform	0.83
Ethyl acetate	0.83
Aqueous	0.88
Conocarpus erectus	
Ethanol	0.39
Petroleum ether	0.07
Chloroform	0.15
Ethyl acetate	0.13
Aqueous	0.46
Coriandrum sativum	
Ethanol	0.74
Petroleum ether	0.76
Chloroform	0.74
Ethyl acetate	0.72, 0.9
Aqueous	0.88, 0.92, 0.96
Cucurbita pepo	
Ethanol	0.17, 0.58
Petroleum ether	0.11, 0.34, 0.60, 0.85
Chloroform	0.13, 0.26
Ethyl acetate	0.06, 0.34, 0.66, 0.85
Aqueous	0.08, 0.23
Cymbopogon schoenanthus	
Ethanol	0.95
Petroleum ether	0.86, 0.96
Chloroform	0.95
Ethyl acetate	0.98
Aqueous	0.20
Foeniculum vulgare	
Ethanol	0.58, 0.69, 0.78, 0.82, 0.96
Petroleum ether	0.29 , 0.96
Chloroform	0.8, 0.85, 0.98
Ethyl acetate	0.84, 0.87, 0.98
Aqueous	0.76, 0.84, 0.95
Hibiscus sabdariffa	
Ethanol	0.8, 0.88
Petroleum ether	0.85
Chloroform	0.77
Ethyl acetate	0.85

Aqueous	0.53, 0.7
Maerua crassifolia	
Ethanol	0.86
Petroleum ether	------
Chloroform	0.86
Ethyl acetate	------
Aqueous	------
Medicago sativa	
Ethanol	0.16, 0.82
Petroleum ether	0.24, 0.96
Chloroform	0.1, 0.24, 0.76, 0.96
Ethyl acetate	-----
Aqueous	0.14
Nicotiana rustica	
Ethanol	0.1, 0.46, 0.9
Petroleum ether	0.1, 0.3, 0.44
Chloroform	0.12, 0.28, 0.44, 0.88
Ethyl acetate	------
Aqueous	------
Nigella sativa	
Ethanol	0. 09, 0.19, 0.30
Petroleum ether	0. 06, 0.09, 0.15, 0.26
Chloroform	0.09, 0.19, 0.32
Ethyl acetate	0.30, 0.47
Aqueous	-----
Panicum turgidum	
Ethanol	0.58
Petroleum ether	-----
Chloroform	0.60, 0.83
Ethyl acetate	0.15 , 0.52
Aqueous	0.13, 0.37, 0.58
Pennisetum americanum	
Ethanol	0.1, 0.26, 0.4, 0.7
Petroleum ether	0.1, 0.24
Chloroform	0.1, 0.28
Ethyl acetate	-----
Aqueous	-----
Solennostemma argel	
Ethanol	0.75, 0.8
Petroleum ether	0.6, 0.72, 0.83, 0.9
Chloroform	0.71, 0.82, 0.9, 0.83
Ethyl acetate	0.63, 0.82
Aqueous	------
Sorghum bicolor	
Ethanol	0.09
Petroleum ether	0.72, 0.82, 0.96
Chloroform	0.92
Ethyl acetate	0.84, 0.92, 0.98
Aqueous	0.08
Trigonella foenum – graecum	
Ethanol	0.39, 0.56, 0.79
Petroleum ether	0.79
Chloroform	0.33
Ethyl acetate	0.81
Aqueous	0.81
Ziziphus spina-christi	
Ethanol	0.70, 0.91
Petroleum ether	0.38, 0.60
Chloroform	0.51, 0.66, 0.87
Ethyl acetate	0.57, 0.92, 0.94
Aqueous	0.87

Appendix

Figures-2. showed results for separation of alkaloids by thin layer chromatography from some plants under study