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EDIBLE AND POISONOUS SPECIES OF CUCURBITACEAE IN THE CENTRAL HIGHLANDS OF KENYA

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ABSTRACT

The family Cucurbitaceae includes species cultivated for vegetables and fruits. Some wild species are used locally as vegetables; others are given to domestic animals as fodder. Some wild species are poisonous, and cases of poisoning, both of people and domestic animals, arise from misidentification of the wild species. Twenty three species were collected and identified. Their poison content, consisting of cucurbitacins, was investigated. Fifteen species were found to contain the dangerous chemicals. An identification key that can be used by people without botanical training is presented. An appendix with short descriptions of the species is included to aid identification.

INTRODUCTION

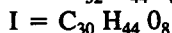
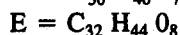
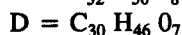
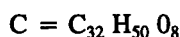
Cucurbitaceae Jussieu is a family of dicotyledonous plants comprising about 850 species in 100 genera. In East Africa the family is represented by 137 species in 28 genera, and of these, 84 species in 24 genera occur in Kenya (Jeffrey, 1967). The plants are mostly rapid growing, trailing and decumbent annual or perennial herbs, rarely woody, often with tendrils, one at each node. Shoots arise from a tuberous root stock, often with abundance of sap in their stems and other tissues (Willis, 1973). Leaves are alternate, simple or compound and exstipulate (Mabberley, 1987). Except for *Momordica spinosa* (Gilg.) Chiov., which has tough spines, the majority of the other plants in this family are covered with conspicuous hairs, which are usually stiff. Flowers are usually unisexual, rarely bisexual, either yellow or white. The fruit is a berry and when hard-walled it is called a pepo, rarely a capsule (Mabberley, 1987).

There are nine genera of Cucurbitaceae in cultivation comprising 15 species, with many cultivars and varieties yielding vegetables and fruits rich in vitamins, minerals and β -carotene (Purseglove, 1968). Cucumbers and melons are good examples. Some are also cultivated for their edible seeds and roots, for example the buffalo gourd *Cucurbita foetidissima* H.B.K. whose seeds yield oil comparable to that of soya beans and sunflower. The roots of this plant are rich in starch, and are consumed as food or used in production of ethanol fuel (Ayensu, 1975; Tampion, 1977; Vickery & Vickery, 1979; Jennie & Eugene, 1985; Brian & Michael, 1986; Nee, 1990). Notes on herbarium specimens as well as literature show that wild species

of this family are also eaten by the local population as well as by their domestic animals. Leaves and fruits of *Cucumis aculeatus* Cogn. are eaten by goats and camels (Timberlake 747, EA). In northern parts of Kenya the leaves of *Cucumis dipsaceus* Enhreb. ex Spach. are eaten as vegetables (Tanner n.d. EA; Verdcourt & Trump, 1969). In East Africa 17 species have been recorded as being used medicinally (Kokwaro, 1993).

Though not all the species have been studied, many of the plants in this family have been reported to be poisonous (Jex-Blake, 1957; Watt & Breyer-Brandwijk, 1962; Vickery & Vickery, 1976). Several herbarium specimens in the East African Herbarium (EA, National Museums of Kenya) are samples relating to police investigations. In Kisii, Kenya, the roots of *Momordica foetida* Schumach. have been used to treat malaria, leading to death of the patient (police/anon. 1424/1971). In another instance a woman was given a decoction prepared from crushed and boiled fruit of *Cucumis dipsaceus* Ehrenb. ex Spach. and death followed (Verdcourt & Trump, 1969). Leaves of *Momordica friesiorum* (Harms) Jeffrey are said to be extremely poisonous and have been known to kill cattle that eat them (Glover *et al.* 995). Poisoning is frequently the result of misidentification, because edible (or medicinal) and poisonous species often look alike. During the field studies it was noticed that the local people could not distinguish between closely related species. Respondents often gave identical vernacular names for species that are different.

The dangerous compounds are called cucurbitacins, which have been shown to belong to the group of naturally occurring compounds called triterpenoids (Hansan, 1985). Several cucurbitacins called A, B, C, D, E, etc. have been isolated and characterised (Enslin, 1954; Enslin *et al.*, 1956, 1957; Rehm *et al.*, 1957; Lavie *et al.*, 1964). Apparently cucurbitacins are formed *in situ* and are not transported in the various parts of the plant (Frohne, 1983). Cucurbitacins have been shown to cause death on consumption of the fruits of *Luffa cylindrica* (L.) M.J. Roem. (Storrs & Pearce, 1982). The toxicity of cucurbitacins C, D, E, & I has been assessed and these compounds ascertained to be lethal (Whitaker & Davis, 1962). Their chemical formulae are:



The fascicle of the *Flora of Tropical East Africa* (FTEA) describing the family Cucurbitaceae (Jeffrey, 1967) is a reliable guide to the identification of species in this family occurring in East Africa. However, it is a technical book used by botanists, and it is of little use to people without botanical training. There is no adequate guide available for the laymen (who happen to be the users of these plants) to distinguish these species.

The aim of this study was to collect and identify wild species of Cucurbitaceae that are used locally in parts of the Central Highlands in Kenya, to determine which species are safe and which ones contain poisonous compounds, and to prepare a simple identification guide.

MATERIALS AND METHODS

Plants were collected in the general area shown in the map (fig. 1), representing selected localities in the Central Highlands of Kenya. Locality references for the field work were obtained from literature as well as from labels of specimens in the East African Herbarium,

Nairobi (EA) and the herbarium of the University of Nairobi (NAI). Additional localities were found during the field work, and voucher specimens have been deposited in EA (appendix 2). Identification was carried out with the aid of the two floras for the area (Jeffrey, 1967; Agnew, 1974) as well as by reference to specimens in EA.

Local residents were consulted concerning information on the plants and mainly on how they use the plants or what danger the plants pose to them. For each specimen information was gathered from at least three respondents. Older people were more knowledgeable on uses of wild plants, and they gave valuable information.

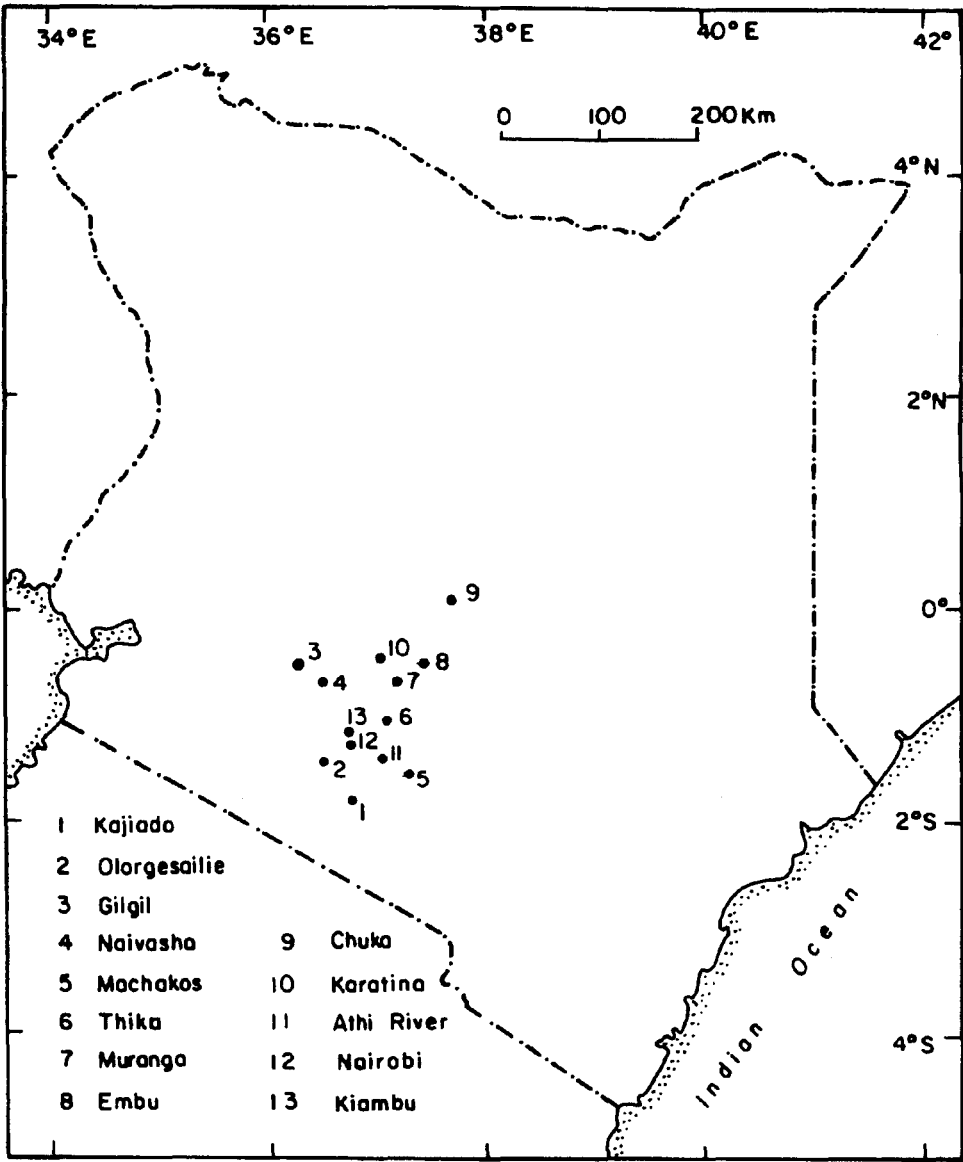


Fig. 1: Main areas where field work was carried out in Kenya

In extraction and analysis the following schedule was followed:

Extraction:

Plant organs macerated with equal quantities of absolute ethanol and lead acetate. Mixture filtered. Aqueous potassium dihydrogen phosphate added to precipitate lead. Cucurbitacins extracted from the aqueous phase with chloroform three times. Extract concentrated at 70 °C.

Precipitate test: Lavie *et al.*, 1964.

5 ml sample + 1 g triphenyltetrazolium chloride; occurrence of red precipitate (formazin) surveyed. Formazin indicates presence of cucurbitacins.

Infrared absorption analysis:

A: Dry sample.

1g dried sample, ground with 10 mg pure potassium bromide; compressed to form discs. Discs analysed in Perkin-Elmer 598 infrared Spectrophotometer.

B: Viscous samples

Sample dissolved in chloroform. Analysis done with pure chloroform in the reference beam.

For both dry and viscous samples, absorption bands of α & β unsaturated hydroxyl keto group of the cucurbitacins assessed.

Chromatography:

Precoated silica plates activated, cooled, then spotted with the samples. Plates run for 30 min (replicated three times) in chloroform - ethanol (95:5) solvent and sprayed with vanillin phosphoric acid reagent. Pure cucurbitacins were used as standards.

For the construction of the key vegetative characters were mainly chosen because they are visible in the plant for most of the time, which allows use of the key even when the plants are not flowering. In some cases species are so similar in vegetative morphology that it is necessary to use flower and/or fruit characters. Fruits usually persist when the rest of the plant has dried and are therefore useful identification characters. Terminology is made as simple as possible so that the key can be used by people who are not trained botanists. Where simplification of terms is not possible, shapes are illustrated.

RESULTS

The plants collected were identified and found to represent 23 species. All except *Myrmecosicyos messorius* were reported by the local people as being used for local consumption (food/medicinal) or as fodder. For the remaining 22 species, the organs used were analysed for occurrence of cucurbitacins. The results are shown in table 1. Plants with Cucurbitacins C, D, E, & I. are to be avoided, as their consumption can lead to illness, or even death.

Table 1: Occurrence of cucurbitacins in different organs. Toxic cucurbitacins are C, D, E and I

	Root	Stem	Leaves	Fruits hi	Seeds eg
<i>Citrullus lanatus</i> (Thunb.) Mansf.					
<i>Coccinia adoensis</i> (A. Rich.) Cogn.		hir			
<i>Coccinia trilobata</i> (Cogn.) C. Jef.		bdg	dhir	g	
<i>Cucumis aculeatus</i> Cogn.		be	r		
<i>Cucumis dipsaceus</i> Spach.	dcg	c	cghlr	abgh	
<i>Cucumis ficifolius</i> A. Rich.	cf	bcdgr	dil	bcgh	-
<i>Cucumis prophetarum</i> L.			fb		
<i>Diplocyclos palmatus</i> (L.) C. Jef.			hi		
<i>Kedrostis foetidissima</i> (Jacq.) Cogn.		l	c		
<i>Kedrostis gijef</i> (J.F. Gmel.) C. Jef.			-	-	
<i>Lagenaria abyssinica</i> (Hook. f.) C. Jef.			cdgh		
<i>Lagenaria sphaerica</i> (Sond.) Naud.				bcgh	
<i>Momordica boivinii</i> Baill.			g		
<i>Momordica calantha</i> Gilg.	bghrce		g		
<i>Momordica charantia</i> L.			-	-	
<i>Momordica foetida</i> Schumach.	bcde	h	grcei	eg	
<i>Momordica friesiorum</i> (Harms.) C. Jef.	hr				
<i>Momordica pterocarpa</i> A. Rich.			hrce		-
<i>Momordica rostrata</i> A. Zimm.	ghcd		-		
<i>Myrmecosicyos messorius</i> C. Jef.					
<i>Peponium vogelii</i> (Hook. f.) Engl.			-		
<i>Sechium edule</i> (Jacq.) Swartz.	bce		f	eih	
<i>Zehneria scabra</i> (L. f.) Sond.	bce	f			

IDENTIFICATION KEY

- | | | |
|---|--|-----------------------------|
| 1 | Tendrils absent, or if present split midway into two or more (fig. 2A & 3C) | 2 |
| | Tendrils present, not split as above (fig. 2B) | 11 |
| 2 | Leaf margin toothed, teeth turning inwards and outwards in a wavy fashion (fig. 2B) | 3 |
| | Leaf margins continuous (not broken), or broken but teeth not arranged in a wavy fashion | 8 |
| 3 | With a pair of warty outgrowths at the junction of leaf blade and leaf stalk | 4 |
| | Without warty outgrowths | 5 |
| 4 | Warty outgrowths at right angles to the leaf stalk (fig. 2C) | <i>Lagenaria sphaerica</i> |
| | Warty outgrowths directed backwards (fig. 2D) | <i>Lagenaria abyssinica</i> |
| 5 | Leaves undivided, comprising only one blade (fig. 2B) | 6 |
| | Leaves divided into two or more leaflets (fig. 2E) | <i>Momordica pterocarpa</i> |
| 6 | Petals bright yellow | <i>Citrullus lanatus</i> |
| | Petals white | 7 |
| 7 | With tongue-like scaly structure at the point where the leaf stalk joins the stem, no projections on the fruit (fig. 2F) | <i>Peponium vogelii</i> |
| | Without tongue-like, scaly structures, fruit with remains of the style (fig. 2G) | <i>Momordica calantha</i> |
| 8 | Leaves divided into two or more leaflets | <i>Momordica friesiorum</i> |
| | Leaves undivided, comprising only one blade | 9 |

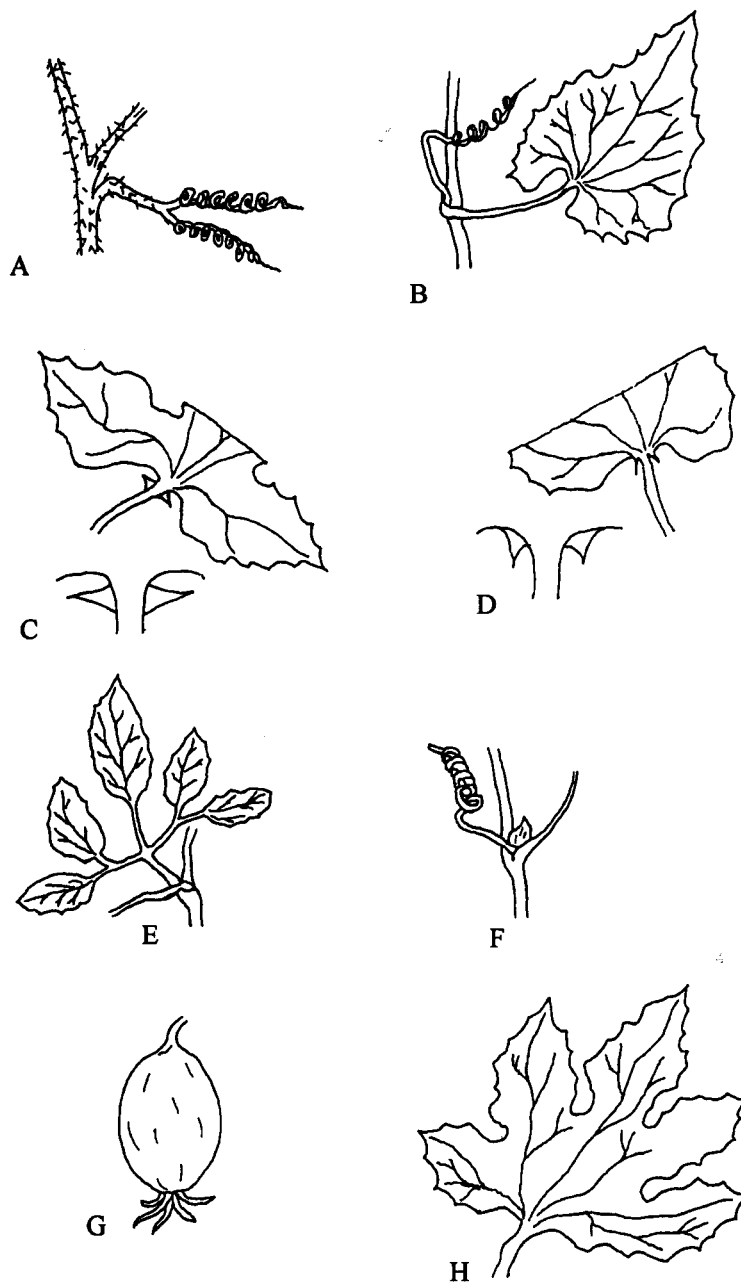


Figure 2. A Tendril split midway into two; B Leaf blade undivided; tendril not split
 C Outgrowths at right angles to the leaf stalk; D Outgrowths directed backwards;
 E Leaf divided into many leaflets; F Tongue-like scaly structure; G Fruit with remains of style;
 H Leaf blade with 5 lobes

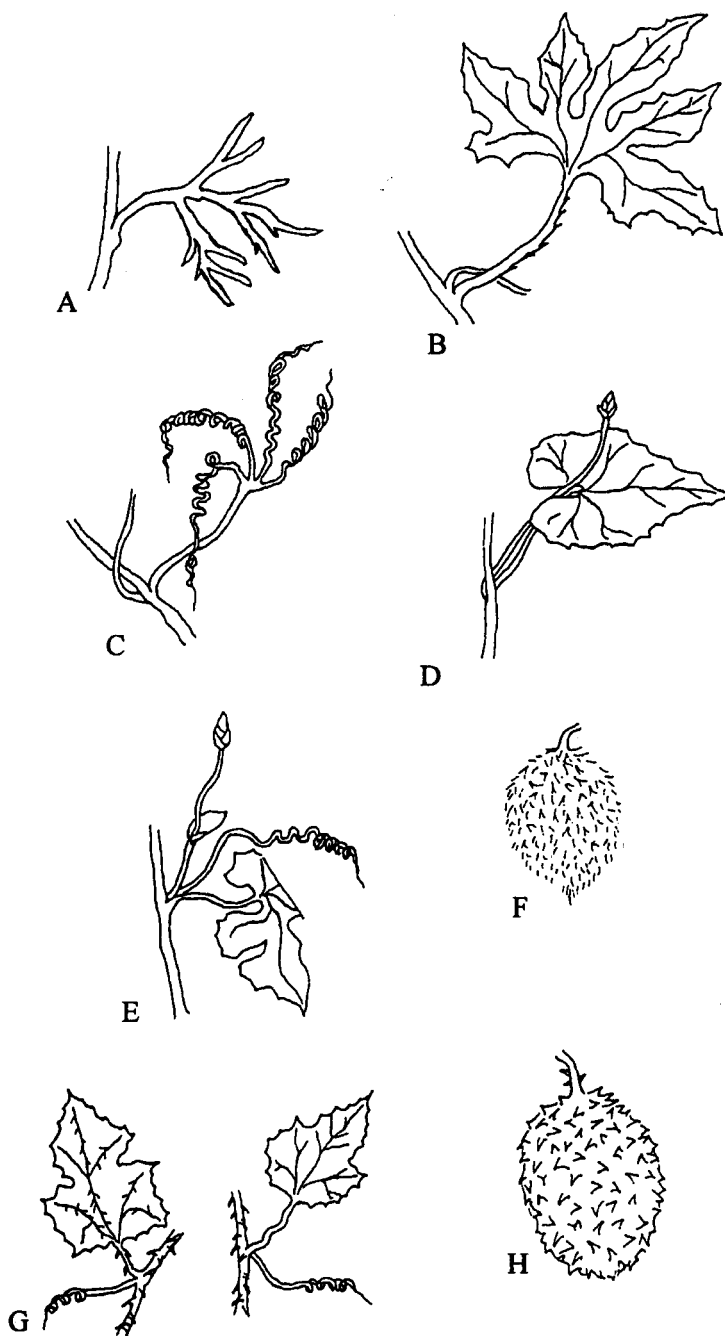


Figure 3. A Leaf blade with many finger-like lobes; **B** Leaf stalk with forward pointing projections; **C** Tendril branched into four parts; **D** Flower stalk passing through recess of the leaf; **E** Flower stalk with a sheathing leaf-like structure; **F** Fruit with translucent bristles; **G** Leaf stalks and leaf veins with recurved spines and prickles; **H** Fruit with prickles

- 9 Leaf blade with 5 finger-like lobes arising from a central axis (fig. 2H) 10
 Leaf blade with more than 5 finger-like lobes
 arising from one basal point (fig. 3A) *Myrmecosycos messorius*
- 10 Tendrils branched midway into two (fig. 3B), leaf stalk with forward pointing
 projections, fruits green or red with streaks of white *Diplocyclos palmatus*
 Tendrils branched into four parts (fig. 3C), leaf stalk without any forward pointing
 projections; fruits light green without streaks of white *Sechium edule*
- 11 Petals and sepals bearing purple or black spots or patches at the base 12
 Petals and sepals without such coloured spots 14
- 12 Leaves undivided, comprising only one blade 13
 Leaves with several leaflets,
 stalk of the middle leaflet longer than the leaf stalk *Momordica rostrata*
- 13 Stems uniform green colour, leaf stalk with a green leaf-like structure below,
 flower stalk parallel to leaf stalk
 and passing through recess of the leaf (fig. 3D) *Momordica boivini*
 Stems with darker green spots, especially the younger stems, flower and leaf not as
 above *Momordica foetida*
- 14 Petals joined at base, flower stalk without a leaf-like structure at base 15
 Petals separate; flower stalk with a green leaf-like structure
 at base (fig. 3E) *Momordica charantia*
- 15 Petals yellow, with light green lines on the upper surface 16
 Petals white, cream, yellow or greenish and if yellow,
 then without green lines as above 19
- 16 Entire plant covered with stiff hairs 17
 Entire plant covered with soft hairs 18
- 17 Stems and leaf stalks with roughly spreading greenish-yellow hairs, fruit with
 translucent bristles (fig. 3F) *Cucumis dipsaceus*
 Stems, leaf stalks, and main leaf veins with recurved spines and prickles, fruits with
 prickles (fig. 3G & 3H) *Cucumis aculeatus*
- 18 Leaf longer than broad *Coccinia adoensis*
 Leaf shorter than broad *Coccinia trilobata*
- 19 Leaf blade continuous, plant with foetid smell *Kedrostis foetidissima*
 Leaf blade lobed, plant without foetid smell 20
- 20 Stems prickly or very rough to touch 21
 Stems softly hairy 22
- 21 All leaves 3-lobed in a spreading finger-like fashion, stems reddish-purple, with a very
 rough, coral-like bark *Kedrostis gijef*
 Younger leaves 3-lobed, older leaves 5-lobed, stems greenish, plant with coarse
 prickly hairs, especially on leaf stalks,
 stems and main leaf veins *Cucumis ficifolius*
- 22 Leaves shallowly lobed, upper surface ornamented with small white dots,
 flowers white *Zehneria scabra*
 Leaves deeply divided into 3 or 4 lobes, flowers yellow *Cucumis prophetarum*

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APPENDIX 1: MAIN DIAGNOSTIC FEATURES OF THE SPECIES STUDIED

Citrullus lanatus (Thunb.) Mansf.

An annual herb soft hairy; with deeply lobed palmate leaves. Middle lobe the largest. Flowers yellow. Fruit hairy, green mottled with paler green or yellowish in irregular longitudinal stripes.

Coccinia adoensis (A. Rich.) Cogn.

A perennial woody climber with a tuberous root stock leaf shape very variable, though mainly ovate in outline, divided into seven lobes. Flowers golden-orange brown, veined on the outside. Fruit tomato-red when ripe with a short beak.

Coccinia trilobata (Cogn.) C. Jeffrey

A perennial woody climber with a swollen fleshy root stock. Leaves usually 5-lobed but sometimes simple, with simple tendrils. Petals yellow with green veins. Fruit bright red with green markings.

Cucumis aculeatus Cogn.

A creeping herb covered with spiny yellow-hooked hairs on stem ridges and major veins of lower leaf surface. Fruit with scattered low conical pustules.

Cucumis dipsaceus Spach.

A herb covered with stiff spreading hairs. Stems grey-green. Fruit softly and densely spiny.

Cucumis ficifolius A. Rich.

A perennial climbing or creeping herb with coarse and soft spreading hairs. Fruit with short bristles, dark green with 10 longitudinal pale green lines.

Cucumis prophetarum L.

Climbing or trailing herb with spreading hairs leaves deeply 3-5 palmatisect. Fruit pale green with distinct darker longitudinal stripes but uniformly yellow when ripe.

Diplocyclos palmatus (L.) C. Jeffrey

A perennial climber with a fleshy rootstock. Leaf petiole with forward pointing projections. Fruits green or red with white stripes.

Kedrostis foetidissima (Jacq.) Cogn.

A glandular-hairy perennial herb giving an offensive smell. Fruits with beaked, hairy fleshy fruits.

Kedrostis gijef (J.F. Gmel.) C. Jeffrey

A woody climber with roughly hairy stems being grooved and corky. Leaves palmate with 3 lobes.

Lagenaria abyssinica (Hook. f.) C. Jeffrey

A climber or trailer with bifid tendrils and palmate leaves. The petiole glands point downwards. Petals white with green nerves below.

Lagenaria sphaerica (Sond.) Naud.

A dioecious climber with bifid tendrils; with robust conical glands at junction of petiole with lamina projecting at right angles to the petiole. Fruit subspherical, deep green with pale yellowish transverse streaks.

Momordica boivinii Baill.

A climbing or training herb with annual stems arising from a tuberous rootstock. Peduncle subtended by a bract. Peduncle running parallel to the petiole and passing through the sinus of the leaf. Fruit elongated and constricted between the seeds.

Momordica calantha Gilg.

A perennial herb with tuberous roots; with simple ovate leaves and white corolla with a black centre. Fruits fleshy velvet smooth with a reflexed persistent strap-shaped receptacle-lobes.

Momordica charantia L.

An annual climber with ridged stems and simple tendrils, peduncle bearing a clasping green bract. Fruit ornamental with about 8 longitudinal rows of subconical tubercles.

Momordica foetida Schumach.

A dioecious perennial climber or trailer with dark-green-spotted stems.

Momordica friesiorum (Harms.) C. Jeffrey

A perennial climber or trailer stems arising from a tuberous rootstock and with compound leaves. Fruit beaked with 10 toothed longitudinal ridges.

Momordica pterocarpa A. Rich.

A perennial climber with stems arising from a tuberous rootstock. Leaves compound with middle leaflet largest. Fruit beaked with 8 longitudinal ridges.

Momordica rostrata A. Zimm.

A dioecious woody climber with perennial stems arising from a fleshy, rootstock which is visible above the ground and tapering upwards into the stems. Leaves compound, the central rachis longer than the petiole.

Myrmecosicyos messorius C. Jeffrey

A monoecious herb with finely dissected leaves, tendrils lacking, pubescent on all parts.

Peponium vogelii (Hook. f.) Engl.

A climber or trailer densely covered with long hair. Leaf lamina reniform-orbicular in outline deeply divided into 5-7 lobes.

Sechium edule (Jacq.) Swartz.

A climber with tetrafid tendrils. Usually cultivated but occurs wild as an escape. Leaves ovate, usually light green in colour.

Zehneria scabra (Linn. f.) Sond.

A dioecious climber with ovate often shallowly lobed leaves. Flowers small, cream-yellow. Fruits formed in clusters, green becoming scarlet when ripe.

APPENDIX 2: VOUCHER SPECIMENS

This appendix gives the localities where the species studied were collected. Grid references, altitudes and the collectors number are given. Collections shown here as GNN are labelled in the East African herbarium as G.N. Njoroge.

Citrullus lanatus (Thunb.) Mansf.

Mugecha Kandara, 0°56'S/37°4'E, 1800 m, GNN 372.

Coccinia adoensis (A. Rich.) Cogn.

Thika, behind Blue Posts Hotel, 1°04'S/37°04'E, 1440 m, GNN 323. Njiru, near Githurai, 1°10'S/36°40'E, 1680 m, GNN 340.

Coccinia trilobata (Cogn.) C. Jeffrey

Thika, near Thika Falls, 1°04'S/37°05'E, 1470 m, GNN 324. Ruiru, near Gitambaya, 1°10'S/37°05'E, 1500 m, GNN 322. Karura Forest, 1°15'S/36°50'E, 1650 m, GNN 343. Museum Hill, Nairobi, 1°14'S/36°55'E, 1680 m, GNN 439. Chiromo, by river side, 1°16'S/36°48'E, 1950 m, GNN 440. Longata Rongai, Langata Prisons, roadside, 1°25'S/36°46'E, 1380 m, GNN 347. Karen, by fence at shopping centre, 1°20'S/36°45'E, 1500 m, GNN 408. Fence Langata Cemetery, 1°22'S/36°40'E, 1350 m, GNN 407. Kiambu, weed in shambas, 1°25'S/36°55'E, 1710 m, GNN 431. Karatina, near Kiamabara, 0°10'S/36°40'E, 1950 m, GNN 388. Chuka, in Meru, 0°20'S/37°45'E, 1950 m, GNN 339. Karura Forest, near residential areas, 1°10'S/36°45', 1650 m, GNN 345. Ukia, in Machakos, 1°44'S/37°35'E, 1500 m, GNN 353. On roadside, 10 km past Athi River towards Mombasa, 1°30'S/37°20'E, 1350 m, GNN 361. Kiritiri, in Embu, 0°39'S/37°37'E, 1500 m, GNN 370. Kimbwezi, near the town 2°23'S/37°55'E, 1050 m, Mwangi sub GNN 377. Karura Forest, near Kiambu road, 1°30'S/36°50'E, 1500 m, GNN 387.

Cucumis aculeatus Cogn.

Buruburu, Nairobi, by roadside, 1°15'S/36°44'E, 1500 m, GNN 304. Kajiado Town, 1°51'S/36°48'E, 1800 m, GNN 385. 4 km past Athi River on Mombasa road, 1°26'S/37°00'E, 1450 m, GNN 348. Machakos, near Katumani Research Station, 1°28'S/37°15'E, 1800 m, GNN 359. Kirimara school near Karatina, 0°15'S/36°55'E, 1500

m, *GNN 418*. 10 km past Athi River towards Mombasa, 1°30'S/37°20'E, 1350 m, *GNN 357*. 9 km from Narok on Narok-Wasonyiro Road, 1650 m, *Mbugua sub GNN 435*. Along Thika-Nairobi Road, on Mama Ngina farm, 1°10'S/37°00'E, 1500 m, *Mbugua sub GNN 438*.

Cucumis dipsaceus Spach.

Ruiru Gitambaya, 1°08'S/36°56'E, 1500 m, *GNN 321*. Machakos Town, 1°28'S/37°15'E, 1650 m, *GNN 350*. Magadi Road 8 km from Olepolos, 1°27'S/36°37'E, 1880 m, *GNN 365*. 5 km from Athi River crossing towards Mombasa, 0°33'S/36°55'E, 1350 m, *GNN 363*. Chuka in Naka, 1°15'S/37°55'E, 1800 m, *GNN 384*. Kibwezi, 3 km from town towards Mombasa, 1°25'S/37°55'E, 1050 m, *GNN 384*. 4 km from Mwatate to Voi, 1°25'S/36°55'E, 900 m, *GNN 436*.

Cucumis ficifolius A. Rich.

On grassy ground in Kenyatta University, 1°09'S/37°02'E, 1500 m, *GNN 308*. Behind Botany Offices, Kenyatta University, 1°12'S/36°55'E, 1500 m, *GNN 313*. Near Kahuho, in Gilgil, 0°33'S/36°20'E, 1980 m, *GNN 424*.

Cucumis prophetarum L.

Voi, on road by passing town, 3°25'S/38°33'E, 900 m, *Masinde sub GNN 392*. Kibwezi, 3 km from town towards Mombasa, 1°25'S/37°55'E, 1050 m, *Mwangi sub GNN 378*. Kibwezi, 2 km from town towards Nairobi, 1°30'S/37°50'E, 1050 m, *Mwangi sub GNN 379*.

Diplocyclos palmatus (L.) C. Jeffrey

Near Nairobi River, 1°33'S/36°50'E, 1650 m, *GNN 337*. Thika, west of Blue Posts Hotel, 1°04'S/37°05'E, 1470 m, *GNN 329*. Museum Hill, just above Nairobi River, 1°13'S/36°51'E, 1650 m, *GNN 325*. Nairobi, along State House Road, 1°24'S/36°48'E, 1680 m, *GNN 402*. Karura Forest, near Kiambu road 1°30'S/36°50'E, 1650 m, *GNN 390*.

Kedrostis foetidissima (Jacq.) Cogn.

Olorgesale, near prehistoric site, 1°43'S/36°26'E, 950 m, *GNN 301*. Mt Kulal below Gatab, 2°35'S/36°56'E, 1200 m, *Newton 3724*. Chiromo area in Nairobi, 1°15'S/36°41'E, 1650 m, *GNN 401*. State House Road, Nairobi, 1°30'S/36°50'E, 1500 m, *GNN 400*.

Kedrostis gijef (J.F.Gmel.) C. Jeffrey

Just near Olorgesale prehistoric site, 1°38'S/36°30'E, 900 m, *GNN 306*. Otepesi, on Magadi Road, 1°32'S/36°27'E, 900 m, *GNN 367*.

Lagenaria abyssinica (Hook.f.) C. Jeffrey

Karatina near Kirimara market, 0°10'S/36°50'E, 1650 m, *GNN 410*. Kahuho, near Gilgil, 0°05'S/35°40'E, 1500 m, *GNN 423*. Near Murindati stream, 0°10'S/35°42'E, 1500 m, *GNN 429*.

Lagenaria sphaerica (Sond.) Naud.

Ruiru near Gitambaya Matipeni, 1°08'S/36°55'E, 1450 m, *GNN 341*. Kahawa, near the army barracks, 1°10'S/36°50'E, 1500 m, *GNN 434*.

Momordica calantha Gilg

Chuka, near Naka Forest, 0°17'S/37°40'E, 1680 m, *GNN* 327. Inside the compound of Chuka High School, 0°20'S/37°35'E, 1680 m, *GNN* 333. Nairobi near State House School, 1°20'S/36°40'E, 1650 m, *GNN* 399. Boy-1-Kamiti, near Njiru, Kiambu, 1°30'S/36°45'E, 1680 m, *GNN* 422. Thika below Chania River, 1°05'S/37°05'E, 1650 m, *GNN* 330. Naka Forest margin, 0°15'S/37°38'E, 1800 m, *GNN* 336. Kwamaiko, in Kiambu, 1°25'S/36°40'E, 1680 m, *GNN* 423a.

Momordica charantia L.

Ruiru, near the town, 1°07'S/36°55'E, 1500 m, *GNN* 300. Kenyatta University residential area, 1°10'S/36°56'E, 1500 m, *GNN* 300a. Machakos township, 1°28'S/37°15'E, 1800 m *GNN* 351. Thika, near School for the Blind, 1°04'S/37°05'E, 1455 m, *GNN* 326.

Momordica boivinii Baill.

Ukia, Mukueni, Machakos, 1°35'S/37°25'E, 1650 m, *GNN* 352. Embu Town, 0°30'S/37°26'E, 1320 m, *GNN* 371.

Momordica foetida Schumacher.

Just below the Intercontinental Hotel, Nairobi, 1°10'S/36°53'E, 1500 m, *GNN* 393. Museum Hill, Nairobi, 1°15'S/36°49'E, 1500 m, *GNN* 397. Tambach, in Baringo, 0°40'N/35°30'E, 1440 m, *GNN* 409. Karatina, near Kirimara, 0°11'S/36°50'E, 1800 m *GNN* 414. Karatina, near railway line, 0°13'S/36°55'E, 1800 m, *GNN* 415. Kiamabara in Karatina, 0°15'S/36°55'E, 1800 m, *GNN* 420. Thika, near Chania River, 1°05'S/37°00'E, 1440 m, *GNN* 378. Near Nairobi River, 1°10'S/36°50'E, 1500 m, *GNN* 395. Boy-1-Kamiti, Kiambu, 1°30'S/36°50'S, 1500 m, *GNN* 421.

Momordica friesiorum (Harms) C. Jeffrey

Museum Hill, Nairobi, 1°15'S/36°40'E, 1650 m, *GNN* 394.

Momordica pterocarpa A. Rich.

Gilgil, near Kahuho School, 1°28'S/36°20'E, 1500 m, *GNN* 428.

Momordica rostrata A. Zimm.

Kajiado, 5 km from town, 1°55'S/36°40'E, 1650 m, *GNN* 435. Machakos, near Katumani Research Station, 1°22'S/37°05'E, 1800 m, *GNN* 360. Olepolos, on Magadi Road, 1°27'S/36°37'E, 1800 m, *GNN* 364. 20 km to Elangata Wuas from Athi River, 1°50'S/36°35'E, 1800 m, *GNN* 374. Kiritiri, near Nyamgura, 0°39'S/37°37'E, 1500 m, *GNN* 368. Machakos, near Ukia School, 1°35'S/37°15'E, 1500 m, *GNN* 356. Machakos, Mvia Mweu, near Kivaani, 1°40'S/37°22'E, 1480 m, *GNN* 358. 11 km from Olepolos on Magadi Road, 1°29'S/36°38'E, 1800 m, *GNN* 366.

Myrmecosicyos messorius C. Jeffrey

Kajiado, 32 km towards Nairobi, 1°50'S/36°42'E, 1620 m, *GNN* 376.

Peponium vogelii (Hook.f.) Engl.

Karura Forest, near tree nursery, 1°13'S/36°50'E, 1650 m, *GNN* 342. Thika, near the Thika Falls, 1°04'S/37°05'E, 1455 m, *GNN* 331.

Sechium edule (Jacq.) Swartz.

Kenyatta University, near Botany Department, 1°10'S/36°56'E, 1500 m, *GNN* 305. Chuka High School, 1°17'S/37°37'E, 1800 m, *GNN* 332. Museum Hill, Nairobi, 1°33'S/36°50'E, 1500 m, *GNN* 396.

Zehneria scabra (Linn. f.) Sond.

Karura Forest, main entrance, 1°15'S/36°50'E, 1500 m, *GNN* 302. Kahaini, in Kandara, 0°56'S/37°04'E, 1800 m, *GNN* 299. Turitu, in Kiambu, 1°12'S/36°45'E, 1650 m, *GNN* 318. Chuka, near Naka Forest, 1°17'S/37°37'E, 1800 m, *GNN* 338. Karen, in the outskirts of Nairobi, 0°11'S/36°42'E, 1550 m, *GNN* 404. Ruiru, near the market place, 1°10'S/36°55'E, 1550 m, *GNN* 318. Chiromo area by river side, 1°15'S/36°50'E, 1600 m, *GNN* 315. Thika west of Blue Posts Hotel, 1°04'S/37°05'E, 1455 m, *GNN* 320. Longonot area in Naivasha, 1°42'S/36°26'E, 1800 m, *GNN* 440. Gilgil near Kahuho School, 0°25'S/36°15'E, 1650 m, *GNN* 427. Karatina, near Kirimara High School, 0°10'S/36°50'E, 1800 m, *GNN* 413. Kiamabara near Karatina town, 0°20'S/36°45'E, 1950 m, *GNN* 411. State House Road, Nairobi, 0°15'S/36°40'E, 1500 m, *GNN* 398. Longai, in Nairobi, 1°25'S/36°45'E, 1350 m, *GNN* 406. Kirimara near the railway line, below Kinamara Primary School, 0°15'S/36°52'E, 1800 m, *GNN* 412. Sagana, 2 km on the road to Karatina, 0°20'S/36°30'E, 1800 m, *GNN* 416. On the fence at Kirimara High School, 0°10'S/36°55'E, 1750 m, *GNN* 419. Kahuho, along Ol Kalau Road, 0°20'S/36°24'E, 1750 m, *GNN* 433.