

Phytosociological Studies of the Weed Flora of Abandoned Rubber Plantations in Bendel State, Nigeria.

ILL. ONYIBE AND L.S. GILL.*

ABSTRACT

Phytosociological parameters, viz: Abundance, Density, Relative Density, Cover, Relative Cover, Frequency, Relative Frequency and Importance Value Index of the weed flora of some abandoned rubber plantations have been investigated from Bendel State Nigeria. One hundred and eighty-four weeds belonging to 60 families have been encountered. Of these, 3 (1.6%) are ferns, 48 (26.1%) are monocots while 133 (72.3%) are dicots. The broadleaved weeds are 165 (89.7%) whereas the grasses and sedges are 11 (6.0%) and 8 (4.3%), respectively. On the basis of their "Importance Value Index" and the "Semmed Dominance Ratio", the five most dominant weeds are *Culcasia scandens* Beauv., *Geophylla obvolata* G. Don, *Palisota hirsuta* (Thumb.) Sehm., *Hevea brasiliensis* (Kunth.) Mull. Arg. and *Icacina tricantha* Oliv. The "Species Diversity Index" and life form classes of the weed community have also been presented.

INTRODUCTION

The rubber tree, *Hevea brasiliensis* (Kunth.) Mull. Arg., was introduced into Nigeria from South America in 1895 (F.A.O., 1966). With the recent

influx of improved clones into the country, the already existing plantations of unselected and low yielding clones are being abandoned by the plantation owners. Consequently, the abandoned rubber plantations become very conducive for the luxuriant growth of weeds.

Although there has been previous attempt at enumerating weeds of plantation tree crops (Komolafe, 1976), the only phytosociological study of weeds of plantation tree crops in Nigeria has been on the oil palm (Gill and Onyibe 1986, 1988a & 1988b). However, Agbaka (1977) gave a check list of weeds of some rubber plantations in Bendel State, Nigeria, while Afolayan (1988) studied the phytosociology of weeds of some abandoned farm lands in Western Nigeria. The present study is the first on weeds of abandoned rubber plantations in Nigeria and is part of a larger project on the biology of weeds of plantation crops in Nigeria.

MATERIALS AND METHODS

The Study Area.

The abandoned rubber plantations studied are located around Obaretin and Iyanomo villages, about 25 km from Benin City. The area is situated between Lat. 5°N, 6°N and Long. 5°E, 6°E on an elevation of approximately 300m, above sea level. The vegetation

* Department of Botany, University of Benin, P.M.B. 1154, Benin City, Nigeria

is typical of a lowland rain forest. The annual rainfall is 2,450 mm. while the mean monthly relative humidity varies from 64% in the dry season to 94% in the wet season. The mean monthly maximum and minimum temperatures are 35°C and 20°C respectively.

Sampling Technique

Field trips were undertaken from November 1987 to March 1989 and during this period the rubber plantations were surveyed and sampled for weeds using a 1.441m x 0.74m. rectangular quadrat. Identification of the weeds were carried out with the aid of the works of Hutchinson and Dalziel (1958 – 1968) and confirmed by cross-checking with the voucher specimens at the Nigerian Forest Research Institute's herbarium.

Phytosociological Techniques

The phytosociological parameters such as Abundance, Cover, Relative Cover, Density, Relative Density, Frequency, Importance Value Index, Summed Dominance Ratio, and Species Diversity Index were determined as follows:

ABUNDANCE (A)

This was determined by counting the number of individuals of a species.

COVER (C)

This was an estimate of the proportion of the ground occupied by a vertical projection to the ground from the aerial parts of the plant (Pandeya et al. 1968, Mueller-Dombois and Ellenberg 1974).

Scale for cover estimate:-

- 5 Any number of individuals covering more than 3/4 of the area.
- 4 Covering 1/2 to 3/4 of the area
- 3 Covering 1/4 to 1/2 of the area
- 2 Covering 1/10 to 1/4 of the area
- 1 Covering 1/20 to 1/10 of the area
- 0.5 Seldom, covering less than 1/20 fo the area
- 0.1 Solitary with insignificant cover

RELATIVE COVER (RC)

The relative cover (RC) was calculated from the cover values (C) of a species (i) as a proportion of the total cover (CT) values (Brower and Zar, 1977) and it is expressed in percentage as follows:

$$RC = \frac{C_i \times 100}{CT}$$

DENSITY (D)

Density (D) was determined by estimating the abundance (A) of individuals of a species in a unit sample plot and dividing by the area (a) sampled (Brower and Zar, 1977).

$$D = \frac{A}{a}$$

RELATIVE DENSITY (RD)

The relative density (RD) was determined by expressing the density of a species (Di) as a percentage of the proportion of the total density (DT) of all species present (Brower and Zar, 1977).

$$RD_i = \frac{D_i}{DT} \times 100$$

FREQUENCY (F)

Frequency (F) was estimated as the number of times a given species occurred out of the total number of sample plots examined. It is expressed as a percentage of the total number of samples.

RELATIVE FREQUENCY (RF)

The relative frequency (RF) was determined from the percentage proportion of the frequency (F) of a given species (i) present (Brower and Zar, 1977).

$$RF_i = \frac{F_i}{F_T} \times 100$$

IMPORTANCE VALUE INDEX (I.V.I.)

The Importance Value Index (I.V.I.) was determined for each weed species by using the formula:

$$I.V.I. = \frac{RC + RD + RF}{3}$$

SUMMED DOMINANCE RATIO (S.D.R.)

The Summed Dominance Ratio (S.D.R.) was determined for the first five species following Numata (1971):

$$S.D.R. = \frac{RC + RD + RF + RDW}{4}$$

where RDW is the percentage relative dry weight or biomass of the weed species. It was determined after Brower and Zar (1977) and may be estimated as:

$$RDW = \frac{\text{Biomass of one species}}{\text{Biomass of all sampled species}} \times 100$$

SPECIES DIVERSITY INDEX

The Species Diversity Index was calculated following menhinick (Dm) (1964):

$$DM = S/N$$

where S = total number of species encountered

N = total abundance for all species encountered.

RESULTS AND DISCUSSION

A total of 184 weed species were recorded in the abandoned rubber plantations as against 54 species listed by Agbaka (1977) in some rubber plantations of Bendel State, Nigeria. The values of the phytosociological parameters of the weeds have been summarized in Table 1 in the descending order of their Importance Value Index. The "S.D.R." as well as the "I.V.I." of the five most dominant weeds are given in Table 2.

The 184 weeds are distributed in 60 families. Of these 3 (1.6%) species are ferns, 48 (26.1%) are monocots while 133 (72.3%) are dicots (Fig. 1). On the basis of leaf form, the weeds can be grouped into three main morphological categories i.e. the broad-leaved which is the largest group consisting of 165 (89.7%) species, the grasses 11 (6.0%) and the sedges 8 (4.3%) species (Fig. 2). Though the number of broadleaved species is higher than those of the grasses and sedges, most of the roadside margins are occupied by grasses while the temporary pools of standing water formed during the rainy season are characterized by luxuriant growth of sedges.

FIG.1. WEED SPECIES DISTRIBUTION IN THE THREE MAIN WEED GROUPS

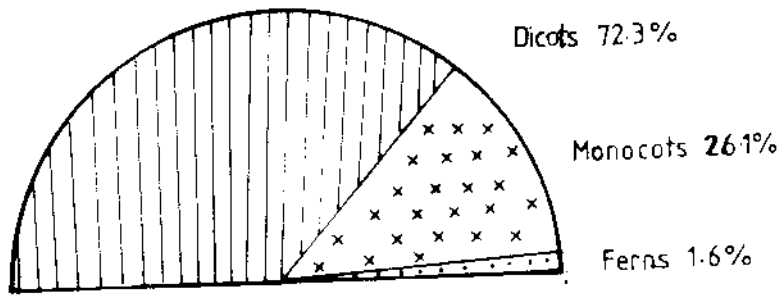


FIG.2. WEED COMPOSITION ON THE BASIS OF LEAFFORM

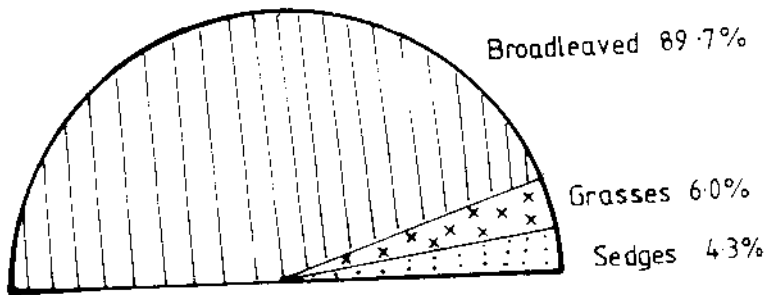
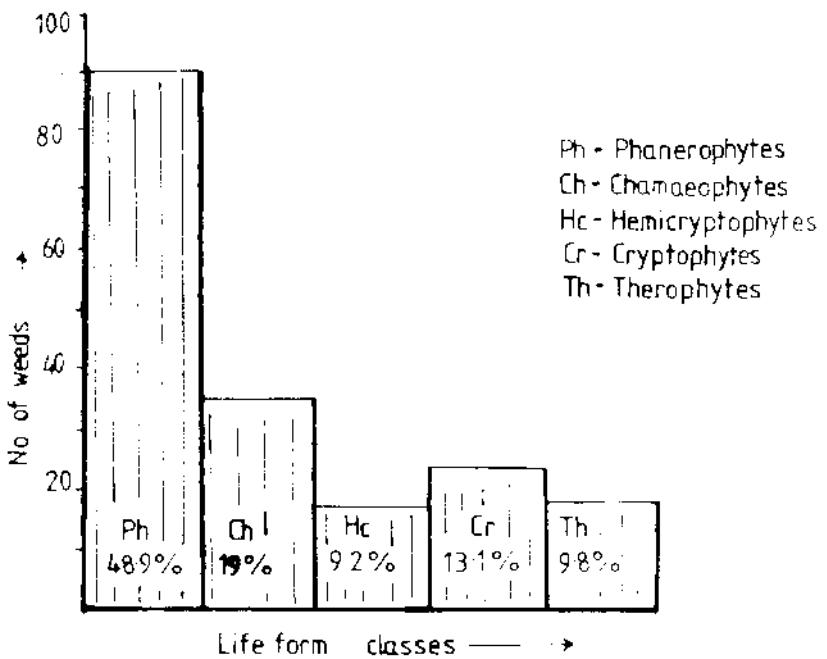


FIG.3. LIFE FORM SPECTRUM OF THE WEED FLORA



Similar observations have been made in cashew, cocoa, coffee and Kola plantations (Komolafe, 1976) and oil palm plantations (Gill and Onyibe, 1988a & 1988b).

From Fig. 3, it is apparent that the Phanerophytes dominate the weed flora and this is in line with that of Hopkins (1965). This is to be expected because the unmaintained nature of the plantations favours the vigorous growth of several weedy taxa. The Therophytes, Cryptophytes, Hemipterophytes, Chamaephytes and Phanerophytes constitute 9.8%, 13.1%, 9.2%, 19% and 48.9% respectively. The diversity index of the weed species in the abandoned plantations is 1.15.

REFERENCES

- Afolayan, A.J. 1988. Phytosociological investigations of three abandoned farmlands in Oyo, Ondo and Kwara States of Nigeria. *Nig. Journ. Weed Sci.* 1: 77-82.
- Agbaka, A.C. 1977. Some weeds of rubber plantations in Nigeria. A preliminary survey. Rubber Research Institute of Nigeria, Benin City, Mineographed 9p.
- Brower, J.E. and Zar, H.J. 1977. Field and laboratory methods for general ecology. Wm. C. Brown Co. Iowa, 194p.
- Food and Agriculture Organisation (F.A.O.), 1966. Agricultural Development in Nigeria. F.A.O., Rome, 117p.
- Gill, L.S. and Onyibe, H.I. 1986. Phytosociological studies of epiphytic flora of oil palm (*Elaeis guineensis* Jacq.) in Benin City, Nigeria. *Feddes Repertorium*, 97:691-695.
- Gill, L.S. and Onyibe, H.I. 1988a. Phytosociological studies of the weed flora of oil palm (*Elaeis guineensis* Jacq.) in Nigeria. *Journ. Plantation Crops*, 16: 88-89.
- Gill, L.S. and Onyibe, H.I. 1988b. Weeds of oil palm (*Elaeis guineensis* Jacq.) plantations in Nigeria. *Pak. Journ. Weed Sci. Res.*, 1: 72-83.
- Hutchinson, J. and Dalziel, J.M. 1958-1968. Flora of West tropical Africa. 3 vols. 2nd edition. Crown Agents for Overseas Govt. & Admin., London.
- Komolafe, D.A. 1976. Weed problems in tree crops in Nigeria. *PANS*, 22: 250-256.
- Menhinick, E.F. 1964. A comparison of some species diversity indices applied to samples of field insects. *Ecology*, 45: 859-861.
- Muller-Dombois, D. and Ellenberg, H. 1974. Aims and methods of vegetation ecology. John Wiley and Sons, New York, 547p.
- Numata, M. 1971. Methodological problems in weed ecological research. *Proc. 1st Indonesian Weed Sci. Conf.*, 1: 41-58.
- Pandeya, S.C., Puri, G.S. and Singh, J.S. 1968. Research methods in plant ecology. Asian Publishing House, Bombay, 272p.

Table 1. Analytical phytosociological values for weeds in the unmanaged rubber plantation.

| WEED SPECIES | A | D | RD | C | RC | F | RF | IVI |
|-------------------------------------|------|--------|------|---|------|----|------|------|
| 1 <i>Geophyla obvalata</i> | 1545 | 6.87 | 6.07 | 4 | 0.90 | 53 | 1.95 | 2.97 |
| 2 <i>Palisota hirsuta</i> | 1035 | 4.60 | 4.07 | 4 | 0.90 | 87 | 3.20 | 2.72 |
| 3 <i>Hevea brasiliensis</i> | 540 | 2.40 | 2.12 | 3 | 0.67 | 67 | 2.46 | 1.75 |
| 4 <i>Icacina tricantha</i> | 360 | 1.60 | 1.42 | 3 | 0.67 | 80 | 2.94 | 1.68 |
| 5 <i>Phaulopsis falcisepala</i> | 825 | 3.67 | 3.24 | 3 | 0.67 | 27 | 0.99 | 1.64 |
| 6 <i>Afromomum daniellii</i> | 615 | 2.73 * | 2.42 | 4 | 0.90 | 33 | 1.21 | 1.51 |
| 7 <i>Oldenlandia corymbosa</i> | 690 | 3.07 | 2.71 | 3 | 0.67 | 20 | 0.73 | 1.37 |
| 8 <i>Culcasia scandens</i> | 480 | 2.13 | 1.89 | 3 | 0.67 | 40 | 1.47 | 1.43 |
| 9 <i>Megaphrynium macrostachyon</i> | 510 | 2.27 | 2.00 | 4 | 0.90 | 27 | 0.99 | 1.30 |
| 10 <i>Fimbristylis litoralis</i> | 690 | 3.07 | 2.71 | 2 | 0.45 | 2 | 0.73 | 1.30 |
| 11 <i>Costus dubius</i> | 360 | 1.60 | 1.42 | 3 | 0.67 | 47 | 1.73 | 1.27 |
| 12 <i>Afromomum sceptrum</i> | 435 | 1.93 | 1.71 | 4 | 0.90 | 33 | 1.21 | 1.27 |
| 13 <i>Desmodium hirtum</i> | 570 | 2.53 | 2.24 | 2 | 0.45 | 27 | 0.99 | 1.23 |
| 14 <i>Scleria naumanniana</i> | 495 | 2.20 | 1.95 | 3 | 0.67 | 27 | 0.99 | 1.20 |
| 15 <i>Scleria boivinii</i> | 375 | 1.67 | 1.47 | 4 | 0.90 | 13 | 0.48 | 0.95 |
| 16 <i>Celosia laxa</i> | 285 | 1.27 | 1.12 | 1 | 0.22 | 40 | 1.47 | 0.94 |
| 17 <i>Alternanthera sessilis</i> | 450 | 2.00 | 1.77 | 2 | 0.45 | 13 | 0.48 | 0.90 |
| 18 <i>Synclisia scabrada</i> | 195 | 0.87 | 0.77 | 3 | 0.67 | 33 | 1.21 | 0.88 |
| 19 <i>Anchomanes difformis</i> | 180 | 0.80 | 0.71 | 4 | 0.90 | 27 | 0.99 | 0.87 |
| 20 <i>Dissotis rotundifolia</i> | 315 | 1.40 | 1.24 | 4 | 0.90 | 13 | 0.48 | 0.87 |
| 21 <i>Chromolaena odorata</i> | 240 | 1.07 | 0.94 | 2 | 0.45 | 33 | 1.21 | 0.87 |
| 22 <i>Setaria megaphyla</i> | 165 | 0.73 | 0.65 | 4 | 0.90 | 27 | 0.99 | 0.85 |
| 23 <i>Oplismenus bumanii</i> | 405 | 1.80 | 1.59 | 2 | 0.45 | 13 | 0.48 | 0.84 |
| 24 <i>Synedrella nodiflora</i> | 405 | 1.80 | 1.59 | 2 | 0.45 | 13 | 0.48 | 0.84 |
| 25 <i>Momordica charantia</i> | 195 | 0.87 | 0.77 | 3 | 0.67 | 27 | 0.99 | 0.81 |
| 26 <i>Phyllanthus amarus</i> | 255 | 1.13 | 1.00 | 1 | 0.22 | 33 | 1.21 | 0.81 |
| 27 <i>Palisota barteri</i> | 135 | 0.60 | 0.53 | 3 | 0.67 | 33 | 1.21 | 0.81 |
| 28 <i>Oldenlandia affinis</i> | 360 | 1.60 | 1.42 | 1 | 0.22 | 20 | 0.73 | 0.79 |
| 29 <i>Culcasia glandulosa</i> | 270 | 1.20 | 1.06 | 2 | 0.45 | 20 | 0.73 | 0.75 |
| 30 <i>Ludwigia erecta</i> | 255 | 1.13 | 1.00 | 2 | 0.45 | 20 | 0.73 | 0.73 |
| 31 <i>Albizia zygia</i> | 120 | 0.53 | 0.47 | 3 | 0.67 | 23 | 0.99 | 0.71 |
| 32 <i>Nephrolepis biserrata</i> | 195 | 0.87 | 0.77 | 4 | 0.90 | 13 | 0.48 | 0.71 |
| 33 <i>Palisota umbigata</i> | 180 | 0.80 | 0.71 | 3 | 0.67 | 20 | 0.73 | 0.71 |
| 34 <i>Commelina diffusa</i> | 300 | 1.33 | 1.18 | 2 | 0.45 | 13 | 0.48 | 0.70 |
| 35 <i>Phytolacca dodecandra</i> | 120 | 0.53 | 0.47 | 4 | 0.90 | 20 | 0.73 | 0.70 |

Table 1 Contd.

| WEED SPECIES | A | D | RD | C | RC | F | RF | IVI |
|---|-----|------|------|---|------|----|------|------|
| 36 <i>Triclisia dictyophylla</i> | 120 | 0.53 | 0.47 | 4 | 0.90 | 20 | 0.73 | 0.70 |
| 37 <i>Dioscorea minutiflora</i> | 150 | 0.67 | 0.59 | 2 | 0.45 | 27 | 0.99 | 0.68 |
| 38 <i>Microdesmis puberula</i> | 90 | 0.40 | 0.35 | 3 | 0.67 | 27 | 0.99 | 0.67 |
| 39 <i>Myrianthus arboreus</i> | 90 | 0.40 | 0.35 | 4 | 0.90 | 20 | 0.73 | 0.66 |
| 40 <i>Urena cordifolia</i> | 195 | 0.87 | 0.77 | 2 | 0.45 | 20 | 0.73 | 0.65 |
| 41 <i>Acacia pentagona</i> | 195 | 0.87 | 0.77 | 3 | 0.67 | 13 | 0.48 | 0.64 |
| 42 <i>Dichapetalum heudelotii</i> | 120 | 0.53 | 0.47 | 3 | 0.67 | 20 | 0.73 | 0.63 |
| 43 <i>Dracaena laxissima</i> | 120 | 0.53 | 0.47 | 3 | 0.67 | 20 | 0.73 | 0.63 |
| 44 <i>Ageratum conyzoides</i> | 240 | 1.07 | 0.94 | 2 | 0.45 | 13 | 0.48 | 0.62 |
| 45 <i>Mikania cordata</i> | 240 | 1.07 | 0.94 | 2 | 0.45 | 13 | 0.48 | 0.62 |
| 46 <i>Pteris mildbraedi</i> | 180 | 0.80 | 0.71 | 3 | 0.67 | 13 | 0.48 | 0.62 |
| 47 <i>Aneilema beninense</i> | 240 | 1.07 | 0.94 | 2 | 0.45 | 13 | 0.48 | 0.62 |
| 48 <i>Baijsea axillaris</i> | 180 | 0.80 | 0.71 | 3 | 0.67 | 13 | 0.48 | 0.62 |
| 49 <i>Commelina africana</i> | 225 | 1.00 | 0.88 | 1 | 0.22 | 20 | 0.73 | 0.61 |
| 50 <i>Ancistrophyllum secundiflorum</i> | 45 | 0.20 | 0.18 | 4 | 0.90 | 20 | 0.73 | 0.60 |
| 51 <i>Parquetina nigrescence</i> | 225 | 1.00 | 0.88 | 2 | 0.45 | 13 | 0.48 | 0.60 |
| 52 <i>Dioscoreophyllum comminsii</i> | 165 | 0.73 | 0.65 | 3 | 0.67 | 13 | 0.48 | 0.60 |
| 53 <i>Trema guineensis</i> | 45 | 0.20 | 0.18 | 4 | 0.90 | 20 | 0.73 | 0.60 |
| 54 <i>Elaeis guineensis</i> | 45 | 0.20 | 0.18 | 4 | 0.90 | 20 | 0.73 | 0.60 |
| 55 <i>Musanga cercropiodes</i> | 45 | 0.20 | 0.18 | 5 | 1.12 | 13 | 0.48 | 0.59 |
| 56 <i>Anthocleista vogelii</i> | 45 | 0.20 | 0.18 | 5 | 1.12 | 13 | 0.48 | 0.59 |
| 57 <i>Cyperus esculentus</i> | 135 | 0.60 | 0.53 | 1 | 0.22 | 27 | 0.99 | 0.58 |
| 58 <i>Costus afer</i> | 150 | 0.67 | 0.59 | 3 | 0.67 | 13 | 0.48 | 0.58 |
| 59 <i>Salacia nitida</i> | 135 | 0.60 | 0.53 | 2 | 0.45 | 20 | 0.73 | 0.57 |
| 60 <i>Momordica cissoides</i> | 120 | 0.53 | 0.47 | 3 | 0.67 | 13 | 0.48 | 0.54 |
| 61 <i>Albizia adianthifolia</i> | 105 | 0.47 | 0.41 | 2 | 0.45 | 20 | 0.73 | 0.53 |
| 62 <i>Strophanthus preusii</i> | 45 | 0.20 | 0.18 | 3 | 0.67 | 20 | 0.73 | 0.53 |
| 63 <i>Phyllanthus muellarianus</i> | 105 | 0.47 | 0.41 | 2 | 0.45 | 20 | 0.73 | 0.53 |
| 64 <i>Fagara lepreurii</i> | 45 | 0.20 | 0.18 | 4 | 0.90 | 13 | 0.48 | 0.52 |
| 65 <i>Ananas comosus</i> | 45 | 0.20 | 0.18 | 4 | 0.90 | 13 | 0.48 | 0.52 |
| 66 <i>Adenolobus rufescens</i> | 150 | 0.67 | 0.59 | 1 | 0.22 | 23 | 0.73 | 0.52 |
| 67 <i>Dalbergia saxatilis</i> | 90 | 0.40 | 0.35 | 2 | 0.45 | 20 | 0.73 | 0.51 |
| 68 <i>Macaranga berteri</i> | 30 | 0.13 | 0.12 | 4 | 0.90 | 13 | 0.48 | 0.50 |
| 69 <i>Mariscus alternifolius</i> | 135 | 0.60 | 0.53 | 1 | 0.22 | 20 | 0.73 | 0.50 |
| 70 <i>Dissotis erecta</i> | 135 | 0.60 | 0.53 | 1 | 0.22 | 20 | 0.73 | 0.50 |

Table 1 Contd.

| WEED SPECIES | A | D | RD | C | RC | F | RF | IV |
|--------------------------------------|-----|------|------|---|------|----|------|-----|
| 71 <i>Physalis angulata</i> | 135 | 0.60 | 0.53 | 1 | 0.22 | 20 | 0.73 | 0.9 |
| 72 <i>Hyparrhenia rufa</i> | 135 | 0.60 | 0.53 | 2 | 0.45 | 13 | 0.48 | 0.4 |
| 73 <i>Sabicea calycina</i> | 75 | 0.33 | 0.29 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 74 <i>Berlinia grandiflora</i> | 15 | 0.07 | 0.06 | 5 | 1.12 | 7 | 0.26 | 0.4 |
| 75 <i>Irvingia gabonensis</i> | 15 | 0.07 | 0.06 | 5 | 1.12 | 7 | 0.26 | 0.4 |
| 76 <i>Ceiba pentandra</i> | 15 | 0.07 | 0.06 | 5 | 1.12 | 7 | 0.26 | 0.4 |
| 77 <i>Harungana madagascariensis</i> | 15 | 0.07 | 0.06 | 5 | 1.12 | 7 | 0.26 | 0.4 |
| 78 <i>Combretum comosum</i> | 120 | 0.53 | 0.43 | 2 | 0.45 | 13 | 0.48 | 0.4 |
| 79 <i>Mallotus oppositifolius</i> | 120 | 0.53 | 0.43 | 2 | 0.45 | 13 | 0.48 | 0.4 |
| 80 <i>Triumfetta cordifolia</i> | 60 | 0.27 | 0.24 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 81 <i>Ficus exasperata</i> | 60 | 0.27 | 0.24 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 82 <i>Rauvolfia vomitoria</i> | 60 | 0.27 | 0.24 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 83 <i>Brachiaria deflexa</i> | 105 | 0.47 | 0.41 | 1 | 0.22 | 20 | 0.73 | 0.4 |
| 84 <i>Centrosema pubescens</i> | 105 | 0.47 | 0.41 | 2 | 0.45 | 13 | 0.48 | 0.4 |
| 85 <i>Clerodendrum fonnricarium</i> | 105 | 0.47 | 0.41 | 3 | 0.67 | 7 | 0.26 | 0.4 |
| 86 <i>Cissampelos owariensis</i> | 105 | 0.47 | 0.41 | 3 | 0.67 | 7 | 0.26 | 0.4 |
| 87 <i>Pterygota bequaretii</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 20 | 0.73 | 0.4 |
| 88 <i>Bertiera racemosa</i> | 45 | 0.20 | 0.18 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 89 <i>Panicum maximum</i> | 45 | 0.20 | 0.18 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 90 <i>Cyperus tuberosus</i> | 150 | 0.67 | 0.59 | 1 | 0.22 | 13 | 0.48 | 0.4 |
| 91 <i>Ipomoea coscinosperma</i> | 150 | 0.67 | 0.59 | 1 | 0.22 | 13 | 0.48 | 0.4 |
| 92 <i>Rinorea dentata</i> | 90 | 0.40 | 0.35 | 2 | 0.45 | 13 | 0.48 | 0.4 |
| 93 <i>Ricinodendron heudelotii</i> | 30 | 0.13 | 0.12 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 94 <i>Milicia excelsa</i> | 30 | 0.13 | 0.12 | 3 | 0.67 | 13 | 0.48 | 0.4 |
| 95 <i>Anthonotha macrophylla</i> | 30 | 0.13 | 0.12 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 96 <i>Chassalia ischnophylla</i> | 30 | 0.13 | 0.12 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 97 <i>Ouratea affinis</i> | 30 | 0.13 | 0.12 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 98 <i>Piptadeniastrum africanum</i> | 75 | 0.33 | 0.29 | 4 | 0.45 | 13 | 0.48 | 0.4 |
| 99 <i>Dioscorea bulbifera</i> | 75 | 0.33 | 0.29 | 4 | 0.45 | 13 | 0.48 | 0.4 |
| 100 <i>Peperomia pellucida</i> | 135 | 0.60 | 0.53 | 1 | 0.22 | 13 | 0.48 | 0.4 |
| 101 <i>Ptilostigma thonningii</i> | 15 | 0.07 | 0.06 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 102 <i>Dracaena mannii</i> | 15 | 0.07 | 0.06 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 103 <i>Dictyandra involucreta</i> | 15 | 0.07 | 0.06 | 4 | 0.90 | 7 | 0.26 | 0.4 |
| 104 <i>Passiflora foetida</i> | 75 | 0.33 | 0.29 | 3 | 0.67 | 7 | 0.26 | 0.4 |
| 105 <i>Combretum racemosum</i> | 75 | 0.33 | 0.29 | 3 | 0.67 | 7 | 0.26 | 0.4 |

Table 1 Contd.

| WEED SPECIES | A | D | RD | C | RC | F | RF | IVI |
|---------------------------------------|-----|------|------|---|------|----|------|------|
| 106 <i>Cuviera longiflora</i> | 15 | 0.07 | 0.06 | 4 | 0.90 | 7 | 0.26 | 0.41 |
| 107 <i>Macaranga monandra</i> | 15 | 0.07 | 0.06 | 4 | 0.90 | 7 | 0.26 | 0.41 |
| 108 <i>Ipomoea asarifolia</i> | 120 | 0.53 | 0.47 | 1 | 0.22 | 13 | 0.48 | 0.39 |
| 109 <i>Solenostemom monostachyus</i> | 120 | 0.53 | 0.47 | 1 | 0.22 | 13 | 0.48 | 0.39 |
| 110 <i>Digitaria horizontalis</i> | 120 | 0.53 | 0.47 | 1 | 0.22 | 13 | 0.48 | 0.39 |
| 111 <i>Mussaenda elegans</i> | 120 | 0.53 | 0.47 | 1 | 0.22 | 13 | 0.48 | 0.39 |
| 112 <i>Dioscorea alata</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 13 | 0.48 | 0.39 |
| 113 <i>Tetrorchidium didynostemom</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 13 | 0.48 | 0.39 |
| 114 <i>Asystasia gangetica</i> | 120 | 0.53 | 0.47 | 2 | 0.45 | 7 | 0.26 | 0.39 |
| 115 <i>Auxopus kameninensis</i> | 105 | 0.47 | 0.41 | 0 | 0.02 | 20 | 0.73 | 0.39 |
| 116 <i>Eragrostis tremulla</i> | 105 | 0.47 | 0.41 | 1 | 0.22 | 13 | 0.48 | 0.37 |
| 117 <i>Mariscus flabelliformis</i> | 105 | 0.47 | 0.41 | 1 | 0.22 | 13 | 0.48 | 0.37 |
| 118 <i>Cyperus iria</i> | 105 | 0.47 | 0.41 | 1 | 0.22 | 13 | 0.48 | 0.37 |
| 119 <i>Veronica abyssinica</i> | 105 | 0.47 | 0.41 | 1 | 0.22 | 13 | 0.48 | 0.37 |
| 120 <i>Newbouldia laevis</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 13 | 0.48 | 0.37 |
| 121 <i>Jateorhiza macrantha</i> | 45 | 0.20 | 0.18 | 3 | 0.67 | 7 | 0.26 | 0.37 |
| 122 <i>Ficus mucoso</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 13 | 0.48 | 0.35 |
| 123 <i>Solanum verbascifolium</i> | 30 | 0.13 | 0.12 | 3 | 0.67 | 7 | 0.26 | 0.35 |
| 124 <i>Carpolobia lutea</i> | 30 | 0.13 | 0.12 | 3 | 0.67 | 7 | 0.26 | 0.35 |
| 125 <i>Pleioceras barteri</i> | 30 | 0.13 | 0.12 | 3 | 0.67 | 7 | 0.26 | 0.35 |
| 126 <i>Paspalum conjugatum</i> | 75 | 0.33 | 0.29 | 1 | 0.22 | 13 | 0.48 | 0.33 |
| 127 <i>Milletia aboensis</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 128 <i>Dictyandra arborescens</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 129 <i>Oncinotis pontyi</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 130 <i>Bridelia ferruginea</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 131 <i>Maesobotrya barteri</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 132 <i>Chlamydocarya thomsoniana</i> | 75 | 0.33 | 0.29 | 2 | 0.45 | 7 | 0.26 | 0.33 |
| 133 <i>Landolphia dulcis</i> | 75 | 0.33 | 0.29 | 2 | 0.45 | 7 | 0.26 | 0.33 |
| 134 <i>Cleistopholis patens</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 135 <i>Barteria ligritiana</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 136 <i>Ouratea monticola</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 137 <i>Ipomoea batatas</i> | 75 | 0.33 | 0.29 | 2 | 0.45 | 7 | 0.26 | 0.33 |
| 138 <i>Sphenocentrum jollyanum</i> | 75 | 0.33 | 0.29 | 2 | 0.45 | 7 | 0.26 | 0.33 |
| 139 <i>Ouratea flava</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 140 <i>Vernonia frondosa</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |

Table 1 Contd.

| | WEED SPECIES | A | D | RD | C | RC | F | RF | IVI |
|-----|---------------------------------|-----|------|------|---|------|----|------|------|
| 141 | <i>Dioscorea smilacifolia</i> | 75 | 0.33 | 0.29 | 2 | 0.45 | 7 | 0.26 | 0.33 |
| 142 | <i>Mitragyna ciliata</i> | 15 | 0.07 | 0.06 | 3 | 0.67 | 7 | 0.26 | 0.33 |
| 143 | <i>Capsicum annum</i> | 60 | 0.27 | 0.24 | 1 | 0.22 | 13 | 0.48 | 0.31 |
| 144 | <i>Gloriosa superba</i> | 60 | 0.27 | 0.24 | 1 | 0.22 | 13 | 0.48 | 0.31 |
| 145 | <i>Solanum nigrum</i> | 60 | 0.27 | 0.24 | 1 | 0.22 | 13 | 0.48 | 0.31 |
| 146 | <i>Combretum platypterum</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 7 | 0.26 | 0.31 |
| 147 | <i>Dioscorea mangelotiana</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 7 | 0.26 | 0.31 |
| 148 | <i>Adenia lobata</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 7 | 0.26 | 0.31 |
| 149 | <i>Smilax kraussiana</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 7 | 0.26 | 0.31 |
| 150 | <i>Ipomoea involucrata</i> | 60 | 0.27 | 0.24 | 2 | 0.45 | 7 | 0.26 | 0.31 |
| 151 | <i>Ipomoea quamoclit</i> | 105 | 0.47 | 0.41 | 1 | 0.22 | 7 | 0.26 | 0.30 |
| 152 | <i>Cissus aralioides</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 153 | <i>Aspilia africana</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 154 | <i>Physalis micrantha</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 155 | <i>Solanum torvum</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 156 | <i>Alchomea cordiflora</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 157 | <i>Sida corymbosa</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 158 | <i>Rinorea subintegrifolia</i> | 45 | 0.20 | 0.18 | 2 | 0.45 | 7 | 0.26 | 0.29 |
| 159 | <i>Rhynchelytrum repens</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 160 | <i>Adenia cissampeloides</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 161 | <i>Strophanthus sarmentosus</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 162 | <i>Alafia barteri</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 163 | <i>Cnestis ferruginea</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 164 | <i>Manniophyton fulvum</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 165 | <i>Barteria fistulosa</i> | 30 | 0.13 | 0.12 | 2 | 0.45 | 7 | 0.26 | 0.27 |
| 166 | <i>Panicum laxum</i> | 75 | 0.33 | 0.29 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 167 | <i>Angylocalyx oligophyllus</i> | 15 | 0.07 | 0.06 | 2 | 0.45 | 7 | 0.26 | 0.26 |
| 168 | <i>Agelaea obliqua</i> | 15 | 0.07 | 0.06 | 2 | 0.45 | 7 | 0.26 | 0.26 |
| 169 | <i>Mitracarpus villosus</i> | 75 | 0.33 | 0.29 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 170 | <i>Chloris barbata</i> | 60 | 0.27 | 0.24 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 171 | <i>Talinum paniculatum</i> | 60 | 0.27 | 0.24 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 172 | <i>Canarium schweinfurthii</i> | 60 | 0.27 | 0.24 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 173 | <i>Osmunda cinnamomea</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 174 | <i>Ludwigia octovalvis</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.26 |
| 175 | <i>Ipomoea muricata</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.26 |

Table 1 Contd.

| WEED SPECIES | A | D | RD | C | RC | F | RF | IVI |
|---------------------------------------|----|------|------|---|------|---|------|------|
| 176 <i>Eulophidium maculatum</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.22 |
| 177 <i>Vernonia cinerea</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.22 |
| 178 <i>Sida acuta</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.22 |
| 179 <i>Coccinia barteri</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.22 |
| 180 <i>Celosia trigevna</i> | 45 | 0.20 | 0.18 | 1 | 0.22 | 7 | 0.26 | 0.22 |
| 181 <i>Celosia argentea</i> | 30 | 0.13 | 0.12 | 1 | 0.22 | 7 | 0.26 | 0.20 |
| 182 <i>Phychotria physchotrioides</i> | 30 | 0.13 | 0.12 | 1 | 0.22 | 7 | 0.26 | 0.20 |
| 183 <i>Cyathula prostrata</i> | 30 | 0.13 | 0.12 | 1 | 0.22 | 7 | 0.26 | 0.20 |
| 184 <i>Brachycory. his sp.</i> | 45 | 0.20 | 0.18 | 1 | 0.11 | 7 | 0.26 | 0.18 |

| | |
|-----|------------------------|
| A | Abundance |
| D | Density |
| RD | Relative Density |
| C | Cover |
| RC | Relative Cover |
| F | Frequency |
| RF | Relative Frequency |
| IVI | Importance Value Index |

Table 2. S.D.R. and I.V.I values for the five most dominant weeds in the rubber plantations.

| S/N | WEED SPECIES | S.D.R. | I.V.I |
|-----|---------------------------|--------|-------|
| 1. | <i>Culcasia scandens</i> | 3.75 | 3.48 |
| 2. | <i>Geophylla obvalata</i> | 2.98 | 2.92 |
| 3. | <i>Palisota hirsuta</i> | 5.18 | 2.67 |
| 4. | <i>Hevea brasiliensis</i> | 2.63 | 1.72 |
| 5. | <i>Icacina tricantha</i> | 2.39 | 1.64 |