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FIELD GUIDE FOR THE STUDY, COLLECTION AND PRESERVATION OF MEDICINAL PLANTS

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INTRODUCTION

MANY DRUGS listed in the pharmacopeia have been derived from plants which in turn have been recognized and used by traditional medical systems from various parts of the world. Examples include morphia, rauwolfia, digitalis, quinine, and chaulmoogra oil. The ancient Chinese pharmacopeia includes at least 60 ancient Chinese remedies identical in botanical or biological origin as drugs used today. More recent work has added several hundred new drugs derived from traditional Chinese medicine to the modern pharmacopeia used in China (Keys, 1976).

Elsewhere in the world similar work is being carried out. A complete analysis of medicinal plants is being carried out in Mexico by the Mexican Institute of Medicinal Plants (IMEPLAM) with priority being given to plants with effects on the cardiovascular system, and with anti-diabetic and anti-parasitic properties (Lozoya, 1977). In Africa, the newly established Centre for Scientific Research into Plant Medicine in Ghana (Ampofo, 1977) reports that tapping the knowledge of the traditional healer has been rewarding, and that many of the herbal preparations produce a satisfactory response in 75% of their patients. Work on medicinal plants is also being conducted in Ethiopia (Kloos, 1977), Papua New Guinea (Sterly, 1975), Fiji (Thaman, 1977) and elsewhere.

Mahler (1977), the Director-General of the World Health Organization, notes that:

"The age-old arts of the herbalists too must be tapped. Many of the plants familiar to the 'wise-woman' or the 'witch-doctor' really do have the healing powers that tradition attaches to them; the pharmacopoeia of modern medicine would be poorer if one removed from it all the preparations, chemicals and compounds whose origins lie in herbs, funguses, flowers, fruits and roots."

"Let us not be in any doubt: modern medicine has a great deal still to learn from the collector of herbs. And already a number of Ministries of Health, in the developing countries especially, are carefully analysing the potions and decoctions used by traditional healers to determine whether their active ingredients have healing powers that 'science' has overlooked. Whatever the outcome of such scientific testing, there is no doubt that the judicious use of such herbs, flowers and other plants for palliative purposes in primary health care can make a major contribution towards reducing a developing country's drug bill."

A renewed interest in the medicinal plants used by traditional herbalists has meant that many of these herbs are now being collected for identification and analysis. However the unsystematic collection of bits of bark, stems, and other plant parts do not provide sufficient material for a proper taxonomic identification to be made. Further, poor ethnological documentation and errorneous or incomplete collection of local vernacular names, often leads to confusion and frustration. The following guidelines are being published to assist would-be collectors in the systematic study, collection, preservation and identification of promising medicinal plants.

TRADITIONAL MEDICINE

The surface of the earth is covered with numerous plants only some of which are of medicinal value. It is therefore essential to begin by tapping

the knowledge of traditional medicine. Ampofo (1977), of the Centre for Scientific Research into Plant Medicine in Ghana, notes that many plant screening programmes have not yielded any fruitful results because traditional healers have not been involved in these trials and that with the advice of the good healers he has had at least a 50/50 change of success. The first step in research into medicinal plants would thus involve the tapping of traditional medical knowledge concerning the value of plants.

In addition to information available as oral traditions, old texts on traditional medicine may exist and can also serve as useful points to start from. However many are written in an archaic language and care must be taken in the translation of terminology relating to pathology, disease names, symptomatology and signs as well as to the local vernacular names of plants. In particular care must be exercised in the translation of plant names and in their identification by informants. Verification from more than one source will be necessary in most cases to ensure accuracy in the translation of such texts.

In the case of oral information obtained from informants, detailed field notes are essential and a tape-recorder may prove invaluable. Information regarding the disease states for which a herb is advocated, the manner in which the herb is prepared, the dosage, and the local vernacular name of the medicinal plant should always be recorded. Particular care must be exercised regarding the local vernacular names of the medicinal plants identified by informants as it is not unusual for an informant to fabricate a name if the real one is not known to him. Verification from more than one source is invaluable.

Care should also be exercised regarding local vernacular medical terms. It is always essential to have these explained and elaborated so that the precise meaning of each term can be compared with modern medical terminology particularly in relation to disease names, pathology, symptomatology and physical signs. Field notes should always be made of the meaning of these local vernacular terms.

COLLECTION OF MEDICINAL PLANTS

Once a number of "promising" medicinal plants have been "identified" either from old traditional medical texts or from informants, such as traditional medicine-men, the next task is to locate a flowering specimen of the plant, collect adequate specimens, and preserve these for taxonomic identification and classification.

Herbarium Specimens

A herbarium is a collection of dried plants that have been systematically arranged to facilitate taxonomic identification and classification, and are most usually maintained by departments of botany in universities, museums, botanical gardens and departments of forests or agriculture, and is the most likely place where promising medicinal plants can be systematically identified. In order to identify a specimen, the botanical taxonomist will need a herbarium specimen, that is a whole plant or a portion of it not exceeding 43 cm $\times$ 28 cm showing all its essential characteristics, such as leaves, flowers and fruits, correctly pressed flat and preserved. A herbarium specimen should always bear an identification tag with the name of the collector and a serial number corresponding to the serial number of the collector's field notes. A label bearing the salient field notes, to be described, should also be attached.

The herbarium specimen should consist of all the essential parts of the plant including its leaves, flowers, and fruits. The more complete the specimen, the easier will be the task of identification.

Field Notes

Complete data recorded with a dark soft lead pencil relating to the specimen should be kept in a prepared field note book that has a stiff cover. It is essential not to record data in washable inks which may become indecipherable from rain. The following data should always be included. Name of collector, serial number of collection, date, geographical locality including name of district and sub-district, habitat, form of plant, its height, bole, and its characteristic features (which might be lost as a consequence of preservation) particularly in relation to its roots, leaves, flowers, fruit, bark and wood, and the local vernacular names by which it is known. These should be systematically noted for every specimen collected.

The initials and *name* of the collector and the collection *serial number* are essentially to label the specimen. It is therefore most important that the collection serial numbers are never duplicated and that each specimen is individually numbered. To avoid confusion, it is advisable to number specimens serially from 001 onwards. The *date* of collection should be recorded in the conventional order of day, month and year.

The geographical *locality* should include the name of the district and sub-district as well as the approximate altitude above sea level. To assist in the identification, a brief description of the *habitat* in which the plant is growing should be noted.

The type of soil, topography, nature of vegetation and relative position of the plant to other vegetation should be included.

The *form* of the plant should be indicated e.g. tree, shrub, herb, or creeper (Fig. 1). For trees, the *height* and *bole*, the length of trunk from ground to the first major limb, should be estimated. The diameter at breast high (d.b.h.) should also be measured.

It is particularly necessary to record those characteristic features of the plant that will be lost as a consequence of preservation. The *texture, colour, smell* and *arrangement of parts* are of particular importance. As a guide the basic types of *roots* are shown in Fig. 1, whilst the basic features of the different parts of a *leaf*, the different types of leaf arrangements, the degrees of lobing of leaves, the different types of leaf venation and the different shapes of leaf that are commonly encountered are shown in Figs. 2, 3 and 4. It should be noted that compound leaves can be distinguished from simple leaves by looking at the base of the leaf stalk. A true leaf stalk or petiole is usually swollen at its point of attachment to the twig and has within its axil a vegetative bud, the axillary bud. A petiolule of a compound leaf does not have an axillary bud (Fig. 2).

The position of the *flowering shoot* as well as the type of *inflorescence* should be described (Fig. 5). Observations regarding features of the *stem, bark* and nature of *wood* should be noted (Fig. 6). Characteristics such as colour, texture, thickness and hardness, particularly those that may be lost as a consequence of preservation should be noted. The size, colour and texture of the *fruits* should also be recorded.

The *local vernacular name* should always be recorded. However care should be taken to verify that the name is correct and that it has been correctly spelt. The language or dialect used should also be recorded.

Collecting the Specimens

The specimen may consist of a whole plant including the roots or a part of the plant, showing all its essential features, but measuring no more than 43 cm by 28 cm. If necessary several parts are collected but each is identified by a tag, a small watchmaker tag is ideal, bearing the initials and name of the collector and a collection number corresponding to the serial number of the field notes. To avoid confusion specimens from the same plant should bear the same collection number while specimens of the same type of plant collected from another site should bear a new collection number. Each specimen bearing a different collection number should be placed in a different specimen folder, each of which is labelled with the corresponding collection number. A specimen folder consists of several folded sheets of newspaper of 44 cm. by 29 cm. between the sheets of which related specimens are placed (Fig. 7). Specimens should always be pressed in a specimen folder the day it is collected and in any case before it wilts.

In addition to an identification tag, each specimen should also bear a label summarising the salient field notes mentioned previously. This is to assist the taxonomist identify the specimen.

PRESERVATION OF SPECIMENS

There are basically two ways of preserving specimens so that they are not attacked by mildew and destroyed. The principal way, used for all specimens intended as permanent herbarium specimens and as specimens for phytochemical analysis, is by drying, either atmospheric drying or heat drying. The second method is by chemical treatment.

Atmospheric Drying

In the tropics, atmospheric drying is usually unsatisfactory for the larger succulent specimens, and will not be considered here. Heat drying is much more satisfactory and is accomplished by heating prepared specimens over kerosene pressure lamps or over electrical incandescent lamps (Fig. 8). Specimens should first be placed between newspaper folds of about 44 cm. by 29 cm. (Fig. 7). Loose flowers and fruits should be placed in a packet bearing a corresponding collection number. If necessary extra folds and pieces of newspaper are added to ensure that the specimen will be properly pressed flat. Each specimen folder is then separated by a sheet of similar sized corrugated board with its corrugations running at right angles to the long axis of the folder. If possible, this is then separated from the next specimen folder and corrugated board by a corrugated sheet of aluminium to facilitate the passage of warm air and the process of drying (Fig. 8). The whole is then bound tightly between two end boards by two strong straps. This drying press is then placed on its side over the drier containing the heating lamps. To direct all the heat through the press, vents and gaps in the top of the drier should be blocked. After 12 hours the straps should be tightened. Drying takes from 24 to 36 hours. The press should be opened and each specimen individually examined. All dried specimens should be removed to prevent excessive drying and brittleness.

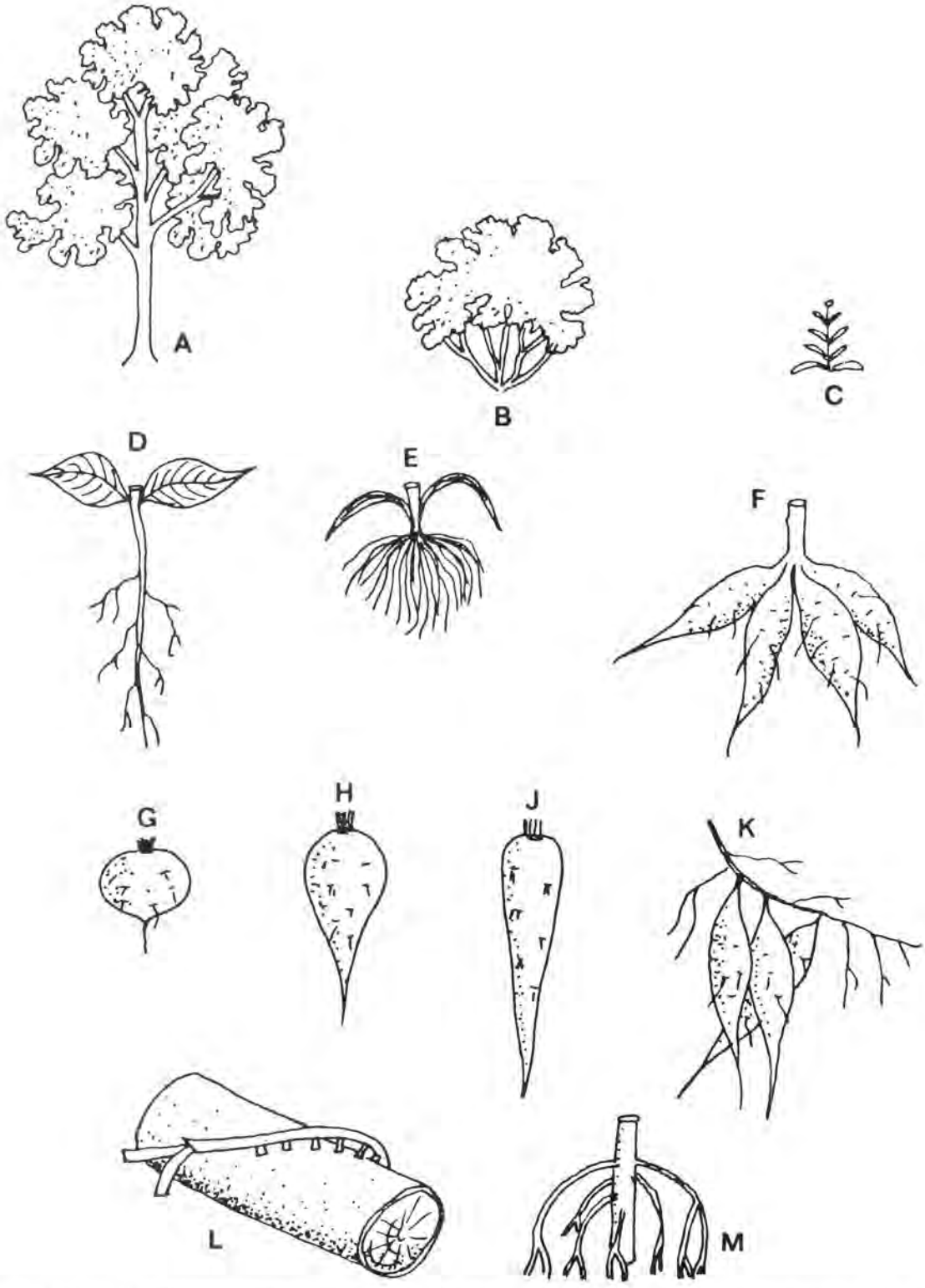

Fig. 1 Diagrammatic representation of: A – tree, B – shrub, C – herb, and of common types of roots: D – taproot, E – fibrous roots, F – fascicled roots, G – spheroidal, H – turbinate, J – obconical, K – fusiform, L – adventitious and M – prop roots.

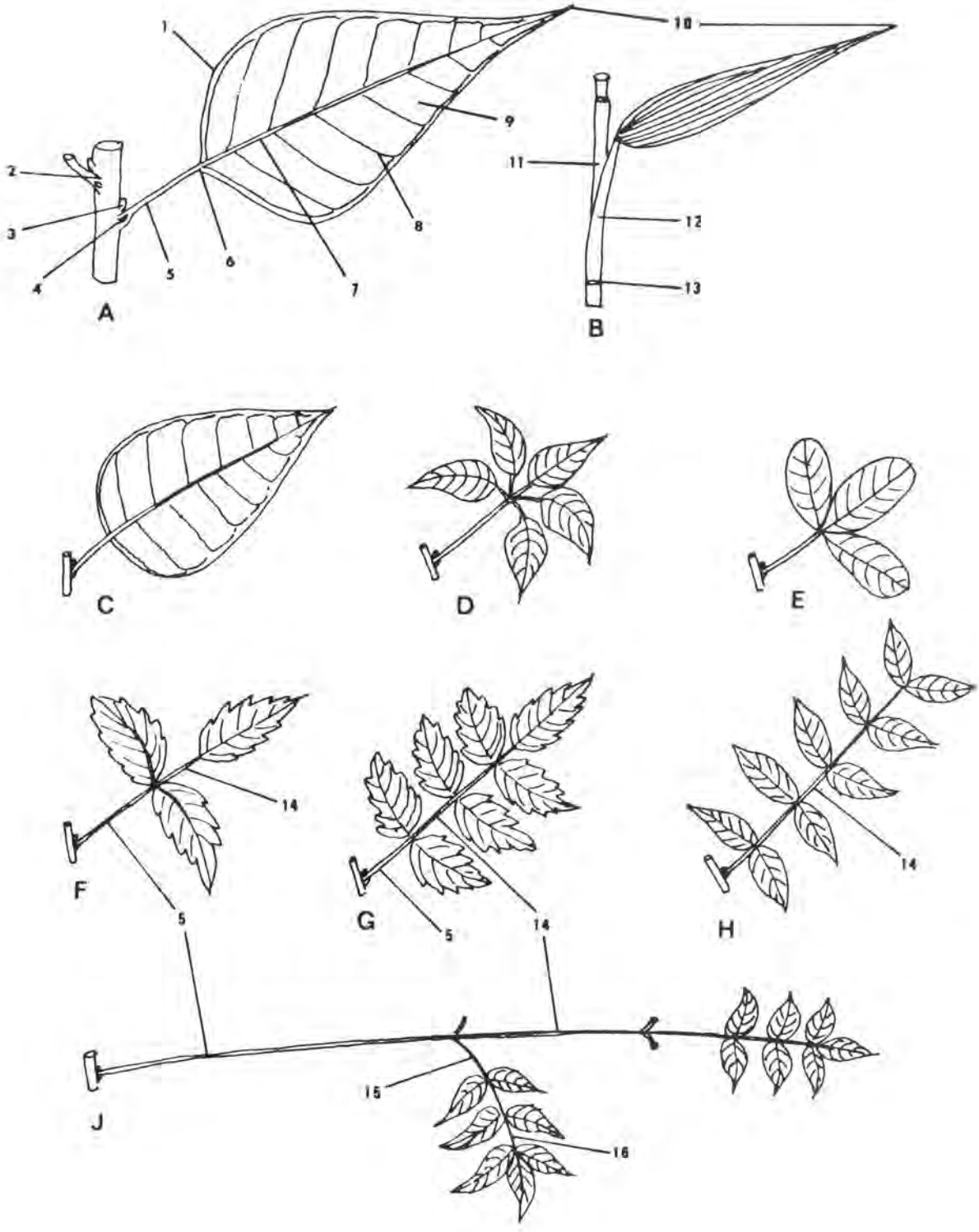

Fig. 2 Parts of a leaf (A and B): 1 – margin, 2 – axil, 3 – axillary bud, 4 – stipule, 5 – petiole, 6 – base, 7 – midrib vein, 8 – lateral vein, 9 – blade, 10 – apex, 11 – internode, 12 – sheath, 13 – node, 14 – rachis, 15 – petiole and 16 – rachilla. Leaf arrangements: C – simple leaf, D – palmately compound, E – palmately trifoliate compound, F – pinnately trifoliate compound, G – odd pinnately compound, H – even pinnately compound and J – bipinnately compound.

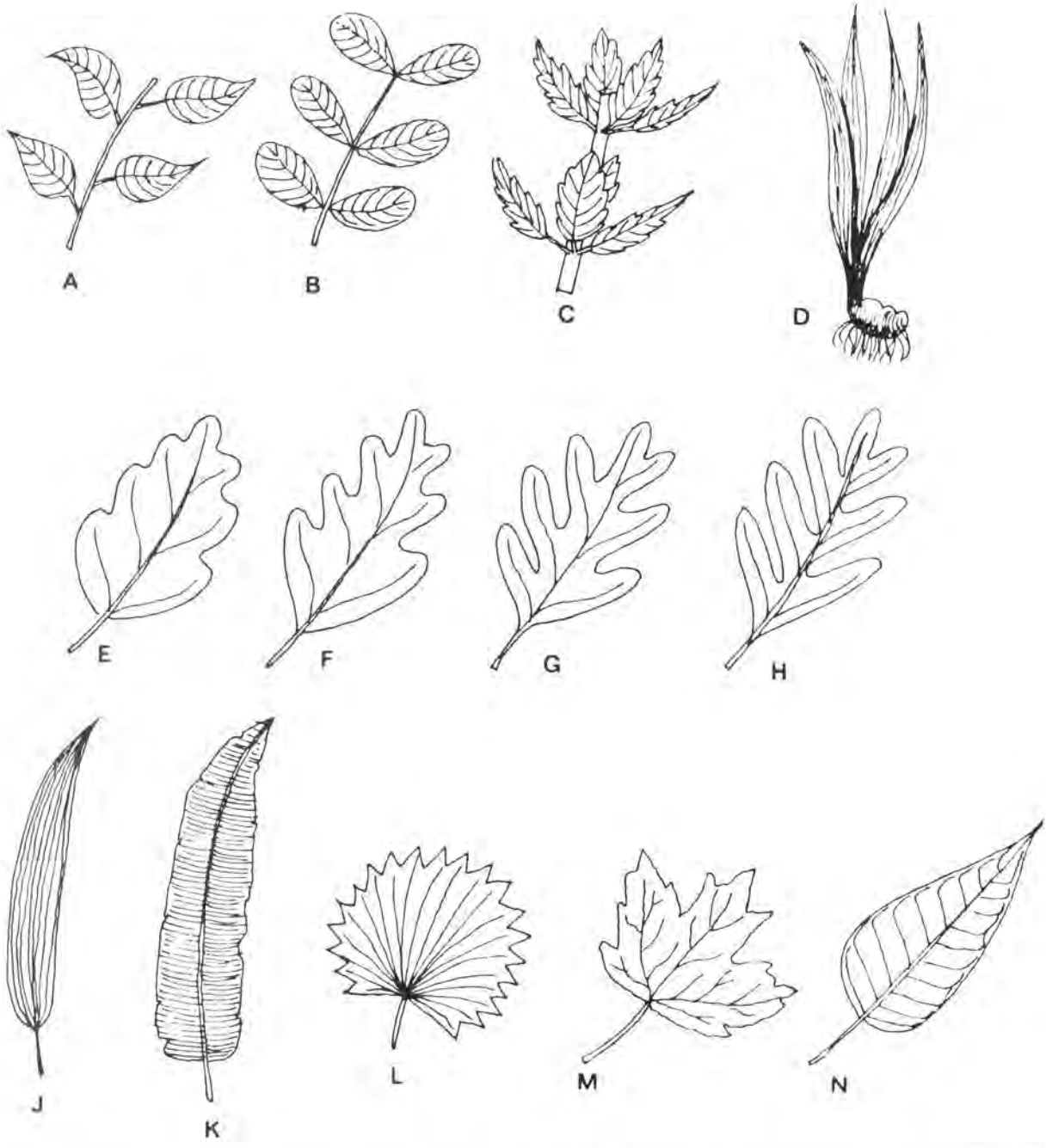

Fig. 3 Leaf arrangements: A – alternate, B – opposite, C – whorled and D – equitant. Degrees of lobing of leaves: E –lobed, F–cleft, G– parted and H – divided. Leaf venation: J – parallel (nerved), K – parallel (pinnate), L – radiate, M – palmately reticulated and N – pinnately reticulated.

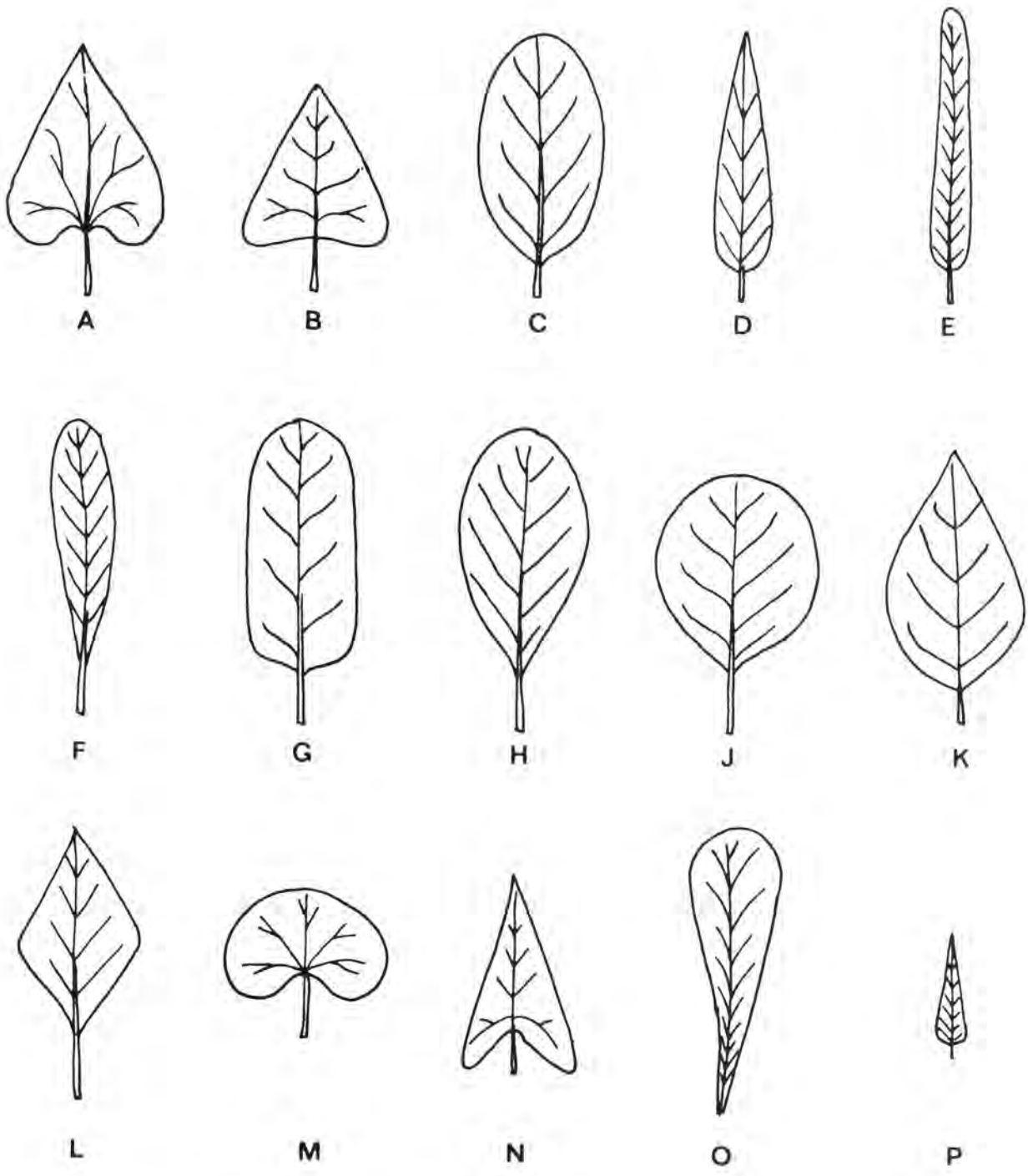

Fig. 4 Shape of leaf blades: A – cordate, B – deltoid, C – elliptical, D – lanceolate, E – linear, F – oblanceolate, G – oblong, H – obovate, J – orbiculate, K – ovate, L – rhombic, M – reniform, N – sagittate, O – spathulate and P – subulate.

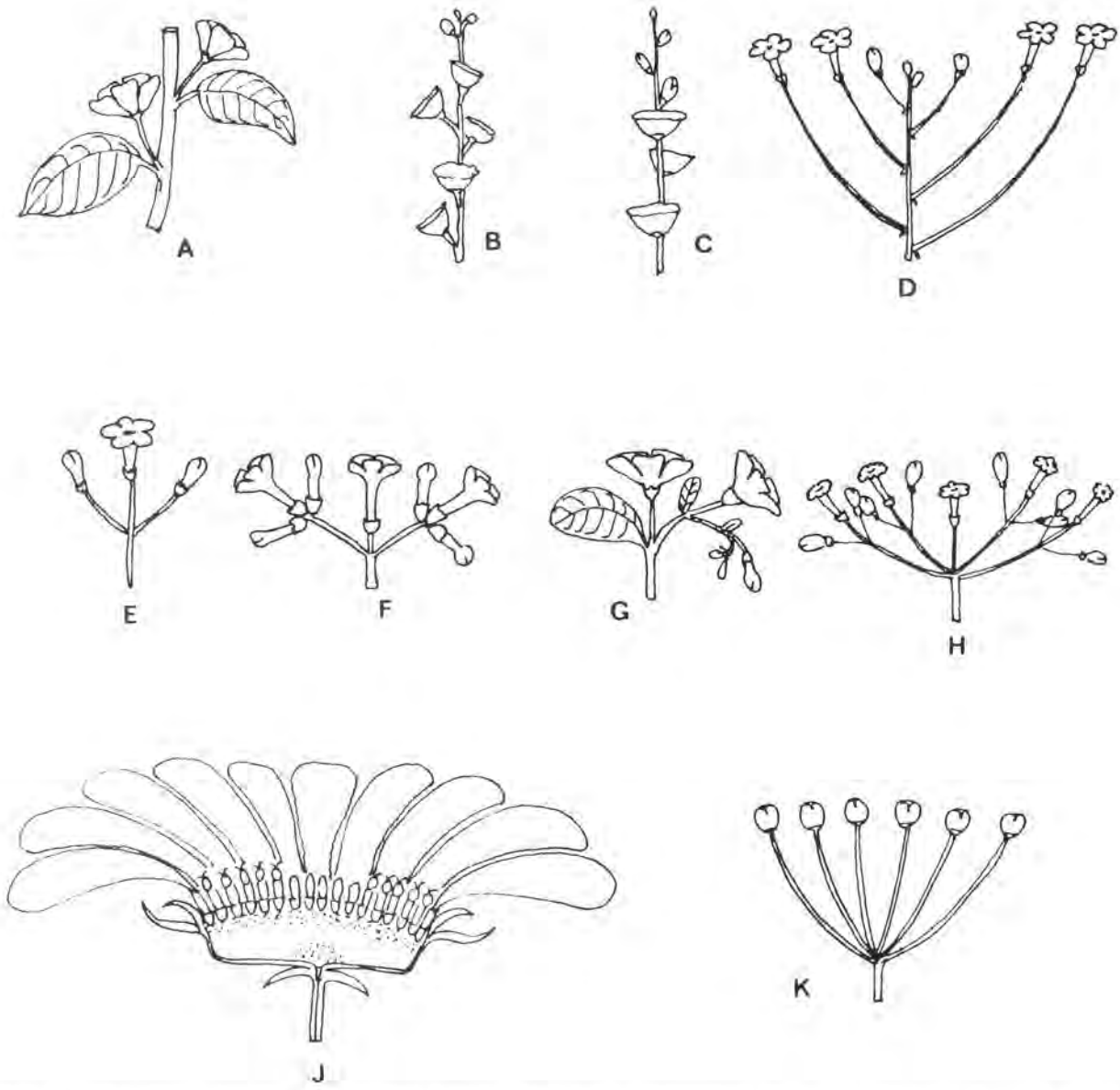

Fig. 5 Inflorescence types: A – axillary flower. Racemose (centripetal) types: B – raceme, C – spike and D – corymb. Cymose (centrifugal) types: E – simple dichasium, F – compound dichasium, G – helicoid cyme, H – pleiochasium. Racemose or cymose: J – capitulum, K – umbel.

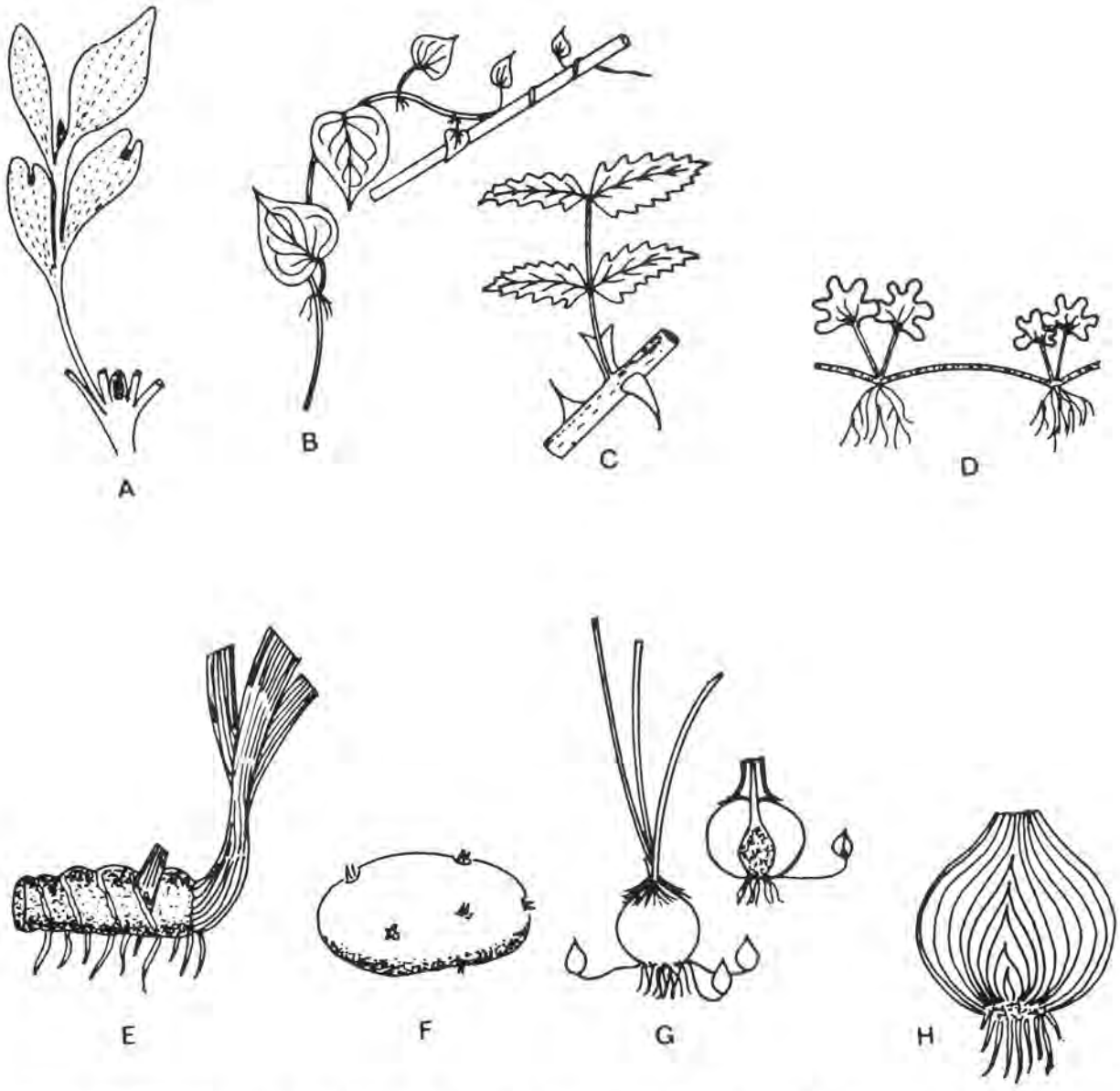

Fig. 6 **Modified aerial stems:** A – phylloclade, B – stem tendril, C – thorns or spines, D – stolon or runner. **Modified subterranean stems:** E – rhizome, F – tuber, G – corm, H – bulb.

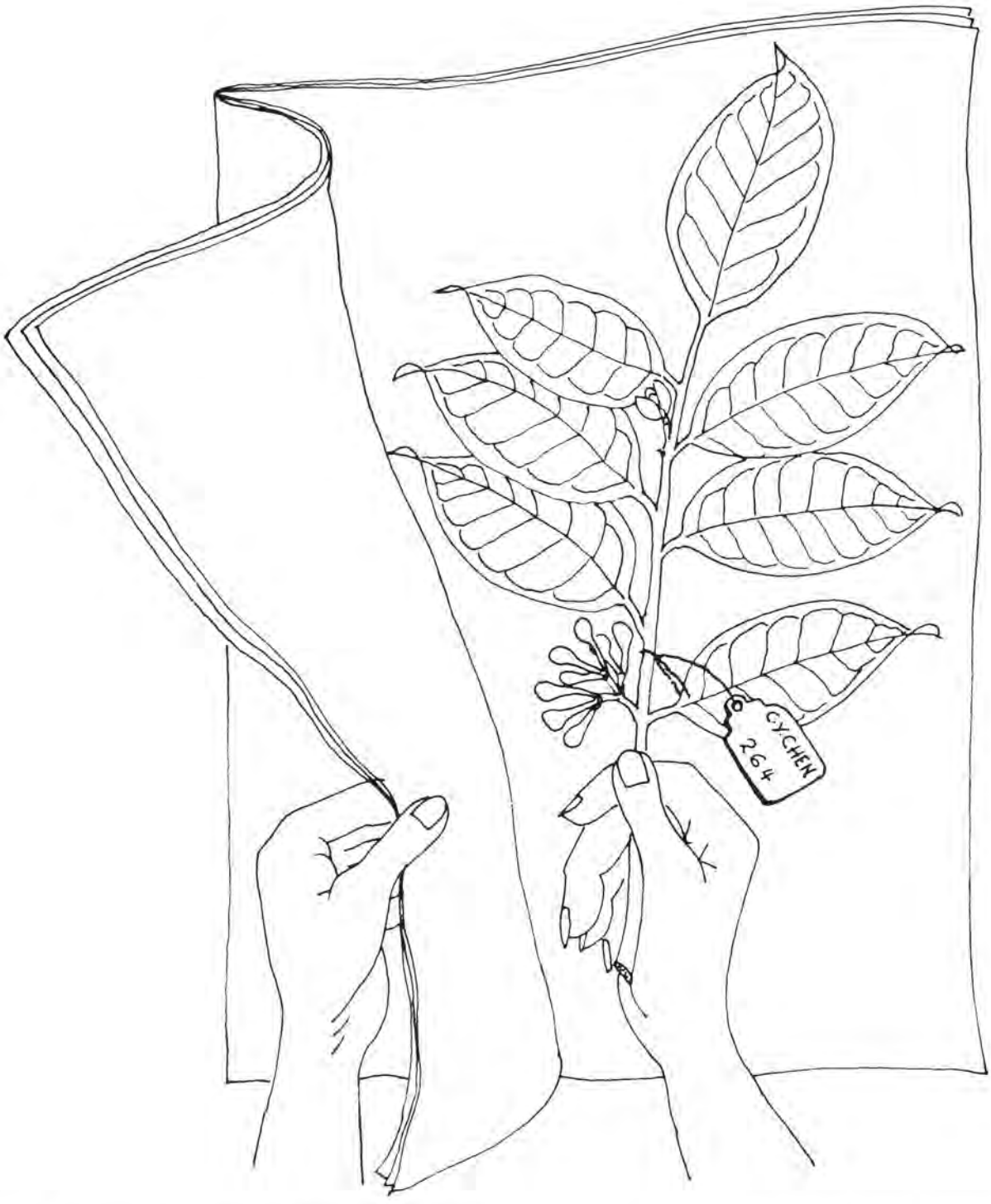

Fig. 7 A specimen complete with flowers and fruits has been tagged and numbered and is being placed between sheets of folded newspapers, measuring 44 cm by 29 cm, ready for pressing.

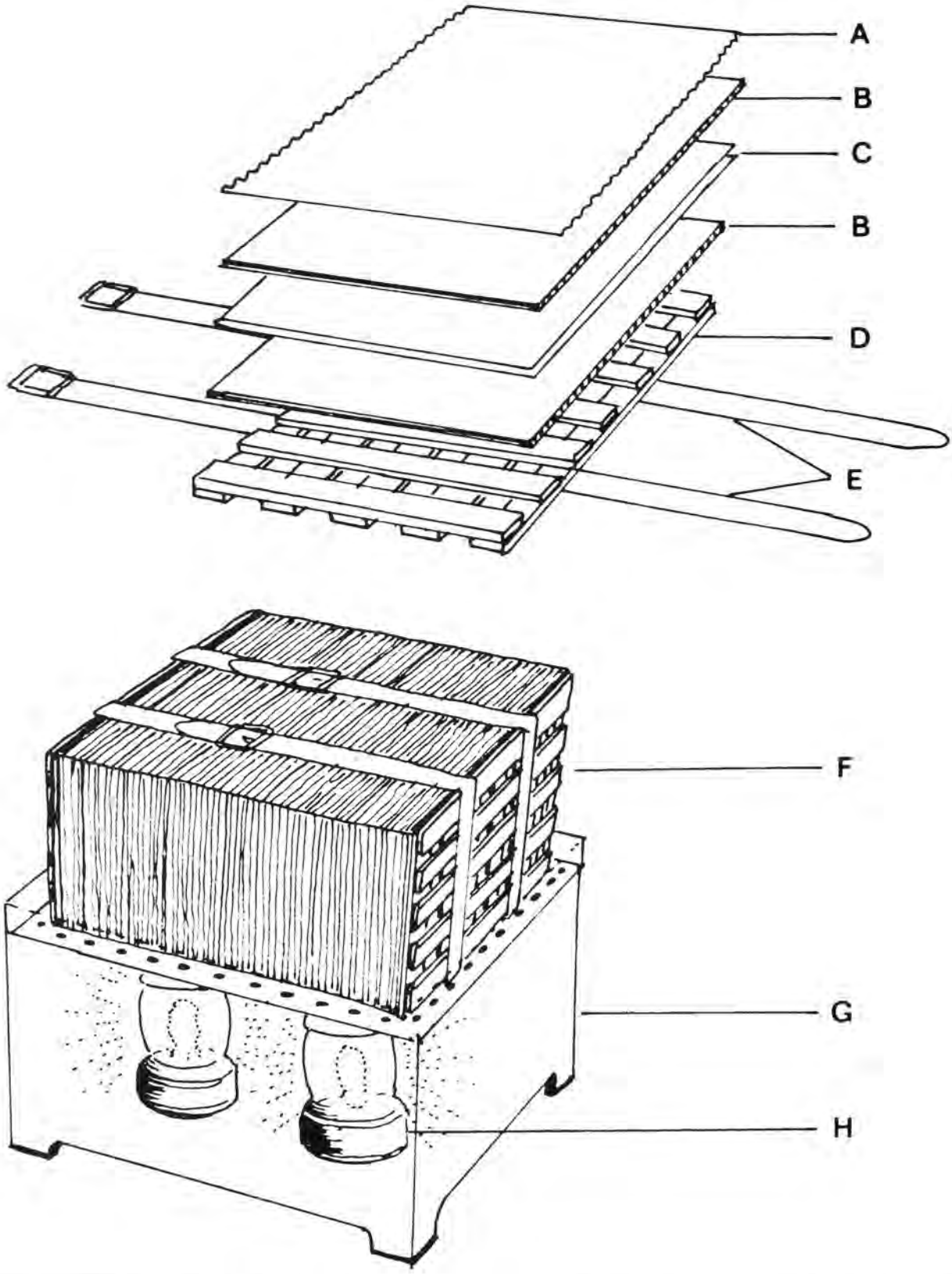

Fig. 8 Construction of a drying press with its component parts shown: A – aluminium corrugate, B – corrugated board, C – specimen folder, D – end board and E – straps to bind the press. The completed drying press (F) is shown in position on its side on top of the drier (G) heated with kerosene pressure lamps (H).

Chemical Treatment

Specimens may also be preserved chemically with either a solution of 4–6% formaldehyde or methylated spirits. As in the case of specimens to be preserved by drying, specimens for chemical treatment are normally placed in between sheets of folded newspapers and pressed for about 12 hours, after which the press is opened and the specimens removed. If necessary the newspaper sheets are replaced. The specimen folders are then neatly inserted into a polythene bag and about 3 cupfuls of methylated spirits or 4–6% formaldehyde spread evenly across the open ends of the bundle of folders. The bag is then sealed and is ready to be sent to the herbarium. Bulky and fleshy fruits can be preserved in a bottle containing methylated spirits or formaldehyde. However it should be borne in mind that chemically treated specimens are only useful for taxonomic identification and cannot be used for phytochemical analysis.

PHYTOCHEMICAL AND PHARMACOLOGICAL TESTS

Once "promising" medicinal plants have been identified sufficient quantities will need to be collected for phytochemical analysis and, eventually, for pharmacological tests. The techniques for these are well established and will not be described in this field guide.

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