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FEATURE ARTICLE

SOME THOUGHTS ON TRADITIONAL ETHIOPIAN CHEMISTRY

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The story of indigenous Ethiopian science and technology remains to be written. It appears, however, that Ethiopian scholars of the past were men of letters, chiefly interested in such matters as poetry, history, theology, law and magic and frequently displayed much depth and ingenuity in their discussions of these topics. A few medical works are known (1) and a bestiary, which is a kind of natural history (2), but there seems to be little evidence of interest in empirical science. In everyday life, however, Ethiopians have been acquainted for a long time with the chemical, physical and biological properties of a wide variety of natural products which they have used (and often still use) in various ways to meet their practical and cultural needs.

Ethiopian chemists have been making significant contributions to world science for a number of years now, but perhaps the establishsment of the Bulletin of the Chemical Society of Ethiopia can be thought of as marking the emergence of a distinct and productive Ethiopian chemical community within the framework of world science. At the same time there has not been a complete break with the pre-scientific past, because many Ethiopian chemists have been re-examining with modern methods the substances that attracted the attention of their traditional predecessors. It seems appropriate, therefore, to remember these anonymous pre-scientists, who were observant enough to recognize the properties of substances in the world around them and how they could be put to use, by reviewing very briefly the chemistry of a few of these.

Probably most Ethiopians, but few foreigners, would immediately recognize the following objects: a cluster of **red flowers;** a spiny **seed capsule;** a **bundle of fresh twigs** wrapped in a leaf of false banana; a handfull of **dried berries;** a cow's horn filled with a greasy, **foul-smelling material.** An examination of these leads to some interesting chemistry and at the same time may provide foreign readers with glimpses of some aspects of Ethiopian life.

The **red flowers** are from *Hagenia abyssinica*, a very characteristic tree of Ethiopian and East African forests at altitudes of 2400-3600 meters. Isolated specimens may be seen in the countryside, and even in Addis Ababa, probably because they were spared on account of their usefulness when the forests were cleared. They can be readily recognized by their shaggy bark and large compound leaves, and especially by their flower clusters half a meter long or so. The tree is dioecious, that is to say the male and female flowers are borne on separate trees. The red flowers are from the female tree; the male flowers are yellowish and less striking.

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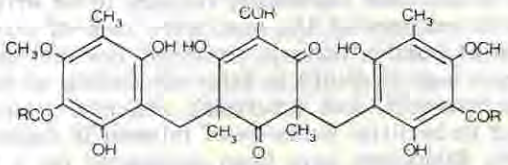
The red female flowers are called *kosso* in Amharic, and they are used as a remedy for tapeworm infestation. The serving and eating of raw beef play an important part in Ethiopian social life, so infection with the beef tapeworm, *Taenia saginata*, is very common. Consequently, a great many plant materials have traditionally been used as teniacides, some probably effective and some unfortunately dangerous (3). The chemistry of most of these is still largely unknown. Kosso, however, appears to be both effective and safe in the dosages normally used. At one time it was included in the pharmacopoeias of several European countries. It first attracted the attention of chemists more than a century ago, but the structures of the active principles were only established definitely in the 1970s (4,5,6,7). These are a number of derivatives of phloroglucinol (1,3,5-trihydroxybenzene) of which the most important are protokossin (**1**) and kossotoxin (**2**).



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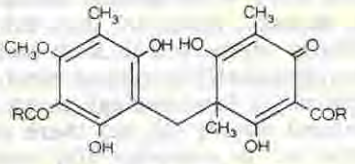

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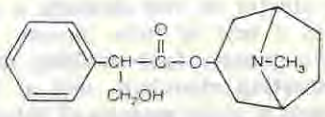
These are not specific individual compounds but rather groups of closely related compounds differing from one another in the nature of the substituents, which may be isopropyl, isobutyl, or secondary butyl. It is interesting that these compounds are found only in the female flowers, although the two sexes are otherwise very similar chemically (8).

The **seed capsule** is the fruit of the Thorn Apple or Jimson Weed, *Datura stramonium*. This is a cosmopolitan weedy shrub up to 2 meters tall, with coarsely toothed leaves and white trumpet-shaped flowers. It has been known for centuries that all parts of the plant, but especially the seeds, are violently toxic and hallucinogenic, and it has often been used by poisoners. The toxicity is due to the presence of atropine (**3**) and related alkaloids (9).



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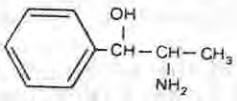
In Ethiopia it has a curious use, suggested by its amharic name, *astenagir*. which has the sense of something causing one to talk. Traditional teachers would adminster carefully controlled doses to sudents, under close supervision. The individual receiving it would then become temporarily demented and talk wildly. His speech and behavior were carefully observed and were thought to provide clues as to what career he should pursue. When he recovered from the effects of the drug, it was thought that his mental capacity would be increased (10).

The **bundle of twigs** represents *chat* or *khat*. This is a tree (*Catha edulis*) which occurs widely in eastern Africa, and is cultivated in Ethiopia and other countries around the Red Sea (11). The leaves have been used for centuries

in this region as a stimulant, particularly but not exclusively by Moslems. Its use is associated with various social relationships, and even religious rituals. There are many curious legends regarding its origin (12).

The nature of the most important active principle of *chat* only became known in the 1970s after the United Nations Commission on Narcotic Drugs became concerned about the possible social problems arising from its use. Earlier investigators working with dried material had isolated nor-pseudoephedrine (**4**), but this alkaloid has only weak pharmacological activity. Studies using fresh material led to the isolation and identification of a ketone which is lost when the material is dried. It has been given the name of cathinone (**5**).



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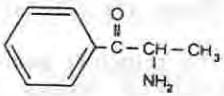


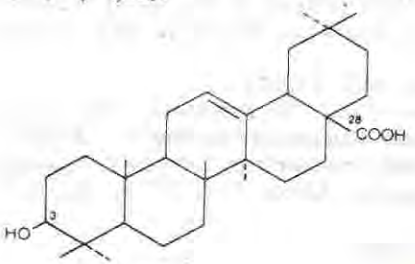
5

Cathinone is related structurally to amphetamine, and is similar to it in its pharmacological effects (14). A number of other alkaloids are also present (15).

The **dried berries** are the fruit of *Phytolacca dodecandra*. This plant is a climbing shrub up to 3 or 4 meters in height. It produces bunches of inconspicuous greenish-white flowers, followed by 5-lobed berries, which are orange or red when ripe. These berries, called *endod* in amharic, contain surface-active materials and have been used, probably for centuries, as a detergent for washing clothes. They are still so used today.

Here Ethiopian traditional chemistry merges dramatically with the main-stream of contemporary science. An Ethiopian parasitologist observed large numbers of dead snails near a site on a river where people had been doing their laundry with endod, and laboratory experiments showed that an extract of the berries was a remarkably effective molluscicide (16). This was an observation of the greates interest, because certain species of snail are the intermediate hosts of the parasites causing bilharzia or schistosomiasis, one of the most wide-spread and debilitating diseases of tropical and sub-tropical regions. One of the most effective means of combatting this disease is to destroy the smails, but synthetic molluscicides are so expensive that the countries that need them most often cannot afford them.

Further chemical and biological investigations revealed that the active principles in endod are monodesmosidic saponins of oleanolic acid (**6**) with a tri-or tetrasaccharide group attached to position 2 in a glycosidic linkage (17,18,19,20,21).



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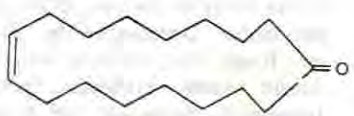

7

Compounds with an additional saccharide group on position 28 in an ester linkage are relatively ineffective (21).

Endod shows real promise for the control of bilharzia (22).

The last specimen in our imaginary collection, and the only one of animal origin is civet (*Zibad* in Amharic). Civet is a curious substance with an intriguing history (23). It is produced by special glands under the tail of the civet cat, *Viverra civetta* (*tirign* in Amharic). This is not really a cat, although it has a somewhat cat-like appearance; it is related to the mongooses. It is about as big as a medium sized dog, gray with black spots and with black rings around its bushy tail, and a black band across its eyes.

Although the smell of pure civet is disagreeable, at high dilutions it is pleasantly musky. Civet has, therefore, been used for many centuries as a component of perfumes. There are several references to it in the works of Shakespeare.

Ethiopia has long been the principal source of the world's supply of civet, especially the western districts of Wollega and Kaffa. Civiculture is a highly specialized branch of animal husbandry (24). The animals must first be caught, since they do not breed in captivity. Traditionally they were then maintained in individual cages, and the civet was removed with a spoon every 10 days or so.

Civet is of some importance in the histroy of chemistry. Its particular odour is due to the presence of a ketone, civetone. Its structure was invetigated in the 1920s by Ruzicka, who described many years later (25) his excitement when he realized that it must have structure (**7**), i.e. it contains a 17-membered ring.

At that time rings of this size were thought incapable of existing, so this discovery led to the study of a whole new class of organic compounds.

These are only a few of the best-known natural products that have been used in Ethiopia. Undoubtedly there are a great many more, and we may hope to see the chemistry of these described during the coming years in this Bulletin.

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