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Terminalia macroptera, its current medicinal use and future perspectives

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ABSTRACT

The tree *Terminalia macroptera* (Combretaceae) is widespread in Western Africa, and in this area, different parts have been utilized in the treatment of various diseases. In this article, we report on the medicinal use of *T. macroptera* in three different districts in Mali (Siby, Dioïla and Dogonland), based on interviews with 78 healers in these districts. Roots, root bark, stem bark, leaves and fruits have all been employed by healers, as has parasitic *Loranthus* species growing on the tree. Major areas of use comprise treatment of wounds and sores, infections, pain, cough, tuberculosis and hepatitis. Some of the medicinal uses of *T. macroptera* appear to be rationally explained by its chemical constituents.

1. Introduction

Terminalia macroptera Guill. & Perr. (Combretaceae) is a tree which grows in Western Africa from Senegal to Cameroon, and occasionally as far as Sudan. The tree is mostly found in Guinean and Sudanese-Guinean savannahs, preferably in moist areas and clayey ground, where it is stated to be common (Burkill, 1985; Arbonnier, 2004). Traditionally, the plant has been used in combination with *Anogeissus leiocarpa* for colouring cotton fabric yellow or ochre. This is then used for treatment of newly circumcised children due to its putative antimicrobial effect (Jansen and Cardon, 2005). The roots of the plant are regarded as an efficient antimicrobial remedy and are sold in markets in Guinea-Bissau (Silva et al., 1996). In Burkina Faso, the plant is employed against malaria (Sanon et al., 2003). The bark is used against diarrhoea and dysentery in Nigeria (Burkill, 1985). A decoction of the leaves is used against hepatitis, ringworm and skin diseases (Maydell, 1990). The leaves are also used in gastritis, colic and hypertension, against fever, lepra and tuberculosis (Arbonnier, 2004). The timber of *T. macroptera* is regarded as strong and resistant, and is popular as building material and in furniture (Winkler, 1912).

Chemical investigations of *T. macroptera* has led to the identification of flavonoids (Nongonierma et al., 1987, 1988, 1990), triterpenoids (Conrad et al., 1998, 2001a), ellagitannins and related phenolics (Silva et al., 2000, 2002; Conrad et al., 2001a, b).

Few university educated medical doctors are practicing in Mali, and traditional healers occupy an important position in health care. It is estimated that about 80% of primary health care in Mali is done by such traditional healers, which usually use knowledge that has been transmitted from generation to generation for centuries (Inngjerdingen et al., 2004). As part of our research on Malian medicinal plants (School of Pharmacy 2011), we have carried out a survey of the use of *Terminalia macroptera* by traditional healers in three different areas in Mali: 26 healers from the Siby area, 14 healers from two different villages in the Dogonland district, and 38 healers from five different villages in the Dioïla district. The results are presented in this communication. To our knowledge, no systematic study of the medicinal use of this plant by traditional healers in Mali has been reported before.

2. Methods

Structured interviews in the Siby area (SW of Bamako) took place on November 24–25, 2008. A total of 26 healers were interviewed; 18 men and 8 women. In Dogonland, 14 healers (all male) were interviewed from November 27 to 28, 2008. Due to the variety of Dogon dialects, Mr. Akouni Dougnon was employed as interpreter during these interviews. In Dioïla (SE of Bamako), 38 healers, of which 4 female, were interviewed in four different villages from December 10 to December 13, 2008. The healers were those who were available at the time of investigation. The age of the healers varied from 26 to 90 years. Interviews in Siby and Dioïla were performed in Bambara. The high prevalence of female healers in the Siby area may be due to the presence of a center for child care in the Jisumala village, since commonly, female healers

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Table 1
Interviews with healers in the Siby area. Three out of the 26 healers interviewed did not use *T. macroptera* in their practice, and are omitted from the Table. In this area, woloba was the local name used for the plant. M = male, F = female.

Age/sex	Village	Indication	Plant part, preparation, administration, dosage
			Root
45/M	Djissoumana	Inner wounds	Root, decoction (10 min). Four tea glasses drunk three times daily for 4 days. Children: half dose.
79/M	Djissoumana	Sores in mouth, gingivitis	Pressed root juice applied to cleaned sore every morning before breakfast until healing. Can be used by everybody, no side effects. Gingivitis: same treatment.
80/F	Djissoumana	Gingivitis	Pressed root juice applied to the inflamed area and rinsed with water 2 times daily for 3 days. Same treatment for all. No side effects.
35/M	Djissoumana	Diarrhoea, dysentery	Root. One tea glass of decoction to be drunk. Children: 1 tablespoon of decoction. No side effects.
59/M	Djissoumana	Inner sores, fever in children	Root. Make a decoction for 2–3 h until it has a syrup-like consistency. Two tablespoons twice daily for one week. Children: half dose. No side effects, but bitter taste. Root. Wash body with decoction twice daily for 4 days
70–80/F	Djissoumana	Inner sores	Root. Decoction drunk until improvement. Same treatment for all.
80/M	Guena	Sores in mouth	Root. Mouth is rinsed with decoction twice daily until improvement. No side effects.
			Bark
26/M	Djissoumana	Cough	Inner stem bark dried and pulverized. Add a little salt and eat alone or with food. Repeated until improvement. Children: lower dose. No side effects.
29/M	Djissoumana	Cough	Inner stem bark: One glass of macerate to be drunk once daily until improvement. Children: half dose. No side effects.
49/M	Djissoumana	Cough, tuberculosis	Stem bark or root: half a teacup decoction drunk three times daily for 4 days. OR: Dried and pulverized root or stem bark, 1 teaspoon, mixed with porridge or soup, to be eaten once daily for four days. Children: Half a tablespoon mixed with hot water with sugar. No side effects.
58/M	Djissoumana	Incontinency, dysentery	Root bark, dried and pulverized: half a tea glass of powder mixed with 200–300 ml hot water. To be drunk once each day before going to bed for 3–7 days. Stem bark: decoction of one handful in 0.5 l water. One teacup of decoction to be drunk. Can be used by children.
67/M	Djissoumana	Inner wounds, sores in mouth	Inner root bark: one tea glass of decoction drunk once daily for 3–4 days. Children: half dose. No side effects. Inner root bark: Pressed bark juice mixed with a little water for rinsing of the mouth. Twice daily until improvement. No side effects.
72/M	Djissoumana	Cough	Inner stem bark: One cup of macerate drunk 3 times daily for up to one week. Same treatment for all. No side effects.
80/F	Djissoumana	Diarrhoea	Decoction of inner root bark, one tea glass, to be drunk once daily for 3 days. Same treatment for all. No side effects.
46/M	Dogoro	Female infertility	Inner root bark dried and pulverized. One tablespoon added to porridge or liquid, consumed once daily until pregnancy. No side effects.
			Leaves
50/F	Djissoumana	Body pains in children	Decoction of 3 bunches of leaves to be used for body wash, thereafter massage with Shea butter. Twice daily for 2 days.
50/M	Djissoumana	Headache, migraine	Decoction of 3 bunches of leaves used for washing the head along with Shea butter soap 3 times daily for 2 days. Can be used by pregnant women.
55/M	Djissoumana	Epilepsy	Decoction of 3–4 bunches of leaves in one teacup. Drink once daily for 3–4 days.
60/F	Djissoumana	Chest pains	Steam bath of leaves followed by body wash with leaf decoction, twice daily until improvement. No side effects.
			Mixed plant parts
80/M	Djissoumana	Inner wounds	Decoction of equal amounts of leaves and roots. Used for body wash and for drinking: 1 cup twice daily until improvement. Same dosage for children and pregnant women.
55/M	Djissoumana	Diabetes, diabetic foot sores	Leaves and decoction of equal amounts, 1 teacup drunk twice daily for 5–7 days. No side effects.
56/F	Djissoumana	Dermatosis in children	Decoction of leaves or roots for body wash 3–4 times.
80/M	Kalassa	Alopecia	Decoction of leaves, stem bark and fruits used for washing hair and body once daily until cessation of hair loss. Can be used on children.

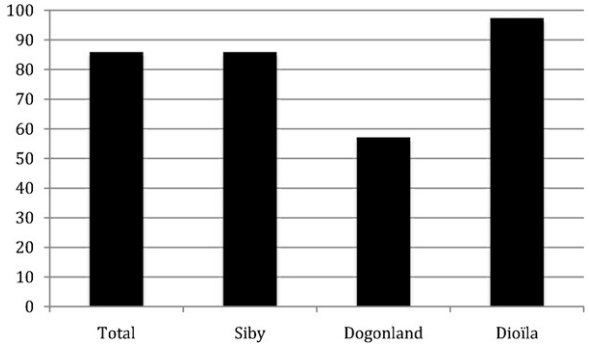

Fig. 1. Prevalence of use (%) of *T. macroptera* in the practice of healers in different districts.

specialize in paediatric care. Most of the male healers were general practitioners. Commonly, the healers had been trained by a parent.

The healers were asked for knowledge about the tree, information about indications for its use, which part was employed, how the preparation used was made, and how the preparation was administered and dosed. *T. macroptera* is a common tree and local names were used to ensure that the healers were talking about the correct species. Interviews were carried out individually, usually taking 15–20 min for each healer to give all their answers. Before being interviewed, the healers were informed about why the interviews were carried out and how the material from the interviews would be used. Each healer was at liberty to take part in the interview or refuse, but only one healer refused to be interviewed. The names of the healers have been omitted in this article to protect their privacy.

3. Results and discussion

The information given by the healers is summarized in Tables 1 (Siby area), 2 (Dogonland) and 3 (Dioïla). Most of the healers (67 out of 78) used *T. macroptera* in their practice (Fig. 1), but the frequency of use varied between areas and between healers. In addition to medical use, some of the healers mentioned use as animal feed and for colouring cloth. "Woloba" (bambara) and "bosokugu" (dogon) were the most common names for the tree.

Terminalia macroptera was used against a variety of ailments – 31 different indications were mentioned by the healers. Sores and wounds, pain, cough, tuberculosis and hepatitis were the most common indications, as demonstrated by their fidelity index (Table 4). Fidelity index (FI) is defined as $(N_p/N) \times 100$ where N_p is the number of reported uses against any specific condition and N is the total number of uses reported (Togola et al., 2008). Stem bark and root, alone or in combination with other parts or other plants, were most frequently used. There may be some geographic variation in the use of different parts of the tree. Thus, in Dogonland, *Loranthus* spp. (parasitic creepers on *T. macroptera*) were often used, while stem bark and roots were more common in Siby and Dioïla (Table 5). Preparations of parts of the tree were usually made as decoctions and administered orally. However, in some cases, use in a steam bath or for washing the whole body or the body part responsible for symptoms was recommended. In some instances, the dried and pulverized material was applied to the skin, directly or as an ointment in Shea butter (fat from the seeds of *Butyrospermum parkii*).

From our investigations, it is apparent that the uses of *T. macroptera* among traditional healers are multiple. The lower percentage of users in Dogonland may be due to the tree being less common in that district. While bark and leaves are used medicinally in all three districts, use of the roots is common in Siby, but unknown in Dogonland. Use of *Loranthus* creepers is common in Dogonland, but much less so in Dioïla and unknown in Siby. Thus,

Table 2
Interviews with healers in Dogonland. Out of 14 healers interviewed, 8 used *T. macroptera*, but for some of these, it turned out that parasite plants (*Loranthus* spp.) growing on *T. macroptera* were used. M = male, F = female.

Age/sex	Village	Vernacular plant name	Indication	Part of the tree, preparation, administration, dosage
				Bark
38/M	Banani	Bosokugo	Hepatitis	Stem bark: Decoction is mixed with porridge and drunk 3 times daily until improvement. No side effects.
58/M	Iriguili	Bosokuko	Unconsciousness	Outer stem bark pulverized and applied to nose and skin with Shea butter.
84/M	Iriguili	Akouko	Hepatitis	Stem bark of *T. macroptera*, *Anogeissus leiocarpus* and root bark of *Strophantus sarmentosus* mixed. Three to four handfuls of a decoction of this is drunk twice daily for 5 days.
				Leaves
64/M	Iriguili	Baskogo	Conjunctivitis	Decoction of leaves: Eyes washed twice daily until improvement. Same treatment for all.
				Loranthus *parasite plants*
55/M	Banani	Basokugo	Hepatitis	Decoction of *Loranthus* leaves to be drunk: 3–4 handfuls twice daily for 3–4 days. No side effects.
66/M	Banani	Bosokugo	Hepatitis	Decoction of *Loranthus* to be drunk: 3–4 handfuls twice daily for 3 days. Rest of decoction used for body wash.
69/M	Banani	Bosokugo	Hepatitis	Decoction of *Loranthus* to be drunk and used for body wash as above.
70/M	Iriguili	Baskugo	Rheumatism	Decoction of *Loranthus* leaves drunk once a day for 2 days, thereafter steam bath until improvement.

Table 3
Interviews with healers in the Dioïla area. Out of 38 healers interviewed, 37 used *T. macroptera* in their practice. In this area, woloba was the vernacular name used for the plant. M = male, F = female.

Age/sex	Village	Indication	Plant part, preparation, administration, dosage
			Root
72/M	Bancó	Malaria	Roots mixed with root of *Blighia sapinda*. One teacup of decoction drunk and body washed with decoction twice daily for 3–4 days. Children: half dose. No side effects.
69/M	Bancò	Hepatitis	Pressed root juice is mixed with a little water. Three handfuls drunk.
65/M	Bancò	Fungal infections in mouth	Decoction of roots to be drunk: one teacup twice daily for 1 week. Half dose for children. No side effects.
66/M	Beleco	Diarrhoea	Roots: one tea glass of decoction drunk once daily until improvement. Same dose for children. Side effect: constipation with overdose.
62/M	Dioïla	Chronic wounds, hemorrhoids, vaginal	Roots powdered and applied to cleaned wound twice daily until improvement. Powdered roots mixed with butter and applied twice daily for 3 days. Decoction of roots for topical washing and drinking: 1 teacup daily until improvement.
40/M	N'Dia Dougou-tiguila	Inflammation	Carbonized root powder mixed with fat and applied topically twice daily for 1 week.
34/M	N'Dia Dougou-tiguila	Vaginal infections	Dried and pulverized roots. Two fingers of powder applied topically twice daily until improvement.
			Bark
73/M	Bancò	Hypertension, cerebral hemorrhage	Stem bark mixed with stem bark of *Sclerocarya birrea*. One tea glass of decoction drunk and body washed once daily for 15–20 days. Alternatively: Dried and pulverized stem bark of the above plants, half a tea spoon, consumed with food once daily for 15–20 days. Dried and pulverized stem bark of the above plants, half a tea spoon, consumed with food once daily for 15–20 days.
65/M	Bancò	Neurological ailments, burning feeling in feet	Stem bark and root bark: decoction as foot bath twice daily for 5 days.
50/F	Bancò	Menstrual pain	Stem bark. One teacup of decoction drunk once daily and steam bath of stomach until improvement. No side effects, but bitter taste due to tannin content.
40/M	Bancò	Hepatitis	Stem bark and root bark: 2 handfuls of decoction drunk and body washed with decoction twice daily for 3 days.
36/M	Bancò	Fungal infections in mouth of children	Stem bark decoction (very concentrated) for topical application twice daily for 4 days.
60/M	Bancò	Chest and back pain	Stem bark and *Loranthus*: decoction for washing the body for 3–4 days.
38/M	Bancò	Diabetes	Stem bark and stem bark of *Sclerocarya birrea*. One tea glass of decoction drunk twice daily for 2 weeks. Half dose for children.
37/M	Dioïla	Dermatitis	Stem bark and root bark. Half a litre of decoction drunk twice daily and body wash with rest of decoction for 1 month. Children: half a tea glass. No side effects.
62/M	Dioïla	Amenorrhea	Stem bark macerated overnight. One teacup drunk 3 times daily for 3 days.
76/M	Dioïla	Cough	Decoction of stem bark (boiled for a long time): One tea glass drunk twice daily for 7 day. Children: half dose. No side effects.
55/M	Dioïla	Chronic external wounds dysmenorrhea, syphilis	Powdered stem bark or root bark applied once daily for one week. Stem bark or root bark: one tablespoon of powder mixed in porridge, eaten once daily for 1–2 weeks. Same treatment as for dysmenorrhea
51/M	Dioïla	Ear infections	Stem bark or root bark mixed with Shea butter, applied to the ear three times in total.
70/F	Dioïla	Inner wounds	Stem bark powder mixed with porridge, eaten twice daily until improvement.
63/M	N'Dia Dougou-tiguila	Rheumatism	Stem bark mixed with stem bark of *Erythrina senegalensis*. One tea cup of decoction drunk 3 times daily and body washed with decoction until improvement.
52/M	N'Dia Dougou-tiguila	Body pains	Stem bark: Decoction used for washing the body until improvement.
50/M	N'Dia Dougou-tiguila	Pain in lower stomach region	Stem bark decoction as steam bath for lower stomach region, in addition to drinking as much as possible of the decoction until improvement. No side effects.
39/M	N'Dia Dougou-tiguila	Infertility in women	Stem bark dried and pulverized, and mixed with salt. To be eaten alone or with food. No amount specified.
			Leaves
43/M	Bancò	Vaginal fungal infections	Carbonized leaves mixed with salt and eaten. In addition: Carbonized leaves mixed with fat for topical application. 1–2 times daily for 2 days.
72/M	Dioïla	Fever in children	Leaf decoction used for washing as often as possible.
51/M	Dioïla	Growth of teeth, nightmares in children, eye pain	Leaf decoction once daily for 1 week. Same treatment as above. Leaf decoction used topically twice daily for 1 week.
55/M	Dioïla	Vaginal infections	Leaf decoction: one teacup drunk and topical washing twice daily for 1 week.
83/M	N'Dia Dougou-tiguila	Deformed baby head	Freshly pressed juice from small leaves applied to the head 3 times daily. Condition cured within 3 days.
			Loranthus *parasite plants*

Table 3 (*Continued*)

Age/sex	Village	Indication	Plant part, preparation, administration, dosage
70/M	Bancò	Nausea caused by pregnancy	*Loranthus* decoction for washing the body 3 times.
70/F	Bancò	Body pains	*Loranthus* powder mixed with water and used for body wash. In addition: Infusion of 5 fingers of powder drunk twice daily until improvement.
40/F	Bancò	Stomach pains	*Loranthus* powder mixed with water and used for body wash. In addition: Infusion of 3 fingers of powder drunk twice daily for 1 week. No side effects.
48/M	Dioïla	Premature birth, dysmenorrhea	Dried and pulverized *Loranthus* boiled with 1/4 l water and drunk 1–2 times daily for 3 days. As above. In addition: steam bath of lower body.
75/M	Dioïla	Eye catarrh, eye infections	Dried and pulverized *Loranthus*: 1 handful mixed with 1 l water and used for washing the eyes twice daily until improvement.
70/M	Dioïla	Eye infections	*Loranthus* decoction for eye wash twice daily for 3 days. Same treatment for all.
54/M	N'Dia Dougou-tiguila	Night fever in children	*Loranthus* decoction for washing the child.
			Mixed plant parts
50/M	Bancò	Tuberculosis	Stem bark and leaves. Powdered mixture of the plant parts mixed with salt. One teaspoon eaten three times daily for 3 days. Half dose for children.
38/M	Bancò	Chest and back pains	Stem bark and *Loranthus* decoction used for washing the body twice daily for 4 days.

Table 4
Fidelity index (FI, in %) of *T. macroptera* use. Uses with a total FI of more than 5% are shown.

Indication	Siby	Dogonland	Dioïla	Total
Pain, rheumatism	13	13	28	21
Wounds	38	0	8	16
Hepatitis	0	63	5	10
Cough, tuberculosis	17	0	5	9
Diarrhoea, dysentery	13	0	3	6
Fever, malaria	4	0	8	6

Table 5
Medicinal use of different parts of *T. macroptera* in different districts.

	Siby	Dogonland	Dioïla	Total
Root	15 (50%)	0	12 (27%)	27 (33%)
Stem bark	6 (20%)	3 (37%)	19 (43%)	28 (34%)
Leaves	8 (27%)	1 (13%)	6 (14%)	15 (18%)
Loranthus	0	4 (50%)	7 (16%)	11 (13%)
Fruits	1 (3%)	0	0	1 (1%)

it appears that the part of the tree used is to some extent geographically determined. The fruits are virtually unused, with only one report from Siby and none from the other districts.

The difference in use between districts is reflected in the fidelity index of plant use. As can be seen from Table 4, the fidelity index for all three areas combined is fairly low for the uses reported, but when calculated for each area, some major uses such as treatment of wounds in Siby and hepatitis in Dogonland are evident. The difference in use in the three areas might be due to different plant parts being used (Table 5). Pain and rheumatism is the only indication reported from all three areas. From the data in Tables 4 and 5, it is seen that in the Siby area, the roots were used against wounds and the bark (in some instances defined as the stem bark) against coughs and tuberculosis. Against pain and rheumatism, the leaves were commonly used. This was also found in Dioïla, but there, stem bark was also employed against these ailments. In Dogonland, hepatitis was the most common indication, and stem bark and/or *Loranthus* was used. The widespread use against wounds and infections may point to the presence of antimicrobial substances in the plant. This could be related to the presence of ellagitannins, which are known antimicrobial compounds (Adesina et al., 2000). We have recently isolated the ellagitannin corilagin from *T. macroptera* leaves (Pham et al., 2011). Interestingly, this substance has been reported to potentiate the activity of β-lactam antibiotics against methicillin-resistant strains of *Staphylococcus aureus* (Shimizu et al., 2001). Combination of *T. macroptera* preparations with antibiotics might be worth while to study in future research.

Tannins may also be involved in the anti-dysenteria and anti-diarrhoea effects of *T. macroptera* preparations. Such effects are well known (Heinrich et al., 1992; Schulz et al., 2001). Other uses of *T. macroptera* by healers might well be worth further investigation. Since inflammatory diseases and diabetes are wide spread throughout the world, finding leads towards new and effective medicines against these diseases would be highly valuable.

4. Conclusion

In conclusion, we have found that *T. macroptera* is widely used against a variety of diseases in different areas in Mali. Some of the major medical uses of this plant may well be rationally connected with its constituents. Some of the effects reported have been mentioned in earlier literature, though in less detail. However, the analgesic activity and wound healing properties appear to be poorly known previously for this plant and if effective, might

well be useful in future therapy. These and further uses seem to merit investigation.

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