Evaluation of Ethnomedicine and Ethnobotany of *Maerua triphylla* A. Rich. (Capparidaceae)

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**ABSTRACT**

*Maerua triphylla* A. Rich. is a shrub or small tree collected from the wild for its edible leaves and also used as traditional medicine. This study is aimed at evaluating the ethnomedicinal and ethnobotanical uses of *M. triphylla*. Results of the current study are based on data derived from several online databases such as Scopus, Google Scholar, PubMed and Science Direct, and pre-electronic sources such as scientific publications, books, dissertations, book chapters and journal articles. This study revealed that the fruit, leaf, root, stem bark and twig infusion and/or decoction of *M. triphylla* are mainly used as ethnoveterinary medicine, aphrodisiac and antidote for poisoning, and traditional medicine for rheumatism, boils, cancer, respiratory problems, snakebite, headache, migraine and gastro-intestinal problems. Phytochemical compounds identified from dried aerial parts and branches of *M. triphylla* include betaines and quaternary ammonium compounds such as 3-hydroxyprolinebetaine, glycine betaine, proline betaine and 3-hydroxy-1,1-dimethyl pyridinium. Preliminary ethnopharmacological research revealed that *M. triphylla* leaf extracts have acaricidal and cytotoxicity activities. Documentation of the medicinal uses, phytochemistry and pharmacological properties of *M. triphylla* is important as this information provides baseline data required for future research focusing on ethnopharmacological properties of the species. *Maerua triphylla* should be subjected to detailed phytochemical, pharmacological and toxicological evaluations aimed at correlating its medicinal uses with its phytochemistry and pharmacological properties.

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**INTRODUCTION**

*Maerua triphylla* A. Rich. is a shrub or small tree belonging to the Capparaceae or caper family. The Capparaceae family is a tropical and subtropical taxon of trees, shrubs, herbs and lianas consisting of approximately 417 species ([Kers *et al.*, 2003; *Ilitis *et al.*, 2011] The genus *Maerua* Forssk has been recorded in tropical and southern Africa, and tropical Asia with about 60 species recorded from the African continent ([Ellers *et al.*, 1964]). The genus name "Maerua" means "drooping" about the drooping foliage ([Venter and Venter, 2015]). The specific epithet "triphylla" is a Greek word meaning "three leaflets" about the trifoliate leaves that characterize the species.

*Maerua triphylla* is variable and four varieties, namely var. *calophylla* (Gilg) DeWolf, var. *Johannis* (Volkens & Gilg) DeWolf, var. *pubescens* (Klotzsch) DeWolf and var. *triphylla* have been described ([DeWolf, 1962]). However, in Kenya, where all four varieties have been recorded, it was
found to be impossible to eliminate the varieties as the morphological characteristics appeared to be continuous (Mollel, 2013). The English common names of *M. triphylla* are “small bead-bean” and “maerua” (Dharani, 2019). The synonyms associated with the name *M. triphylla* include Crateva avicularis Burch. et DC., *C. coffa* Burch. ex DC., *M. dupontii* Hemsl., *M. jasminifolia* Gilg & Gilg-Ben., *M. pubescens* (Klotzsch) Gilg, *M. trachycarpa* Gilg, *M. trichocarpa* Gilg & Gilg-Ben. and *M. variifolia* Gilg & Gilg-Ben (Wild, 1960; Elfers et al., 1964). *Maerua triphylla* is an evergreen, erect or scendent tree or shrub, growing to a height of nine meters (Palgrave, 2002).

The branches of *M. triphylla* are dense, long, pendulous, young branches brown, glabrous with several lenticels and forming a round crown. The leaves are alternate, simple, trifoliolate, with entire margins, dull grey-green, narrowly oval with a rounded apex. The flowers are small, regular, bisexual, cream to white, borne singly in the upper leaf axils. The fruit is a cylindrical capsule and constricted between the seeds, bluish-green at first, turning creamy-brown when ripe. The seeds are irregularly kidney-shaped, pale brown and obscurely warted. *Maerua triphylla* has been recorded in evergreen or deciduous bushland, wooded grassland, dry woodland, termite mounds, thickets and margins of the drier forests, along rivers and lakes. *Maerua triphylla* has been recorded in the Democratic Republic of Congo, Ethiopia, Djibouti, Tanzania, Kenya, Uganda, Somalia, South Sudan, Sudan, Malawi, Mozambique, Zambia, Zimbabwe, Madagascar and Seychelles an altitude ranging from sea level to 2300 m above sea level (Elfers et al., 1964; Palgrave, 2002).

The leaves of *M. triphylla* are eaten as leafy vegetables in Ethiopia and Tanzania (Luoga et al., 2000; Lulekal et al., 2011) and also consumed as famine food (Mollel, 2013). In Kenya and Tanzania, during periods of famine, the roots of *M. triphylla* are boiled for a long time to remove toxic compounds and prepared as porridge (Hamilton and Hamilton, 2006; Dharani, 2019). The species is also important for bee forage (Mollel, 2013). Wild and domesticated animals browse the leaves and shoots of *M. triphylla* in Kenya, Ethiopia and Uganda (Gemedo-Dalle et al., 2006; Mbuvi et al., 2019). In East Africa, *M. triphyllais* planted in rocky sites, and other degraded landscapes as a management strategy for soil reclamation, and the species is often spared when clearing land for agricultural purposes (Mollel, 2013). *Maerua triphylla* is one of the important medicinal plants in tropical Africa, and the species is included in the book "Plant resources of tropical Africa 11(2): Medicinal plants 2", a photographic guide to the most commonly used medicinal plants in tropical Africa (Mollel, 2013). Therefore, *M. triphylla* is a valuable plant species with potential for improving food and nutritional security and primary healthcare of local communities in tropical Africa. Thus, this review aims to provide an integrated and detailed appraisal of the existing knowledge on the ethnomedicinal uses and ethnobotany of *M. triphylla*.

**MATERIALS AND METHODS**

Results of the current study are based on a literature search on the ethnomedicinal uses and ethnobotany of *M. triphylla* using information derived from several internet databases. The databases included Scopus, Google Scholar, PubMed and Science Direct. Other sources of information used included pre-electronic sources such as journal articles, theses, books, book chapters and other scientific articles obtained from the university library.

**RESULTS AND DISCUSSION**

**Medicinal uses of *Maerua triphylla***

The fruit, leaf, root, stem bark and twig infusion and decoction of *M. triphylla* are mainly used as ethnoveterinary medicine, aphrodisiac and antidote for poisoning, and traditional medicine for rheumatism, cancer, respiratory problems, snakebite, headache and gastrointestinal problems (Table 1; Figure 1). In Tanzania, the leaves of *M. triphylla* are mixed with those of *Boscia salicifolia* Oliv and taken orally as an antidote for poisoning and traditional medicine for tuberculosis (Hedberg et al., 1982; Maroyi, 2019). In Kenya, the roots of *M. triphylla* are mixed with those of *Uvaria acuminata* Oliv and taken orally as traditional medicine for breast cancer, dizziness and hallucinations (Waswala-Olewe et al., 2014).
Table 1: Medicinal uses of *Maerua triphylla*

| Medicinal Use                  | Part used                                | Country                  | Reference                                                                 |
|--------------------------------|------------------------------------------|--------------------------|---------------------------------------------------------------------------|
| Antidote for poisoning         | Leaf ash taken orally                     | Mozambique and Tanzania   | (Mollel, 2013)                                                             |
| Antidote for poisoning         | Leaves mixed with those of Boscia salicifoliaOliv. taken orally | Tanzania                  | (Hedberg *et al.*, 1982; Maroyi, 2019)                                     |
| Aphrodisiac                    | Leaf, root and stem bark infusion and decoction are taken orally | Kenya and Tanzania        | (Hedberg *et al.*, 1982; Kimondo *et al.*, 2015)                          |
| Backache                       | Leaf infusion and decoction are taken orally | Tanzania                  | (Matthews, 1993)                                                           |
| Boils                          | Leaf ash applied topically                | Djibouti and Kenya        | (Ichikawa, 1987; Hassain-Abdallah *et al.*, 2013)                         |
| Burns                          | Leaf decoction applied topically          | Kenya                     | (Fratkin, 1996)                                                           |
| Cancer (breast) and leukaemia   | Root and stem bark infusion and decoction are taken orally | Tanzania                  | (Augustino and Gillah, 2005; Matata *et al.*, 2018)                       |
| Cancer (breast)                | Roots mixed with those of Uvaria acuminataOliv. taken orally | Kenya                     | (Waswala-Olewe *et al.*, 2014)                                            |
| Diphtheria                     | Leaf infusion and decoction are taken orally | Djibouti                  | (Hassain-Abdallah *et al.*, 2013; Abdoul-latif *et al.*, 2016)             |
| Dizziness                      | Roots mixed with those of U. acuminata taken orally | Kenya                     | (Mollel, 2013; Waswala-Olewe *et al.*, 2014)                               |
| Eye problems                   | Leaf maceration applied as a lotion       | Kenya                     | (Ichikawa, 1987; Mollel, 2013)                                            |
| Gastrointestinal problems      | Bark, leaf and root infusion and decoction are taken orally | Djibouti, Ethiopia and Kenya | (Hassain-Abdallah *et al.*, 2013; Mollel, 2013)                           |
| Hallucinations                 | Roots mixed with those of U. acuminata taken orally | Kenya                     | (Waswala-Olewe *et al.*, 2014)                                            |
| Headache and migraine          | Leaf, root and stem bark infusion and decoction are taken orally | Tanzania                  | (Hedberg *et al.*, 1982; Mollel, 2013)                                     |
| Headache                       | Roots mixed with those of Capparis cartilaginea Decne. taken orally | Kenya                     | (Waswala-Olewe *et al.*, 2014)                                            |
| Loss of appetite               | Leaf infusion and decoction are taken orally | Ethiopia                  | (Paulos *et al.*, 2016)                                                   |
| Malaria                        | Twig infusion and decoction are taken orally | Mozambique                | (Mollel, 2013)                                                            |
| Marasmus and malnutrition      | Roots boiled prepared as porridge         | Tanzania                  | (Hedberg *et al.*, 1982; Mollel, 2013)                                     |

*Continued on next page*
Table 1 continued

| Medicinal Use                                           | Part used                                      | Country      | Reference                                                                 |
|--------------------------------------------------------|-----------------------------------------------|--------------|---------------------------------------------------------------------------|
| Menstrual problems                                     | Leaves                                        | Ethiopia     | (Paulos et al., 2016)                                                    |
| Protective charm                                       | Roots                                         | Uganda       | (Tabuti et al., 2003)                                                    |
| Respiratory problems (asthma, chest pains, colds and   | Leaf and root infusion and decoction are taken orally. | Kenya and Tanzania | (Augustino and Gillah, 2005; Waswala-Olewe et al., 2014)                  |
| cough)                                                 |                                               |              |                                                                           |
| Tuberculosis                                           | Leaves mixed with those of B. salicifolia     | Tanzania     | (Hedberg et al., 1982; Maroyi, 2019)                                     |
| Rheumatism                                             | Fruit and root decoction applied topically    | Kenya and Tanzania | (Augustino and Gillah, 2005; Waswala-Olewe et al., 2014)                  |
| Sexually transmitted infections (gonorrhoea and venereal diseases) | Root infusion and decoction are taken orally | Kenya        | (Mollel, 2013; Waswala-Olewe et al., 2014)                                 |
| Snakebite                                              | Root decoction applied topically              | Tanzania     | (Hedberg et al., 1982; Dharani, 2019)                                    |
| Snakebite                                              | Roots mixed with those of U. acuminata and bark of Boscia angustifolia A. Rich. applied topically | Kenya | (Waswala-Olewe et al., 2014)                                              |
| Tonic                                                  | Leaf and stem bark infusion and decoction are taken orally | Kenya | (Kimondo et al., 2015)                                                   |
| Toothache                                              | Roots mixed with those of C. cartilaginea and applied topically | Kenya | (Waswala-Olewe et al., 2014)                                              |
| Vertigo                                                | Root infusion and decoction are taken orally  | Tanzania     | (Hedberg et al., 1982)                                                   |
| Wounds                                                 | Leaf, root and stem bark decoction applied topically | Kenya | (Fratkin, 1996; Kimondo et al., 2015)                                    |
| Ethnoveterinary medicine (Babesiosis, red water disease, galactagogue and ticks) | Leaf infusion and decoction are taken orally or leaves mixed with those of Parvonia spp., Phytolacca dodecandra L’Hér. and Tagetes minuta L. taken orally | Ethiopia and Uganda | (Katunguka-Rwakishaya et al., 2004; Zorloni, 2008) |
Similarly, the roots of *M. triphylla* are mixed with those of *Capparis cartilaginea* Decne. As traditional medicine for headache, and the roots of *M. triphylla* are mixed with those of *U. acuminata* and bark of *Boscia angustifolia* A. Rich. and used against snakebites (Waswala-Olewe *et al.*, 2014). In Ethiopia, leaves of *M. triphylla* are mixed with those of *Parvonia* spp., *Phytolacca dodecandra* L’Hér. and *Tagetes minuta* L. and used as ethnoveterinary medicine for babesiosis or red water disease (Katunguka-Rwakishaya *et al.*, 2004).

**Phytochemical and pharmacological properties of *Maerua triphylla***

The ethnobotanical data about *M. triphylla* is related to three primary use categories which are centered around herbal medicine, fodder and a source of food, especially during difficult times. However, there is very little information available concerning the phytochemistry and pharmacological properties of the crude extracts or compounds isolated from the species. Little work has been done to characterize the nutritional attributes of *M. triphylla*, but a report on its leaves showed high amounts of proteins averaging 21.4% (Lehouérou, 1980; Mollel, 2005). There is need for nutritional evaluation of both the leaves and roots of the species as *M. triphylla* is widely used as wild food, both as supplementary and famine food (Luoga *et al.*, 2000; Lulekal *et al.*, 2011). There is also need to evaluate the toxicological properties of the species as uncooked roots are perceived as toxic, and boiling and re-boiling them several times is suggested to render them non-toxic and edible (Hamilton and Hamilton, 2006; Tairo, 2011).

(McLean *et al.*, 1996) identified the betaines and quaternary ammonium compounds such as 3-hydroxyprolinebetaine, glycine betaine, proline betaine and 3-hydroxy-1,1-dimethyl pyrrolidinium from dried aerial parts and branches of *M. triphylla*. (Loontjens, 2013) argued that quaternary ammonium compounds are potent biocides widely used in medical applications, cosmetics, disinfectants, surfactants and solvents. Some of these phytochemical compounds may be responsible for the biological activities of the species. (Zorloni, 2008) evaluated the acaricidal activities of acetone and hexane extracts of *M. triphylla* leaves against adult *Rhipicephalus pulchellus* ticks. The extracts exhibited good repellent properties against the ticks at 10.0% concentration. These findings support the use of leaf infusion and decoction against ticks in Ethiopia (Zorloni, 2008). (Matata *et al.*, 2018) evaluated the cytotoxicity activities of methanol: dichloromethane (1:1) extracts of *M. triphylla* leaves using the brine shrimp toxicity assay with Catharanthus roseus (L.) G. Don. Anticancer compounds characterized it as a positive control. The extract exhibited moderate activities with median lethal concentration (LC₅₀) value of 57.5 µg/ml in comparison to LC₅₀ value of 6.7 µg/ml exhibited by the positive control (Matata *et al.*, 2018). Therefore, the brine shrimp assay results corroborate ethnomedicinal applications of the roots and stem bark of the species against breast cancer and leukaemia in Tanzania (Augustino and Gillah, 2005; Matata *et al.*, 2018).

**CONCLUSIONS**

*Maerua triphylla* is known to be poisonous, and there is a need for detailed clinical and toxicological evaluations of crude extracts and compounds isolated from the species. Therefore, the widespread use of *M. triphylla* as food plant and source of traditional medicines throughout its distributional range suggest that the species is not taken at toxic dosages. But the use of *M. triphylla* as food and for the treatment of human diseases and ailments should be treated with caution and rigorous toxicological and clinical studies of the bark, fruits, leaves, roots and tubers, and compounds isolated from the species are necessary.

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**Conflict of Interest**

The authors declare that they have no conflict of interest for this study.

**REFERENCES**

Abdoul-latif, F. M., Osman, D. A., Fourreh, A. E., Abdallah, A. H., Merito, A., Hassan, S., Asfaw, Z., Kelbessa, E. 2016. Candidate medicinal plant species of Djiboutian pharmacopoeia for testing pharmacological activities on common microbial diseases. *International Journal of Pharmacy and Pharmaceutical Sciences*, 8(10):78–78.

Augustino, S., Gillah, P. R. 2005. Medicinal Plants in Urban Districts of Tanzania: Plants, Gender Roles and Sustainable Use. *International Forestry Review*, 7(1):44–58.

DeWolf, G. P. 1962. Notes on African Capparidaceae:
Dharani, N. 2019. Field guide to common trees and shrubs of East Africa. Struik Nature, Cape Town.

Elfers, R. A., Grahama, D. G., Dewolf, P. 1964. Capparidaceae Crown Agents for Overseas Governments and Administrations. Flora of Tropical East Africa., pages 30001562–30001564.

Fratkin, E. 1996. Traditional medicine and concepts of healing among Samburu pastoralists of Kenya. Journal of Ethnobiology, 16:63–98.

Gemedo-Dalle, Isselstein, J., Maass, B. L. 2006. Indigenous ecological knowledge of Borana pastoralists in southern Ethiopia and current challenges. International Journal of Sustainable Development & World Ecology, 13(2):113–130.

Hamilton, A., Hamilton, P. 2006. Plant conservation: An ecosystem approach. Earthscan, London., pages 324–324.

Hassan-Abdallah, A., Merito, A., Hassan, S., Aboubaker, D., Djama, M., Asfaw, Z., Kelbessa, E. 2013. Medicinal plants and their uses by the people in the Region of Randa, Djibouti. Journal of Ethnopharmacology, 148(2):701–713.

Hedberg, I., Hedberg, O., Madati, P. J., Mshigeni, K. E., Mshiu, E. N., Samuelsson, G. 1982. Inventory of plants used in traditional medicine in Tanzania. I. Plants of the families acanthaceae-cucurbitaceae. Journal of Ethnopharmacology, 6(1):29–60.

Ichikawa, M. 1987. A preliminary report on the ethnobotany of the SuieiDorobo in northern Kenya. African Study Monographs Supplement, 7:1–52.

Ilitis, H. H., Hall, J. C., Cochrane, T. S., Sytsma, K. 2011. Studies in the Cleomaceae I. On the Separate Recognition of Capparaceae, Cleomaceae, and Brassicaceae1. Annals of the Missouri Botanical Garden, 98(1):28–36.

Katunguka-Rwakishaya, R., Nalule, S., Sabiti, E. 2004. Organisation for social science research in eastern and southern Africa. Dryland Husbandry Project (DHP) Publication Series, (9):9–35.

Kers, L. E., Kubitzki, K., Bayer, C. 2003. The families and genera of vascular plants. Springer-Verlag, Berlin, 5:36–56.

Kimondo, J., Miron, J., Mutai, P., Njogu, P. 2015. Ethnobotanical survey of food and medicinal plants of the Ilkisonko Maasai community in Kenya. Journal of Ethnopharmacology, 175:463–469.

Lehouérou, H. N. 1980. Browse in Africa: The current state of knowledge. International Livestock Centre for Africa.

Loontjens, J. A. 2013. Quaternary ammonium compounds. In Moriarty, F., Zaat, J., S. A., Busscher, J., H., editors, Biomaterials associated infection, pages 379–404. Springer Science and Business Media.

Luulekal, E., Asfaw, Z., Kelbessa, E., Damme, P. V. 2011. Wild edible plants in Ethiopia: a review on their potential to combat food insecurity. Afrika Focus, 24(2):71–121.

Luoga, E. J., Witkowski, E. T. F., Balkwill, K. 2000. Differential utilization and ethnobotany of trees in kitulanghalo forest reserve and surrounding communal lands, eastern tanzania. Economic Botany, 54(3):328–343.

Maroyi, A. 2019. Boscia salicifolia: a review of its botany, medicinal uses, phytochemistry and biological activities. Journal of Pharmaceutical Sciences and Research, 11(8):3055–3060.

Matata, D. Z., Ngassapa, O. D., Machumi, F., Moshi, M. J. 2018. Screening of plants used as traditional anticancer remedies in mkuranga and same districts, Tanzania, using brine shrimp toxicity bioassay. Evidence-Based Complementary and Alternative Medicine.

Matthews, P. 1993. Medicinal plants of the Tanzanian coastal forest: A list of species with local names and applications. The Society for Environmental Exploration.

Mbuvi, M. T. E., Kungu, J. B., Gachathi, F. N., Leley, C. W. N., Muthini, J. M. 2019. Annotated checklist of plant species of Loita Forest (Entim e Naímina Enkiyio Forest or the forest of the lost child). Int. J. Adv. Res. Biol. Sci, 6(3):54–110.

McLean, W. F., Blunden, G., Jewers, K. 1996. Quaternary ammonium compounds in the Capparaceae. Biochemical Systematics and Ecology, 24(5):427–434.

Molrel, N. P. 2013. Maerua triphylla A. Rich. In: Schmelzer, G.H., Gurib-Fakim, A. (eds), Plant resources of tropical Africa 11(2): Medicinal plants 2. Backhuys Publishers, Wageningen., 11(2):166–168.

Palgrave 2002. Keith Coates Palgrave Trees of southern Africa. Struik Publishers, Cape Town.

Paulos, B., Fenta, T. G., Birsat, D., Asres, K. 2016. Health seeking behavior and use of medicinal plants among the Hamer ethnic group, South Omo zone, southwestern Ethiopia. Journal of Ethnobiology and Ethnomedicine, 12(1):44–44.

Tabuti, J. R. S., Lye, K. A., Dhillion, S. S. 2003. Traditional herbal drugs of Bulamogi, Uganda: plants, use and administration. Journal of Ethnopharmacology, 88(1):19–44.

Tairo, V. E. 2011. Utilization of woody plants during times of food scarcity from selected drylands.
of Iringa District, Tanzania. PhD Thesis. University of Nairobi.

Venter, F., Venter, J. A. 2015. Making the most of indigenous trees. Briza Publications, Pretoria.

Waswala-Olewe, B. M., Andanje, S. A., Nyangito, M. M., Njoka, J. T., Mutahi, S., Abae, R. 2014. Natural resources utilization by the Aweer in Bonilungi and Dodori national reserves, Kenya. Tanzania Journal of Forestry and Nature Conservation, 83:28–43.

Wild, H. 1960. Capparidaceae Flora Zambesica1. Crown Agents for Oversea Governments and Administrations. Crown Agents for Oversea Governments and Administrations, pages 194–245.

Zorloni, A. 2008. Evaluation of plants used for the control of animal ectoparasites in southern Ethiopia. Oromiya and Somali regions doctoral dissertation.