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## RESEARCH ARTICLE

### ETHNOBOTANICAL SURVEY OF ANTIMALARIAL PLANTS OF ODISHA, INDIA

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#### ABSTRACT

Malaria is one of the most common major health problems all over the world. In developing countries, where malaria is endemic, depend strongly on traditional medicine as a source for inexpensive treatment of this disease. It is important that antimalarial medicinal plants are investigated, in order to establish their efficacy and to determine their potential as sources of new antimalarial drugs. In this study, we evaluated the claimed antimalarial properties of eighty nine plants used in traditional medicine against malaria fever, mainly Odisha regions. However, traditional remedies against malaria are practised among the rural communities because of ease of availability and convenience and also due to social, psychological and cultural reasons. Eighty nine plant species belonging to 49 families were documented during the study. Asclepiadaceae, Apocynaceae, and Fabaceae families represented the species most commonly cited in treatment of malaria.

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#### INTRODUCTION

Malaria is a global disease but predominant in tropics. Medicinal plants, since times immemorial, have been used in virtually all cultures as a source of medicine. In India, herbal medicine dates back several thousand years to the Rig-Veda, the collection of Hindu sacred verses (Agbedhanusi *et al.*, 1998). This has led to a system of health care known as Ayurvedic medicine. In view of the problems associated with antimalarial drug resistance, new drugs or drug combinations are urgently required today for treatment of malaria. Plants have always been considered to be a possible alternative and rich source of new drugs and most of the antimalarial drugs in use today. The greatest problem associated with this treatment is emergence of Drug resistance which leads to treatment failure in significant number of cases (Hoareau *et al.*, 1999) Literature pertaining to medicinal plants of Odisha in phytotherapy has always been a part of the system itself like any other region in India. There is a vast scope for medicinal plant heritage in tribal areas of Odisha for biorespecting of plant based on traditional practices among the tribal healers to meet the health care. Botanical survey of India has done pioneering work on the tribes of Odisha during 1970-1971 (Saxena and Dutta, 1975).

Since then a number of ethnobotanical studies have been carried out on the various tribe communities of Odisha

#### Importance of indigenous system

Medicinal use of plants seems to have been developed by ethnic races through trial and error methods. As time rolled by, each tribe added the medicinal power of herbs in their area to the knowledgebase. Many drugs commonly used today are of herbal origin. Of late about 25% of the prescriptions dispensed in developed nations contain at least one active ingredients derived from plant material either extracted from plants or synthesized to mimic the natural plant compound (Makinde J.M. *et al.*, 1985). Today there is a renewed interest in investigating plants for medically useful compounds, with some of the leading pharmaceutical and research institutions involved in this search. Several important drugs used in modern medicine have come from medicinal plant studies, eg, taxol/paclitaxel, vinblastine, vincristine, topotecan, irinotecan, etoposide, teniposide, *etc.* the linking of the indigenous knowledge of medicinal plants to modern research activities provides a new approach, which makes the rate of discovery of drugs much more effective than with random collection. (Kong *et al.*, 2003). According to World Health Organization (WHO), nearly four billion people accounting roughly for 66.6% of the world population employ plants and plant products for primary health care in one form or the other (Penso, 1976).

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Table 1.Plants having Antimalarial activities:

| SR no | Name of plant   | Family           | Parts            | Methods of preparation,modes of Administration and uses   | Local name  | Locality    | Name of the tribes |
|-------|---|------------------|------------------|---|-------------|-------------|--------------------|
| 1.    | <i>Andrographis paniculata</i> (Burm.f.) Wall.ex.Nees | Acanthaceae      | Leaf             | Leaf paste mixed with country honey is administered orally twice a day for three days.  | Bhuinimba   | Udala       | Santal             |
| 2.    | <i>Diplazium esculentum</i> (Retz)sw.                 | Athyriaceae      | Rhizome          | Paste mixed with light warm water is given twice a day for five days.   | Bot         | Simlipal    | Santal             |
| 3.    | <i>Aegle marmelos</i> (L.)Corr                        | Rutaceae         | Root             | Root paste is taken in empty stomach twice a day for 15 days.   | Bela        | Lathikotha  | Kondh              |
| 4.    | <i>Alstonia scholaris</i> (L.)R.Br.                   | Apocynaceae      | Leaf             | Half tea spoon full decanded leaf is mixed with honey and administered thrice a day for one week.                                       | Saptaparna  | Dabugaon    | Gond               |
| 5.    | <i>Calotropis gigantea</i> (L.) R.Br                  | Asclepiadaceae   | Root             | Root paste mixed with country honey is administered orally twice a day for three days.  | Arakha      | Daspalla    | Sabar              |
| 6.    | <i>Achyranthes aspera</i> L.L..                       | Amaranthaceae    | Root paste       | Root paste is taken orally with old jaggery twice a day for 10 days.  | Apamaranga  | Khajuripada | Kondh              |
| 7.    | <i>Aeschynomene indica</i> L.                         | Fabaceae         | Leaf and Stem    | Juice of the young stem and leaf along with cumeen seeds are made in to paste and taken twice a day for seven days.                     | Lajuari     | Harisankar  | Munda              |
| 8.    | <i>Asparagus racemosus</i> Willd.                     | Liliaceae        | Root             | Decoction of root is given twice a day after lunch and dinner for fifteen days.   | Satawari    | Baliguda    | Sabar              |
| 9.    | <i>Cissampelos pareira</i> L.                         | Menispermaceae   | Root             | Root paste is taken twice a day for one week in case of Chronic malaria.  | Akanbindhi  | Karanja     | Munda              |
| 10.   | <i>Costus speciosus</i> (Koenig)Sm.                   | Zingiberaceae    | Rhizome          | Paste of Rhizome( one tsp) is taken orally with old chirayata and honey twice a day for 10 days.  | checkikanda | Dabugaon    | Gond               |
| 11.   | <i>Ficus benghalensis</i> L.                          | Moraceae         | fruits           | Fruits with cumeen seeds are made in to paste and taken twice a day for seven days.   | Baro        | Hemagiri    | Kolha              |
| 12.   | <i>Saccharum spontaneum</i> L.                        | Poaceae          | Root             | Decoction of root is given in severe fever for three days.  | Puyal       | Chandipur   | Santal             |
| 14.   | <i>Woodfordia fruticosa</i> ( L.)Kurz                 | Lythraceae       | Leaves           | Decoction of leaf is given in severe fever for one week.  | Dhataki     | Barbil      | Munda              |
| 13.   | <i>Adina cordifolia</i> (Roxb.)Hook.f.ex Brandis      | Rubiaceae        | Stem and bark    | Juice of stem and bark with cumeen seeds are made in to paste and taken twice a day for seven days.                                     | kurum       | Chandahandi | Gond               |
| 14.   | <i>Aristolochia indica</i> L.                         | Aristolochiaceae | Leaves and root  | Decoction of root and leaf is given twice a day for one week in case of chronic fever .   | Panairi     | Khajuripada | Saora              |
| 15.   | <i>Bacopa monnieri</i> (L.)Pennell                    | Scrophulariaceae | Leaf             | Leaf juice mixed with black pepper are made in to paste and taken twice a day for five days .   | Brahmi      | Khandapada  | Kolha              |
| 16.   | <i>Caesalpinia bonduc</i> (L.)Roxb                    | Caesalpiniaceae  | Leaf             | Leaf juice with old jaggery is given thrice a day for one week  | Gila        | Rayagada    | Saora              |
| 17.   | <i>Cassia tora</i> L.                                 | Caesalpiniaceae  | Seeds            | Decoction of seeds are given in severe fever for three days   | Chakunda    | Manamunda   | Bathudi            |
| 18.   | <i>Holarrhena pubescens</i> (Buch-Ham.)Wall.ex G.Don  | Apocynaceae      | Stem and bark    | Juice of stem and bark with cumeen seeds are made in to paste and taken twice a day for ten days  | Korei       | Kapilash    | Kolha              |
| 19.   | <i>Nyctanthes arbour-tristis</i> L.                   | Oleaceae         | Leaves           | Leaf juice mixed with black pepper are made in to paste and taken twice a day for six days.   | Gangaseoli  | Raikia      | Kondh              |
| 20.   | <i>Vitex peduncularis</i> Wall.ex.Schauer             | Verbenaceae      | Leaves           | An infusion of leaves are made in to paste and taken once a day for ten days  | Madhurgudia | Panposh     | Bhumija            |
| 21.   | <i>Eclipta prostrata</i> (L.)L.                       | Asteraceae       | Leaves           | Decoction of dried Leaf with tea leaf tincture is administered orally twice a day for five days.  | Bhringaraj  | Kodinga     | Bathudi            |
| 22.   | <i>Pongamia pinnata</i> (L.)Pierre                    | Fabaceae         | Leaves and seeds | Half tea spoon full decoded leaf and paste of seed is mixed with coconut water and lime water is administered twice a day for one week. | karanja     | Maidalpur   | Bathudi            |
| 23.   | <i>Tinospora cordifolia</i> (Willd.)Hook.f.& Thoms.   | Menispermaceae   | Young stem       | Young stem juice is taken thrice a day for one week preferably after food   | Guluchi     | Saptasajya  | Munda              |

Continue.....

|     |  |                  |                    |   |                 |              |         |
|-----|--|------------------|--------------------|---|-----------------|--------------|---------|
| 24. | <i>Alstonia scholaris</i> (L.)R.Br.                  | Apocynaceae      | Stem bark          | Stem-bark juice with light hot water is taken once a day for 10 days after dinner                         | Chattina        | Anandapur    | Juang   |
| 25. | <i>Bauhinia racemosa</i> Lam.                        | Caesalpinilaceae | Young leaf         | Decoction of young leaf used for chronic fever twice a day for one week after food .                      | kanchan         | G.Udayagiri  | Kolha   |
| 26. | <i>Justicia adhatoda</i> L.                          | Acanthaceae      | Leaves             | Fresh leaf juice mixed with half tsp. full honey is taken in empty stomach once a day for one week        | Vasak           | Chandaka     | Munda   |
| 27. | <i>Acacia leucophloea</i> (Roxb.) Willd.             | Mimosaceae       | Leaf               | Leaf juice mixed with cumeen seeds are made in to paste and taken twice a day for six days                | Gohira          | Ranpur       | Kondh   |
| 28. | <i>Caesalpinia crista</i> L.                         | Caesalpinilaceae | Leaves             | Leaf juice is taken thrice a day for five days  | Gila            | Bonai        | Bhumija |
| 29. | <i>Cassia fistula</i> L.                             | Caesalpinilaceae | Leaves and flowers | Leaves and flower juice mixed with little salt are taken orally with honey thrice a day for 5 days        | sunari          | Indrabati    | Gond    |
| 30. | <i>Alangium salvifolium</i> (L.F.)Wang               | Alangiaceae      | Root juice         | Root juice mixed with little amount of Goat milk is orally taken for one week in case of Chronic malaria. | Ankula          | Rairangpur   | Munda   |
| 31. | <i>Amaranthus spinosus</i> L.                        | Amaranthaceae    | Leaf               | Leaf juice (one tea spoonful) is given to patients suffering from chronic fever twice a day for one week  | Kantareutia     | Nayagarh     | Kolha   |
| 32. | <i>Gymnema sylvestre</i> (Retz.)R.Br.ex Schult.      | Asclepiadaceae   | Leaf               | Leaf juice with slight honey is taken thrice a day for seven days   | Mera-singi      | Umerkote     | Gond    |
| 33. | <i>Hemidesmus indicus</i> (L.)R.Br.                  | Periplocaceae    | Leaf               | Decoction of leaf is given in chronic fever.  | Anantamula      | Raighar      | Gond    |
| 34. | <i>Lagerstroemia parviflora</i> (Rox b.)             | Lytharaceae      | Root and bark      | Juice of root and bark with coriander seeds are made in to paste and taken twice a day for seven days.    | chhena          | Kunaria      | Shabar  |
| 35. | <i>Madhuca indica</i> L.                             | Sapotaceae       | Bark               | Bark juice is taken once a day for one week   | Moha            | Lulung       | Santhal |
| 36. | <i>Mimosa pudica</i> L.                              | Mimosaceae       | Whole plant        | Whole plant juice is taken orally in case of severe fever   | lajkuli         | Malkangiri   | Bonda   |
| 37. | <i>Pergularia daemia</i> (Forssk.)Chiov.             | Asclepiadaceae   | Tender leaves      | Decoction of the leaves (1 tea spoon full) with amla juice is taken after food once a day for one week    | utrali          | Karangia     | Kolha   |
| 38. | <i>Wrightia arborea</i> (Dennst.)Mabb.               | Apocynaceae      | Root               | Decoction of root is given in severe fever  | Pita karuan     | Kashipur     | Kharia  |
| 39. | <i>Oldelandia corymbosa</i> L.                       | Rubiaceae        | Leaves             | Leaf juice with little salt is given orally twice a day for ten days                                      |                 | Pattamundai  | Santal  |
| 40. | <i>Croton bonplandianus</i> Baill.                   | Euphorbiaceae    | Leaf               | Decoction of leaf is given in case of chronic fever.  | Ban mirchi      | Harishankar  | Gadaba  |
| 41. | <i>Abutilon indicum</i> (L.)Sweet                    | Malvaceae        | Roots              | Decoction of root is given in severe fever.   | Pedi-pedica     | Phurlijharna | Gadba   |
| 42. | <i>Drymaria cordata</i> (L.)Willd.ex.Roem.& Schultes | Caryophyllaceae  | Plant juice        | Plant juice is taken orally for in case chronic malaria   |                 | Simlipal     | Santal  |
| 43. | <i>Adiantum incisum</i> Forssk.                      | Adiantaceae      | Rhizome            | Decoction of rhizome is taken twice aday for one week   | Banda           | Simlipal     | Santal  |
| 44. | <i>Centella asiatica</i> (L.) Urban                  | Apiaceae         | Whole plant        | Whole plant juice mixed with coconut milk is taken orally twice a day for ten days                        | Thalkuri        | Chandaka     | Kondh   |
| 45. | <i>Cymbopogon martinii</i> (Roxb.)wats.              | Poaceae          | Leaf               | Decoction of leaf is given in chronic fever.  | Goelkher        | Simlipal     | Santal  |
| 46. | <i>Diplocyclos palmatus</i> (L.)Jeffrey              | Cucurbitaceae    | Whole plant        | Paste of Whole-plant mixed with juice of sugarcane is taken orally twice a day for 5 days.                | Shivlinga       | Sunabeda     | Kharia  |
| 47. | <i>Dodonaea viscosa</i> (L.)Jacq.                    | Sapindaceae      | Leaves             | Leaf juice mixed with golmorich is taken once a day for 15 days.  | Mohra           | Bolani       | Munda   |
| 48. | <i>Lantana camara</i> L.                             | Verbenaceae      | Leaf               | Dried leaf powder mixed with light warm water is taken once a day for 10 days in case of chronic fever    | Naguari         | Khandadhar   | Bhuia   |
| 49. | <i>Plumbago zeylanica</i> L.                         | Plumbaginaceae   | Roots              | Root paste is taken in empty stomach once a day for one week  | Dhala chitaparu | Banapur      | Shabar  |
| 50. | <i>Sida acuta</i> Burm.f.                            | Malvaceae        | Stem               | Juice of stem with cumeen seeds are made in to taken twice a day for ten days                             | Bajramuli       | Kantamal     | Gond    |
| 51. | <i>Solanum torvum</i> Sw.                            | Solanaceae       | Root bark          | Root bark mixed with acyranthes aspera root is taken in empty stomach once a day for 15 days.             | Kathkoli        | Keonjhar     | Juang   |
| 52. | <i>Strychnos nux- vomica</i> L.                      | Strychnaceae     | bark               | Paste of bark mixed with water is taken orally twice a day for 10 days.                                   | Kocchila        | Nabarangpur  | Gond    |

Continue.....

|     |   |                  |                  |   |                 |               |         |
|-----|---|------------------|------------------|---|-----------------|---------------|---------|
| 53. | <i>Terminalia chebula</i> Retz.                           | Combretaceae     | Bark             | Bark paste mixed with old jaggery is taken twice a day for five days  | Harida          | Tikarapada    | Munda   |
| 54. | <i>Viscum articulatum</i> Burm. f.                        | Loranthaceae     | Whole plant      | Whole plant juice is mixed with country ghee is taken orally in case of Chronic malaria.  | Malang          | Daitari       | Kuolha  |
| 55. | <i>Erycibe paniculata</i> Roxb.                           | Convolvulaceae   | Bark             | Bark paste is boiled in water, and filtered. The decoction is administered once a day for seven days in case of chronic malaria | Chain katho     | Deogarh       | Kondh   |
| 56. | <i>Scindapsus officinalis</i> Roxb.Schott                 | Araceae          | Roots            | Cooled decoction of dried roots are given once a day after dinner for one week  | Gaja pipali     | Nabarangpur   | Gond    |
| 57. | <i>Chloroxylon swietiana</i> DC.                          | Rutaceae         | Young twig juice | Juice of young twig with cumeen seeds are made in to paste and taken twice a day for ten days                                   | Bherua          | Deogarh       | Kondh   |
| 58. | <i>Desmodium gangeticum</i> DC                            | Fabaceae         | Root             | Root paste mixed with country honey is administered orally twice a day for three days   | Salaporni       | Kaptipada     | Bathudi |
| 59. | <i>Ixora arborea</i> roxb.                                | Rubiaceae        | Stem             | Tender stem paste is given once a day for one week  | Patrakaria      | Arjunpur      | Saora   |
| 60. | <i>Cassia occidentalis</i> L.                             | Caesalpiniaceae  | Root             | One cupful extract of fresh root juice is given orally twice a day for fifteen days   | Kasinda         | Hemagiri      | Kolha   |
| 61. | <i>Polygonum strigosum</i> R.Br.                          | Polygonaceae     | Leaf             | Leaf paste rubbed on forehead daily twice a day for 3 days to get relief from high temperature                                  | Chirarita       | Chalanti      | Santal  |
| 62. | <i>Vernoria cinerea</i> (L.)Less.                         | Asteraceae       | Root             | Root paste mixed with country honey is administered orally twice a day for three days   | Poka-sungo      | Niligiri      | Santal  |
| 63. | <i>Hemidesmus indicus</i> (L.)R.Br.                       | Asclepiadaceae   | Root             | Decoction of root is given once a day for three days in case of severe fever and  | Thapa           | Khajuripada   | Kondh   |
| 64. | <i>Holarrhena pubescens</i> (Buch.-Ham)Wall.ex G.Don      | Apocynaceae      | Bark             | Paste of bark with country honey is administered orally twice a day for 5 days.   | Indrajala       | Laxanpur      | Kisan   |
| 65. | <i>Barringtonia acutangula</i> (L.)Gaertn.                | Barringtoniaceae | Roots            | Decoction of root is given in shivering fever   | Hinjal          | Athagarh      | Kondh   |
| 66. | <i>Celastrus paniculata</i> Willd.                        | Celastraceae     | Seeds            | Seed paste is rubbed on forehead twice a day for 3 days in case of severe temperature   | Pengue          | Harisankar    | Gond    |
| 67. | <i>Acorus calamus</i> L.                                  | Aracaceae        | Rhizome          | Paste of Rhizome is taken orally with twice a day for 10 days   | Vacha           | Purunakot     | Munda   |
| 68. | <i>Sesbania grandiflora</i> (L.)poir.                     | Fabaceae         | Flower juice     | Flower juice is orally taken twice a day for one week.  | Agasthi         | Tumudibandha  | Kondh   |
| 69. | <i>Stereospermum colais</i> (Buch.-Ham.ex.Dillw)Mabberley | Bignoniaceae     | Root             | Root paste mixed with country honey is administered orally twice a day for three days   | Patuli          | Nrasinghanath | Saora   |
| 70. | <i>Toddalia asiatica</i> (L.)Lam.                         | Rutaceae         | Root             | Root paste mixed with country honey is administered orally twice a day for three days   | Tundapuda       | Karlapat      | Paroja  |
| 71. | <i>Alternanthera sessilis</i> (L.)R. Br. Ex DC            | Amaranthaceae    | Whole plant      | Whole plant juice is taken orally in case of severe temperature   | kantaneutia     | Bhadaghoda    | Santal  |
| 72. | <i>Baliospermum montanum</i> (Willd.)Muell.-Arg.          | Euphorbiaceae    | Roots            | Root paste mixed with country honey is administered orally twice a day for three days   | Kanaka          | Nrasinghanath | Saora   |
| 73. | <i>Biophytum sensitivum</i> (L.)DC.                       | Oxalidaceae      | Whole plant      | Whole plant juice is administered once a day for three days after post malaria treatment to reduce weakness                     | Chhota lajkulii | Bonai         | Munda   |
| 74. | <i>Boswellia serrata</i> Roxb.ex.colebr.                  | Burseraceae      | Stem bark        | Stem bark juice is taken orally twice a day for seven days.   | Salia           | Kapilash      | Kolha   |
| 75. | <i>Butea monosperma</i> (Lam.)Taub                        | Fabaceae         | Young leaf       | Young leaf juice mixed with its flower juice is taken twice a day for seven days.   | Palasa          | Satkosia      | Munda   |
| 76. | <i>Calycopteris floribunda</i> Lam.                       | Combretaceae     | Leaves           | Decoction of leaf is given in chronic fever   | Kokundia        | Barbil        | Bathudi |
| 77. | <i>Cardiospermum halicacabum</i> L.                       | Sapindaceae      | Stem             | Tender stem paste is rubbed on forehead to reduce the temperature   | Kanphuta        | Narla         | Gond    |
| 78. | <i>Careya arborea</i> Rox b.                              | Barringtoniaceae | Stem-bark        | Stem-bark juice mixed with sugarcandy is orally taken twice a day for 10 days.  | Kumbhi          | Devkund       | Munda   |
| 79. | <i>Clerodendrum Viscosum</i> Vent                         | Verbenaceae      | Leaves           | Two spoonful extract of leaf is given twice a day for five days in case of high temperature                                     | Madhavi         | Kantamal      | Kondh   |
| 80. | <i>Elephantopus scaber</i> L.                             | Asteraceae       | Roots            | Fresh root are made in to paste and orally taken once a day for three days  | Tutamuli        | Umerkote      | Gond    |
| 81. | <i>Holostemma annulare</i> (Roxb.)Schum.syn.              | Asclepiadaceae   | Roots            | Paste of root mixed with water is taken orally twice a day for 10 days  | Maran arak      | Malkangiri    | Bonda   |
| 82. | <i>Melia azadirachta</i> L.                               | Meliaceae        | Roots            | Fresh root paste are mixed with sugar candy is taken orally twice a day for 5 days.   | Mahalimba       | Chandaka      | Santhal |
| 83. | <i>Morinda pubescens</i> Sm.                              | Rubiaceae        | Leaves           | Decoction of leaves are administered once a day preferably after dinner for 5 days  | Aachu           | Sonepur       | Saora   |
| 84. | <i>Oroxylum indicum</i> (L.)Benth.                        | Bignoniaceae     | Roots            | Rootpaste mixed with blackpeeper juice is taken twice a day after dinner for one week.  | Phemphana       | Harbhanga     | Saora   |
| 85. | <i>Phyllanthus amarus</i> Schum&Thonn.                    | Euphorbiaceae    | Whole plant      | Whole plant juice mixed with sugarcandy is taken orally twice a day for 7 days.   | Bhuinamala      | Barbera       | Kondh   |
| 86. | <i>Premna corymbosa</i> (Burm.f.)Rottl.& Willd.           | Verbenaceae      | leaves           | Decoction of leaves is given in case of severe fever  | Bhutabairi      | Jharsuguda    | Bhuia   |
| 87. | <i>Withania somnifera</i> (L.)Dunal.                      | Solanaceae       | Leaves           | Leafpaste mixed with blackpeeper is taken once a day for one week.  | Aswagandha      | Bargarh       | Gond    |
| 88. | <i>Wrightia tinctoria</i> (Roxb.)R.Br.                    | Apocynaceae      | Bark             | Decoction of Bark is taken once a day for five dayspreferably after food in case of severe weakness after post malaria          | Pitakaruan      | Talabasta     | Kolha   |



Field surveys were executed in such a way as to accommodate all relevant information in different stages of their life history.

### Field survey

Various Medicinal plants were identified and field trips were conducted at regular intervals in different seasons. Tribal uses of plants, were studied *in situ* by establishing close intimacy with the tribal healers. Folklore claims were documented along with voucher specimens. Local names are given in the list wherever it is available.

### Data recording

The detailed information about the plants, parts, dosages, duration, method of preparation, mode of administration to be taken etc. were recorded. The folklore claims as revealed by the practitioner in colloquial languages were recorded in the tape recorder. Where ever difficulties were encountered in understanding the language, the tapes were replayed before the tribal head and the correct meanings were ascertained.

### Criss-cross checking

Efforts were made to cross check the folklore claims. This study involved checking and rechecking of a particular folklore claim by the different dwellers of the same tribe in different forest pockets. This method was followed to clear many doubts regarding the use and identity of plant specimens.

### Critical identification

Plant identification was given highest priority. Identification of plant by the local name is non-scientific and hence was avoided. If the plant can not be identified, all the effort of ethnobotanical recordings will become a futile exercise. 'The Flora of Orissa' (1994-1996) by Saxena and Brahmam, in four volumes was consulted for proper identification.

### Botanical Families Involved in the Study

Various species of plants belonging to 49 different families were collected. Asclepiadaceae, Apocynaceae and Fabaceae families are the most represented followed by the other families as shown in Figure 1. Various plant parts are used by the tribals as shown in Figure 2.

## DISCUSSION

The present article brings out information on different medicinal plants used in various parts of world for the treatment of malaria. Eighty nine medicinal plants have been recorded here in for their use as anti-malarials (Table 1). Although traditional remedies are widely used to treat malaria, and are often more available and affordable than Western drugs, they are not without limitations. Some of the limitations include unpredictable efficacy, non-established dosage and the short and long term safety are not known. The development of new antimalarials from the highly active natural products, which have already been discovered, is crucial in order to overcome the increasing resistance of *Plasmodium* to available antimalarial drugs (Panda and Padhi, 2008). Therefore, there is a need to advance the work on plants which have already

been shown to have antimalarial activity through further *in vitro* and *in vivo* testing in animal models of malaria. Followed by sub-acute and chronic toxicity tests. This is likely to reveal suitable candidate molecules which may serve as leads which can be optimized followed by development into new antimalarials (Kantamreddi *et al.*, 2009).

### Conclusions

Indian medicinal plants possess tremendous therapeutic potential as indicated in the various citation as promising antimalarial agents. One of the key challenges in the fight against malaria is not just to develop effective and safe treatments, but also to make sure they are available to local people at a price that will allow widespread use (Wennen *et al.*, 1990). New antimalarials are also needed because resistance has rapidly been building up against existing treatments. The challenge ahead lies in determining the best alternative therapies for use now, the best prospect for drug development, regulatory approval and use in short term and the establishment of mechanisms and projects to ensure that improved drugs are sustainably discovered and developed into the future. Continued and sustainable improvements in antimalarial medicines research and development are essential for the world's future ability to treat and control malaria. The results in this study lend some credence to the use of the numerous active species in traditional medicine in the treatment of fever and malaria although the potencies of these active extracts would have to be tested and compared to those of the standard drug test.

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