Role of plants in treating cancer : a review.

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Abstract

Plants have been used for treating diseases since the dawn of modern civilization. Since time immemorial plants are used as traditional medicines for basic health care. But during the last century research have been focused on developing drugs from plants to treat cancer. Cancer is one of the world’s dangerous diseases and it is one of the leading causes of death globally. The number of cancer patients in the world is increasing rapidly. There are several treatment available for cancer like surgery, radiotherapy and chemotherapy but they are costly and have serious side effects.

Plants and plant derived products have proved effective and safe in the treatment and management of cancers. The present review is an attempt to describe some common plants that possess anticancer activity.

Introduction:-

Plants are the greatest gift from god to the mankind. Plants not only fulfill our basic needs to continue life but also provide valuable natural products that helps in curing disease and leads to a better life. In traditional system of medicines like Ayurveda, Unnani plants are used as medicines for basic health care but they have stood up to the test of time and contributed many novel compounds for preventive and curative medicine to modern science.

Cancer has become a major health problem worldwide. CANCER is an abnormal growth and proliferation of cells. Cancer cells usually invade and destroy normal cells. It is a dreadful disease because the patient suffers pain, disfigurement and loss of many physiological processes and ultimately leads to death. Cancer may be uncontrollable and incurable, and may occur at any time at any age in any part of the body. It is caused by a complex, poorly understood interplay of genetic and environmental factors. Most cancers are related to environmental, lifestyle, or behavioral exposures. The major causes of cancer are smoking, dietary imbalances, hormones and chronic infections leading to chronic inflammation. Cancer is an enormous global health burden, touching every region and socioeconomic group. According to American society of cancer, cancer accounts for about 1 in every 7 deaths worldwide – more than HIV/AIDS, tuberculosis, and malaria combined. In 2012, there were an estimated 14.1 million cases of cancer diagnosed around the world and 8.2 million cancer deaths.

There are several chemopreventive agents that are used to treat cancer, but they cause toxicity that prevents their usage. To find out effective treatments for cancer, research is being done throughout the world, which includes the use of plants to relieve and treat cancer patients. This treatment makes use of the compounds naturally present in plants especially secondary metabolities that posses ability to inhibit or kill carcinogenic cells.

Role of plants in treating cancer:-

From a wide variety of plant species there are more than one thousand plants that have been found to possess significant anticancer properties. While many molecules obtained from nature have shown wonders, there are a huge number of molecules that still remains to be tapped. Taxol, one of the most outstanding agents, obtained from yew tree has been found beneficial in treatment of refractory ovarian, breast and other cancers. Paclitaxel is a drug used to treat ovarian, breast, lung, pancreatic and other cancers. Another prominent molecule includes Podophyllotoxin extracted from the roots and rhizomes of Podophyllum species. Synthetic modification of this molecule led to the
development of Etoposide, known to be effective for small cell cancers of the lungs and testes. Camptothecin isolated from *Camptotheca acuminata* also have been extensively studied. Curcumin a polyphenol derived from the rhizome of turmeric is used for both cancer prevention and treatment. Other important molecules include Vincristine, Vinblastine, Colchicine, Ellipticine and Lepachol and many more.

Keeping in view the importance of plant species for the treatment of cancer, this study was planned to know about the medicinal plants and their use in cancer treatment. Present work is includes some common anti-cancer plant species present around us. This review includes 50 plants describing their scientific name, common name, plant part used, active principle, families and various cell lines used in different studies. These plants are used directly or their extracts made in different solvents or only active components are isolated from the plant and used against cancer. Different plant parts like seeds, roots, fruit, flower, bud, stem, leaves and sometimes the whole plant have been used in cancer treatment. The available literature pertaining to the present study is reviewed as follows:

**List of common anticancer plants:-**

| S. No | Plant Species / Family | Common Name | Active Principle /Extract | Plant part Used | Cell-lines Used and Reference |
|-------|------------------------|-------------|---------------------------|-----------------|-------------------------------|
| 1.    | *Aegle marmelos* L. Rutaceae | Indian beal | Methanol extract | Fr. | Anti-cancer<sup>11</sup> |
| 2.    | *Allium sativum* L. Liliaceae | Garlic | Allicin | Bu. | MCF-7 / HT-29 cells<sup>12</sup> |
| 3.    | *Amaranthus gangeticus* L. Amaranthaceae | Tandalja bhaji | Aqueous extract | ND | HepG2 / MCF-7<sup>13</sup> / Caco-2 |
| 4.    | *Asparagus racemos* L. Asparagaceae | Shatavari | Saponins(A4)(A5)(A6)A(7) Which have Sarsasapogenin / Glucose / Rhamnose | R | Human epidermal carcinoma<sup>14</sup> |
| 5.    | *Bauhinia variegata* L. Fabaceae | Kachnar | Ethanolic extract | ND | Ehrlich Ascites Carcinoma<sup>15</sup> |
| 6.    | *Beta vulgaris* L. Chenopodiaceae | Beet | Vitexin-2"O-rhamnoside / isorhamnetin 3- gentiobiosid / rutin | L | MCF-7<sup>16</sup> |
| 7.    | *Brassica chinensis* L. Brassicaceae | Pak choi | Sulforaphane / erucin | S | Anti-cancer<sup>17</sup> |
| 8.    | *Calotropis gigantea* L. Apocynaceae | Arka | Alcoholic / hydro-alcoholic(1:1) / aqueous; highest effect in alcoholic | R.Br. | Colo 320<sup>18</sup> |
| 9.    | *Camellia sinensis* L. Theaceae | Green tea | Epicatechin (EC) / epigallocatechin (EGC) / EC 3-gallate (EGC) / EGC 3-gallate (EGCG) | L | (HH870) / (DU145) / (HH450) / (HH639)<sup>19</sup> |
| 10.   | *Carica papaya* L. Caricaceae | Papaya | Aqueous extract | L | Jurkat, Molt-4, CCRF- CEM and HPBALL / K562 / Hela / (H9) / ARH77<sup>20</sup> |
| 11.   | *Catharanthus roseus* L. Apocynaceae | Peri winkle | Vinblastine/ vincristine | F | Anti-cancer<sup>21</sup> |
| 12.   | *Cedrus deodara* L. Pinaceae | Deodar | Quercetin / 8-C-methyl Quercetin | W, Ba. | Human epidermal carcinoma of |
| No. | Species Name | Family | Parts Used | Extraction Method | Plant Parts | Usage |
|-----|-------------|--------|------------|-------------------|-------------|-------|
| 13. | Curcuma longa L. | Zingiberaceae | Turmeric | Turmerin / curcumin | Rh. | Colorectal cancer |
| 14. | Datura innoxia L. | Solanaceae | Datura | Methanolic extract | L | HCT 15 Hep-2 |
| 15. | Dillenia indica L. | Dilleniaceae. | Elephant apple | Betulinicacid | Fr | Cancer cell lines |
| 16. | Eclipta alba L. | Asteraceae | Bhringraj | Steroidal Alkaloids | ND | M-109 |
| 17. | Eleusine indica L. | Poaceae | Methanol extract | WP | HeLa / A549 / MRC-5 cells |
| 18. | Euphorbia hirta L. | Euphorbiaceae | Asthma plant | Euphorbins A/ B/ C/ D/E/Euphorbianin/ leucocyanidol/camphol/ quercitrin and quercitol /Gallic acid/ myricitrin/ Betulinic acid | ND | Malignant melanomas/ squamous cell Carcinoma |
| 19. | Ficus bengalensis L. | Moraceae | Banyan | Leucopelargonidin-3-0-α-Lrhamnoside / leuco cynidin 3-0-α-D galactosyl cellobioside / glucoside / beta glucoside / pentatriacontan-5-one/beta 19-20 sitosterolalpha-D-glucose | Ba. | Anti-cancer |
| 20. | Ficus carica L. | Moraceae | Commom fig | Apigenin / apigenin 7-O-glucoside / kaempferol 3-Oglucoside / kaempferol 3,7-di-O-rhamnoside / quercetin and quercetin 3-O-glucoside | L T | Anti-cancer |
| 21. | Ficus hispida L. | Moraceae | Hairy fig | Ethanol water / methanol / water / methanol and ethyl acetate | Ba. | Anti-cancer |
| 22. | Garcinia densivenia L. | Clusiaceae | Gallic acid (3,4,5-trihydroxybenzoic acid) | ND | Anti-cancer |
| 23. | Ginkgo biloba L. | Ginkgoaceae | Ginko | Ginkgo-flavone glycosides / terpenoids / Ginkgolides and Bilobalides | L | HepG2 (BCRCNo. 60025) / Hep3B2.1-7 (Hep3B, BCRC No. 60434) |
| 24. | Hibiscus syriacus L. | Malvaceae | Rose of Sharon | Acetone extract / water extract | Ba. | A549 / H209 / H661 |
| 25. | Indigofera tinctoria L. | Fabaceae | Indigo or neelini | Methanol extracts | ND | HCT 116 |
| 26. | Jasminum sambac L. Oleaceae | | Jasmine or Mogra | Alkaloids / flavonoids / terpenoids / carbohydrates / Proteins / phenols / tannins / saponins / phytosterols | T W | Breast cancer |
| 27. | Jatropha curcas L. | Euphorbiaceae | Barbados nut | ND | L, St. | HepG2 / NCIH460 / HCT116 / HeLa |
| 28. | Lantana camara L. | Verbenaceae | Big sage | Different extract | R | Leukemia cell line |
| 29. | Luffa cylindrica L. | Sponge gourd | N-hexane / chloroform and ethyl | F | Anti-cancer |
| Order               | Family            | Species                             | Plant Part           | Compound(s)                                                                 | Cell Line(s)                                                                 |
|---------------------|-------------------|-------------------------------------|----------------------|-----------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 30.                 | Cucurbitacea      | *Lycium barbarum* L.                | Goji berry           | Polysaccharide- protein complex                                            | R, Ba. S180 cell<sup>40</sup>                                                 |
| 31.                 | Moraceae          | *Maclura tinctoria* L.              | Old fustic           | Glycosides                                                                 | St. Ba. Anti-cancer<sup>41</sup>                                              |
| 32.                 | Solanaceae        | *Marjorana hortensis* L. Labiaceae  | Marjoram             | Essential oils                                                            | L. Leukemia HL-60 / NB4cells<sup>42</sup>                                     |
| 33.                 | Solanaceae        | *Melissa officinalis* L. Lamiaeae   | Lemon balm           | Cardiac glycosides / flavonoids / alkaloids / tannins                      | L. Anticancer<sup>43</sup>                                                    |
| 34.                 | Olacaceae         | *Minquartia guianensis* L. Olacaceae| Black manwood        | Minquartynoic acid                                                        | St. Ba. Ovarian cancer cell lines<sup>44</sup>                                |
| 35.                 | Olacaceae         | *Ocimum gratissimum* L. Olacaceae   | Clove basil          | ND                                                                          | L. Prostate cancer / breast cancer<sup>45</sup>                              |
| 36.                 | Oleaceae          | *Olea europaea* L.                  | Olive                | Maslinic acid                                                             | ND. HT29<sup>46</sup>                                                         |
| 37.                 | Lamiaeae          | *Oreganum vulgare* L.               | Oregano              | Ethanol extract                                                            | ND. Caco2<sup>47</sup>                                                        |
| 38.                 | Poaceae           | *Oryza sativa* L.                   | Rice                 | Cyanidin (1) and malvidin                                                 | ND. U937<sup>48</sup>                                                         |
| 39.                 | Pinaceae          | *Pinus acutisleginum* L.            | NA                   | Aristolactams / 4,5-dioxoaoporphines                                      | ND. A-549, SK-MEL-2 and SK-OV-3<sup>49</sup>                                  |
| 40.                 | Piperaceae        | *Piper betel* L. Piperaceae         | Betel                | Aristolactams and 4,5-dioxoaoporphines                                    | ND. Anti-cancer<sup>50</sup>                                                  |
| 41.                 | Piperaceae        | *Piper longum* L. Piperaceae        | Long pepper          | Beta –sitosterol                                                           | Fr. Anti-cancer<sup>51</sup>                                                  |
| 42.                 | Apocynaceae       | *Plumeria rubra* L. Apocynaceae     | Frangipani           | Ethanolic extract                                                         | L. Ehrlich ascites carcinoma cell<sup>52</sup>                               |
| 43.                 | Berberidaceae     | *Podophyllum hexandrum* L.          | Himalayan may apple  | Podophyllotoxin                                                           | R, Rh. Anti-cancer<sup>53</sup>                                               |
| 44.                 | Rubiaceae         | *Rubia cordifolia* L.               | Indian madder or Manjista | 1-hydroxytectoquinone                                                     | ND. Ehrlich ascites / carcinoma A375 Hep2 U937<sup>54</sup>                   |
| 45.                 | Solanaceae        | *Solanum indicum* L. Solanaceae     | Brihati              | β-Sitosterol / β-sitosterol glucoside / dioscin/methyl \ protoprosapogenin A of dioscin / methy \ protodioscin / protodioscin | WP. Colo-205/KB HA22T / Hep-2 GBM8401/ TSGH / Hl477<sup>55</sup> and (PC-12)10 and (HCT116) cells<sup>56</sup> |
| 46.                 | Solanaceae        | *Solanum nigrum* L. Solanaceae      | Black nightshade     | Steroidal glycoside / galactopyranoside / Solamargine / solasonine        | WP. (PC-12)10 and (HCT116) cells<sup>56</sup>                                |
| 47.                 | Malvaceae         | *Waltheria indica* L.               | Sleepy morning       | Epicatechin / quercetin / tiliroside                                       | WP. Anticancer<sup>57</sup>                                                   |
| 48.                 | Ashwagandha       | *Withania somnifera* L.             | Withanolides / withaferin A / B L NCI-H460/                           |                                                                            |
Conclusion:
Cancer has become an unsolved mystery for the researchers and plants have proved the key to solve that mystery. Natural products discovered from medicinal plants have played an important role in treatment of cancer. In this review some anticancer plants have been presented. These plants possess good immunomodulatory and antioxidant properties leading to anticancer activity. In conclusion this article provides the knowledge about anticancer medicinal plants, their active principle etc. This will also prove beneficial for further studies in development of novel anticancer drugs from medicinal plants.

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