



# A BRIEF REVIEW ON PHARMACOLOGICAL SIGNIFICANCE OF *PARKINSONIA ACULEATA*.

<sup>1</sup>Revanayya C. Swami, <sup>2</sup>Darshan S. Lokhande, <sup>3</sup>Rakesh G. Gaikwad.

<sup>1</sup>Author, <sup>2</sup>Author, <sup>3</sup>Author.

<sup>1</sup>Department of Pharmacognosy and Phytochemistry.

<sup>1</sup>Lokmangal College of Pharmacy, Wadala, Solapur, Maharashtra, India.

## ABSTRACT:-

The medicinal herbs are the nature's blessing for mankind to have healthy and disease-free style of living. India is a unique nation of pharma culture in the universe where the medicinal plant included in the component of classical convention for complementing the quality of life. *Parkinsonia aculeata* plant that belongs to the family Fabaceae and it is a shrubby tree, which grows up to the height of 4-10 m. Presently *Parkinsonia aculeata* can be found in most tropical, sub-tropical and Mediterranean countries. In this article pharmacological significance of *Parkinsonia aculeata* is precisely covered with different medicinal activities. The phytoconstituent evaluation of the leaves, flowers, seeds and stems of *Parkinsonia aculeata* has exposed the presence of glycosides, flavonoids, alkaloids, saponins, tannins, phenolic compound, gums, and reducing sugars. *Parkinsonia aculeata* shows several health benefits because of the presence of a large number of bioactive phytochemicals. Habitually *Parkinsonia aculeata* is also known to the medicinal shrub for its beneficial effects as antimicrobial, anti-cancer, anticonvulsant, analgesic, antipyretic and anti-inflammatory, antidiabetic, antispermatic and antimalarial activities. A few plant species that have health-promoting effects and have been used as traditional foods and herbal remedies, though a limited information has been documented on their specific biological properties. Moreover, medicinal plants are low cost and tend to have fewer side effects than synthetic drugs. In this review, the introduction about plant, method of extraction of various parts of plants, bioactive constituents, pharmacological significance with result and discussion are succinctly explained.

**KEY WORDS:-***Parkinsonia aculeata* Linn., Fabaceae, Anticonvulsant, Antispermatic, Sialic acid, Sperm motility.

## INTRODUCTION:-

Traditionally herbal medicinal plants are used from very long period and trace its roots to ancient civilizations. They are important as medicines before the availability of synthetic drugs. Venerable herbal infusion, decoction were household medicament for common ailments. *Parkinsonia aculeata* is a tree from the family Fabaceae. It is a spiny deciduous tree which can grow up to 4 to 10 meters in height. It remains green throughout the year. The bark, branches and the twigs are yellow green or blue green in colour. *Parkinsonia aculeata* is well known as medicinal plant. Belongs to the family Fabaceae (pea family). This plant shows the essential role in the human life. In response to the global need for whole information on medicinal plants, the present review compiles all relevant information on the traditional, therapeutic, biological, chemical and all details of *Parkinsonia aculeata*.<sup>[1]</sup>

Commonly known as parkinsonia, and Ram babul, The leaves and barks of the plant have crucial therapeutic values on a lot of diseases. Like it has anti-microbial activity, anti-bacterial activity, antioxidant, and also used as anti-healing, anti-diabetic, anti-convulsant, and as anti-cancer activity. The ethanolic extract of leaves of *Parkinsonia aculeata* has a helpful effect in the treatment of piles or hemorrhoids. The use of herbs has conventional medicinal value and the products are used for the treatment of many ailments has been generally considered as therapeutically effective. *Parkinsonia aculeata* plant which contains substances, chemicals or phytoconstituents like alkaloids, flavonoids, glycosides, saponins, tannins, phenolic compounds, gums, reducing sugars, etc. which are used for therapeutic purposes.<sup>[2]</sup> It was used in Indian traditional system of medicine

for empirical treatment of piles or hemorrhoids, and microbial infection. In addition to these properties, *Parkinsonia aculeata* has a wide range of pharmacological activities including piles, Antimalarial and antimicrobial properties. *Parkinsonia aculeata* is a Shrubby tree, smooth yellow greenish Bark, in every season the tree is fully greenery, branches armed with strong spines of Stipule or leaf rachis origin. It is often branching near the ground with a very open crown of spreading branches and very thin dropping foliage.

**scientific classification:-**

Kingdom	Plantae
Division	Magnoliophyta
Class	Magnoliopsida
Order	Fabales
Family	Fabaceae/ Leguminosae
Genus	Parkinsonia
Species	<i>Parkinsonia aculeata</i>

**vernacular classification:-**

English	<i>Parkinsonia aculeata</i>
Marathi	Ram babul
Hindi	Vilayti kikar
Kannada	Parangi jali
Tamil	Sinia tumana
Telugu	Seemathumma
Other	Jerusalem, Jelly bean tree

***PARKINSONIA ACULEATA:***

The plant of *parkinsonia aculeata* was found in all over countries. Mainly in western Australia, the northern territory, America, and in India. The plant materials were collected from the site of origin of plant. Such as leaves, seeds, flowers, stems are majorly used for the preparation of the different formulations. Further formulations are used for the treatment of various diseases.



*parkinsonia aculeate.*

**EXTRACTION OF PHYTOCONSTITUENTS FROM LEAVES OF *PARKINSONIA ACULEATA*:**

The leaves of *Parkinsonia aculeata* were collected from the areal region of India. The collected leaves were kept for drying in a room temperature for the period of one week. After drying, the dried leaves were crushed in a powdered form. The powder was dissolved in alcohol using soxhlet extraction apparatus at specific temperature. After completion of particular cycles of extraction, the extract was collected and the collected product was filtrated using whatman filter paper and at final the extract was collected in a suitable containers. Further these extracted product was used for the study of different analytical processes. <sup>[12]</sup>

## PHARMACOLOGICAL APPLICATIONS OF *PARKINSONIA ACULEATA*:-

### ANTI MICROBIAL ACTIVITY:

The ethanolic leaf extracts of *Parkinsonia aculeata* against *S. typhi* shows the antimicrobial activity. The antibacterial activity of *Parkinsonia aculeata* ethanolic extracts was tested against *E. coli*, *S. typhi*, *K. pneumonia* bacteria. The results indicated that the three concentrations were effective against tested bacteria. Besides, the effects of pH caused a significant variation in the zone of inhibition.<sup>[1]</sup> The maximum antibacterial activity has been checked for ethanolic extract against three bacterial strains. The optimization or maximum antibacterial activity has been checked for ethanolic extracts against bacterial species. After the analysis, the final parameters was determined, and it was concluded that temperature, concentration and pH were significant among the three factors studied against the *E. coli*, *S. typhi*, and *K. pneumonia*. By using Response Surface Methodology (RSM). Hence, it is suggested from this review work that *Parkinsonia aculeata* when used in proper PH, Temperature, and Concentration, can be working to treat profuse bacterial inflammations in the biological systems.<sup>[3]</sup>

### ANALYTICAL EVALUATION OF *PARKINSONIA ACULEATA*:-

#### GAS CHROMATOGRAPHY-MASS SPECTROMETRY (GC-MS):-

The essential oil of *Parkinsonia Aculeata* was treat with GC-MS analysis using Thermo Fisher Scientific U.S.A, TRACE DSQ Mass spectrometer, column type: - THERMO TR-5ms SQC, the injector temperature was 220, temp. program:- 60 °C then 240 °C at 6 °C/min.

GC/MS chromatogram of the essential oil of *Parkinsonia aculeata* GC/MS chromatogram of the essential oil of *Parkinsonia aculeata*.<sup>[1]</sup>

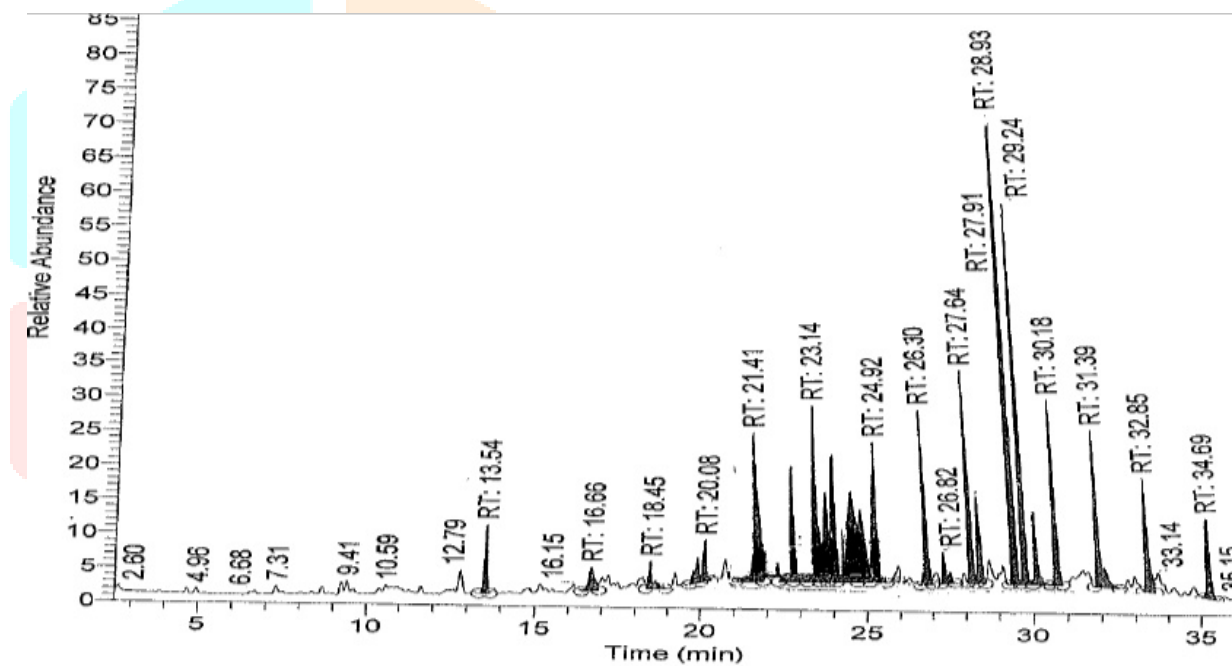


fig. gc/ms chromatogram of the essential oil of *parkinsonia aculeata*.

### IDENTIFICATION OF THE COMPOUNDS:-

Identification of the essential oil components was based on GC retention time and matching with Wiley 275 L library additionally to the comparison the dissolution design of mass spectra with the literatures.

### RESULTS AND DISCUSSION:-

Antimicrobial screening for the essential oil of *Parkinsonia aculeata* was assessed against Gram positive bacteria *Staphylococcus aureus* and *Staphylococcus epidermidis* and Gram negative bacteria *Pseudomonas aeruginosa* and *Escherichia. Coli* also fungi *Aspragillus niger* and *Candida albicans* at a dose of 50mg/ml tested by determination of the zone of inhibition. It was found to be strong activity against *E.coli*, *S.pneumonia*, *A.fumigates* and *S. racemosum* while the others showed no activity when compare to control standard. Providentially, the extract of *Parkinsonia aculeata* leaves showed maximum antibacterial activity opposed to *E.coli* with zone of inhibition  $23 \pm 0.02$ mm at concentration of 500mg/ml and *P. aeruginosa* with zone of inhibition  $21.12 \pm 0.033$ mm at 10mg/disc concentration. Hexane and methanol extracts of *Parkinsonia aculeata* was found to be active against various bacteria at concentration. In different study, the crude ethanol, petroleum ether and chloroform extracts of the leaves of *Parkinsonia aculeata* were found to inhibit many bacteria. The

minimal inhibitory concentration of the crude extracts were reported in between 35-50 mg/ml. The reports put forward that plants containing phenolic compounds like tannins, consequently, the principle active compounds detected may be responsible for antibacterial activity of the tested organisms. Hence it confirms that our results and the presence of phenolic components in the essential oil of *parkinsonia aculeata* plant.

#### **ANTI CANCER ACTIVITY:-**

Cancer is the uncontrollable programmed growth of the abnormal cell in the body. It can occur in any part of the body which affects to the normal mechanism of a working cell. There are different types of cancers which are the leading to cause of death. Tobacco is the major cause of cancer, which is responsible for patients cancer deaths. The cancer treatment includes many treatments such as surgery, chemotherapy, and radiation therapy. These all treatments having painful side effects.<sup>[9]</sup> Such as chemical changes in body, weight loss, difficulty in breathing, fatigue, and hair loss. Plant of *Parkinsonia aculeata* having source of providing the latest chemoprotective potential against cancer. The ethanolic leaves extract using soxhlet extraction apparatus of *Parkinsonia aculeata* contains parkinsonin-A, parkinsonin-B, and parkintin, have shown that some flavonoids modulate the metabolism and can contribute to cancer prevention.

In the In-vitro antimutagenic and DNA protecting potential of methanol, hexane, n-butanol and aqueous extract of *Parkinsonia aculeata*. It was evaluated by two different assays, the Ames assay and DNA nicking assay. The study was found that all the extract inhibited DNA damage by the hydroxyl radicals. The study found that *Parkinsonia aculeata* is effectively act as antimutagenic against 4-Nitro-o-phenylenediamine and sodium azide and 2-Aminofluorene in the strains of Salmonella typhimurium.

#### **RESULTS AND DISCUSSION:-**

The effect of *Parkinsonia aculeata* extract on change in the tumor growth. The well founded criteria to conclude the value of any anticancer drug are the prolongation of life span of the animals and the decrease of leukemic cells from blood. The percent increase in tumor cell volume and a number of viable tumor cells were found to be significantly less when compared to the Ehrlich ascites carcinoma control. Hence, it may be reported that the extracts by a direct cytotoxic effect and by arresting the tumor growth. The percentage increases life span at the 400 mg/kg body weight dose of the leaf extract of *Parkinsonia aculeata*. The Ehrlich tumor cells are one of the speedily growing carcinoma with very belligerent behavior and are able to grow in almost all strains of mice. The current review was managed to evaluate anticancer activity of *Parkinsonia aculeata* on Ehrlich ascites carcinoma bearing mice. Plants are the crucial source of the medicinal uses which can help in the treatment of various irremediable diseases. Plant materials contains of the several natural products which are extracted by different techniques. *Parkinsonia aculeata* is the medicinal shrub which consists of glycosides and flavonoids. The flavonoids like quercetin, orientation have been concluded as to possess antimutagenic and anti-malignant effect. Ethanol is commonly used for the extraction of the *Parkinsonia aculeata* for obtaining effective results.

#### **ANTI CONVULSANT ACTIVITY:-**

Convulsion is a disease of the brain defined by at least two unprovoked seizures occurring more than 24 hours. And this devastating multicausal chronic disease it is observed by recurrent spontaneous seizures. In these case *Parkinsonia aculeata* shows the potent anti convulsant effect. The dried leaves of the plant *Parkinsonia aculeata* were collected about 1kg of weight. The leaves were crushed in a fine and coarse powder. Extracted using ethanol as a solvent in a soxhlet extraction apparatus for 24 hours.<sup>[10]</sup> The study of anticonvulsant action by collection of concentrated mass of water, chloroform and benzene extract of leaves. Which contain the flavonoid and tannins that shows the anti convulsion activity. *Parkinsonia aculeata* considered for anticonvulsant activity using maximal electroshock induced seizures (MES) and pentylenetetrazole (PTZ) induced convulsions model and neurotoxicity can be studied using rotarod model in albino mice.<sup>[9]</sup> The leaves extract of Chloroform, benzene and ethanolic extract that were used for the determination of an anticonvulsant activity. From the aqueous and ethanolic leaves extract prevented maximal electroshock seizure induced tonic extensor of hind limb. And all the extracts will not shows any effect on pentylenetetrazole induced convulsion model.

#### **RESULT AND DISCUSSION:-**

The various leaf extract of the *Parkinsonia aculeata* showed significant anticonvulsant activity at a dose of 3, 10, 30,100,300 mg/kg body weight. The result of anticonvulsant activity of various extracts *Parkinsonia aculeata* on mice by Electro shock induced seizure test and Pentylenetetrazole induced seizure test method. And the neurotoxicity of various extracts was identified by rotorod method. Various leaf extracts of *Parkinsonia aculeata* showed remarkable anticonvulsant activity with respect to the reference standards Phenytoin and Valproic acid. The fraction obtained by extraction from aqueous and ethanolic extract of *Parkinsonia aculeata* that clearly shows a good anticonvulsant activity in electro shock induced seizure test. All fraction of extracts are inactive in Pentylenetetrazole induced seizure test. The aqueous, Ethanol,

Chloroform and Benzene extracts shows no neurotoxicity at doses 3, 10, 30,100,300 mg/kg body weight by Rotarod method.

#### **ANALGESIC, ANTIPYRETIC AND ANTI INFLAMMATORY ACTIVITY:-**

The problem of unmanageable pain, inflammation, and high body temperature. For these treatment the alcoholic extract of the powdered leaves of plant *Parkinsonia aculeata* was extracted using the soxhlet extraction apparatus. The prepared extract, on removal of solvent using vacuum that shows dark green semisolid residue. The 100 gram of coarse powder was macerate with water and kept for 5 days at room temperature, protected from sunlight and shaken several times daily.<sup>[19]</sup> The concentration extract by distilling off the solvent and then that was evaporating to dryness on water bath that appears as a yellowish brown semisolid residue and which manifest the essential action of analgesic, antipyretic and anti inflammatory activity.

#### **ANALGESIC ACTIVITY:-**

The *Parkinsonia aculeata* bark extract showed analgesic activity. From the chloroform, benzene, ethanol and aqueous extracts were prepared, between them chloroform extract showed the significant analgesic activity. Moreover the study of researchers also reported as the alcoholic extract of *Parkinsonia aculeata* bark at a dose of 200 mg/kg body weight act as analgesic, antipyretic and anti inflammatory as compared to aqueous extract. The tailimmersion and hot plate test tell out that plant is analgesic in activity also it outstandingly inhibits the body temperature up to the 4 to 6 hours the following extract administration.<sup>[9]</sup> Furthermore it found that alcoholic extract that inhibited Carrageenan-induced paw edema.

#### **ANTIPYRETIC ACTIVITY:-**

The study was reported that *Parkinsonia aculeata* bark extract has antipyretic activity. The chloroform, benzene, ethanol and aqueous extracts were prepared, among them the chloroform extract showed interesting antipyretic activity.

#### **ANTI-INFLAMMATORY:-**

The *Parkinsonia aculeata* also showed the antiinflammatory activity in carrageen and formalin induced paw edema in rats. The study showed that petroleum ether and aqueous extract that inhibits respectively in rat model of paw edema at 500 mg/kg oral dose.<sup>[9]</sup> And in case of formalin induced edema petroleum ether extract inhibits and aqueous extract inhibits that considered as effective results. It was disclose that anti-inflammatory activity of parkinsonia aculeata is due to free radical scavenging activity and inhibition of cyclooxygenase and 5-lipoxygenase in arachidonic acid pathway.

#### **RESULT AND DISCUSSION:-**

*Parkinsonia aculeata* conventionally used as analgesic, antipyretic, and anti inflammatory action. Also for antirheumatic, diaphoretic, abortifaciant and for urinary tract infection. Recently it was found that plant can be used as anti-diabetic, antibacterial, anticonvulsant, anti-amoebic and cytotoxic, which have potent active effect on body.<sup>[5]</sup> The study is needed to isolation and identification of the bioactive ingredient responsible for the various pharmacological activities.

#### **ANTI DIABETIC ACTIVITY:-**

The disease free fresh plant material of Bark were collected, The powdered bark about of 800ethanol in Soxhlet extractor and simple maceration with triple distilled water that traced by concentrating each extract under vacuum. The benzene extract of the bark showed the presence of phytosterols. The chloroform and ethanolic extracts of the bark showed the presence of alkaloids & flavonoids, the aqueous extracts of bark showed the presence of carbohydrates and tannins. Furthermore, the extracts were used for the study of antidiabetic activity. It was noticed that the chloroform extract of bark at a dose of 500mg/kg body weight showed maximum antidiabetic activity as compaired to the other extracts.<sup>[7]</sup> The chemical constituents which are found in the chloroform extract out from the bark of *Parkinsonia aculeata* are good antidiabetic agents. Hence we can affirm that the major component are responsible for antidiabetic activity may be present in chloroform extract of the bark of *Parkinsonia aculeata*.

It was found that hydro-ethanolic extract partitioned with ethyl acetate from the aerial parts of *Parkinsonia aculeata* that showed development in insulin protest in mouse model of diet induced obesity. The study was conducted on mice and was fed either with standard rodent chow diet or a high-fat diet for 12 consecutive weeks. at two doses (125 and 250mg/kg/day)<sup>[7]</sup>that increased glucose, insulin and pyruvate tolerance, and circulating leptin levels, which is due to enhancement of the insulin signaling pathway.

Diabetes was induced in overnight-fasted rats by injection of 150 mg/kg. After alloxan administration, The diabetic state was assessed by calculating blood glucose and serum levels in 3 days afterwards. The result determines that the rats with administration of glucose of above 250 mg/dL were considered as diabetic.

**RESULT AND DISCUSSION:-**

The oral administration of a dose of 5 g/kg did not result in any observable behavioral changes such as writhing, gasping, palpitation, and decreased respiratory rate, in the treated mice. The oral acute toxicity of *Parkinsonia aculeata* was, considered as unclassified, it was greater than 5 g/kg of body weight/oral route. The Fasting of Serum Glucose and Urinary Glucose Levels. Daily treatment for 16 days in alloxan-induced diabetic rats, significantly reduced serum glucose levels. At the same time urinary glucose levels decreases in diabetic treated groups. On the other hand, comparison of normal non-diabetic groups during the entire 16 days of treatment showed no any new differences in these groups, regarding urinary and serum glucose levels.

The study was carried out with adult male wistar rats. they were kept to the experimental conditions in metabolic cages and in environmental conditions. The animals that adjust to the provided cages 3 days earlier to the experiment. For acute toxicity test, adult male Swiss mice were used and kept under the same environmental conditions. Diabetes was induced in overnight-fasted rats by injection. After administration, The diabetic state was assessed by measuring the serum blood glucose levels. Rats with fasting glucose that was considered as diabetic.

**ANTISPERMATOGENIC ACTIVITY:-**

The bark of *Parkinsonia aculeata* extracted with ethanol and administered in male rats at doses of 50, 100 and 200 mg kg per day for 60 days. The weights of reproductive organ decreased while the body weight not decreased in rats. The motility was observed. the decrease in fertility to 100% in the extract which is treated with rats. The cell count of microscopic testicular of spermatocytes was reduced significantly in the rats. The examination of seminiferous tubular diameter and differential count of Leydig cells. There is no change is seen in the blood and serum profile, still testosterone level of serum was decreased. The concentration of testicular cholesterol was upraised because protein, sialic acid, glycogen and fructose content were decreased remarkably. Hence the results proposed that the extract has an antispermatogenic effect in male rats.<sup>[13]</sup>

**RESULT AND DISCUSSION:-**

The study proves that the decrease in testicular cell components in the oral administration of *Parkinsonia aculeata*. The spermatogonia and Sertoli cells were decreased significantly in the study. The preleptotene, pachytene, and secondary spermatocyte that decreases at 50 mg, 100 mg, and at 200 mg of dose level, respectively. The Seminiferous tubular is reduced significantly and the nuclear area of Leydig cells was reduced by 200 mg dose level. The number of mature Leydig cells was decreased, because the number of degenerating cells was increased remarkably.

The oral administration of *Parkinsonia aculeata* leads to the reduction in the testosterone level and in the weights of testes and other sex organs of experimental rats. The androgen dependant epididymis, seminal vesicle, and ventral prostate are androgen dependent, relying on testosterone for their growth and function. The weight loss was reflects as decrease in bioavailability and production of androgen. The diameter of leydig cells and elevation in testicular cholesterol that indicates the decrease in the androgen levels. The decreased fertility was reported by the suppression of sperm motility that might be due to alpha amyryn acetate. The most important predictors is sperm motility for sperm fertilizing ability. The sialic acids are concerned with changing the membrane surface of maturing spermatozoa, coating of spermatozoa with certain antigens, and in the development of their fertilizing capacity. The minimum level of sialic acid that may suppress the fertilizing capacity of spermatozoa. Sperm immotility, that suggests an undersupply of androgens to epididymis, that resulting in impairment of epididymal functions and its weight. The motility of spermatozoa is due to the flagellar beat, which is dependent on the microtubular apparatus of the flagellum and adenosine triphosphate. Low levels of fructose could inhibit the sperm motility by deficient generation. Reduced sperm count in testes and epididymis that may be due to inhibition of the meiotic division of spermatocytes.

**REFERENCE:-**

- [1] Hanan M. Al-Youssef, Waffa H.B.Hassan. Antimicrobial and antioxidant activities of *Parkinsonia aculeata* and chemical composition of their essential oil.(ISSN 2354-323X)Vol.3(4) pp. 147-157 ,April,2015.
- [2] Wafaa H.B. Hassan, Sahar Abdelaziz, Hanan M. Al-Yousef. Chemical Composition and Biological Activities of the Aqueous Fraction of *Parkinsonia aculeata* L. Growing in Saudi Arabia. August 2018 Arabian Journal of Chemistry 12(3)DOI:10.1016/j.arabjc.2018.08.003.
- [3] Abdel Karim M, Ezdehar A, Shazam A. *Parkinsonia aculeata* Oil: GC-MS Analysis and Antimicrobial Activity. The Pharmaceutical and Chemical Journal, 2019, 6(5):35-39.
- [4] SY Mohammed, H Suleiman, M Abubakar, MR Sagir, SA Sule, BM Balarabe and K Mohammed. Preliminary phytochemical screening of *Parkinsonia aculeata* Leaf extracts. International Journal of Chemical Studies 2017;5(2):86-88.
- [5] Raka Kamal and Naina Mathur. Rotenoids from *Parkinsonia aculeata* L and Their In Vitro Amoebicidal Activity.Asian J. Exp. Scientists.,Vol.21,No.1,2007,00-00.
- [6] Shimaa A. Elgaml, Emad Hashish, Wafaa H. B. Hassan, Sahar Abdelaziz. *Parkinsonia aculeata* L. aqueous extract alleviated the hepatotoxicity induced by acetaminophen in albino rats. June 2020Comparative Clinical Pathology 29(3):1-7DOI:10.1007/s00580-020-03102-2
- [7] Leite AC, Araújo TG, de Melo Carvalho B, Maia MB, de Menezes Lima VL. Characterization of the Antidiabetic Role of *Parkinsonia aculeata* (Caesalpinaceae). Evid Based Complement Alternat Med. 2011;2011:692378. doi: 10.1155/2011/692378. Epub 2010 Sep 19. PMID: 20953386; PMCID: PMC2952319.
- [8] Riëks Dekker Van Klinken, Shane Campbell, Tim Heard, J. McKenzie. The biology of Australian weeds 54 *Parkinsonia aculeata* L. September 2009Plant Protection Quarterly 24(3):100-117
- [9] Krushna Zambare, Arun A. Kondapure, Kavya Reddy, Avinash B. Thalkari. A systematic review on potential pharmacological applications of *Parkinsonia aculeata*. January 2021Research Journal of Pharmacy and Technology 14(3):1767-1770 DOI:10.5958/0974-360X.2021.00314.0
- [10] Sable Pravinkumar Namdeorao, Katariya Dhirajkumar Champalal, Dumbare Rahul Kondaji. Anticonvulsant Activity of Leaves of Folklore Plant *Parkinsonia aculeata* (L). Research J. Pharmacognosy and Phytochemistry 2012; 4(1): 4-6 .
- [11] Sharma S, Vig AP. Preliminary phytochemical screening and in vitro antioxidant activities of *Parkinsonia aculeata* Linn. Biomed Res Int. 2014;2014:756184. doi: 10.1155/2014/756184. Epub 2014 Apr 13. PMID: 24822217; PMCID: PMC4005075.
- [12] Sharma S, Vig AP. Evaluation of in vitro antioxidant properties of methanol and aqueous extracts of *Parkinsonia aculeata* L. leaves. Scientific World Journal. 2013 Nov 14;2013:604865. doi: 10.1155/2013/604865. PMID: 24348173; PMCID: PMC3848342.
- [13] Radhey shyam Gupta, H. Rehwani, V. Khushalani, Kumud Tanwar, Y. C. Joshi. Antispermatic Effects of *Parkinsonia aculeata* . Stembark in Male Rats. January 2007 Pharmaceutical Biology 45(1):1-8 DOI:10.1080
- [14] Hashempur MH, Khademi F, Rahmanifard M, Zarshenas MM. An Evidence-Based Study on Medicinal Plants for Hemorrhoids in Medieval Persia. J Evid Based Complementary Altern Med. 2017 Oct;22(4):969-981. Doi: 10.1177/2156587216688597. Epub 2017 Jan 24. PMID: 29228790; PMCID: PMC5871264.
- [15] Dr. Monika Maan, A brief review on bioactive compounds in *Parkinsonia aculeata* Plant; Volume 7, Issue 1 Jan-Feb 2022, pp: 651-659 [www.ijprajournal.com](http://www.ijprajournal.com) ISSN: 2249-7781.
- [16] V. P. Trivedi (1975) Preliminary Studies of Garur Buti (*Parkinsonia Aculeata* Linn.) as an Antirabic Agent, Quarterly Journal of Crude Drug Research, 13:1, 22-28, DOI: 10.1080/13880207509162244
- [17] Sana Shaheen, Raveena, Runjhun Mathur, Abhimanyu Kumar Jha. Antirheumatic Properties of Medicinal Plants: A Review;Journal of Ayurvedic and Herbal Medicine 2021; 7(2): 155-160.
- [18] R. K. Gautam, K. Roy, Gayatri Thapa, Disha Arora, Smriti Parashar, Bhumika Gurung, L. Deb.Perspective of Plant Medicine in Therapy of Rheumatoid Arthritis; Indian J Pharm Sci 2020;82(5):741-765.
- [19] Gupta MK, Mruthunjaya K, Garg SK, Kumawat RS, Jain DA. Evaluation of Analgesic, Anti-inflammatory and Antipyretic Potential of *Parkinsonia aculeata* Linn. leaves. IJRPS 2011,1(1),100-109
- [20] S. Rao, A. K. Sharma, M. P. Dobhal and M. C. Sharma. IDENTIFICATION OF NOVEL NATURAL MOLECULE FROM METHANOLIC STEM BARK EXTRACT OF *PARKINSONIA ACULEATA*;IJPSR, 2020; Vol. 11(7): 3360-3366
- [21] Sharma S, Sharma S, Vig AP. Antigenotoxic potential of plant leaf extracts of *Parkinsonia aculeata* L. using *Allium cepa* assay. Plant Physiol Biochem. 2018 Sep;130:314-323. doi: 10.1016/j.plaphy.2018.07.017. Epub 2018 Jul 17. PMID: 30036860.