International Journal of Botany Studies
ISSN: 2455-541X; Impact Factor: RJIF 5.12
Received: 25-05-2019; Accepted: 28-06-2019
www.botanyjournals.com
Volume 4; Issue 4; July 2019; Page No. 204-209

Therapeutic proposal of *Solanum marginatum* L.: A comparative analysis with *Solanum torvum*

Ruvalcaba Ledezma Jesús Carlos[1*], Chávez González Nallely[2], Ruvalcaba Cobián Jesús Carlos[3], Ramírez Hernández Blanca Catalina[4], Cuevas Figueroa Xochitl Marisol[5], Imbert Palafox José Luis[6], Molina Trinidad Eva María[7]

[1, 2, 6, 7] Department of Public Health in Institute of Health Sciences. Hidalgo State University, Pachuca City, Hidalgo State, México
[3]Anthropological University of Guadalajara, Jalisco Mexico
[4]CUCBA-UdeG,
[5]Marist University of Guadalajara, Jalisco Mexico

Abstract
Aim: To describe the therapeutic usefulness of *S. marginatum* by analyzing the speech of inhabitants of Nopala de Villagran, Hidalgo, Mexico in regards to their perception and experience when using it as a treatment against cancer and other diseases.
Material and Methods: An ethno methodological qualitative study was carried out by conducting a discourse analysis about the use that people give to the *S. marginatum* plant, along with a comparative analysis against the species *S. torvum*.
Results: People who participated in this study provided their empirical knowledge and pointed out in their speech that this plant possesses pharmacological activity against cancer. The comparative analysis shows the same active ingredients against cancer, although the effects of *S. marginatum* have not been studied yet.
Conclusions: The empirical knowledge expressed by users of tea made from this plant and those of similar composition known as *S. torvum* and *S. marginatum* with respect to their active principles make it necessary to carry out scientific research projects towards *S. marginatum* in order to verify its therapeutic anti-carcinogenic impact from scientific knowledge, since both species have in their composition solasodine and solasonine.

Keywords: *Solanum marginatum*, *Solanum torvum*, antibacterial, anti-carcinogenic, anti-inflammatory

1. Introduction
The plant commonly known in the municipality of Nopala, Hidalgo as "caustic soda" or in some other regions, such as "lulo", "holy thistle", "tomato of sting" and "tomatillo" belongs to the Solanaceae family, which is composed by 80 gender and 300 species; in Mexico, there are approximately 150 species [1]. Its scientific name is *Solanum marginatum*, it belongs to the Tracheophyta division, Spermatophyta subdivision, Magnoliopsida class, Solanales order, Solanaceae family, and *Solanum* L genus [2].
Inflorescence: it presents from 3 to 6 flowers known as andromonoecious, with a stormy goblet, white corolla of 3 cm in diameter and yellow anthers [2]. Flowers: The chalice flared and finished in 5 triangular lobes, covered with abundant branching hairs and in one of the flowers of the inflorescence there are also some short spines; the corolla white or whitish, widely flared, split into 5 wide lobes, rounded and finished in a small tip, with hairs on the outer face; stamens 5, with large anthers surrounding the style [3].
Fruits and seeds: fruit pendant, fleshy and globose berry 3cm large - 4cm in diameter, yellow at maturity, with epidermic exocarp parchment ones for and mesocarp juicy yellow-green in color with numerous yellow seeds [2].
It is a plant native to Africa and its secondary distribution has been presented in South America in the region of the Andes and in Mexico it is seen mainly in the states of Michoacan, Queretaro, Federal District, State of Mexico, Veracruz and Hidalgo. It is prohibited in to Zeland [3].
Solanum marginatum plants are medium-sized to large shrub, occasionally to c. 5 m tall; most parts densely white-stellate-tomentose; prickles yellow, to 1.5 cm long. Petioles to c. 4 cm long, prickly. Leaves to c. 25 × 18 cm, broadly ovate or elliptic-ovate, sinuately lobed, glabrated or glabrous and dark green above except for whitish tomentose margin, white-stellate-tomentose beneath; midrib and veins prickly, the prickles to > 1 cm long; base usually deeply cordate; apex rounded. Cymes few-flowered, white-stellate-tomentose and prickly; peduncles to 4 cm long; pedicels pendent at fruiting. Calyx 9-14 mm long; lobes lanceolate-ovate. Corolla 2.5-3.5 cm diam., white, sometimes with purplish veins; lobes broadly triangular-ovate, stellate-tomentose outside. Anthers 6-8 mm long. Berry 2-6 cm diam., globose or subglobose, yellow. Seeds 3-4 mm diam., broad-ovoid to broad-obovoid [4].
The solanaceae family presents fangled molecules such as steroids, saponins, glycosides and alkaloids in roots, stems and leaves. Alkaloids have special importance because they have shown submitting the highest activity in all the cases. It highlights the solanidina, solasodine (the precursor of acetate 16-dehidropregnenolona which is an anti-fertility and anti-inflammatory molecule), solasodieno, solaverinas, solasonine, solaverol, solafloridina, tomatidina, solaverbascina and b-solamarina [6]. *S. marginatum* is characterized by the presence of alkaloids steroidal, saponins, tannins, sapogenins. Solasodine (alkaloid steroids) have been localized in all organs of the plant and only in the fruit, the glycoalkaloids are derived from solasodine solamargine, solasonine and triterpene campesterol [7].
The solasodine is an alternative alkaloid to diosgenina like raw material for steroidal and synthetic drugs, since both are precursors of the acetate known as 16-dehidro-pregnolona, the first precursor in the synthetic steroids like

corticoesteroids, contraceptive sexual hormones, espironolactona among other compounds [8].

By the method of Birner it was found that the content of solasodine in the unripe fruits is 2.5 %, in the ripe fruits 2.3 %, and in mature fruits corresponds to 1.4 %, on basis of the dried and pulverized *S. marginatum* fruit. These results indicate that the obtaining of solasodine can choose fruits falling between the green state and dry [9].

By modifications to the technique of Panipa and Col. a yield of 2.1 % in the removal of solasodine from green fruits and dry of *S. marginatum* was achieved. The yield is high enough to consider the fruits of this plant useful in obtaining industrial solasodine [9]. *Solanum marginatum* has an important economic potential because its fruits are a source of solasodine, an alkaloid steroid used in the marketing of sexual hormones products [10]. The main glucoalkaloid derived from solasodine found in this and other species such as potatoes, tomatoes and eggplant is the solamargine [11], it is regarded as a poisonous chemical compound, their cytotoxic effect is compared to the cisplatin, methotrexate, 5-fluorouracil, epirubicin and cyclophosphamide against breast cancer cells; achievement be checked that induces and active tracks extrinsic and intrinsic apoptosis of breast cancer cells [12].

Solasodine, like the solamargine, are inducers of apoptosis in a wide variety of cells of cancer such as lung, liver and colon [13].

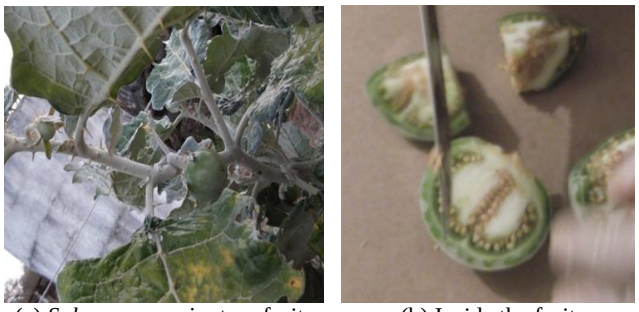
It contains a compound called solasodamina, by mixing the green fruits of the *S. sodomaeum* and *S. marginatum*, thus combining the well-known glycoalkaloids, solasodina and solamargina, respectively [11].

There are no toxicological assessments carried out with this plant, but the fruits are reported toxic due to the presence of sterols and glycoalkaloids; It was considered as a weed in pastures and grasslands [5]. Alkaloids in the mesocarp of the fruit as glycoalkaloid solanine, mainly Tomatina, group steroidal nucleus which is responsible for the toxicity of the fruit were identified, and a 3.250mg./kg average lethal dose was determined in the juice of the fruit. The seeds have an oil whose structure and properties are classified within semi-drying oils, the yield oil is comparable to the soybean seeds. Industrially, it can be used as semi-drying oil in the manufacture of paints, taking advantage of the residual pulp of seeds, as raw material for the manufacture of paper, likewise used the residual pulp of soybeans and other oilseeds plants. Non-toxic oil can be used as edible oil [3].

A methanolic extract of the entire plant showed antihypertensive activity to be evaluated in rats, intragastric to the dose of l00mg/kg. This same extract, as well as an aqueous extract, showed a weak activity depressing the central nervous system in rats intravenously, to the dose of l0mg/kg. The aqueous extract of the entire plant, as well as a methanolic extract of fruits, showed bradycardic activity, although it promotes depressing the central nervous system, it was also reported as weak [6]. It produces only transient effects which persisted for 60 min [14]. Some preparations containing glycosides of solasodine are used in the treatment of skin cancer. Other glycoalkaloids as solamarina inhibit the sarcoma 180 in mice and glycoalkaloids as solamargine and solasodine presented antifungal properties [15].

Presents a positive effect in the treatment against herpes simplex, herpes zoster and herpes genitalis, in which all patients showed improvement and/or disappearance of signs and symptoms in a period of 5 to 10 days, the treatment consisted of the daily application of a cream with a composition of alkaloids to 1% (solamargine, solasonine), dissolved in acetic acid 10 %, in a cream base made of hydrophilicity. In spite of the fact that this study was based on another species of the genus *Solanum*, the alkaloids used in this study are found in the same way in *S. marginatum* [15].

It is most frequently used in the country for the rheumatism by putting the area suffering by way of cataplasm, with outbreaks of the plant you can make a tea for vomiting, combining the leaves and the fruit becomes a tea for diarrhea and the bronchitis, while the leaves are used only for the cough [6], is also used as healing of wounds and against skin infections [5].



(a) *Solanum marginatum*-fruits (b) Inside the fruit

Fig 1: *Solanum marginatum*; (a) plant with fruit and (b) the internal structure of the fruit, very similar to a green tomato.

© Lobulated shaped leaves of 24 cm y 11 cm, shining green beam where there are thorns, whitish in the margins and nerves (d) Inflorescence of 5 to 6 flowers; whitish approximately 1 cm long.

Fig 2: The leaf of *Solanum marginatum* (c) with thorns on both sides and (d) Inflorescence.

(e) Shrub of *S. marginatum*, approximate height of 1.50 m (f) Mature and green fruits, approximately 4 cm long.

Fig 3: *Solanum marginatum* (e) image of the plant and (d) mature and green fruits

Aim

Describe the therapeutic usefulness of *Solanum marginatum* L. derived from an analysis of the speech of people who

have used it as treatment against cancer and other diseases in people of Nopala de Villagran Hidalgo, Mexico.

Materials and Methods

A joint qualitative ethnometodological study was conducted along with a discourse analysis in regards to the use that people from a community give to the plant *S. marginatum*, as well as a comparative analysis against the species *S. torvum*. This study was carried out from the ethno, exploratory-comparative approach in order to assess the active ingredients of the species of *S. torvum* and *S. marginatum.*

Documentary research

Gather data from other investigations about the plant *S. marginatum* documented in various articles and published in journals of national and international high-impact.

Research Field

In the research field, interviews to the residents of the region of Nopala were conducted, the research focused on the clinical cases who consumed *S. marginatum* and the development of the case in particular towards cancer. The plant was collected following the directions provided by the interviewees in order to have a better result in the exploratory research.

Exploratory Research

The information obtained from the interviewees from Nopala and the information already documented were employed following the principles of the scientific method. Data was collected in order to analyze and accomplish the experimental research.

Pilot Phase

In this part of the project, we conducted a series of steps in order to obtain a focused tool, with the aim of finding the main components that act against cancer and other diseases, for later processing and be able to experience, in crops of cellular carcinogenic or with some other method. The first step was to gather the plant in the morning, based on the method of preparation explained by the interviewees, according to them it has to be in a fresh state, as well as it must be collected on full moon days. Thus, stem, leaves, fruits and some flowers were collected. Later it is placed in safe dark site to prevent it from drying up and in order to carry out the macerating process in the afternoon.

To obtain the macerate or tincture, the plant has to be rinsed with drinking water, then with purified water and finally with distilled water; the process is repeated for each part of the *S. marginatum* (stem, leaf, and fruit) separately.

Each part is cut into small pieces, each piece is placed in an sterilized bottle and all parts of the plant are mixed. Homeopathic alcohol is added to each bottle to a level where the content of plant is slightly exceed, each bottle is closed and wrapped with paper, it is stored in a cool place, out of contact with light. During the next five days the bottles were inside the box and shaken once a day for a week.

On the tenth week and as stipulated by interviewees, the contents of the bottles are filtered, with a basic technique for filtering "squeezing with a cloth firmly and subsequently with filter paper into a fully sterilized container.

Each of the macerated materials are placed in a funnel with filter paper, which was introduced in a measuring cylinder, with the objective of creating a more concentrated and of higher quality substance, the macerate remaining is placed in a special cloth to filter, it is pressed so that it will be nicely pressed and thus a greatest amount is obtained. The process was modified according to the quantity.

This process was conducted with each of the macerated materials separately, to later be packaged and continue with the procedure.

It was observed that the colors and smells of each filtering were different.

Later it was transported to a homeopathic laboratory to generate from the mixture of tinctures, the mother tincture and of this the homeopathic medicine to be used in a later project to determine the pathogenesis of the medicine *Solanum marginatum.*

Results

The results emerge from the analysis of speech that denotes empirical knowledge on how to prepare the tea, as accustomed to take as part of the treatment and its effects. That is why the analysis was grouped and the information was gathered from the narrative discourse of people who have already had the experience of drinking the tea made from *S. marginatum* as treatment against cancer.

Below there is a representation of the categories; type of cancer, preparation of tea, treatment, and treatment and effect.

The popular consciousness. People knows the plant, their experience is based on the empirical knowledge derived from the experience from the case of ovarian cancer in her daughter.

 "The collection and the plant is cut in the morning between the 6:00 AM and 8:00 AM or in the afternoon around 6:00 PM or 7:00 PM, to get the tea, the person starts to boil water after that the leaves of *S. marginatum* are placed ino boiling water and the stove is turned off, the tea is obtained in this way to ensure that it can be drank as normal water throughout the day, it is believed that it is best taken on an empty stomach, this procedure will be followed during 10 days, depending on the extent of the disease and approximately on the third day you may have vomiting, diarrhea, or both, but this is considered a normal effect"

The comparative analysis between S. torvum and S. marginatum. Allows to propose the profucndización in investigation of the pharma-logical effect of S. marginatum against the cancer present in the discourse of the people who have used it, based on their "empirical knowledge" against this disease. (table, 1, 2 and 3)

Table 1: General characteristics of both species of the genus *Solanum*

Solanum torvum	***Solanum marginatum***
* Simple leaves and elliptical of variable size that is close to the 15cm long and 8-10cm wide, on the whole surface has small spines of different lengths with the same color of the leaf [15]. * Small Flowers of white, are produced in groups and their stamens are with prominent anthers [16].	*The leaves are lobed 12cm - 18cm long and 8.5cm - 12cm wide with a beam of bright green color, and with whitish in the margins [2]. *Presents 3 to 6 flowers andromonoecious, with goblet rest stormy, corolla white of 3cm in diameter and yellow

* Period of flowering occurs between May and April, while the fruiting continues at the time that the plant reaches approximately 1m [9]. * Fruits are small berries that have a yellowish tinge when are not ripe, the color is green, they are filled with pulp and in the center numerous brown color seeds are contained with approximately 1.5 -2mm long, they are round and flat [15].	anthers [2] *The fruit hanging, fleshy and globose of 3cm - 4cm in diameter, yellow at maturity, with epidermic exocarp parchment ones for and mesocarp juicy yellow-green in color with numerous yellow seeds [2].

Table 2: The composition and pharmacological properties for *S. torvum* and *S. marginatum*

Solanum torvum	***Solanum marginatum***
* The chemical components that have been found in the plant are solasodine [1], saponins, solasonine [1], solamargine [1], flavonoids [15], vitamin of the B group [16], vitamin C [16], iron salts [16], sulphate isoflavonoides [15], glycosides-steroidal [15], torvanol [15] and the cafeato bromide [20].	* It is characterized by the presence of steroidal alkaloids, saponins, tannins, sapogenins; solasodine (alkaloid steroids) have been localized in all organs of the plant and only the fruit the glycoalkaloids has solasodine solamargine, solasonine and triterpene campesterol [5]. * The content of solasodine in the unripe fruits is 2.5 %, in the fruits ripe fruits of 2.3 % and in mature fruits of 1.4 % [7]. * The main glucoalcaloide derived from solasodine is the solamargine [9], poisonous chemical compound that induces and active extrinsic tracks and intrinsic apoptosis of breast cancer cells [9, 10]. The solasodine, like the solamargine, are inducers of apoptosis in a wide variety of cells of cancer such as lung, liver and colon [11].

Table 3: Scientific pharmacological uses for *S. torvum* and empiric uses of *S. marginatum*

Solanum torvum	***Solanum marginatum***
* Method for various diseases, such as colon cancer, leukemia, tuberculosis, diphtheria, diabetes mellitus [14], and lung cancer of the cervix. * Used as anti-inflammatory [15], antifungicida [16], antiviral [17], antioxidant [15], antiulcerogenica [16], antihiperglusemico [18], antimycobacterial [15], antiplatelet [15], antidepressant, parasite [19] and has also been found its antiproliferative activity in various adenocarcinomas.	* The aqueous extract of the complete plant, as well as a fruit with methanol extract, showed bradycardic activity, it also acts as a central nervous system depressant, although this effect was also reported as weak [4]. * It presents a positive effect in the treatment against Herpes simplex, Herpes zoster and Herpes genitalis, in which all patients presented improvement or disappearance of signs and symptoms in a span of 5 to 10 days [13].

Treatment: * While normally people take medicines prescribed by the doctor, other people take a liter a day of tea, three tablespoons of soda in the morning, at noon and in the evening a mixture of honey with tequila or whisky and 3 tips of tender savila, a spoonful of viper rattlesnake ground in the morning and an afternoon tea made of arnica or capitaneja, tea of a dove or white thistle with 5 drops of lemon.

Effect. Disappearance of the disease, to heal.

Discourse Analysis. The person narrates the way of preparing tea of *Solanum marginatum*, also points out, that the most common is that they consume a prepared aloe, arnica and other teas. They do not take only the medical treatment, but a variety of natural products are prepared, this geared towards confounding factors in this case.

Case 1. Ovarian Cancer.
Treatment. Exploratory surgery, ovarian hysterectomy, fallopian tubes and uterus, 25 radiation, 8 months of chemotherapy taken (mejestrol).

Alternative treatment. Sosa (*Solanum marginatum*) and Capsules of viper rattlesnake

Mejestrol: medicine used in advanced cases of breast and endometrial cancer. Indicated for the loss of appetite, malnutrition and weight loss. This corresponds to a man-made version of the progesterone.
"I am a patient of chronic diseases from 22 years ago approximately; I suffer from diabetes and high blood pressure controlled and igniting to live with the best quality of life. In July of 2007 I was operated by an exploratory surgery because they were never attending me; physicians an ovary burst and duration as well under observation in the emergency department 5 realized that he had days and had not a diagnostic favorable nor consistent already found on the findings a tumor approximately 1kg and the tumor grew so much that I blew out my ovary the doctor who operated a surgeon who specializes in the difficult cases noted that there was nothing in the pelvic cavity some other tumor but by the color of my tumor he never thought that it was a malignant cancer and it was sent to pathology and proved to be an ovarian cancer called carcinoma. The court in pathology said it was a malignant tumor in my diagnosis and according to my gynecologist in its discretion had to practice me another surgery before receiving any treatment and there was when I took the Sosa and capsules of rattle snake while I was waiting for a second surgical intervention but already by the oncologist in which I performed a hysterectomy obviously by removing the other ovary fallopian tubes and uterus and once again control my case to pathology where they had already found another tumor in the endometrium called endocarsinoma and also malignant size of an egg, the recovery time passed and I continued taking my alternative treatment while receiving my treatment for the ovary that were 25 Radiation and 8 months of chemotherapy taking mejestrol. Doctors assumed I had to take it for 1 year but the side effects were very strong one of them was that the glucose rose up to 450 and that is why I am no longer going down to the oncologist and the chemotherapy was suspended and I was told that it was easier to die in a diabetic coma than of cancer and when it did have several months as 6 that I had been given high oh surprise! He went out again another tumor in the thyroid and was a nodule left, only that it was not malignant thanks to God and to the soda that I continued taking."

Discourse Analysis. The person narrates the way of preparing tea of *Solanum marginatum.* Points out the medicines prescribed by the doctor and that other people

take a liter a day of tea. “I have much faith that it helps me”

Case 2. Type of cancer: bladder cancer

"I began urinating blood during 3 days, I go to my doctor, he told me that it was something in my bladder and he had to make me a ultrasound and there in the ultrasound what was wrong with my bladder came out, then he recommended to me with another doctor of Queretaro and there I underwent an emergency, to have it checked what I had (a tumor), it turned out that it was malignant. Then I started with a treatment. The cancer that I had was encapsulated within the bladder, and I would be dealt with before leaving, because it was only a ball (I think that helped me). "The treatment began by applying an injection every week direct into the bladder for which I had to go to electrocute me to the hospital, according to that it was chemotherapy. It ached so much I was burning and it took 2 days to recover. The year it reviewed and I had another operation, in total I had 3 operations, in the fourth I was told that it was going well and I got an appointment up to November. Between each operation I had approximately 6 injections already except in the last. Because right now I am only checking myself up and sometimes they give me medication for any infection or something that can be brought. In the operations they were doing was starting at the root, but without my bladder, said the doctor that best will be sorely missed. I started drinking sosa after that they told me that I had cancer, all the days I made tea in the evening in a liter of water it put a medium size leaf (as I was told), I took the other day on an empty stomach, and the rest of the day as drinking water, together with my husband. At times I was disappointed but I know that it is for my own good, there are already 4 years taking it every day without failing to do so. As I ate the snake of rattlesnakes, daily in everything I eat such as soup, water, everything.

Effect. With the plant I have felt very well, I have much faith that it helps me.

Discourse Analysis. The person narrates the way of preparing tea of *Solanum marginatum.* In this last operation I do no longer receive treatment of injections and they told me that I was going well, that it was no longer there but that I had to go check to see if the tumor does not appear again. With the plant I have felt very well, “I have much faith in that helps me”.

Discussion

One of the diseases that has a greater impact on the health of the people is cancer, there is a wide diversity of this disease within the body or location in the body, although among the most impacted areas include; lung cancer, breast cancer, cervical, colon and others. This generates the need to engage in scientific research in the search for possibilities to fold this disease, the comparison between *S. torvum* and *S. marginatum* allows establishing that this second plant can be applied as anti-carcinogenic, however such comparison invites you to try its effect.

The speech of people with cancer who used extracts and tea of *S. marginatum* denotes that there is a positive effect, this would be from then in a much more forceful so, if the people only had taken tea of the plant, a situation that is difficult because of the type of disease do not opt to use a type of medical care, come from with healers to the utility of various alternatives or types of medicine, up to the

hospitals or clinics where they were treated by medical specialists, hence the importance of that in addition to propose to this plant before the scientific community as a plant with activity anti-carcinogenic derived from the analysis of their chemical composition and the similarities in their composition In respect to active principles, it is necessary to continue its evaluation in the laboratory, from crops of lines of cancer cells and the active principles of *S. marginatum*.

Conclusions

The empirical knowledge expressed by users of the tea made from this plant and the similar composition known of *Solanum torvum* and *Solanum marginatum* with respect to their active ingredients makes it necessary to postulate to scientific research projects of *S. marginatum* to verify its therapeutic anti-carcinogenic impact from scientific knowledge, since both species present in their composition solasodine and solasonine. This makes it possible to propose to *S. marginatum* as a plant with active components which are useful as anti-carcinogenic.

Acknowledgments

The authors of the present research article would like to acknowledge and truly thank the collaboration of *Yesenia Elizabeth Ruvalcaba Cobián* who has a B.A in Teaching English as a Foreign Language, for her contributions on the revision and translation of the article; situation which allows the possibility to increase the transferring and modification of scientific knowledge.

Conflict of interest. The authors declare that no conflict of interests for the publication of this research paper.

Referencias

1. Pérez-Amador MC, Muñoz Ocotero V, García Castañeda JM. González Esquinca International Journal of Experimental Botany. 2007; 76:39-45. 2. Interagency Taxonomic Information System. *Solanum marginatum* L. f. http://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=30444
2. Argelia Herrera A, Y Gabriel Kecan M. Análisis fitoquímico y farmacológico de *Solanum marginatum*. TESIS. Colombia, 1970, 42-88.
3. Sykes WR, Webb CJ, Phil Garnock-Jones J. Flora of New Zealand: Naturalised pteridophytes, gymnosperms, dicotyledons. Balogh Scientific Books, 1988, 4.
4. Conabio, Maleza de México, ficha informativa *Solanum marginatum* -http://www.conabio.gob.mx/malezasdemexico/solanaceae/solanum-marginatum/fichas/ficha.htm, última modificación 13 de Agosto del 2009, última revisión 01 de Mayo del 2014.
5. Zhañay Andrade Miguel Ángel. Relación entre la actividad antioxidante y concentración de compuestos fenólicos contenidos en el fruto del pungal Solanum crinitipes. TESIS de grado, Ecuador, 2012, 1-97.
6. Pilco G. Comprobación del efecto adelgazante de la tintura de apio (Apiumgraveolens) y el perejil (Petroselinumsativum) en voluntarios con sobrepeso. Tesis Bioquímica y Farmacia. Escuela Superior Politécnica de Chimborazo. Facultad de Ciencias. Riobamba. Tesis. 2012; 32(33):35-48.
7. Redrobán K. Comprobación del efecto cicatrizante de los extractos hidroalcohólico de berro (Nasturtium officinale) y llantén (Plantago major) en ratones (Mus musculus). Tesis Bioquímica y Farmacia. Escuela Superior Politécnica de Chimborazo. Facultad de Ciencias. Riobamba. Tesis. 2012; 43(46):47-52.
8. © D.R. Biblioteca Digital de la Medicina Tradicional Mexicana. Atlas de las Plantas de la Medicina Tradicional Mexicana // *Solanum marginatum*, 2009, http://www.medicinatradicionalmexicana.unam.mx/monografia.php?l=3&t=sosa&id=7760, última revisión 01 de Mayo del 2014.
9. Juliana Parsons, Ana M. giulietti y Julián Rodríguez TALOU, Efecto de la Elicitación en la Síntesis de Solasodina en Cultivos de Raíces Transfomadas de Solanum eleagnifolium Cav, 2006, 414-20.
10. Antonio Sanabria Galindo. Alcaloides de *Solanum marginatum* II. Extracción directa de solasodina y contenido de la misma en tres estados de madurez de los frutos. Rev. Colomb. Cienc. Quím. Farm, 1980, 29-35.
11. Rivka Dulberger, Arieh Levy y Dan Palevitch, Andromonoecy in *Solanum marginatum*. Bot. Gaz. 1981; 142(2):259-266.
12. Shiu LY, Chang LC, Liang CH, Huang YS, Sheu HM, Kuo KW. Solamargine induces apoptosis and sensitizes breast cáncer cell to cisplatin. Food Chem Toxicol. 2007; 45(11):2155-64.
13. Lee KR, Kozukue N, Han JS, Park JH, Chang EY, Baek EJ, *et al*. Glycoalkaloids and metabolites inhibit the growth of human colon (HT29) and liver (HepG2) cancer cells. J Agric Food Chem. 2004; 52:2832-2839.
14. Srinivas Koduru DS, Grierson M, Van de Venter, Afolayan AJ. Anticancer Activity of Steroid Alkaloids Isolated from Solanum aculeastrum. Pharmaceutical Biology. 2007; 45(8):613-618.
15. Horacio Vidrio, Bertha Soto, Federico García, Sylvia Méndez. Actividad hipotensora de extractos de Solanum marginado en la rata. Planta Med. 1988; 54(2):111-113 DOI: 10.1055/s-2006-962363.
16. Bernardo Chataing, Nersa B De Cristancho Alfredo Usubillaga Y. Tratamiento Topico Del Herpes Simplex, El Herpes Zoster Y El Herpes Genital Con Una Mezcla De Alcaloides De Solanaceas. 1998; 7:1-4.
17. Adolfo Andrade-Cetto, Michael Heinrich. Mexican plants with hypoglycaemic effect used in the treatment of diabetes. Journal of Ethnopharmacology. 2005; 99:325-348.
18. Zubaida Yousafa, Ying Wanga B, Elias Baydounc. Phytochemistry and Pharmacological Studies on Solanum torvu Swartz. Journal of Applied Pharmaceutical Science. 2013; 3(04):152-160.
19. Jaiswal *Solanum torvum* BS. A review of its traditional uses, Phytochemistry and pharmacology. Int J Pharm Bio Sci. 2012; 3(4):104-111.