SOLANACEAE PLANTS OF ISRAEL AND PALESTINE - RICH SOURCE OF MEDICINALLY ACTIVE NATURAL PRODUCTS

Abdullatif Azab[a]*

Keywords: *Solanaceae;* alkaloids; physalins; withanolides; medicinal activity; psychoactive; poisoning.

Solanaceae is one of the most studied among all plant families. Plants of this family are very rich with medicinally active natural products, some of them, with nutritional importance. Some of these compounds are psychoactive and mind altering. Alkaloids, physalins and withanolides are the major notable active natural products present in these plants. In this review article, we will present the vast majority of published research about these plants. This work will include biological and medicinal activities, extended presentation of natural products, their activities and in some cases, their synthesis, biosynthesis and production, along with other chemical aspects. Despite all the wideness of this article, we have introduced limited (but not ignored. presentations of two important aspects of this plant family, mainly due to the large size of this article. One, ethnobotany and ethnomedicine uses of these plants, and two, the influence of various cultivation conditions on these plants, and the results of these conditions.

* Corresponding Authors
Fax: +972-4-6205906
Phone: +972-50-5650025
E-Mail: eastern.plants@gmail.com
[a] Eastern Plants Research Institute, Box 868, Arara, Israel 30026

INTRODUCTION

The *Solanaceae* plants family is one of the most known and used by humans since the early dawn of humanity. It comprises 90 genera and 3000-4000 species, including some domesticated plants like potatos (*Solanum tuberosum*), tomatos (*S. lycopersicum*), eggplant (*S. melongena*) and chili pepper (*Capsicum annuum*).[1] These human cultivated species are among the most important for human nutrition and possees high economical value. Life forms of these plants are diverse and range from trees to annual grass.

They attracted the attentions of humans since antiquity. One of the earliest documented uses of these plants for medicinal uses can be found in the "Dioscorides Codex" (815 A.D).[2] All human civilizations utilized the plants of the *Solanaceae* family, while ancient people of the Americas (Maya) were the first to use the plants for food, ritual and religious matters.[3] These civilizations used a wide variety of *Solanaceae* plants including the genera of *Capsicum* (some for war uses), *Solanum*, *Datura* and others. Shamanistic physicians of ancient Egypt used mandrake (*Mandragora autumnalis*) for several uses, including hypnosis, rituals and medications.[4] Later studies showed that this type of use of *Solanaceae* plants was very common among all civilizations of the "Old World".[5]

Like other peoples of the world, ancient nations of the Middle East used the *Solanaceae* plants for many purposes, and these uses found their respectful rank in traditional medicines of civilizations of this region.[6] They used and still use *Lycium europeaum*, *Solanum nigrum*, *Hyoscyamus aureus*, *Hyoscyamus albus*, *Datura* spp., *Mandragora autumnalis* and *Wifhania somnifera*. Arab-Palestinian ethnomedicine used these plants with clear caution and only in limited cases.[7,8]

Finally, in the region between the Mediterranean sea and the Jordan river (Israel and Palestine), there are 24 species of *Solanaceae* wild plants.[9] All of them were thoroughly studied except *Solanum cornutum* about which, as far as our knowledge could reach, there is not a single publication about its medicinal activities.

PUBLISHED REVIEW ARTICLES: *SOLANACEAE* AND TROPANE ALKALOIDS

Expectedly, many review articles were published about this plant family that contains great numbers of biologically active natural products. In addition, some of the plants of this family are edible and highly nutritious (especially, the domesticated species), while some of the wild species, are highly toxic and psychoactive. In this part of our review, we will introduce some selected, previously published review articles, bearing in mind that many will not be presented here, since they contain almost the same information included in the articles that we will present. We will introduce these review articles as brief summaries rather than a table, since this presentation will include many figures and some notices. Each summary will present the reviewed species, major presented topics and references. The presentation is according to alphabetical order of the species names.

1. *Datura* ssp. focusing on *D. stramonium*. A comprehensive article that presents all ssp. of the genus of *Datura*. It introduces some botany, ethnomedicine, modern medical uses (detailed), toxicity and some important active compounds.[10]

2. *Datura* ssp. Systematic, clearly presented and comprehensive review, with good figures and tables of active alkaloids of *Datura*. Ethno uses in Mexico and Spain are presented.[11]

3. *Datura* ssp., antibacterial activity. Partial scan of natural products of *Datura* with antibacterial activity. The review focuses on few compounds, extensively presenting one of them, with a strange error.[12,a] See Figure 1.

Tandon *et al*. (ref. 12) attempted to review "most promising" natural products in *Datura* ssp. with antibacterial activity. The only structure that they chose to present is the structure of this steroidal alkaloid that was isolated from *Datura metel*.

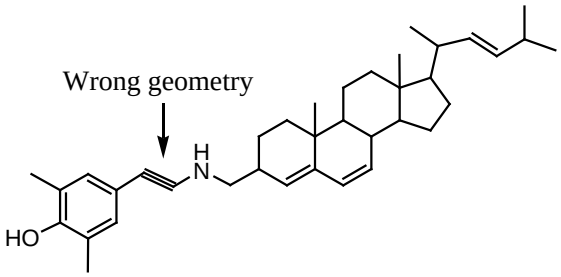


Figure 1. Wrong structure of steroidal alkaloid presented in reference 12

They cite: Okwu, D. E, Igara, E. C., Isolation, characterization and antibacterial activity of alkaloid from *Datura metel* Linn leaves, *Afr. J. Pharm. Pharmacol*., **2009**, *3*, 277-281. Oddly enough, authors of the original research and the review article presented the structure of the alkaloid containing alkyne functional group with *trans* (*E*) stereochemistry instead of linear. Nonlinear geometry of alkynes exists only in reactive intermediates. See: Sanz, R., Recent Applications of Aryne Chemistry to Organic Synthesis. A Review, *Org. Prep. Proced. Int*., **2008**, *40*, 215-291.

4. *Datura* ssp. Very detailed review of pharmacological activities of *Datura* ssp., with clear presentations of the structures of active natural products. Detailed tables also presented. Error in reference 12 is repeated here[13] (see above).

5. *Datura* ssp. This very important review presents various *Datura* ssp. but focuses mainly on *D. stramonium*. The review introduces in great details its content of Tropane alkaloids (Figure 2), especially scopolamine and hyocsyamine, and the poisoning potential of the plants to animals.[14]

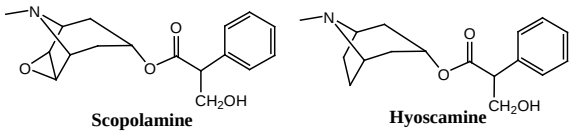


Figure 2. Tropane alkaloids, scopolamine and hyoscyamine

6. *Datura* ssp. This review focuses on *D. stramonium* and presents in very useful and detailed manner the different possibilities of *Datura* poisoning, its medical expressions and mechanisms, and most important, treatment of poisoning cases. It also presents some antidotes such as the natural alkaloid physostigmine (Figure 3).[15-17]

7. *Datura stramonium*. These comprehensive articles review the knowledge about this plant. Their major advantage is the detailed style but it lacks presentaion of important natural products structures. *D. fastuosa* is also reviewed (ref. 18. but this plant does not exist in the region of the inerest of our article.[18,19]

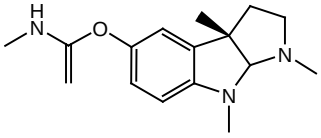


Figure 3. Physostigmine, natural alkaloid, antidote of *Datura* poisoning.

8. *Datura stramonium*. It is an important review with brief presentation of pharmacological activities of the plant, but with a wide scan of toxicity. It also includes an important, clear part of active natural products structures, alkaloids and many others.[20]

9. *Datura stramonium*. A short document that presents active constituents.[21]

10. *Datura stramonium*. Another short document that presents in details active constituents, some structures, pharmacological activities, traditional uses (brief), with a list of amino acids present in the plant.[22]

11. *Datura stramonium*. It is a veryshort documents with very few details. Useful short introductions of the plant.[23-26]

12. *Datura stramonium*. A short review that focuses on neurotoxicity of this plant, and provides a detailed list (no structures) of active compounds.[27]

13. *Datura stramonium*. Despite the fact that the title of this short document gives the expression of presenting *Datura* ssp., it actually presents the toxicity history of *D. stramonium* in the 18-19th centuries in Europe.[28]

14. *Hyoscyamus* ssp. This article reviews three plants of this genus namely *H. albus*, *H. niger* and *H. reticulatus*. It presents ethnobotanical uses, medicinal activities and list of some active natural products present in these species.[29]

15. *Mandragora*. In one of the most comprehensive and useful review articles about this genus authors have presented in a very clear manner, with detailed structures, the interesting active natural products contained in the plants of these plants. In addition to tropane alkaloids, hydroxy acids, esters resulting from previous two families, N-oxides of tropane alkaloids, very interesting epoxy carotenoids, the structues of polyhydroxy tropane alkaloids, named Calystegines and of the alkaloid Coscohygrine, are presented.[30] In Figure 4 we present selected structures of three calystegines and of coscohygrine.

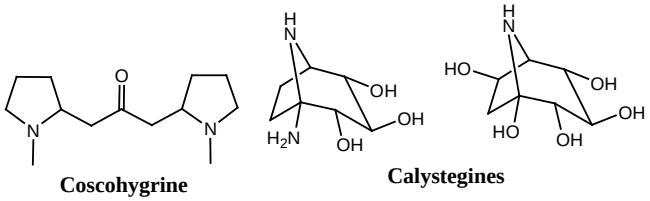


Figure 4. Structures of selected calystegines and coscohygrine (ref. 30).

16. *Nicandra physalodes*. The only published review about medicinal activities of this plant, and ethomedicinal uses are also presented. It lacks introduction of active natural products.[31]

17. *Physalis angulata*. One of the most comprehensive reviews about this plant. Information about traditional applications and medicinal activities is provided. Active natural products are extensively shown, clear structures and family classifications.[32] Some of these natural products are shown in Figure 5.

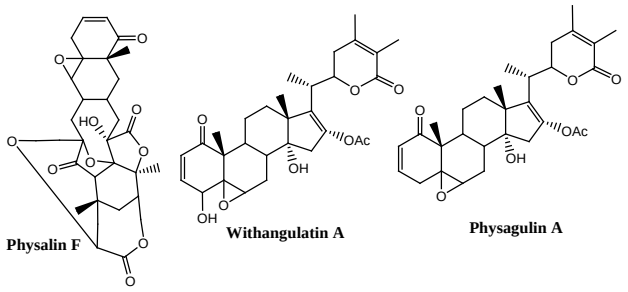


Figure 5. Selected natural products isolated from *Physalis angulata* (ref. 32).

18. *Physalis angulata*. A brief review that presents only medicinal activities.[33]

19. *Physalis angulata*. This review presents medicinal activities and list some of the active compounds but does not provide structures.[34]

20. *Physalis* ssp. Wide scan of traditional uses as well as systematic review of active natural pruducts and their structures (see Figure 6) are the two great adavantages of these reviews. They also include some medicinal activities.[35,36]

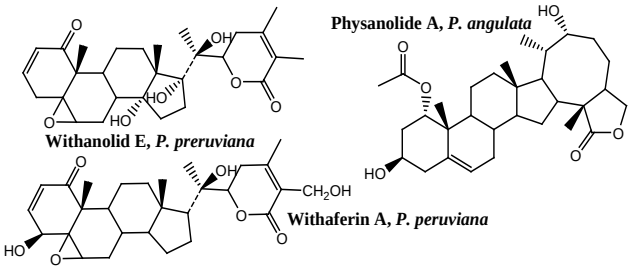


Figure 6. Structures of natural products isolated from *Physalis* ssp. (35).

21. *Physalis peruviana*. The main focus of these reviews (by the same author. is highlighting the nutritional importance of this plant. Medicinal activities and natural products are presented.[37,38]

22. *Physalis peruviana*. The morphology of the plant has been thoroughly discussed in this review, as well as its nutritional value. Limited chemical composition is presented.[39]

23. *Physalis peruviana*. This short review presents the protective potential of this plant against intoxications by cigarette smoke, acetaminophen, cadmium and CCl_4.[40]

24. *Solanum* ssp. One of the most comprehensive and informative review articles about alkaloids of the *Solanum* genus and their structures. The article presents the glycoalkaloids and their free forms (aglycons, without the saccharide units).[41] In Figure 7, the structure of α-Solanine is presented in both forms.

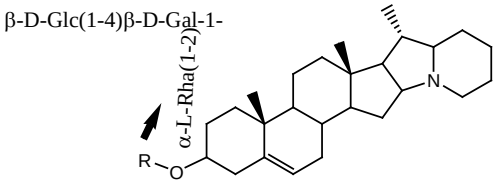


Figure 7. Glyco-α-solanine and its aglycon (ref. 41).

25. *Solanum* ssp. This review focuses on the medicinal activities of *Solanum* alkaloids, without presenting their chemistry or structures. Instead, it presents the basic structures of active natural products. For example, it presents the bicyclic skeleton on tropane alkaloids, without examples. Some of the structures are poorly presented.[42]

26. *Solanum* ssp. This wide review focuses on two glyco-streroidal-alkaloids found in *Solanum* plants: Solamargine and Solasonine (Figure 8). In addition to their structures and pharmacological activities, methods of their analysis are presented.[43]

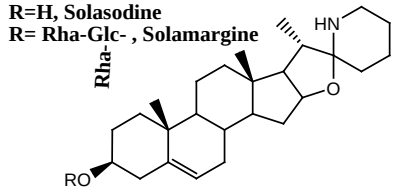


Figure 8. Solamargine and Solasonine (ref. 43).

27. *Solanaceae*. This vast, excellent review, presents the different active compounds groups in the *Solanaceae* plant family, their biological activities, toxicity and mechanisms of action. In Figure 9, we present some alkaloids from *Nicotiana glauca*.[44]

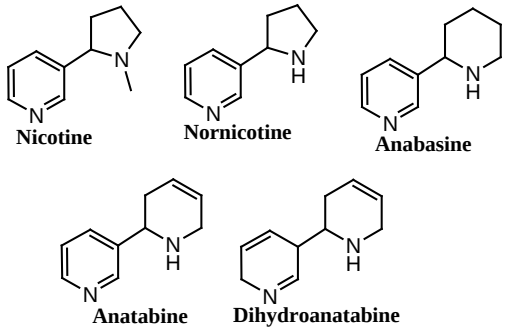


Figure 9. Selected alkaloids of *Nicotiana glauca* (ref. 44).

28. *Solanaceae*. In this large review, the focus is only on insecticidal activity of alkaloids of this plant family. It presents a brief introduction about the structures of these compounds, but provides a clear presentation of the mechanisms of action and structure activity relationship. It also provides very detailed (10 pages) table of plants, alkaloids and their bioinsecticidal activities.[45]

29. *Solanum elaeagnifolium*. This article discusses the botany and biology of this plant, that few decades ago was almost rare, and now, it is spreading rapidlay. In some areas of the Mediterranean basin, it became "monospecific". The article presents its negative effect on agricultural crops.[46]

30. *Solanum incanum*. Two short reviews about the ethnopharmacology, medicinal activities and very short presentations of the chemical compositions. In both reviews, structures are not presented.[47,48]

31. *Solanum nigrum*. Very colorful document, that presents the botany of the plant, very limited chemical composition (no structures. and some medicinal activities).[49]

32. *Solanum nigrum*. A partial and brief presentation of chemical composition and medicinal activities of this plant.[50]

33. *Solanum nigrum*. Despite the fact that the title of this article states that it discusses anticancer and antitumor activities of this plant, it also presents other activities.[51]

34. *Solanum nigrum*. A short review of the major active natural products.[52]

35. *Solanum nigrum*. Presentation of botany, partial composition and some medicinal activities of this plant.[53]

36. *Solanum nigrum*. An extended review that presents most topics related to this plant, including composition and medicinal activities. Special attention is drawn to the genetics of the plant, and some ethobotanical aspects are presented.[54]

37. *Solanum nigrum*. Very brief sections of traditional uses and chemical composition of the plant are presented, but a wider part of medicinal activities is provided.[55]

38. *Solanum nigrum*. Very short document that presents culinary uses and anti-inflammatory activity of the plant.[56]

39. *Solanum nigrum*. The capacity of this plant to hyperaccommulate heavty metals from contaminated soil or water is presented.[57]

40. *Solanum villosum*. Short review of botany, ethnomedicine, medicinal activities and very partial composition of the plant.[58]

41. *Withania somnifera*. In this comprehensive review about many medicinal activities of this plant, chemical composition is not presented.[59]

42. *Withania somnifera*. This excellent review, that focuses on antibacterial and antifungal activities of the plant, includes short chemical composition description, with structures of selected active compounds. The various medicinal activities of the plants are presented, and the selected activities are very detailed in a very helpful table.[60]

43. *Withania somnifera*. This document summarizes the research of anticancer activity of this plant. Various types of cancer are reviewed, mechanisms of action are presented and partial chemical composition is listed, especially the natural products with anticancer activity.[61]

44. *Withania somnifera*. This excellent and very comprehensive review about this plant, presents very datailed structures of active natural products, their biosynthesis, and their medicinal activities. This review provides some explanations for understanding the structures of withanolides (Figure 10).[62]

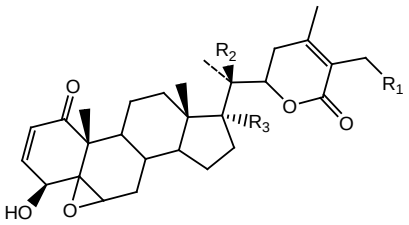


Figure 10. General structure of withanolides (ref. 62).

45. *Withania somnifera*. A minireview of medicinal activities of this plant with some information about withanolides. Structure of withanolide A is presented.[63]

46. *Withania somnifera*. An extensive review of many medicinal activities of this plant, which includes almost every possible activity. Short chemical composition and ethnobotanical uses are presented.[64]

47. *Withania somnifera*. Many medicinal activities are presented in these reviews, chemical structures and ethnobotanical uses are presented.[65-72]

48. *Withania somnifera*. A very good review that extensively presents the biosynthesis of withanolides. An excellent scheme is presented (page 5). The article presents an expanded review of ezymatic and genetic aspects, and builds future perspectives.[73]

49. *Withania somnifera*. This review includes medicinal activities, partial chemical composition, genetic modifications, future perspective and molecular profiling. *W. coagulans* (that is not included in our review) is also discussed.[74]

50. *Withania somnifera*. This is a very important and highly informative review. It presents extensive chemical composition part, along with some interesting modifications of natural products (an example is shown in Figure 11)[b]. Many medicinal activities are presented, focusing on anticancer activity (an excellent figure on page 5) and neuprotection activities (excellent figure page 6).[75]

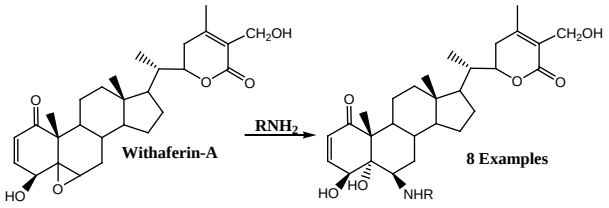


Figure 11. Aminolysis of Withaferin-A (ref. 75)[b] b. Citation of Joshi, P. *et al*., ref. 721.

51. *Withania somnifera*. This very extensive and excellent review presents various medicinal activities of the plant. Also, it includes a vast chemical composition section. But unlike all published reviews about this plant, this review specifies medicinal activity with single natural product. This information is summarized in clear, readable tables. In addition, it discusses the composition of the plant in two major habitats, India and Israel.[76]

52. *Withania somnifera*. Anticancer activity specific review. It presents in details the anticancer activity of the plant products, its active compounds, as well as detailed mechanisms of action.[77]

53. *Withania somnifera*. This review presents the beneficial effects of the plant products on human male fertility.[78]

54. *Withania somnifera*. An excellent review of male fertility benefits of this plant and its products. The article presents general background of treating male infertility and sexual weakness with medicinal plants, partial chemical composition of this plant and some medicinal activities of it. It presents in clear and useful manner (very helpful tables and figures) the mechanism of action of the plant and its products in enhancing male reproductivity and sexual functioning.[79]

55. Tropane alkaloids. This review is a followup of reference 14. It presents this family of natural products in clear link to *Solanaceae* plants, since these plants cause many cases of food contamination and poisoning, for humans and animals. The article provides chemical composition part, including general schemes of biosynthesis. But its main focus is toxicity of these compounds.[80]

56. Tropane alkaloids. These three articles focus on biosynthesis and laboratory synthesis of tropane alkaloids. Biosynthetic and synthetic paths are presented in general scopes. To use these schemes for practical purposes, readers must use the original research papers cited by these review articles.[81-83]

MEDICINAL, BIOLOGICAL AND OTHER ACTIVITIES OF *SOLANACEAE* WILD PLANTS

In this much extended section, we will present the published articles about the medicinal, biological and other activities of these plants. But it is important in our opinion to make it clear that some types of articles will not be presented here, for example, most publications of reported methods of enhancing the production of active natural products by these plants, through genetic engineering or various agricultural conditions. We cited some of them in order to enable the interested readers to start exploring this information, and continue their search if they want to. Due to the great phrmacological importance of these active natural products, an enormous number of researches have been published about this very important issue, a number of carefully selected articles of this type will be also presented in the next section.

The chemistry of the natural products that were isolated from the *Solanaceae* plants is very important and extremely interesting. But the vast majority of these publications are not included in this article. We have very carefully selected a few of them, which in our humble opinion, have special importance. These will be presented in a separate section.

Finally, the information in this section will be presented in tables, each presenting the published data about a single species. In this way, it is easier fot the interested readers to extract information about each plant. Publications are sorted by activity. All notes and figures related to a specific table will be shown right after it.

Datura ferox

This species is the less widespread among the three spcies that grow in our region (the others are *D. innoxia* and *D. stramonium*). But its natural habitat is very wide, including all continents. The activities of this plant are presented in Table 1.

Table 1. Medicinal, Biological and Other Activities of *Datura ferox.*

Activity/Property	Major Findings/Reference
Defensive alkaloids	Production of defensive alkaloids in leaves of this plant, mainly atropine, hyoscyamine, scopolamine and solanine; is adaptive to cope with herbivores.[84]
Alkaloids content (Argentina)	The alkaloid content ranged from 0.02-0.52 g of total alkaloids in different parts of the plant, and 0.0029-0.32 g of scopolamine per 100 g of dried material.[85]
Alkaloids content (Algeria)	Qualitative study of alkaloid content revealed that hyoscyamine and scopolamie are major compounds.[86]
Alkaloids content (Argentina)	An extended qualitative study of alkaloids content (HPLC, GC-MS) found five additional alkaloids compared with previously punlished (ref. 85).[87]
Alkaloids content (Algeria)	Quantitative study of alkaloid content revealed that hyoscyamine is major compound.[88]
Alkaloid effect on hens and broilers	A mixture of scopolamine and hyoscyamine (98:2), was incorporated at different alkaloid levels, into a control diet fed to 100 egg-laying hens for 3 months. Various tests were performed to determine the effect of this treatment on different health aspects of the birds. Alkaloid dose as high as 75 mg kg^{-1} feed is safe.[89,90]

Chemical composition (partial)	Morphology and partial chemical composition, as well as general composition of the seeds were studied.[91]
Poisoning of horses	Severe poisoning of horses by *D. ferox* contaminated hay, that resulted serious health problems that lead to euthanasia in some case. Analysis showed that hyscyamine was the major toxin.[92]
Human pisoning, special forensic method	A special method of forensic analysis was developed for detection an conformation of atropine and scopolamine, helped confirm the death cause of a man by this plant.[93]
Toxicity test for pigs	Alkaloid toxicity for pigs showed a limit of 1.5 mg kg^{-1} feed, for animals with 20-60 kg weight.[94]

Datura innoxia (or inoxia)

In our region, *D. innoxia* is widespread like *D. stramonium* and most people can not distinguish between both species. It has been thoroughly studied, and a summary of these studies is presented in Table 2.

Table 2. Medicinal, biological and other activities of *Datura innoxia.*

Activity/Property	Major Findings/Reference
Defensive alkaloids	Production of defensive alkaloids in leaves of this plant, mainly atropine, hyoscyamine, scopolamine and solanine; is adaptive to cope with herbivores.[84]
Alkaloid content	HPLC determination of total alkaloid content in different parts of the plant. Hyoscyamine and scopolamine were tested as well.[95] Determination of alkaloids with various liquid chromatography techniques.[96] Comprehensive analysis of 38 alkaloids, and comaprison between alkaloid content of the plants in Egypt and Bulgaria.[97] Effect of various growing conditions on alkaloid content.[98,99] GC-MS determination of 53 alkaloids contained in the plant in Morocco.[100] Influence of quantification methods on results of alkaloid determination.[101] Feeding plants with alkaloids with certain stereochemistry has no effect on the enantiomer composition and content.[102]
Analgesic	Aqueous leaves extract was tested and found active analgesic. It was analyzed for major active compounds.[103]
Antibacterial, antimicrobial, antifungal	Aerial parts were extracted with water and organic solvents. Extracts were tested against different bacteria. Methanolic extract was most active.[104] Flowers were extracted with 90 % aqueous ethanol, folllowed by various organic solvents. Extract was active against different bacteria.[105] Aqueous and methanolic extracts were prepared from seeds, leaves and roots of the plant. They were tested against some bacteria and the methanolic extract was more active.[106] Leaves were extracted with 95 % aqueous ethanol and the extract had clear antibacterial activity.[107] Lectin was isolated from seeds of the plant and found antibacterial and antifungal.[108] Ethanolic and aqueous extracts of leaves were tested, and ethanolic extract was found more active.[109] Leaves and seeds aqueous extracts, that were fractionized by organic solvents, found active against some bacteria and fungi.[110] Methanolic extract of aerial parts was found active against some bacteria strains.[140]
Anticancer and related activities	Leaves methanolic extract was found active against colon and breast cancer cells.[111] Flowers methanolic extract was prepared and fractionized with other solvents. Extract and fractions showed clear cytotoxicity and anti-angiogenesis properties.[112] Dinoxin B, was isolotared from the methanolic extract (and fractions) of leaves, and was found cytotoxic to cancer cells.[113]
Anti-inflammatory	Aqueous leaves extract was tested and found active anti-inflammatory.[103] Aqueous and methanolic extracts were prepared from seeds, leaves and roots of the plant. They were tested against *Aspergillus niger* fungus. Methanolic extract was more active.[106]
Antiparasitic, insecticide	Leaves and seeds were extracted with non-polar solvents. Extracts were active pediculocidal.[116] Leaves aqueous extract had high nematicidal activity. General chemical composition was also reported.[117] Leaves were extracted with water, methanol and hexane, and tested against *Agonoscelis pubescens*. Hexane extract had highest activity.[118] Fruits aqueous extract found active against *Holotrichia Serrata* (Fab).[119] Leaves aqueous had insecticidal activity against *Locusta migratoria*.[120] Leaves were extracted with methanol and hexane. Both extracts found active against *Spodoptera Litura* (F.).[121] Leaves were extracted with ethanol and extract was found active against *Meloidogyne incognita*. General chemical composition of the extract was determine.[122]
Antioxidant	Leaves and seeds aqueous extracts were prepared and antioxidant capacity was determined (DPPH).[110] Leaves methanolic extract had high antioxidant capacity, determined with three methods.[114] Leaves and seeds ethanolic extracts had high antioxidant capacity, determined with three methods.[115] Seeds and roots were extracted with six

	solvents and antioxidant capacity was determined by two methods. General chemical composition was determined.[123]
Chemical composition	Leaves and seeds aqueous extracts were prepared and total phenolic contents and total flavonoid content were determined.[110] Dinoxin B, a withanolide was isolated from the methanolic extract and characterized.[113] See Figure 12. General composition was determine for all parts of the plant, separately.[124,125] Quantitative analysis of Hyoscine (see Figure 12) in three extracts of seeds.[126] Scopolamine and hyoscyamine content was determined in the seeds of diploid (2n) and induced autotetraploid (4n) forms.[127] Total alkaloid content (1.75 %) and qualitative analysis of alkaloids was performed for leaves of Nigerian species.[128] Roots and leaves were extracted with methanol and chloroform, successively, and phenylpropanoids and fatty acids were quantified.[129]
Enzyme inhibition	Leaves and seeds aqueous extracts were prepared and protein kinase inhibition was tested.[110]
Phytoremediation	The plant was found good hyperaccumulator of Cd, Cu, Pb and Zn, for phytoremediation of contaminated soil.[130]
Toxicity	Leaves were extracted with 95 % aqueous ethanol and the extract had clear toxicity to rats.[107] Leaves and seeds aqueous extracts were prepared and brine shrimp toxicity was determined.[110] Aqueous and methanolic leaves extracts were found toxic to rats.[131]

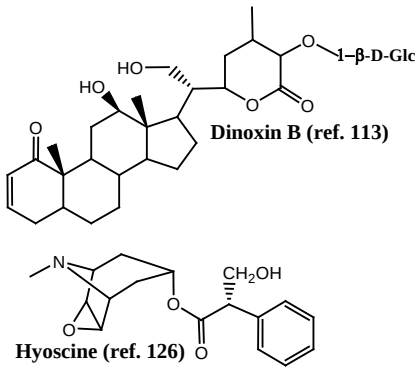


Figure 12. Selected active compounds isolated from *Datura innoxia* (Table 2).

Datura stramonium

D. stramonium is the most widespread of *Datura* species in the reviewed area. This is the main reason for the large number of published studies about it. This is also the reason of the high number of poisoning by it to humans and animals. Summary of selected published activities of this plant is presented in Table 3.

Table 3. Medicinal, Biological and Other Activities of *Datura stramonium*

Activity/Property	Major Findings/Reference
Alkaloids	Production of defensive alkaloids in leaves of this plant, mainly atropine, hyoscyamine, scopolamine and solanine; is adaptive to cope with herbivores.[84] Alkaloid analysis was done by GC-MS and the structures on new compounds were elucidated. Two of them are shown in Figure 13.[132] This is a followup, expanded study of previous one.[133] Ammonia assested, whole plant extraction yielded hyoscine and atropine as main alkaloids.[134] The effect of nitrate fertilization on alkaloids production of the plant was tested. Results differ between young and mature plants.[136] Effect of various hormones and fertilizers on alkaloid production is reported.[137,138,139]
Antibacterial, antimicrobial, antifungal	Ethanolic and aqueous extracts of leaves were tested, and ethanolic extract was found more active.[109] Methanolic extract of aerial parts was found active against some bacteria strains.[140] Dry leaves were extracted with 95 % aqueous ethanol. Extract was active against some bacteria. General chemical composition was determined.[141] Methanolic and ethanolic leaves extracts were tested against 7 bacteria, and found active against 4.[142] Leaves were extracted with four organic solvents, and extracts were tested against some bacteria types. Chloroform extract was most active.[143] Leaves were extracted with several organic solvents and extracts were tested against few bacteria. Hexane and ethyl acetate extracts were most active.[144] Leaves were extracted with ethanol, and extract was found active against bacteria isolated from chicken.[145] Leaves were extracted with 85 % aqueous ethnol, and extract was found active against *Staphylococcus aureus* isolated from sheep.[146] Leaves were extracted with some organic solvents, and extracts were tested against several types of bacteria and found active. Against *E. coli* they had weak activity, but in combination with *Abutilon indicum*, synergism was observed.[147] Aerial parts were extracted with ethanol, chloroform and benxene. All extracts showed antibacterial and antifungal activities.[154] Methanol-Water (70 %) **extract** of aerial parts

	had strong antifungal activity against *Fusarium* ssp.[155,156] Leaves aqueous extract showed singnificant antibacterial activity against few types of bacteria. In this study, general chemical composition was also determined.[157] Silver nanoparticles were prepared with leaves aqueous extract, and they had antibaterial activity.[158] Ethanolic and aqueous extracts were prepared and found antibacterial. General chemical composition was determined in this study.[159] Alkaloids were extracted (ethanol, H_2SO_4) and found very active against some types of bacteria. Alkaloids were isolated and characterized.[160] Different parts of the plant were extracted separately with 4 organic solvents, and extracts were tested and found aftive against several types of bacteria. General chemical composition was also determined with special attention to glycoalkaloids.[161] Ethanolic extract was found active antibaterial/ General chemical composition was determined.[162] Leaves were extracted with 80% aqueous ethanol, and protiens were isolated and found active against several types of bacteria.[163] Differenet parts of the plant were extracted separately with cold methanol. All extracts showed antibacterial activity. General chemical composition was also determined.[164] Leaves were extracted with five organic solvents, and all extracts had antibacterial activity. Despite the article title, no chemical composition was reported.[165] Fresh whole plant was extracted with 90 % aqueous ethanol, and extract showed strong antibacterial activity. Total alkaloid content was also determined.[166] Leaves were extracted with Soxhlet assembly successively with petroleum ether, benzene, solvent ether, chloroform, acetone, ethanol and methanol, and all extracts showed antibacterial activity. General chemical composition was determined.[167] Seeds were extracted with methanol and extract had strong antibacterial activity. Total alkaloid content was determined.[168]
Allelopathy	Alkaloid wash inhibited the growth of *Helianthus annuus*.[148] Leaf leachate (contained high concentration of alkaloids) inhibited the germination of *Linum usitatissimum*.[149] Extracts had no effect on *Sorghum halepense* germination but the inhibited its growth.[150] A wide range of extract concentrations was studied for its effect on *Zea mays* L. and *Helianthus annuus*. Interesting results were found, from growth stimulation to inhibition.[151] Aqueous leaf concentrations (2-8 %) inhibited the growth of *Vigna unguiculata* and *Triticum Aestivum*.[152] Leaves aqueous extract was prepared in concentrations of 1-5 %, and found to have negative effect on the growth of *Phaseolus vulgaris*, *Vigna sinensis*, *Cajanus cajan* and *Medicago sativa*.[153] Essential oil was prepared and analyzed for chemical composition. The main components were phytosterols (see Figure 13). Saturated aqueous solution of this EO inhibited germination and growth of four crops.[169] Aqueous extract was used to prepare MgO-NPs which had antibacterial activity.[175,c]
Anticancer and related activities	Flowers were extracted with several solvents, but only ethyl acetate extract had anticancer activity (liver). Unlike claimed in article, no pure compound was isolated.[170] Seeds were extracted with methanol and the extract showed cytotoxic activity against MCF7 cell line. Two active compounds were identified by TLC, but they were not isolated.[171] Leaves methaolic extract had immunomodulatory and anticancer (lung, breast) activities.[172] Leaves were extracted with methanol, and extract was analyzed for alkaloids, yielding three known compounds. This fraction showed anticancer activity.[173]
Antidiabetic, antidyslipidemic and related activities	Leaves aqueous extract showed singnificant α-amylase inhibition activity.[157] Roots were extracted with 70 % aqueous methanol. Extract was hypoglycemic (STZ-induced diabetic mice) and antidyslipidemic.[174]
Antioxidant, anti-inflammatory, anticoagulant, wound healing and related activities	Leaves were extracted with some organic solvents, and extracts had moderate antioxidant activity (DPPH).[147] Leaves were extracted with Soxhlet with ethanol and the antioxidant activity of the extract was determined (DPPH).[167] Seeds were extracted with methanol and extract had strong antioxidant activity (DPPH).[168] Seeds were extracted with methanol and the extract was tested for antioxidant activity (4 methods).[171] Roots were extracted with 70 % aqueous methanol. Extract had significant antioxidant activity (DPPH).[174] Flowers were extracted with chloroform and methanol (5:7) and extract showed anticoagulant activity in poultry birds.[176] Seeds powder was washed with petroleum ether to remove fatty compounds, then extracted with 70 % aqueous methanol.

	Extract showed anti-inflammatory activity in carrageenan induced paw edema in rats.[177,d] Fresh leaves were extracted with methanol and extract had high antioxidant activity (DPPH).[178] Leaves were extracted with several solvents and tested for antioxidant activity (DPPH, NO/super-oxide scavenging). Ethyl acetate had highest activity. General chemical composition was determined.[179,180] Leaves were extracted with methanol and extract had high anioxidant activity (DPPH, ABTS).[181] Essential oil was extracted from seeds by hydrodistillation and had anti-inflammatory activity.[182] Leaves were extracted with petroleum ether and 50 % aq. EtOH. Extract showed analgesic activity in two tests in rats. General chemical composition was obtained.[183] Leaves were extracted with 70 % aq. EtOH and extract had wound healing effect on rats.[192]
Chemical composition	Scopolamine and hyoscyamine content was determined in the seeds of diploid (2n) and induced autotetraploid (4n) forms.[127] Total alkaloid content (1.29 %) and qualitative analysis of alkaloids was performed for leaves of Nigerian species.[128] Roots and leaves were extracted with methanol and chloroform, successively, and phenylpropanoids and fatty acids were quantified.[129] Alkaloids were extracted (ethanol, H_2SO_4) and characterized by GC-MS (see Figure 13).[160] Essential oil was extracted from seeds by hydrodistillation and was analyzed by GC-MS. Terpenes were major compounds in this EO.[182] Two studies of general chemical composition.[184,185] Seeds were analyzed for chemical composition (GC-MS), yielding mainly alkaloids and terpenes.[186] Seeds were analyzed by column chromatography, and some compounds were isolated for the first time from the genus *Datura* or from the *Solanaceae* family. Two of them are shown in Figure 13.[187]
Enzyme inhibition, brain influencing, fertility influencing and related activities	Alkaloid extracts found as inhibitors of E-NTPDase, E-NTDase and ALP and stimulants of Na^+/K^+ ATPase.[135] Leaves were extracted with MeOH and extract inhibited serine protease.[181] Leaves were extracted with 90 % aq. EtOH and extract showed clear inhibition of acetylcholinesterase.[188] Known alkaloids were extracted (hydroethanol) and analyzed by GC-MS. Extracts showed inhibitory activity of cholinesterase and monoamine oxidase.[189] Seeds cold aqueous extracts had sedative activity on mice, showed by elongation of diazepam-induced sleeping periods.[190] Leaves were extracted with petroleum ether, ethanol and water. Ethanolic extract had clear antiovulatory activity.[191]
Insecticidal, antiparasitic and related activities	Leaves ethanolic extract showed high insecticidal activity against *Aedes Aegypti* and *Culex Quinquefaciatus*.[193] Ethanolic seeds and leaves extract had efficient inseticidal activity against *Tribolium castaneum*.[194] Acetone extract of aerial parts (excluding flowers) had lethal effect on *Callosobruchus maculatus*.[195] Leaves were extracted with several solvents and ethanolic extract showed highest activity against larvae of *Culex quinquefasciatus*.[196] Seeds were extracted with acetone, ethanol and chloroform, and acetone extract was most insecticidal against *Sitophilus oryzae* L.[197] Shoots were extracted with methanol and extract had nematicidal activity.[198]
Metal chelating, accummulation and nanoparticles	Alkaloid extracts had Fe^{2+} and Cu^{2+} chelating abilities.[135] Silver nanoparticles (AgNP's) were prepared by reduction of $Ag^+_{(aq)}$ with leaves aqueous extract, and they had antibaterial activity.[158] Aqueous extract was used to prepare MgO-NPs.[175,c]
Toxicity, body changes after feeding	Methanol-Water (70 %) extract of aerial parts showed high toxicity in brine shrimp test.[156] Alkaloid leaves wash was found toxic to chicken when concentrations were higher than 1 %.[199] Alkaloid seed extract that was prepared by a multi-step method, was tested for toxicty in mice. This is a detailed study that tested different variables and results.[200] Fatal case of dog posoning was reported of an animal that ate leaves. Damage was found in most body organs.[201] Small dosages (0.02-0.08 mL kg^{-1} of body mass) of seeds aqueous extract was administered to buck (Africa), icreased white blood cells or spermatogenesis. Extract was not evaporized and material concentration was not reported.[202,203,204] Alkaloid seed extract (1.5 mg kg^{-1} of body mass) caused mild toxicity in pigs.[205] Consuming aerial parts that were present in horse food, reasulted in a poisoning outbreak.[206] A case report of three horses that were poisoned by eating fresh leaves while grazing other plants.[207] Many case reports of human poisoning after consumption of the plant, mistakenly or deliberately. Special attention is drawn to poisoning management in children.[208-211]

(c) This report (ref. 175) is unclear and even misleading. Authors claim that they used *D. stramonium* aqueous extract to prepare MgO-NPs. They report that the strating material was "magnesium nitrate, $Mg(NO_3)\cdot 3H_2O$". To the best of our knowledge, Mg(I) nitrate does not exist. Moreover, in all reports of NPs green synthesis, plants extracts either reduce the ions in starting materials or do not change their oxidation state. In this report, the Mg^{+} ions were oxidized to Mg^{+2} (MgO). This contradicts all known published reports. In addition, we found no commercial suppliers of manesium nitrate trihydrate (only di- and hexahydrate are commercially available). See:
Imani, M. M., *et al*., MgO-NPs, https://doi.org/10.1155/2019/6063832 ; Duong, T. H., *et al*., MgO-NPs, https://doi.org/10.1155/2019/4376429; Ezealisiji, K.M., *et al*., ZnO-NPs green synthesis, DOI: 10.1007/s40089-018-0263-1
(d) In the experimental section of ref. 177 there is a mistake in one of the plant mentions. It is mentioned as *Thevetia peruviana*.

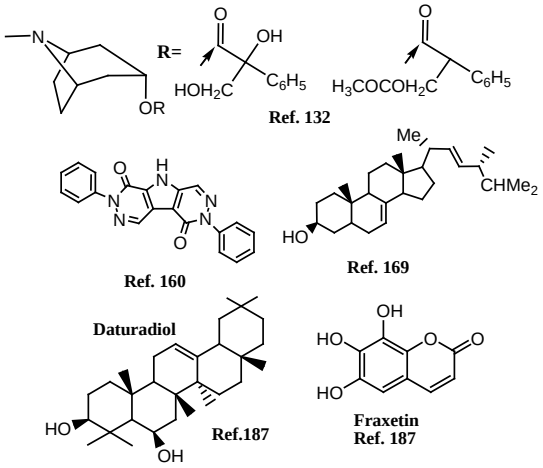


Figure 13. Selected active compounds in *D. stramonium.*

Hyoscyamus albus

Among the plants of the genus *Hyoscyamus*, this species, *H. albus* is the most studied so far. But it is important to mention that this genus is currently less investigated than some (not all) other genera of this family. Summary of selected published activities of this plant is presented in Table 4.

Table 4. Medicinal, biological and other activities of *Hyscoyamus albus.*

Activity/Property	Major Findings/Reference
Alkaloids	Auxin, an indole alkaloid plant hormone, increased the production of hyoscyamine and scopolamine (Figure 2) in roots.[212] Roots were analyzed for alkaloids, where some compounds were identified in this plant for the first time, along with some novel alkaloids. Two isomers are presented in Figure 14.[213-215]
Antibacterial, antimicrobial, antifungal, analgesic and related activities	Aerial parts were extracted with aqueous methanol (70 %) and extract was found active antibacterial against some types of bacteria. Total alkaloid content and general chemical composition were determined.[216] Leaves methanolic extract showed anlgesic (acetic acid, formalin) and antipyretic (Brewer's yeast) activities. Extract had no toxicity for albino rats.[217] Leaves were extracted successively with petroleum ether, chloroform and methanol. General chemical composition was determined, and extract was active against few bacteria species.[218]
Anticancer and related activities	Aerial parts were extracted with methanol, and extract had antitumor activity several cancer cell lines.[219] Atropine was isolated by HPLC and was active anticancer agent.[222]
Antidiabetic, antidyslipidemic and related activities	Seeds were extracted by ion exchange column and total fraction of calystegines (polyhydroxylated aminosugars, see Figure 4) was isolated. The toxicity of this fraction was measured (non-toxic up to 2000 $mgkg^{-1}$) and had significant antidiabetic activity (STZ-induced) in rats.[220]
Antioxidant, anti-inflammatory, anticoagulant, wound healing and related activities	Leaves were extracted successively with petroleum ether, chloroform and methanol. General chemical composition was determined and antioxidant capacity was measured with two methods.[218] Seeds were extracted for calystegines-rich fraction, and its antioxidant (4 methods) and anti-inflammatory (carrageenan-induced paw edema) activities were tested.[221] Leaves were extracted as in ref. 218. General chemical composition was determined and extract had antiulcer actvity induced by ethanol.[223] Leaves were extracted as in ref. 218. General chemical composition was determined and extract had hepatoprotective actvity against CCl_4-induce toxicity.[224]
Chemical composition	Aerial parts were extracted with several solvents successively, and total lipid content as well as fatty acid composition were determined by TLC and GC-MS. C16:0, C17:0 and C18:0 were detected with highest concentrations.[225] Aerial parts were extracted with several solvents successively and fractions were analyzed by TLC. Along with known compounds, two new natural products were isolated and their structures were elucidated by NMR spectroscopy (see Figure 14).[226] Roots of the plants were fed with auxin-free supplements and Putrescine N-Methyltransferase was isolated from them. Alkaloid composition was also determined.[227]

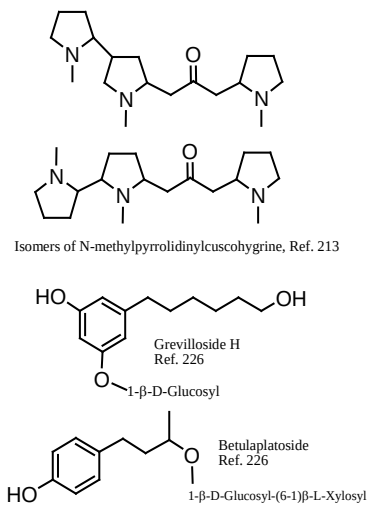


Figure 14. Selected compounds isolated from *H. albus.*

Hyoscyamus aureus

This plant is one of the least studied in the *Solanaceae* family and in the *Hyscyamus* genus. Very few studies were published about its medicinal activities, and none about its complete chemical or alkaloid compositions. So, here in this part of this review, we will present the few published studies, and some will be presented in the Discussion section.

Composition: aerial parts were extracted with several solvents successively, and total lipid content as well as fatty acid composition were determined by TLC and GC-MS. C16:0, C18:0 and C17:0 were detected with highest concentrations.[225]

Alkaloid production: different growth promoters (mixtures) were used for cultivation of the plants, and total alkaloid content was measured.[228]

Insecticidal: leaves and flowers were extracted with 70 % aqueous ethanol, extract was dissolved in water, and the solution had insecticidal activity against three species of insect. Fatal concentration was 62.5 mgmL^{-1}.[229]

Hyoscyamus desertorum

This is a typical desert plant that can be easily found in Southern Israel, Egypt and some regions of North Africa. Despite this, very few studies were published about its composition and medicinal properties, all were done in Egypt. Alkaloid composition of plants in Egypt was analyzed by GC-MS detecting 39 different compounds.[214,230]

Hyoscyamus muticus

On scanning the published literature about this plant, it is apparent that it has been very partially studied. Summary of these studies is presented in Table 5.

Table 5. Medicinal, biological and other activities of *Hyoscyamus muticus.*

Activity/Property	Major Findings/Reference
Alkaloids	Alkaloid composition of plants in Egypt was analyzed by GC-MS detecting 39 different compounds.[214]
Antibacterial, antimicrobial, antifungal	Aerial parts were extracted with aqueous methanol (70%) and extract was found active antibacterial against some types of bacteria. Total alkaloid content and general chemical composition were determined.[216] Different species of fungi were exposed to hyoscyamine and scopolamine isolated from this plant. All fungi were tolerant to scopolamine but died when treated with hyoscyamine.[231] Ethanolic, chloroform and hexane extracts of aerial parts were prepared by cold extraction. Each extract was dissolved in DMSO and tested against gram-positive and gram-negative bacteria. All extracts were active. General chemical composition was determined.[232] Aerial parts were extracted with 80% aqueous ethanol and phenolic compounds were analyzed in extracts. No new compounds were reported. Extract was active against several types of bacteria.[233]
Allelopathy	Aqueous extract and alkaloid fraction were prepared from the aerial parts. Both materials were tested and found active allelopathic against *Cichorium intybus* seeds germonation. Alkaloid fraction was analyzed and detailed compostion and structures are reported (all known compounds).[235]
Antioxidant	Aerial parts were extracted with 80 % aqueous ethanol and phenolic compounds were analyzed in extracts. Antioxidant activity was determined with DPPH test.[233] Methanolic extract and essential oil of aerial parts were prepared and analyzed by GC-MS. No new compounds were reported. Both extract and EO were tested (DPPH) for antioxidant activity.[234]
Chemical composition	Whole plant was extracted with various solvents, and each extract was analyzed by GC-MS. A detailed chemical composition is provided, including known compounds that were isolated for the first time from this plant (*iso*-fucosterol, scopoletin) and new withnolide, Muticin (Figure 15).[236]
Insecticidal, antiparasitic and related activities	Aerial parts were extracted with 80 % aqueous ethanol and phenolic compounds were analyzed in extracts. Extract found active against larvae of

	Spodoptera littoralis (Egyptian cotton leafworm).[233] Whole plant was extracted with various solvents, and each extract was analyzed by GC-MS. Chloroform root alkaloid extract had high activity against *Teteranychus urticae*.[236]

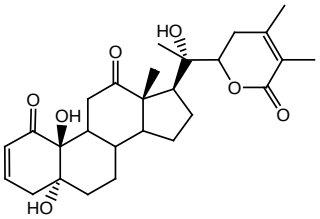


Figure 15. Structure of Muticin isolated from *Hyoscyamus muticus* (Ref. 236).

Hyoscyamus pusillus

The natural habital of this plant in the reviewed region is desert and semi-arid soils. Despite this, it is not a rare plant, but was very limitedly studied and published. Findings are summarized in Table 6.

Table 6. Medicinal, biological and other activities of *Hyoscyamus pusillus.*

Activity/Property	Major Findings/Reference
Alkaloids	Alkaloid content of whole plant was extracted and fractionized by several solvents. All isolated alkaloids are know, including apohyoscine and tropine (Figure 16).[237] Alkaloid content was analyzed in whole plant effected by two variables: growth stage and fertilizers supply. Flowering stage had the highest content and fertilizers enhanced the production of alkaloids. Hyoscyamine and scopolamine were major compounds.[238] Genetic analysis of different species of *Hyoscyamus* in realtion with alkaloid production in plants, showed that in genetically close species, similar alkaloids were produced, mainly hyoscyamine and scopolamine.[239] Comparison between different species of *Hyoscyamus* showed that *H. pusillus* contained mainly scopolamine.[240]
Antibacterial	Ultrasound assisted extraction was done to whole plant with water and ethanol. Both extracts were active against several types of bacteria.[241]
Anti-inflammatory	Ultrasound assisted extraction was done to whole plant with water and ethanol. Both extracts had anti-inflammatory activity (COX1-inhibition).[241]

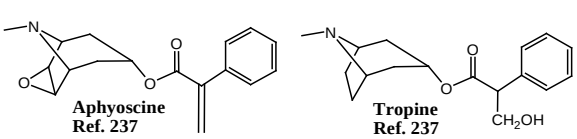


Figure 16. Active compounds isolated from *Hyoscyamus pusillus.*

Hyoscyamus reticulatus

This species was also, like most plants of the *Hyoscyamus* genus has been partially studied. But unlike most other species, studies of this plant are diverse. A summary is given in Table 7.

Table 7. Medicinal, biological and other activities of *Hyoscyamus reticulatus.*

Activity/Property	Major Findings/Reference
Alkaloids, chemical composition	Aerial parts were extracted with several solvents successively, and total lipid content as well as fatty acid composition were determined by TLC and GC-MS. C16:0, C17:0 and C18:0 were detected with highest concentrations.[225] Genetic analysis of different species of *Hyoscyamus* in realtion with alkaloid production in plants, showed that in genetically close species, similar alkaloids were produced, mainly hyoscyamine and scopolamine.[239] Comparison between different species of *Hyoscyamus* showed that *H. pusillus* contained mainly hyoscyamine.[240] HPLC analysis of different aerial parts of the plant revealed that leaves contain the highest level of tropane alkaloids.[242]
Antinociceptive	Aerial parts were extracted with methanol, and extract was active against pain in mice, induced by hot plate and acetic acid writhing.[243]
Antihyperuricemia	Aqueous extract of aerial parts found active Antihyperuricemic in mice.[244]
Antioxidant	Aqueous extract of aerial parts found active antioxidant (ABTS).[244]
Enzyme inhibition	Aqueous extract of aerial parts found active xanthine oxidase inhibitor.[244]
Toxicity	Case report of 19 children (Israel) poisoning that was treated with phytostigmine.[245] Six females (Turkey) were poisoned by consuming the plant and treated as mentioned before.[246]

Lycium depressum

Plants of the *Lycium* (4 in our region) were parially studied, and this one, is one of the least. Its chemical composition is completely unkown, and wether it contains alkaloids or not, is also unkown until today. Leaves were extracted with water or 80 % aqueous ethanol, and both extracts showed notable antioxidant (several methods)

activity. Both extracts had no effect on four species of bacteria.[247] In another study, leaves were extracted with methanol, and extract had significant wound healing activity in diabetic rats.[248]

Lycium europaeum

One of the notable properties of this plant is that its aerial parts are not toxic, and it is used as medicinal food, although it contains alkaloids and other cytotoxic natural products. But despite this, it has also been partially studied. Summary of the published data is presented in Table 8.

Table 8. Medicinal, biological and other activities of *Lycium europaeum.*

Activity/Property	Major Findings/Reference
Anticacer, cytotoxicity and related activities	Fruits were extracted with 80 % aqueous ethanol and extract had cutotoxic effect on A549 human lung cancer cells and PC12 rat adrenal medulla cancer cells.[249] Fruits were extracted with supercritical CO_2. Obtained oil inhibited Caco-2 cell growth. Oil was analyzed and its composition was determined (no new compounds).[252]
Antidiabetic and related activities	Aqueous leaves extract was prepared and was found antihyperglycemic and antihyperlipidemic in diabetic (alloxan) rats. Total phenolic and flavonoid contents were also determined.[250]
Antioxidant, anti-inflammatory, analgesic	Fruits were extracted with 80 % aqueous ethanol and extract had antioxidant activity (H_2O_2).[249] Aqueous leaves extract was prepared and was found active antioxidant (DPPH).[250] Leaves were extracted with water and extract had antioxidant (DPPH, H_2O_2) activity.[251] Fruits were extracted with supercritical CO_2. Obtained oil had antioxidant activity (ABTS, DPPH).[252] Whole plant methanolic extract was prepared and showed notable antioxidant (two methods) and analgesic (hot plate) activities.[253] Polysaccharide was isolated from the aqueous extract of fruits. It had antioxidant (DPPH, H_2O_2) and anti-inflammatory (carrageenan-induced paw edema in rats) activities.[254] Roots were extracted with several solvents, and extracts were analyzed for chemical composition. Main isolated compounds were terpenes and an alkaloid (see Figure 17). All extracts and isolated natural products had antioxidant (DPPH) activity.[255]
Internal organs protection, wound healing	Leaves were extracted with water and extract had kidney and liver protection activity against Cisplatin induced injuries .[251] Whole plant methanolic extract was prepared and showed notable hepatoprotective and nephroprotective activities against CCl_4-induced injuries in mice .[253] Polysaccharide was isolated from the aqueous extract of fruits. It had hepato and renal protection against CCl_4-induced toxicity.[254]
Enzyme inhibition	Roots were extracted with several solvents, and extracts were analyzed for chemical composition. All extracts and isolated natural products had acetylcholinesterase inhibition activity.[255]
Food	Fruits are used in North Africa as food.[256]

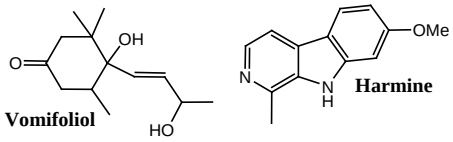


Figure 17. Selected compounds isolated from *L. europaeum* (Ref. 255).

Lycium chweinfurthii

As far as we could find in our published literature search, only two publications could be found. Different parts of the plant were extracted separately with several solvents. Each extract was analyzed and isolated compounds were characterized. No new compounds reported.[257] A new glucoside (3-methoxy-4-*O*-β-D-glucopyranosyl-methyl benzoate) that was isolated from fruit aqueous extract, showed α-glucosidase inhibition activity.[258]

Lycium shawii

A thorny plant with red fruits, that its natural habital is desert edge. It has been partially studied and a summary of published data is presented in Table 9.

Table 9. Medicinal, biological and other activities of *Lycium shawii.*

Activity/Property	Major Findings/Reference
Antibacterial, analgesic and related activities	Leaves were extracted with methanol and extract was active against some drug resistant pathogens.[260] Seeds were extracted with 70 % aqueous methanol and extract was very active against *Staphylococcus aureus*.[261] Fruits were extracted successively with several solvents. Most extracts showed significant activity against bacteria strains.[262]
Anticacer, cytotoxicity and related activities	Leaves methanolic extract was prepared and found active against HEK293 cancer cell line.[259] Aerial parts were defatted with *n*-hexane, suspended in aqueous ethanol (50 %) and extracted with several solvents.

	Most extracts showed anticancer activity.[263]
Antioxidant, anti-inflammatory, wound healing	Leaves were extracted with methanol and extract had notable antioxidant activity (DPPH, ABTS). Geral chemical composition, total phenolic and total flavonoid contents we also determined[260] Fruits were extracted successively with several solvents. Most extracts showed significant antioxidant activity. Total phenolic and total flavonoid contents were also determined.[262] Aerial parts were defatted with *n*-hexane, suspended in aqueous ethanol (50 %) and extracted with several solvents. All extracts showed anticancer activity.[263]
Chemical composition	Aerial parts were defatted with *n*-hexane, suspended in aqueous ethanol (50 %) and extracted with several solvents. Ethyl acetate fraction was analyzed and detailed list of compounds is provided. No new compounds.[263] Two new compounds were isolated and characterized (see Figure 18).[264] Detailed chemical compositions were determined effected by seasonal variations. The components that were reported are: general chemical composition, saccharides, fatty acids, hydrocarbons (including three sterols), total alkaloid, phenols, flavonols and tannins.[265] Chemotaxonomic significance study of the chemical composition. No new compounds.[266]
Internal organs protection	Aerial parts were defatted with *n*-hexane, suspended in aqueous ethanol (50 %) and extracted with several solvents. Most extracts showed hepatoprotective activity.[263]
Enzyme inhibition	Active urease inhibitors were scanned and a structure-activity relationship study was performed.[267]

Mandragora autumnalis

M. autumnalis is a single species of the *Mandragora* genus, that grows in the reviewed area. Ripe fruits are edible and have pleasant smell, but all other parts of the plant are highly toxic, as can be seen in Table 10.

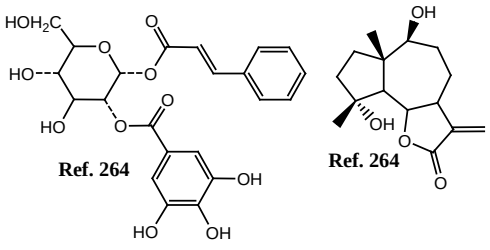


Figure 18. Selected natural products isolated from *L. Shawii.*

Table 10. Medicinal, biological and other activities of *Mandragora autumnalis.*

Activity/Property	Major Findings/Reference
Antioxidant	Aerial parts were extracted with acetone and methanol. Extracts showed high antioxidant capacity (4 methods) and metal chelating activity. Total phenolic and flavonoid contents were determined.[268]
Chemical composition	Aerial parts were extracted with acetone and methanol. Extracts were analyzed for fatty acids: 11 saturated (C8:0-C22:0) and 11 unsaturated (C14:1ω5-C20:2ω6).[268] Roots were analyzed for alkaloids and some compounds were indentified for the first time in *Mandragora* plants. Two of these alkaloids are presented in Figure 18.[269] In these five publications, detailed compositions of volatile and odoriferous compounds are presented after analysis or extraction of essential oil. Alkaloids or withanolides are not included.[270-274] Composition and morphological characteristics are presented in order to avoid misidentification that leads to poisoning.[275]
Enzyme inhibition	Aerial parts were extracted with acetone and methanol. Extracts had notable enzyme inhibition (cholinesterase, tyrosinase, α-amylase, α-glucosidase).[268]
Toxicity	72 Y.O. Female was poisoned after eating fruits that she mistaked with edible *Borago Officinalis*.[276] Two Greek and 15 Brazilian adults (separately) were treated with phytostigmine after being hospitalized with fruits eating poisoning.[277,278]

Nicandra physalodes

N. physalodes, known also as "Apple of Peru", is the most widespread species of the three included in the *Nicandra* genus. It was partly investigated, and most published researches focus on its active ingredients (Table 11)

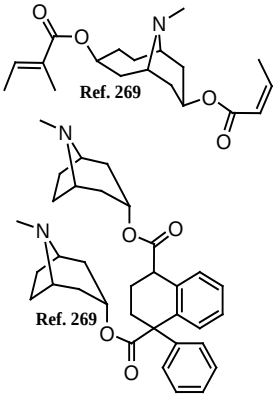


Figure 19. Natural products isolated from *M. atumnalis.*

Table 11. Medicinal, Biological and Other Activities of *Mandragora autumnalis.*

Activity/Property	Major Findings/Reference
Antibacterial	Leaves were extracted with acetone and crude extract was fractionized with several solvents. Extract and fractions had various levels of antibacterial activity.[287]
Anti-inflammatory	Fruits were extracted with 70 % aqueous ethanol and 18 glycosides were isolated, 3 of them new. Extract and pure compounds showed anti-inflammatory activity (NO prodution inhibition).[284]
Diuretic	Ethanolic and aqueous extracts of whole plant found diuretic in Wistar rats.[279]
Insecticidal	Petroleum ether extract was prepared (plan part is not indicated) and was chromatographed for general composition: triterpenes, hydrocarbons and sterols. The crude extract and fraction had insecticidal activity against Spotted Spider Mites (*Tetranychus urticae*).[280] Nicandrenone, a natural product with insecticidal activity was isolated from leaves.[283] Leaves were extracted with acetone and crude extract was fractionized with several solvents. Extract and fractions had various levels of insecticidal activity against *Aedes aegypti*.[287]
Chemical composition	General chemical composition was determined in fresh fruits tissue, and detailed composition of vitamins, antioxidants and minerals.[282] Nicandrenone was isolated and characterized (Figure 20).[283] Three new glycosides were isolated from fruits, one of them is shown in Figure 20.[284] Three new withanolides were isolated from the flowers and characterized. One of them (nicphysatone B) is shown in Figure 20.[285] Nicanlodes A and B were isolated from the aerial parts (Figure 20).[286] Five new withanolides were isolated from leaves acetone extract. One of them is presented in Figure 20.[287]
Nanoparticles and their applications	Leaves aqueous extract was prepared and used to reduce $Ag^{+}_{(aq)}$ ions, to prepare AgNP's, that had anti-mosquito activity.[281]

Nicotiana glauca

N. glauca is the only wild species of the *Nicotiana* genus (21), that grows in the reviewed area. Domesticated varieties of *N. tabacum* are cultivated and both species include many common natural products. *N. glauca* is toxic, as can be seen in Table 12.

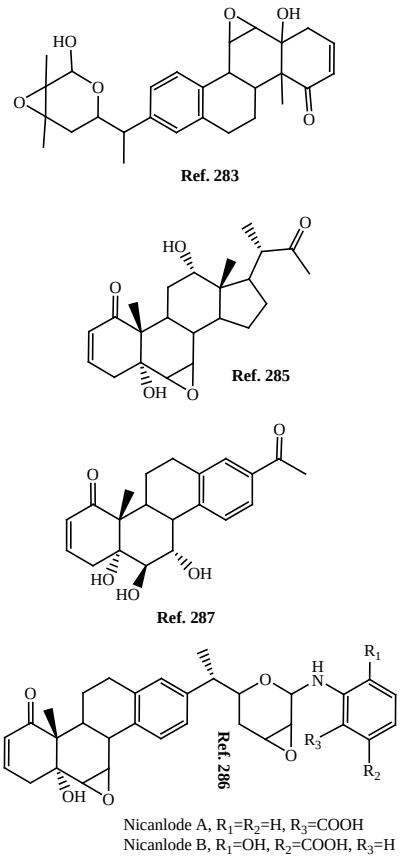


Figure 20. Natural products isolated from *N. physalodes.*

Table 12. Medicinal, biological and other activities of *Nicotiana glauca.*

Activity/Property	Major Findings/Reference
Allelopathic	Aqueous extracts of different parts of the plant were prepared and their effect on the growth of *Juniperus procera* was studied. Leaf extract promoted growth, while root extract supressed growth.[288]
Antibacterial	Aerial parts were extracted with water and *n*-hexane, several times over a time period of one year, and seasonal as well as location influemces were studied. Extracts had notable antibacterial activity.[289]
Anti-inflammatory, antioxidant	Aerial parts were extracted with water and *n*-hexane, several times over a time period of one year, and seasonal as well as location influemces were studied. Content of different antioxidant compound families, including enzymes was determined.[289] Who plant was defatted with *n*-hexane and extracted with methanol and for alkaloids. Each part of the plant was treated similarly, and all extracts were tested for anti-inflammatory (ear edema) and antioxidant (DPPH, ABTS) activities. General chemical composition is also reported.[290]

Insecticidal	Leaves were extracted for alkaloids and extract was analyzed by HPLC to obtain pure anabasine (Figure 9). Both alkaloid and anabasine showed high activity against cabbage white caterpillars (*Pieris rapae*).[291]
Chemical composition	Aerial parts were extracted with water and *n*-hexane, several times over a time period of one year, and seasonal as well as location influemces were studied. General chemical composition, fatty acids composition and enzyme composition, were recorded.[289] First isolation and characterization of anabasine.[292] High hydrocarbons (C29-C33) were analyzed in leaves by GC-MS.[293] Leaves essential oil was prepared by water distillation and analyzed by GC-MS.[294]
Corrosion inhibition, metal accummu-lation	Leaves aqueous extract was prepared and found efficient corrosion inhibitor of steel, under different conditions of acidity and salinity. Detailed potentiodynamic polarization curves are presented.[295] General chemical composition was determined after extraction of leaves and flowers with several solvents. Metal accummulation in these plants parts (that grew in polluted habitat) was low.[296]
Toxicity	Two cows died after eating leaves. Postmortem analysis detected nicotine and anabasine in corpses.[297] Seven ostriches that ate leaves died and anabasine was the major toxicant.[298] Five reports of human poisoning by leaves of the plant, with some fatal cases.[299-303]

Physalis angulata

P. angulata is one of two species of the *Physalis* genus, that grow in our area. Both of them, were sufficiently studied until now. In addition, research included many areas and topics, as can be seen in Table 13.

Table 13. Medicinal, biological and other Activities of *Physalis angulata.*

Activity/Property	Major Findings/Reference
Antibacterial, antimicrobial, antifungal	Fruits ethanolic extract found active against some bacteria, separately or with ZnO in an formulation.[304] Essential oils of aerial parts and roots were separately prepared by hydrodistillation. EO of aerial parts was more active against tested bacteria, and both EO's did not affect *Staphylococcus aureus*.[305] Fruits ethanolic extract was against some bacteria species. Physalin B that was isolated from this extract was proposed as the natural product responsible for this activity.[306] Known physalins (B, D, F) were found active against several types of bacteria, while physalin D was most active. Some NMR results for physalin D are reported for the first time.[343]
Anticancer and related activities	Fruits were extracted with several solvents and all extracts were active against human breast cancer MAD-MB 231 and MCF-7 cell lines.[307] Leaves were extracted with 70 % aqueous ethanol, and extract was active against human ovary cancer cell lines (SKOV3) and human blood cancer cell lines (HL60).[308] Whole plant was extracted with 96 % aqueous ethanol and extract was active against myeloma cell line.[309] Ethanol and aqueous extracts of fresh leaves were prepared. Both extracts inhibited lymphocyte cell proliferation.[310] Nine studies that present similar researches: anticancer actvities of natural products isolated from this plant (physalines and withanolides, see Figures 5, 6, 10). It is important to mention that many of these compounds are new.[311-319] Stems and leaves were extracted with ethanol and methanol. Extracts had antitumor activity.[324] Whole plant was extracted with dichloromethane and fractionized with several solvents. Physalin B and its 5,6-epoxide were isolated. Both compounds were cytotoxic (WI-38 cells).[334] Physalin F was isolated (no plant part or solvent indicated) and proved antiproliferative against HTLV-1-infected cells.[341] Leaves were extracted with ethanol and 15 physalins were isolated, five of them were new. All compounds had high anticancer activity against different human cancer cell lines.[342] Cytotoxic compounds search using various methods and techniques, revealed many active natural products, some are new physlains, withanolides and physagulides.[345-349]
Antioxidant, anti-inflammatory and related activities	Ethanol and aqueous extracts of fresh leaves were prepared. Total phenolic content was determined for both extracts, and their antioxidant capacities were measured.[310] Leaves methanolic extract was found analgesic (acetic acid induced writhing test) and anti-inflammatory (carrageenan induced paw edema) in mice.[320] Aerial parts were extracted with super critical CO_2 and extract had anti-inflammatory activity against TNBS-induced colitis in rats.[321] Whole

	plant aqueous extract was prepared and found anti-inflammatory (carrageenan induced paw edema) in rats. General chemical composition was determined in this study.[322] Leaves were extracted with water, ethanol and methanol. Extracts had anti-inflammatory and anti-arthritic activities. Aqueous extract was most active. General chemical composition was determined.[323] Roots aqueous extract had antinociceptive activity against formalin induced pain in rats.[325] Leaves were extracted with methanol and extract had antioxidant (DPPH) activity.[326] Leaves were extracted with water and extract was found active against oxidative stress in cell, induced by 2,4-dichlorophenoxyacetic acid.[327] Physalin E was isolated from aerial parts and tested for anti-inflammatory (12-O-tetradecanoyl-phorbol-13-acetate-induced) activity in rats.[328] Twelve new labdane-type diterpenoids were isolated from leaves and tested for anti-inflammatory activity (LPS-induced NO production). Ten of them found active, and structures of two of them are shown in Figure 21.[329] Physalin B was isolated from whole plant ethanol extract and was active against LPS-induced inflammation.[330] Different parts of the plant, which was collected in different locations and seasons, were extracted separately with 80 % aqueous ethanol. Each extract was tested for anioxidant capacity (3 methods), analyzed for total phenolic content, total flavonoid content, total phenolic acids content and analyzed with HPLC for phenolic compounds. New compounds were not reported.[331] Fruits were separately extracted with 70 % aqueous ethanol and water. Each extract was tested for antioxidant capacity (ABTS, FRAP, DPPH), analyzed for total phenolic content and general chemical composition, including use of NMR.[332] Leaves were extracted with methanol and general chemical composition was determined. Extract found active against ethanol-induced ulcer in rats.[333] Methanolic extracts from leaves, roots, stems, and fruits were prepared, general chemical composition of each part was determined, and antioxidant capacity of these extracts were determined (DPPH).[338] Leaves were extracted with ethanol and 15 physalins were isolated, five of them were new. most compounds inhibited NO production induced by LPS.[342]
Chemical composition	Whole plant was extracted with dichloromethane and fractionized with several solvents. Physalin B and its 5,6-epoxide were isolated.[334,e] Essential oil was extracted from leaves by hydrodistillation. No new compounds reported.[335] Whole plant was extracted with CH_2Cl_2 and *n*-BuOH. Three known compounds were isolated and characterized: physalin B, physalin G and quercetin 3-O-rutinoside.[336] Precise and comprehensive analysis of the chemical compositions of plant parts. All reported compounds are known.[337] Leaves (dried or fresh) were extracted and fractionized with several solvents and total contents of alkaloids, phenolics flavonoids and saponins were determined.[339,340] Leaves were extracted with ethanol and 15 physalins were isolated, five of them were new. One of them is shown in Figure 21.[342] Three new withanolides (physagulins A, B, C, see Figure 5) were isolated and characterized, from methanolic of fresh leaves.[344]
Immune system and blood cells enhancing activities	Leaves aqueous extract was prepared and had antisickling activity (blood cells).[350] Leaves aqueous extract was prepared and fractionized. Fractions tested and found active in enhancing blastogenesis and stimulatory activity on B cells and less effect on T cells.[351]
Enzyme inhibition and related activities	Whole plant was extracted with CH_2Cl_2 and *n*-BuOH. Three known compounds were isolated and characterized including physalin G which inhibited α-glucosidase.[336]
Insecticidal, anti-parasitic and related activities	Whole plant was extracted with dichloromethane and fractionized with several solvents. Physalin B and its 5,6-epoxide were isolated. Both compounds were antiplasmodial (*Plasmodium falciparum*).[334] Known Physalins were active antileishmanial in parasite infected mice.[352,353] Roots aqueous extract had notable activity against *Leishmania infantum*.[354]Whole plant and different parts were extracted and fractionized ethanol, methanol, ethyl acetate, dichoromethane, chloroform, and hexane. Each extract was analyzed to obtain pure physalins. These were tested and found active against *Biomphalaria tenagophila*.[355]
Nanoparticles synthesis	Leaves were extracted with water and extract was used to prepare nickel oxide nanoparticles (NiO-NPs). Extract was used as stabilizing agent

	not reductant.[356]
Toxicity	Administration of plant extract (parts, solvents, not indicated) along with Methylprednisolone (immunosupressor, anti-inflammatory) resulted no toxicity in mice.[357]

(e) Physalin B that was reported by P.M. Kimpende and his colleagues (ref. 334) is not a new compound. Its reported epoxide was also mentioned in the past, but both epoxides differ in the stereochemistry of the epoxide group. See: Kawai, M., *et al*., *Bull. Chem. Soc. Jpn*., **1994**, *67*, 222–226.

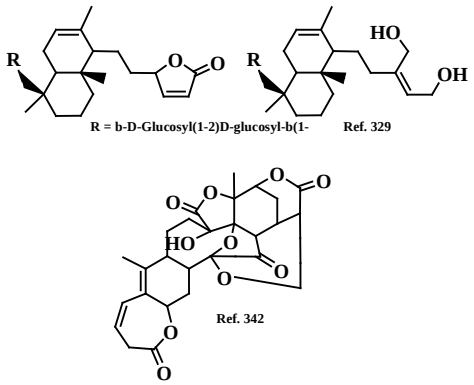


Figure 21. Selected natural products isolated from *Physalis angulata.*

Physalis peruviana

Even though *P. peruviana* is less widespread than *P. angulata*, locally and globally, it has ben reasonably studied. The amount of published research is sufficient and properties that were studied are diverse. Summary of research findings is presented in Table 14.

Table 14. Medicinal, biological and other activities of *Physalis peruviana*.

Activity/Property	Major Findings/Reference
Antibacterial, antimicrobial, antifungal	Fruits were extracted (solvent not indicated) and the resulting extract/s was/were active against 9 (out of 11 tested) species of bacteria.[358] Leaves and fruits were extracted with 95 % aqueous ethanol, and extract was active against *Listeria* ssp. isolated from meat.[359] Leaves and fruits were extracted with ethanol, and extract was active against *Salmonella* ssp.[360] Fruits aqueous extract was prepared and found active againts six bacteria species. General chemical composition was determined in this study.[361] Flowers were extracted with 80 % aqueous methanol and extract was active against four bacteria species. Detailed chemical composition was reported but all compounds are previously known.[362] Ethanolic extracts of different plant parts (fruit, seed, root, stem and leaf) were prepared separately. All extracts were active against several types of bacteria, where the fruit extract was most active. General chemical composition was determined.[363]
Anticancer and related activities	Fruits aqueous extract was prepared and found active against two types of human cancer cells.[361] Flowers were extracted with 80 % aqueous methanol and extract was active against three types of human cancer cells.[362] Whole plant was extracted with 95 % aqueous ethanol and extract was active against nicotine-derived-nitroamine-ketone-induced cancer in rats.[364] Active natural product 4β-hydroxy-withanolide E was isolated from different parts of the plants with different solvents and fractionation steps and found active against various human cancer cells.[365-368] Fresh leaves were extracted separately with *n*-hexane and ethanol. Both extracts were tested and found active against two human breast cancer cell lines.[369] Fruits were extracted with ethanol and *iso*-propanol. Both extracts had anticancer and immunomodulatory activities.[395]
Antidiabetic, antiobesity and related activities	Fruits were defatted with petroleum ether then extracted with 95 % aqueous ethanol. The extract showed antidiabetic (STZ-induced) high-fat fed rats.[370] Fruits aqueous extract was added to drinking of STZ-induced diabetic rats, resulting improvement of biochemical parameters in their brains.[371] Flowers were extracted and fractionized with several solvents. Butanol and 80 % aqueous ethanolic farctions had antidiabetic activity.[372] Fruits ethanolic extract had α-amylase inhibition activity.[373] Obese diabetic (alloxan-induced) rats were treated with fruits ethanolic extracts, resulting improvement of both tested parameters. General chemical composition was determined in this study.[374] Fruits fresh juice had high antidiabetic activity in STZ-induced diabetic rats.[375] Dried fruit pomace was fed to high-cholesterol diet-induced hypercholesterolemia in rats resulting in body weight control.[376] Fresh fruits were crushed and processed as pulp, which promoted insulin-dependent skeletal muscle glucose uptake.[752]
Antioxidant, anti-inflammatory and related activities	Fruits aqueous extract was prepared and tested for antioxidant capacity (DPPH).[361] Ethanolic extracts of different plant parts (fruit, seed, root, stem and leaf) were prepared separately. All extracts had notable

	antioxidant activity (DPPH).[363] Fresh leaves were extracted separately with *n*-hexane and ethanol. Both extracts had antioxidant capacity (DPPH). General chemical composition and detailed volatile compounds content were determined.[369] Fruits fresh juice had high antioxidant (DPPH) activity.[375] Filtered fresh fruite juice ameliorated rabbit eye inflammation.[377] Flowers petroleum ether extract was prepared, and its anti-inflammatory activity was tested by two methods: TNBS-induced colitis in rats and inhibition of NO production induced by LPS. Antioxidant capacity of extract was determined (DPPH, ABTS).[378] Leaves methanolic extract inhibited ovalbumin‑induced airway inflammation by attenuating the activation of NF‑κB and inflammatory molecules.[379] Flowers were extracted with methanol and 4β-Hydroxywithanolide E was isolated. It had anti-inflammatory activity by inhibiting the NF-κB signaling in diabetic mouse adipose tissue. [380] 4β-Hydroxywithanolide E and physalactone (Figure 22) were isolated from flowers and had anhibited LPS-induced inflammation.[381] Aerial parts were extracted with water or different concentrantions of aqueous ethanol (20-95 %), and antioxidant capacity of all extracts was tested ($FeCl_2$-Ascorbic acid and lipid peroxidation). 95 % Aqueous ethanol extract had the highest activity.[382] Fresh fruit juice was added to rats food that had CCl_4-induced liver oxidative stress, and improvement was recorded compaired with control animals.[383] Fruits were extracted with ethanol and fractionized with several solvents. Extract and fractions were tested against rotenone-induced oxidative stress in astrocytic cells. Extract and acetone fraction were most active.[384] Fresh fruits juice of wild and culivated plants were tested for antioxidant capacity (DPPH), and cultivated fruits were more active.[385] Fruits were extracted with ethanol and *iso*-propanol. Both extracts were analyzed for general chemical composition, total phenolic and β-carotene contents, and antioxidant capacity was determined (DPPH, FRAP).[395] Fresh fruits were crushed and processed as pulp, which prevented inflammation and lipoperoxidation in the liver of diet-induced obese mice.[752]

Chemical composition	First report of isolation and characterization of 4β-Hydroxywithanolide E.[386] First report of isolation and characterization of perulactone.[387] Different protection compounds (mainly withanolides and their derivatives) were isolated from leaves and flowers (aqueous extract) and fresh fuits (juice) in various maturity steps. New compounds are not reported.[388] Fresh berries juice; seeds, and pulp/peel (extracts); were analyzed by HPLC, GC-MS and FT-IR for fatty acids, lipid classes, triacylglyerols, phytosterols, fat-soluble vitamins, phenolics and β-carotene.[389-391] New alkaloids, such as physoperuvine (Figure 22) were isolated and characterized.[392] Comprehensive alkaloid analysis revealed eight compound, three of them reported first time in *Physalis* genus.[393] Whole plant was analyzed using various techniques, resulting the determination of 18 odor compounds. Aroma recombination and sensory evaluations tests were also performed.[394] Flowers of cultivated plants were analyzed with various methods, revealing high concentrations (compared with wild plants) of phytoprostanes (phenolics), some detected for the fist time in this plant.[396] A group of irinans (one is shown in Figure 22), androstane-type withanolides, were isolated for the first time and characterized.[397]
Hepatoprotective	Roots were extracted with ethanol and 50 % aqueous methanol, successively. Extract had hepato-renal protective activity against CCl_4-induced toxicity in rats. Further analysis of extract revealed that the major active natural product responsible for this activity is cuscohygrine (Figure 4).[398] Fresh fruits juice had hepatoprotective activity against CCl_4-induced toxicity in rats. Analysis of extract revealed that the major active natural product responsible for this activity is kaempferol. In this study, general chemical composition and antioxidant capacity (TBARS, NO radical inhibition) were determined.[399]
Insecticidal	Withanolide E was the major antifeedant against larvae of *Spodoptera littoralis*.[400]
Nutrition	Fresh fruits juice of wild and culivated plants were analyzed for nutritional value, and cultivated fruits contained more vitamin-C and β-carotene.[385]
Toxicity	Fresh fruit juice was administered to rats and a very detailed toxicity study

was performed. Results showed (entire body and organs) that it is not toxic.[401]

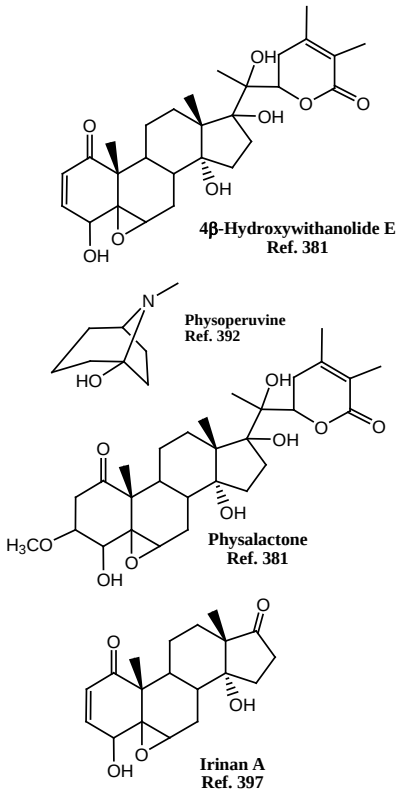


Figure 22. Selected natural products isolated from *Physalis peruviana.*

Solanum cornutum

No publications.

Solanum elaeagnifolium

This plant is one of the most known of the *Solanaceae* family and the *Solanum* genus in the reviewed region of Israel and Palestine. It can be easily confused with *S. incanum*, especially in terms of flowers shapes and colors. But leaves of both species are slightly different, where leaves of *S. elaeagnifolium* have smooth-shaped edges, while leaves of *S. incanum* have gulf-like edges.

Figure 23. Solanum elaeagnifolium

Even though *S. elaeagnifolium* was always a well known plant, it grew with low densities over a very wide range of natural habitats, excluding only very arid, desert areas. In recent years, this plant is spreading very rapidly, and now, in habitats of heavy soils, it is one of the most common plants. Its medicinal properties are presented in Table 15.

Table 15. Medicinal, biological and other activities of *Solanum elaeagnifolium.*

Activity/Property	Major Findings/Reference
Allelopathy	Seeds were extracted with water and several organic solvents or mixtures. All extracts were tested for allelopathic activity against for plants growing in Corn (*Zea mays*) fields. Active extracts and fractions were analyzed (GC-MS), and ethanolic extract was most active, containing chlorogenic acid.[402] Leaves aqueous extract had pesticidal activity against nematode *Meloidogyne incognita* and three weed species. Active ingredients were known phenolics.[403]
Antibacterial	Leafy branches were extracted with water and several organic solvents. Each extract was tested against bacteria strains and analayzed, mainly for lipids and fatty acids. Detailed data is provided. New compounds were not reported.[404]
Anticancer	Seeds were extracted with 30 % aqueous ethanol and chloroform-methanol (2:1, v/v), separately. Extracts found active in anti-proliferation test (MMT).[405] Whole plant was extracted with 90 % aqueous methanol and extract was chromatographed and analyzed, leading to isolation of two compounds (one new, see Figure 24) that had activity against several human cancer cell lines.[406] Fruits were extracted with 10 % aqueous methanol, and extract was active against several breast cancer cell lines. Extract was analyzed and approximate composition is provided, presenting mainly known active phenolics.[407]
Antidiabetic	Fruits were extracted successively with cyclohexane, dichloromethane, ethyl acetate and methanol. Each extract was tested for antidiabetic activity with Anti-AGEs assay.[408]
Antioxidant, anti-inflammatory and related activities	Seeds were extracted with 30 % aqueous ethanol and chloroform-methanol (2:1, v/v), separately. Extracts anti-inflammatory activity (LPS-induced NO production inhibition) and antioxidant capacity (4 methods).[405] Fruits were extracted successively with cyclohexane, dichloromethane, ethyl acetate and methanol. Each extract was tested for

	antioxidant capacity (4 methods) and metal chelating activity.[408] Five organic solvents and water used to extract seeds. For each extract, general chemical composition was determined and antioxidant capacity (TAOC, DPPH) was measured.[409]
Hepatoprotective	Methanolic extract of aerial parts was prepared and found hepatoprotective against paracetamol-induced liver injury. In this study, a new compound was isolated and characterized (Figure 24).[410]
Insecticidal, molluscicidal	Seeds methanolic extract had moderate insecticidal effect on three pest species, and strong effect inhibiting their oviposition. Leaf extract had lower efficiency.[411,412] Seeds were extracted with several solvents successively. Methanolic extract was most active against snails (*Galba truncatula*). Analysis of this extract revealed active compound β-solamarine, which was isolated for the first time from this plant. Total alkaloid and saponin contents of this extract were also determined.[413]
Toxicity	Alkaloid extract caused congenital craniofacial malformations in rats and high ratio of deformed litter incidence. It is reported that solasodine (Figure 8) is the major cause of these effects.[414]
Chemical composition	Detailed seed oil chemical composition is presented.[415] Leaves were extracted and analyzed with standard multi-step isolation procedure, yielded a new compound (Figure 24) along with known others.[416]

Solanum incanum

S. incanum has a close appearance to *S. elaeagnifolium*, but the former grows in drier areas and it is less widespread in eastern part of the Mediterranean basin.

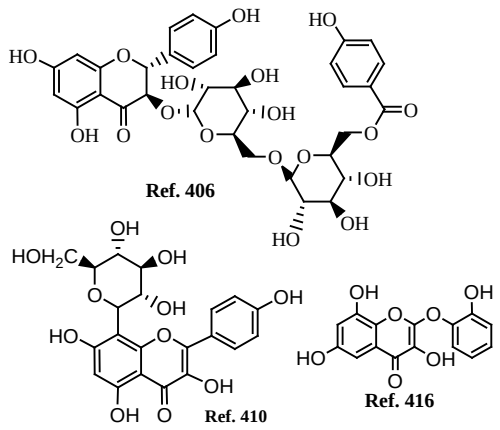


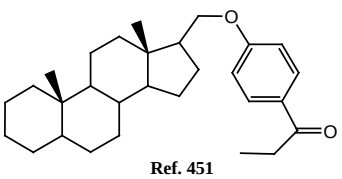
Figure 24. Selected natural products isolated from *Solanum elaeagnifolium.*

Table 16. Medicinal, biological and other activities of *Solanum incanum.*

Activity/Property	Major Findings/Reference
Antibacterial and related activities	Aqueous and methanolic leaves extracts found active against several bacteria species.[417] Aerial parts were extracted with several organic solvents and all extracts were found weak antibacterial (*B. subtilis, S. aureus E. coli, K.pneumoniae, P. aeruginosa*).[418] Ethanolic fruits extract was analyzed for general chemical composition, and it had notable antibacterial activity.[419] Unripe fruits methanolic extract found active against some bateria species.[420] A mixture of ripe and unripe fruit juice was prepared and diluted with water to prepare solutions with ten solutions, 10-100 μL/10 mL. 70 μL Was most effective against oral bacteria.[421] Fruits methanolic and aqueous extracts were prepared, diluted to a range of concentrations, and foud active against *S. aureus* and/or other bacteria species. General chemical composition was determined in these studies.[422,423] Aerial parts were extracted with 80 % aqueous ethanol. Extract was analyzed for general chemical composition and found active against several bacteria types.[424] Fruits juice was filtered on silica gel and fractionized with several solvents. Some fractions had notable antibacterial activity, but it is reported that a compound that had "purine-like in structure and probably phosphorylated" had high activity. Compound was isolated by TLC but structure is not reported.[425] All parts of the plant, including ripe and unripe fruits were extracted separately with methanol, petroleum ether and cholroform, each. All extracts were tested (10-20 %) against six microbial species. Methanolic extract of ripe fruit was most active and peroleum ether extracts were inactive. General chemical composition is reported.[426] Fruits were extracted with 70 % aqueous ethanol. Extract was analyzed for qualitative composition and found active against several bacteria species.[427] Fruity aerial parts were extracted with methanol and extract was analyzed for general chemical composition. It was found active against two bacteria species.[428] Nano particles were prepared by mechanical procedure from dry fruits powder and from dry methanolic extract of this powder.

	Both nano particles found active against *P. erinaceus* and *E. coli*.[429]
Anticancer	Extract "SR-T100" (no preparation method) which contains mainly alkaloid fraction (solamargine), had anti-ovarian-cancer activity. Mechanism of action is also investigated.[430] Extract "SR-T100" (partial preparation method) found active against lung melanoma cells.[431] Aqueous fruit extract found active against human colorectal carcinoma cell line (HCT 116).[432] First isolation and characterization of incanumine (fruits, methanolic extract), structure elucidation, which revealed a glycoside of solasodine (Figure 8). It was found active against human hepatoma cancer cells.[433]
Antidiabetic	Aqueous fruit extract modulated glucose uptake by yeast cells inhibited the enzymes α-glucosidase and α-amylase.[434] Fruits aqueous extract had clear antihyperlipidemic activity in alloxan-induced diabetic rats.[435]
Antioxidant, anti-inflammatory and related activities	Roots were extracted with dichloromethane and extract was found active antinociceptive (formalin-induced) and anti-inflammatory (carrageenan-induced).[436] Leaves were extracted with 80% aqueous methanol and extract had analgesic activity in hot plate test and acetic-acid induced writhing test in mice.Very general chemical composition was deterined.[437] Roots were defatted with petroleum ether and extracted in a standard procedure to obtain flavonoid-rich extract, and it was analyzed for general chemical composition. This extract had anti-inflammatory and antinoceceptive activies, after inducing these health disorders (both) in mice with formalin.[438] Methanolic extract of aerial parts was prepared, and its antioxidant (DPPH) capacity was measured.[439] Leaves methanolic extract was prepared and an ointment was made containing 1% of this extract. Ointment found active against burn wound induced by hot metal rod.[440]
Insecticidal, molluscicidal, antiparasitic	Methanolic extract of aerial parts was prepared and was found active against four parasite species.[439] Roots were extracted with 98% aqueous ethanol and extract was active against *Schistosoma mansoni*-infected mice.[441] Fresh fruits aqueous extract and found active against Chilli root knot nematodes (*Meloidogyne*).[442,f]
	Fresh fruit juice was diluted with water and was found active against cattle ticks larvae (*Rhipicephalus decoloratus*).[443] Fresh fruit juice was found active insecticidal against cabbage aphids (*Brevicoryne brassicae*).[444,f]
Nutrition	Nurtitional values and general chemical composition are reported.[445,446] Fresh fruit juice added to milk resulting milk clotting for the purpose of cheese manufacturing.[447]
Toxicity	Unripe fruits were found toxic to goats.[448] Unripe fruits and seed are reported as causing poisoning cases of livestock. Results are: diarrhea, lacrimation incoordination, inappetance.[449] Fruits ethanolic extract was added to healthy female Swiss mice, in a single dose of 100, 250, 500, 750, 1000 and 2000 $mgkg^{-1}$ body weight. Signs of toxicity and mortality were noted after 1, 4 and 24h of administration of the extract for 14 days.[450]
Chemical composition	Analysis of 80 % aqueous methanolic extract of leaves and fruits, resulted the isolation and charcterization of a new steroid shown in Figure 25.[451] Whole plant was extracted with petroleum ether, chloroform, methanol, and ethanol, separately. Each extract was analyzed with GC-MS. Detailed chemical compositions and spectra are presented. New compounds are not reported.[452] General chemical composition is presented.[453-456] Using two countercurrent chromatographic techniques resulted the isolation of solasonine and solamargine (Figure 8).[457] Changes in the concentration of glycoalkaloids solasonine and solamargine according to growth steps.[458,459]

Despite this, it was more investigated as can be concluded according to published studies about both plants. Summary of these studies is presented in Table 16.



Ref. 451

Figure 25. Struture of a steroid isolated from *Solanum incanum.*

Solanum nigrum

This species is the most studied among the plants of the *Solanum* genus. In the reviewed region, it is unmistakable with other plants, since most people can identify it very easily. It has been very extensively studied and published for almost every possible activity and property. Summary of these published studies is presented in Table 17.

Table 17. Medicinal, biological and other activities of *Solanum nigrum.*

Activity/Property	Major Findings/Reference
Allelopathy	Shoots and roots were extracted separately with water. Both extracts had allelopathic effect on seed germination of cabbage, spinach and tomato. Roots essential oil was prepared and analyzed by GC-MS. A detailed composition is presented but new compounds are not reported.[460]
Antibacterial, antifungal, antiviral and related activities	Various parts of the plants were extracted with methanol and extracts were tested against four bacteria species. Extract of whole plant had highest activity.[461] Fruits were extracted with seven solvents and extracts were tested against some bacteria species. Methanolic and aqueous extracts had highest activities.[462] Leaves were extracted with 95% aqueous ethanol and extract was found active against pathogenic bacteria.[463,464] Acetone whole plant extract was prepared and found active antibacterial. General chemical composition was determined in this study.[465] Leaves aqueous extract was used to prepare silver nanoparticles (AgNP's), that had activity against *S. typhi* and *S. aureus*.[466] Solanine was isolated from leaves and found active against several bacteria species.[467] Aerial parts were ultrasonic-assisted-extracted with ethanol. Extract had activity against several bacteria species, with rutin as the major active compound. A mechanism of action is presented.[468] Aqueous and methanolic extracts were prepared and both were active against bacteria and fungi. General chemical composition was determined.[469,470] Gold nanoparticles AuNP's were prepared using aqueous extract of leaves. AuNP's had strong antibacterial activity.[471] Ethanolic extract was prepared after defatting the "plant materials" (no parts indicated) with petroleum benzene and its antibacterial properties were tested. General chemical composition was determined and functional groups (in extract) were detected by IR spectroscopy.[472] Leaves were extracted with five solvents and for each extract, antibacterial activity and general chemical composition were determined.[473] Leaves methanolic extract was prepared and found active antibacterial. General chemical composition and detailed analysis by GC-MS is provided, with structures and chromatograms. Some interesting siloxans are shown.[474] Whole plant was extracted with water, acetone and ethanol, separately. Each extract was tested for antibacterial activity and analyzed for flavonoids.[475] Leaves were extracted with water, chloroform and *n*-butanol, separately. For each extract, general chemical composition and antibacterial activity were determined.[476] Leaves aqueous extract was prepared and found activie against different fungi species. General chemical composition is presented.[477,478] Whole plant was extracted with 70 % aqueous ethanol, and extract was active against Cabbage Black Leaf Spot Disease (*Alternaria brassicicola*). Analysis (LC-MS, NMR) of extract lead to the natural product responsible for this activity: degalactotigonin (Figure 26).[479] Different parts of the plant were extracted with methanol and extract was fractionized with acetone, *n*-hexane and chloroform. Extract and fractions had antiviral activity (hepatitis C), where seed extract was most active.[480]
Anticancer	Solanine was isolated from leaves and found active against HEP-2 and AGS cell lines.[467] Aerial parts were ultrasonic-assisted-extracted with ethanol. Extract had activity against several cancer cell lines, with rutin as the major active compound. A mechanism of action is presented.[468] Ethanolic, methanolic and aqueous extracts of fruits were prepared. All had anticancer activity against HL-60 human leukemia cell lines.[481] Leaves were extracted with chloroform and 80 % aqueous methanol. The combined extracts were active against PC3 and Hela-a cancer cells.[482] Leaves aqueous extract had anticancer activity against human breast cancer cells. Detailed mechanism of action is presented.[483] Unripe fruits were extracted with hexane and chloroform, then with methanol. Extract was treated for alklaloid extraction and HPLC analysis showed high concentration of α-solanine. This extract had high activity against

	Adriamycin (commercial name, active compound: doxorubicin) resistant cancers.[484] Fruits ethanolic extract was active against breast cancer cells.[485] Aqueous whole plant extract had activity against human breast cancer cells MCF7 cells. Mechanism of action is presented.[486] Solanine A, a new natural product that was isolated from the fruits, showed activity against MGC803, HepG2 and SW480.[487] A new nor-spirosolane (unnamed) type steroidal alkaloid was isolated from unripe fruits, exhibited anticancer activity against HL-60, U-937, Jurkat, K562, and HepG2 cell lines.[488] Leaves were extracted with ethanol and water, separately. Both extracts were analyzed for active compounds and a detailed list and structures are presented. New compounds are not reported. Both extracts and active compounds had anticancer activity (HepG2).[489] Solamargine (commercially purchased) was found active against human cholangiocarcinoma QBC939 cancer cells.[490] Ten (purchased) known alkaloids were tested for anticancer activity through SAR study.[491] Leaves aqueous extract was found active against AU565 breast cancer cells. It was analyzed (HPLC) for phenolics and a detailed composition is presented.[492] Six known glycoalkaloids were tested and found active against MGC-803 cancer cells.[493] Stems were defatted with petroleum ether and extracted with 80% aqueous methanol, to obtain a polysaccharide (glucose and galctose). This polysaccharide was found active against RAW 264.7 cancer cells.[494] Leaves were extracted and fractionized with several solvent, yielding the isolation of a new saponin. Uttroside B. It was characterized (Figure 26) and found active against liver cancer cell line, HepG2.[495] Polysaccharide was isolated (plant part not indicated) by extraction with ethanol. Extract had activity against H22 cancer cells. Monosaccharide composition is not reported.[496] Six new steroidal saponins were isolated from whole plant ethanolic extract, along with degalactotigonin, and all had activity against four types of cancer cell lines.[497] Degalactotigonin was isolated from leaves and commercially purchased, and found active osteosarcoma cells.[498] Leaves aqueous extract acted synergitically with known anticancer synthetic drugs (Cisplatin, Doxorubicin, Docetaxel, and 5-Fluorouracil) against human colorectal carcinoma cells.[499] Leaves extraction with methanol yielded seven known compounds. Five of them had anticancer activity (inhibition of GLI1-DNA complex formation), where phisalin H was most active.[500] Commercial solamargine inhibited the progression of gasrtic cancer by regulating lncNeat1_2 via the MAPK pathway.[501] Alkaloid fraction was extracted with *n*-butanol, and it was active against LIM-1863 human colon carcinoma cell line.[562]
Anticonvulsant	Leaves were extracted with *n*-hexane, benzene, chloroform, ethanol and water. All extracts were analyzed for flavonoid composition, and tested for anticonvulsant activity (electric shock in rats). Ethanolic extract was most active.[502]
Antidiabetic, anti-obesity and related activities	Low concentrations of fruits aqueous extract, have vasodilatory effect in diabetic (STZ-induced) and non‑diabetic rats. Higher concentrations produced counter effect.[503] Fruits aqueous extract had nephropathy prevention effect in diabetic (STZ-induced) rats.[504] Fruits aqueous extract had blood glucose lowering, antihyperlipidimic, and sensitivity lowering of the vascular mesenteric bed to phenylephrine effects, in diabetic (STZ-induced) rats.[505] Leaves were extracted with 50 % aqueous ethanol, and extract had α-amylase inhibition activity in STZ-induced diabetic rats. Phenolic composition was determined.[506] Rats were toxicated with ethanol resulting elavation blood lipid levels. Animals were treated with fruits aqueous extract, which showed strong antihyperlipidemic activity.[507] Phenolic (aqueous) whole plant extract was found to have anti-obesity activity in high-fat-diet mice.[508] Leaves aqueous extract was active in diabetic (STZ-induced) rats.[569]
Antioxidant, anti-inflammatory and related activities	Solanine was isolated from leaves and found active antioxidant (DPPH, H_2O_2).[467] Gold nanoparticles AuNP's were prepared using aqueous extract of leaves. AuNP's had strong antioxidant (DPPH, H_2O_2) activity.[471] Solanine A, a new natural product that was isolated from the fruits, showed anti-inflammatory activity through inhibition of LPS-induced NO

	production.[487] A new nor-spirosolane (unnamed) type steroidal alkaloid was isolated from unripe fruits, exhibited anti-inflammatory activity through inhibition of LPS-induced NO production.[488] [488] Leaves were extracted with ethanol and water, separately, and extracts were analyzed for active compounds. Both extracts and active compounds had antioxidant activity (DPPH).[489] Stems were defatted with petroleum ether and extracted with 80 % aqueous methanol, to obtain a polysaccharide (glucose and galctose). This polysaccharide inhibited LPS-induced NO production.[494] Leaves were extracted with *n*-hexane, benzene, chloroform, ethanol and water. All extracts were analyzed for flavonoid composition, and tested for anti-inflammatory activity (carrageenan-induced paw edema in rats). Ethanolic extract was most active.[502] Rats were toxicated with ethanol resulting elavation of oxidant thiobarbituric acid reactive substances. Animals were treated with fruits aqueous extract, which showed strong antioxidant activity.[507] Whole plant was extracted with 95 % aqueous methanol, and extract showed significant dose dependent anti-inflammatory activity in carrageenin and egg white induced paw edema in rats.[509] Leaves chloroform extract was found to have antinociceptive (hot plate and formalin tests), anti-inflammatory (carrageenan-induced paw edema) and antipyretic (Brewer's yeast-induced pyrexia test) in mice.[510] Fresh fruits were extracted with 50 % aqueous ethanol to obtain a new compound, Spirost-5-ene-3β,12β-diol (Figure 26) along with other known natural products. Extract and isolated compounds inhibited LTC_4-release (anti-inflammatory activity).[511] Oral inflammation was induced in rats by methotrexate and radiation. Leaves aqueous extract was found active against this inflammation.[512] Ethanoloc extracts of aerial parts (excluding flowers) were tested for antioxidant activity (Mo-VI, DPPH), and their general chemical compositions were determined.[513] Leaves or fruits were extracted with several solvents and antioxidant capacity (DPPH) of extracts was determined.[514-517,522] Leaves were extracted with several solvents and antioxidant capacity of extracts was determined by stabilization of Sun flower oil. Polar extracts were more active than nonpolar ones. General chemical compositions were determined in this study.[518] Aerial parts were extracted with 95 % aqueous ethanol. Extract was analyzed for general chemical composition, and had antioxidant, anti-inflammatory and anti-ulcer acttivities.[519] Leaves were extracted with water, and extract was fractionized for alkaloid content. Both crude extract and alkaloid fraction had significant antioxidant activity.[520] Fruits were extracted with several aqueous-organic mixed solvents, and extracts were tested for antioxidant capacity (DPPH) and general chemical compositions were determined.[521] Frozen fruits were extracted for anthocyanins fraction, and it was analyzed for its componets. Its antioxidant capacity was determined by ABTS test.[523] Leaves aqueous extract had notable activity of healing second degree burn wounds in rats.[524]
Anti-stress	Stress was induced in rats by cycles of light-dark and immobilization. These animals were treated with leaves aqueous extract, resulting improvement in several physiological parameters (brain enzymes) compared with control.[525]
Hepatoprotective	Leaves were extracted with water, and extract was fractionized for alkaloid content. Both crude extract and alkaloid fraction inhibited formation of thiobarbituric acid reactive substances in rats liver.[520] Fruits were extracted with 95 % aqueous ethanol and extract was active against CCl_4-induce damage of liver rats.[526-529] Leaves aqueous extract had protective effect in rats liver against oxidative damages of thymus DNA.[530] Aqueous extract (plant part not indicated) had ameliorative effect on high-fat/ethanol damages of rat liver. Extract had also antidiabetic effect.[531]
Insecticidal, molluscicidal, antiparasitic	Seeds were extracted with methanol and extract had nematicidal activity.[198] Plants were cultivated with growth promoters to produce high concentrantions of glycoalkaloids, which were extracted with 95 % aqueous methanol. These extracts were highly active against bilharziasis.[532] Aerial parts were extracted successively with dichloromethane, methanol and 80 % aqueous methanol. Extracts were active against *Galba truncatula*

	(snail).[533] Leaves were extracted with methanol, and extract had antileishmanial activity in mice. Extract antibacterial activity was also investigated.[534] Eight extracts were prepared from leaves using water and organic solvents. All extracts were tested for molluscicidal (*Lymnaea acuminata*) and insecticidal (*Culex vishnui*) activities. General chemical composition is also presented.[535] Several fruits extracts were found active mosquitocidal (*Culex quinquefasciatus*).[536] Alkaloid fraction extracted from leaves was active against citrus whitefly (*Dialerodus citri*).[537] Leaves were extracted with 1:1 methanol:chloroform (v:v). Extract had strong activity against two mosquito species (*Culex vishnui* and *Anopheles subpictus*).[538] Green leaves were extracted with several solvents, and extracts were found active against Colorado potato beetle, *Leptinotarsa decemlineata*, where methanol extract was most active. Among active compounds, *cis*-hex-3-enyl acetate, was highly active.[545]
Metal accummulation, corrosion inhibition, nanoparticles	Leaves aqueous extract was used to prepare silver nanoparticles (AgNP's) by reduction of silver nitrate solution.[466] Gold nanoparticles AuNP's were prepared using aqueous extract (reductant) of leaves and AuCl.[471] Leaves methanolic extract was prepared and used for steel corrosion inhibition and preparation of gold nanoparticles (AuNP's) by reduction of chloroauric acid ($HauCl_4$).[539] Growth of the plants and its production of different natural products, especially antioxidant enzymes, was tested under the effect of cadmium accummulation. The metal ions were accummulated in highest concentration in leaves, and over all tested properties and activities of the plant were not affected.[540] Plant was found as a good phytoremediator for cadmium removal from contaminated soils, without or with biochar.[541,542]
Nutrition	Comprehensive analysis of seed with special focus of nutritional potential. Presented parameters are: protein content, ash and mineral contents, dry matter, fatty acids composition, iodine value, saponification value, peroxide value, energy value, viscosity and triglyceride composition.[543] Ripe fruits were extracted and fractionized with various solvents, including obtaining alkaloid fraction. All products were analyzed for general chemical composition and some medicinal activities (such as antioxidant) to determine the toxicity/safety of these fruits. The aim of this study was to consider the possible use of these fruits as food source. The results indicate that the fruits are not toxic.[544]
Chemical composition and related activities	Changes in the concentration of glycoalkaloid solasonine according to growth steps.[459] Solanine A (Figure 26), a new natural product that was isolated from fruits along with other three new compounds: 7α-OH khasianine, 7α-OH solamargine and 7α-OH solasonine .[487] A new nor-spirosolane (Figure 26 unnamed) type steroidal alkaloid was isolated from unripe fruits, with two novel spirosolane type steroidal alkaloid glycosides.[488] In the following reports, chemical compositions and some activities were reported but new compounds were not isolated. In some cases, known natural products were isolated for the first time from this species or the *Solanum* genus. Some reports are very detailed.[546-561] Two new quercetin-3-gycosides were isolated from fruits meathnolic extract.[563] Two new saponins, solanigroside Q and solanigroside R (Figure 26) were isolated from whole plant methanolic extract.[564] Whole plant was extracted with several solvents and extracts were fractionized. Extracts had anticholinesterase and anti-tyrosinase activities. Two new phenolic glycosides were isolated, one of them is shown in Figure 26.[565]

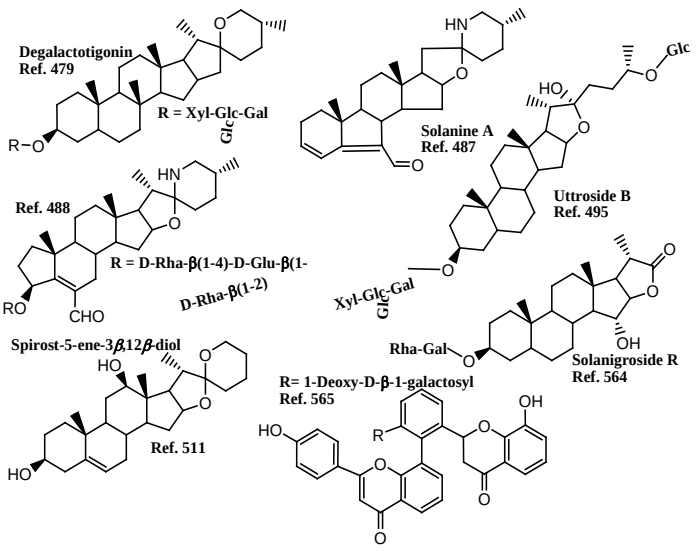


Figure 26. Structures of selected natural products isolated from *Solanum nigrum.*

Solanum villosum

Despite the very wide habitat of this plat, where it grows in the coldest and most rainiest areas (North) of the reviewed region, to the driest and most arid deserst areas in the South. It is very easy to confuse it with *S. nigrum*. Out of fruit ripening season, the major visible difference is that stems (and to less extent, leaves) of *S. nigrum* are smooth while these of *S. villosum* are hairy. After fruits ripening, is very easy to distinguish both species: fruits of *S. villosum* are very red while fruits of *S. nigrum* are black. *S. villosum* was limitedy studied, and a summary of selected published studies about it are presented in Table 18.

Table 18. Medicinal, biological and other activities of *Solanum villosum.*

Activity/Property	Major findings/Reference
Antibacterial	Leaves aqueous extract was found active against frour bacteria species.[572] Oils from leaves and fruits were extracted using petroleum ether. Both oils had activity against four bacteria species.[573]
Anticancer	Alkaloid fraction was extracted with *n*-butanol, and it was active against LIM-1863 human colon carcinoma cell line.[562] Leaves ethanolic extract was found active against diethylnitrosamine-induced hepatocellular carcinoma in experimental rats.[566] Silver nanopartcles (AgNP's) were prepared using leave aqueous/ethanolic extract to reduce $AgNO_3$ solution. Extracts and AgNP's had anticancer activity (diethylnitrosamine-induced).[567,568,578]
Antidiabetic	Leaves aqueous extract was active in diabetic (STZ-induced) rats.[569]
Antioxidant	Leaves were extracted with ethanol, and antioxidant capacity (DPPH) of extract was determined. General chemical composition is reported.[570] Ethanolic extract of leaves enhanced the production of antioxidant enzymes in goat liver.[571]
Hepatoprotective	Hepatotoxicity in rat was induced by carbon tetrachloride, and was treated 95 % aqueous whole plant extract, which had also antifibrotic actvity. Comprehensive chemical composition is presented with detailed GC-MS data.[574]
Insecticidal	Green leaves were extracted with several solvents, and extracts were found active against Colorado potato beetle, *Leptinotarsa decemlineata*, where methanol extract was most active. Among active compounds, *cis*-hex-3-enyl acetate, was highly active.[545] Leaves aqueous extract was found active against three mosquito species.[572] Leaves were extracted with six organic solvents and each extract was tested against larvae of *Culex quinquefasciatus*. Methanol:chloroform (1:1) extract had the strongest activity.[575] Fruits were extracted with six organic solvents and each extract was tested against larvae of *Stegomyia aegypti*. Methanol:chloroform (1:1) extract had the strongest activity.[576] Leaves were extracted with methanol:chloroform (1:1) and extract was active against larvae of *Anopheles subpictus*.[577]
Nanoparticles synthesis	Silver nanopartcles (AgNP's) were prepared using leave aqueous/ethanolic extract to reduce $AgNO_3$ solution.[567,568,578]
Nutrition	Ripe fruits were extracted and fractionized with various solvents, including obtaining alkaloid fraction. All products were analyzed for general chemical composition and some medicinal activities (such as antioxidant) to determine the toxicity/safety of these fruits. The aim of this study was to consider the possible use of these fruits as food source. The results indicate that the fruits are not toxic.[544] Oils from leaves and fruits were extracted using petroleum ether, and their fatty acid compositions were determined, in purpose of testing their nurtitional potential.[573]
Toxicity	Leaves ethanolic extract was orally fed to rats and found non-toxic.[579]
Chemical composition	Leaves were extracted with ethanol and extract was analyzed by GC-MS. A detailed composition is presented but new compounds are not reported.[580]

Withania somnifera

There is only a single species of the *Withania* genus in the reviewed region. Globally, this genus includes 12 species, and another one, *W. obtusifolia*, grows on Eastern side of the Jordan valley. *W. somnifera* was extensively studied, and published researches about it are summarized in Table 19.

Table 19. Medicinal, biological and other activities of *Withania somnifera.*

Activity/Property	Major findings/Reference
Allelopathy	Aqueous extract and alkaloid fraction were prepared from the aerial parts. Both materials were tested and found active allelopathic against *Cichorium intybus* seeds germonation. Alkaloid fraction was analyzed and detailed compostion and structures are reported (all known compounds).[235]

Antibacterial, antifunga, antiviral and related activities	Leaves were extracted with ethanol, and extract was found active against bacteria isolated from chicken.[145] Leaves were extracted with 95 % aqueous ethanol and extract was found active against pathogenic bacteria.[463] Whole plant was extracted with three solvents and tested against four bacteria species. Activity order of extracts was ethyl-acetate > ethanol > dichloromethane.[581] Fresh leaves were extracted with 95 % aqueous ethanol and extract was active against *E. coli*.[582] Whole plant was extracted with water and extract was used to prepare silver nanoparticles (AgNP's), which had antibacterial activity.[583] Roots were extracted with methanol and extract was used to prepare silver nanoparticles (AgNP's), which had antibacterial activity.[584] Plant parts were extracted and fractionized separately with several solvents. Each fraction was extracted for flavonoids, and these extracts were active against five bacteria species.[585] Indian traditional antiviral formulation (Amukkara Choornam) based of roots an leaves powder, was active gainst CHIKV virus in mice.[593]
Anticancer	Roots were extracted with water and extract was administered to patients with breast cancer with chemotherpay. Control group was treated only with chemotherapy. Test group showed positive results.[586] Rats/mice with cancer were treated with 70-75 % aqueous ethanol root extract. Positive results were recorded in test group compared with control.[587,588] Leaves aqueous extract was used to treat HepG2 hepatocarcenoma cells. Molecular modeling and a mechanism of action are presented.[589] Roots ethanolic extract was prepared as Viwithan, and it was active against B16F1 murine melanoma cells. Analysis showed that it contained mainly: withaferin A, withanoloids A, B.[590] Roots methanolic extract analysis yielded six new withanolides named withasilolides A-F (structures very close to compounds in Figures 5, 6, 10, 15, 20, 22). The compounds had cytotoxic effect on four cancer cell lines.[591] Roots were treated with dilute ammonia, methanol and then extracted with water. Extract *in vitro* enhanced the activity of chemotherapy agent, cisplatin, in HT-29 colon cancer cells.[646]
Anticonvulsant	Stems and roots were extracted with ethanol and extracts showed positive results in treating seizures in duced in rats by electrical and chemical (pentylenetetrazol, PTZ) shocks.[592] Ethanolic root extract was active against PTZ-induced seizures in mice. A mechanism of action is proposed.[594]
Antidiabetic, anti-obesity and related activities	Leaves ethanolic extract had lowering effect of collagen glycation and cross-linking in rats.[595] Diabetes was induced in rats by STZ, and they were treated with formalin to induce pain in paws. When fed with roots, pain sensation in test group was lower that in control.[596] Diabetes was induced in rats by STZ, and they were fed with aqueous roots extract. Compared with control groups, test group had lower blood glucose, lower hyperlipidemia and less oxidative stress.[597] Root powder was supplemented to patients and it had significant hypoglycemic and hypocholesterolemic activities.[647]
Antioxidant, anti-inflammatory and related activities	Leaves aqueous extract was used to treat HepG2 hepatocarcenoma cells. Results indicated more production of natural antioxidant enzymes (glutathione S-transferase and glutathione reductase) in treated cells compared with control.[589] Arthritic (collagen-induced) rats were treated with powder or roots aqueous extract of the plant compared with methotrexate treatment, and proved effective.[598,599] Different parts of the plant were extracted separately with 80 % aqueous methanol, and antioxidant capacity of extracts was determined (DPPH). Mature roots had the highest activity.[600] Roots aqueous extract was administered to humans with type II diabetes. Results showed improvement in lowering oxidative stress biomarkers (malondialdehyde, nitric oxide and glutathione).[601] Chronic footshock in rats induced stress that resulted an increase in superoxide dismutase and lipid peroxidation activity, with concomitant decrease in catalase and glutathione peroxidase activities in the brain. Treating animals with glycowithanolides extracted from the plant, altered the oxidative stress.[602] Rats were dehydrated to result kidney oxidative stress, then they were treated with roots aqueous extract that had significant antioxidant activity.[603]
Brain related activities, aeging, addiction, stress, anxiety, memory, depression, neuroprotection,	Chronic footshock in rats induced stress mainly due to oxidative processes in the brain of rats, that were altered after treating animals with glycowithanolides extracted from the plant.[602] Withanamides A and C that

Alzheimer, Parkinson, sleep	were isolated from the fruits, protected PC-12 cells, rat neuronal cells, from β-amyloid induced cell death, supposedly by prevention of fibril formation.[604] Roots were extracted with methanol:chloroform (1:1) and extract was orally (in ethanol) administered to mice. The result was lowering in low density lipoprotein in the liver and β-amyloid in the brain.[605] Anxiety was induced in rats by ethanol, and ethanolic root extract (contained mainly withanolides) had positive effect on these animals.[606] Ethanolic root extract had antiaxiety and antidepressant activities, compared with control groups which were not treated or were treated with standard drugs (benzodiazepine lorazepam and imipramine).[607] Ethanolic root extract had antianxiety and antistress effects in healthy (physical and mental) humans.[608] Roots aqueous extract mixed with Ghee butter, was admistered to mice that went through three depression methods: forced swimming, tail suspension and anti-resperine test. In all cases, the extract had positive effect on animals.[609] Roots ethanolic extract nicotine-induced addiction in mice.[610] Healthy humans were treated with roots extract (70 % aqueous ethanol) and showed antidepressant results.[611] Patients with schezophrenia were treated with roots aqueous extract and positive antianxiety and antidepression results were recorded.[612] Commercial root extract (unkown solvent) was provided to patients with insomnia and anxiety, resulting improvement in both parameters.[613] Roots were extracted with 50 % aqueous methanol, and extract was administered to rats that were exposed to various stress inductors. Improvement was indicated in all tests.[614] Commercial, standardized root extract (Withaferin A, 2.38 %) was administered to Common fruit fly (*Drosophila melanogaster*) to test effect on brain disorders induced by rotenone. The result was lowering of the following parameters: locomotor deficits, oxidative impairments and neurotoxicity.[615] Aqueous root extract was administered to rats, and resulted in amelioration of memory impairment and neurodegeneration in hippo-campus through NO mediated modulation of corticosterone levels.[616] Whole plant (commerial powder) was extracted with water for proteins. Extract, along with scopolamine, were fed orally to rats resulting enhancement of learning and memory.[617] Commericial roots aqueous extract (containing 5 % withanolides) was administered to human patients, resulting in immediate and general memory, as well as improving executive function, attention, and information processing speed.[618] Commercial ethanolic root extract was administered to mice with L-dopa, which resulted in inhiition of haloperidol-induced catalepsy in mice.[619] Root powder was orally fed to mice along with seed powder of *Mucuna pruriens*. This, attenuated the neurotoxicity due to MPTP (1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine hydrochloride) in mice.[620] Ethanolic root extracts of the plant and seed of *Mucuna pruriens* were orally fed to mice. This resulted (several tests) in attenuation of paraquat (*N*,*N*′-dimethyl-4,4′-bipyridinium dichloride) induced parkinsonian.[621] Commercial roots ethanolic extract attenuated 6-hydroxydopamine-induced parkinsonism in rats.[622] Fresh roots were extracted with methanol and extract was fractionized with several organic solvents, yielding the isolation of 18 known compounds. These were tested axon or dendrite growth. It was found that withanolide A enhanced axons while withanosides IV and VI enhanced dendrites.[623] Roots ethanolic extract was prepared and administered to mice that were treated with paraquat and maneb [$(C_4H_6MnN_2S_4)_n$] to induce parkinson. Results showed protection against nigrostriatal dopaminergic neurodegeneration and marked improvement in the behavioral, anatomical and the biochemical deformities.[624] Commercial extract (plant part and solvent not indicated) was active *in vitro* against Aβ peptide- and acrolein-induced toxicity and acetylcholinesterase inhibitor.[625] Root ethanolic extract had protective antioxidant and anti-inflammatory effects against aluminum neurotoxicity, and could prevent the decline in cholinergic activity by maintaining normal acetylcholin-esterase activity.[626] Leaves aqueous extract was found protective against LPS-induced oxidative stress and inflammation that produce neurodegeneration.[627] Commercial roots extract (solvent not indicated) had neuroprotective activity agaist

	MPTP toxicity in mice.[628] Ethanolic root extract had neuroprotective activity by reducing oxidative stress (iNOS) and significantly improved the maneb-and-paraquat mediated induction of a pro-apoptotic state.[629] Commercial standardized extract (plant part and solvent not indicated) was administered to patients with exacerbation of schizophrenia, which resulted in amelioration of their mental health.[630] Whole plant powder was orally fed to rats resulting in attenuation of neuropathic pain arises due to chronic constriction injury.[631] Roots ethanolic extract was given to patients with obsessive-compulsive disorder, which reduced their food addiction.[632] Leaves aqueous extract had neuroprotective effect against stress in sleep-deprived rats.[633] Standardized root extract (70 % aqueous ethanol) had positive effects on patients with nonrestorative sleep disorder.[634] Roots were extracted with 50 % aqueous ethanol was administered orally to rats, and had significant antistress (that was induced by several methods) adaptogenic activity.[635] Roots ethanolic extract was supplemented to rats (100 $mgkg^{-1}$ of body weight). As a result, behavioral deficits induced by Bisphenol A were alleviated, and treatment reinstated the number of NMDA receptors in hippocampus region in the brain.[660] Methanolic roots extract was prepared and analyzed by HPLC. It was supplemented to rats resulting prevention of morphine withdrawal-induced decrease in spine density in nucleus accumbens shell of rats.[666]
Cardioprotection, blood system, sport	Commercial roots hydroalcoholic (ratio is not indicated) extract was prepared and was found cardioprotective against isoprenaline-induced myocardial necrosis in rats. Control animals were fed with Vitamin E.[636-639] Commercial leaves extract (solvent not indicated) was orally fed to rats that were toxicated with doxorubicin. Extract had cardioprotective activity measured by several tests.[640] Water root extract was supplied to athletes and they were tested for their endurance, by measuring peak oxygen consumption. Positive results were recorded.[641] Root powder was supplied to stress-oriented hypertensive subjects, and improvement was recorded when powder was supplied with milk.[642] Commercial root extract was supplied to healthy people who practice sports on regular basis. Several parameters were measured to test the effect of the supplement, and it was found positive in all tested parameters, especially muscle mass, strength and distribution.[643,644] Roots aqueous extract was prepared and supplemented to mice. Tests of endurance and stamina were conducted compared to control. Test group showed clear improvement.[645]
Enzyme inhibition activity	6-*n*-Propyl-2-thio-uracil (PTU) induced hypothyroid in rats, and they were treated with leaves EtOH extract along with eltroxin for 60 days. Results showed recovery of thyroid hormone secretion as compared to control.[648] Whole plant was extracted with methanol and extract was fractionized with several solvents, yielding two new compounds (withanolides, see Figure 10). These compounds and other known had cholineesterase inhibition activity.[649]
Fertility, hormones, sexual functioning	Commercial leaves and roots was supplied to overweight male participants. No significat difference was recorded between test group and control in cortisol, estradiol, fatigue, vigor, or sexual well-being.[650] Root powder was supplied to infertile men (in stress or normal, 5 g day^{-1}) orally for 3 months with milk. Positive indication of fertility increase (pregnancy of female mates) and stress reduction were recorded.[651,652] High concentration methanolic roots extract was supplied to healthy women, who reported increase of sexual function.[653] Roots were extracted with 70 % aq. EtOH and extract ameliorated diet-induced obesity by enhancing energy expenditure via improving mitochondrial activity in skeletal muscle and adipose tissue.[654]
Nephroprotective	Root powder was supplemented to patients and it had significant diuretic activity.[647]
Antiparasitic	Whole plant aqueous extract was prepared and combined with whole plant extract of *Asparagus racemosus*. The combination was used to treat *Leishmania donovani*-infected mice. The results were positive and there was enhancement of the immune system of the animals.[655]
Nanoparticles, metal toxicity	Whole plant (or roots) was extracted with water (or MeOH) and extract redused $AgNO_3$ solution to prepare AgNP's.[583,584] Leaves aqueous extract had glioprotective effect *in vitro* (cells) and *in vivo* (rats) against Lead (lead

	nitrate) toxicity.[656]
Toxicity	Roots ethanolic extract was found toxic to rats when supplemented in very high dosage (1100 mg kg^{-1} of body weight) and safe in lower doses (100 mg kg^{-1}) in rats and mice.[657] Methanolic roots extract standardized for withaferin A, was found safe in rats up to 2000 mg $kg^{-1}$of body weight, which was the highest tested dose.[658] "Purified extract", solvent and plant part were not indicated, contained 35 % glycowithanolides and less than 1 % alkaloids, was commercially prepared. It was found safe to rats up to 2000 mg kg^{-1} of body weight, which is the highest tested dose.[659]
Chemical composition and related activities	Roots were extracted with 50 % aq. MeOH, and two new compounds were isolated and characterized, acylsterylglucosides, sitoindoside VII and sitoindoside VIII (see Figure 27). Known withaferin A was also isolated.[614] HPLC analysis was conducted for 10 commercial products that contain ingredients of the plat. Most of the contained withanolides.[661] General chemical composition of roots of plants that were harvested in five different locations, was determined.[662] Three known compounds (withaferin A, 12-deoxywithastramonolide, withanolide A) were determined in different parts of the plant by LC–ESI-MS-MS (MRM) method.[663] General chemical composition of roots was determined.[664] First isolation and characterization of isopelletierine (Figure 27).[665] Seven new withanolide glycosides were isolated from the methnolic root extract. They were characterized along with identification of other known compounds. The withanolides aglycons are not new. Some of these compounds had inhibitory activity against tachyphylaxis to clonidine (high blood pressure drug) in isolated guinea-pig ileum.[667] Seven withanolides (commercially purchased) were tested for bioavailability to cancer cells. Detailed structures and chromatograms are provided.[668] Quantitative HPLC analysis of withanolides was developed, including the determination of withaferin A and withanolide D.[669] 28 Commercial products were analyzed, mainly by HPLC to determine their compositions and genuineness.[670]

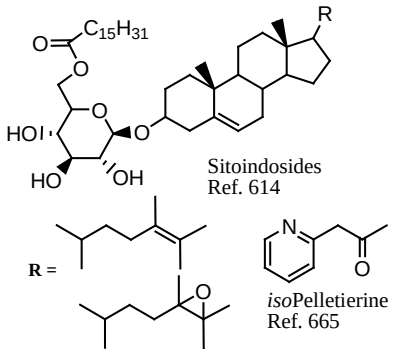


Figure 27. Strutures of selected natural products isolated from *Withania somnifera.*

CULTIVATION OF *SOLANACEAE* PLANTS AND PRODUCTION OF ACTIVE INGREDIENTS

One of the remarkable traits that can be observed immediately when searching literature about wild *Solanaceae* plants is the numerous number of published articles about the cultivation of these plants. This is a huge mass of articles and obviously, the main reason in the interest production of very important, active or potentially active natural product, especially alkaloids and withanolides and their direvatives and analogues. Laboratory syntheses of these compounds is possible (see next section, Synthesis, Biosynthesis and Selected Chemistry of *Solanaceae* Natural Products). But in the vast majority of cases, production of these compounds by cultivation of their plant source, is way easier. So, we reprted very few of these cultivation/production researches in the previous section and we are reporting here some more articles. Among the vast number of publications, these represent the notion of the entire literature in this subject.

Among the wild plants of the *Solanaceae* family plants, *Solanum nigrum* is the most cultivated and most important source of active natural products. A. de Sousa and her colleagues grew doubly sterilized (70 % aqueous ethanol, 0.02 % aq. NaClO) seeds that were harvested from wild plants.[671] They treated young plants fungicide chemical metalaxy ($C_{15}H_{21}NO_4$), which inhibited growth by reduction of photosynthesis and induced photorespiration. As a result, plants produced higher amounts of defense antioxidants and less sugars.

Tropane alkaloids, steroidal alkaloids and their glycons, are among the most active and intesting natural products in the plants of the *Solanaceae* family. They are the major defence compounds. Y. Sun *et al*. cultivated *S. nigrum* in a greenhouse with leaves infection with *Fusarium oxysporum* infectious fungus. As a resut, plants produced more of the enzyme squalene synthase, which has a key role in the biosynthesis of defence steroidal alycoalkaloids (solasodine and γ-solamargine, detected by HPLC-DAD-MS).[672]

Cultivation of *S. nigrum* under heavy metals stress was published by many research groups. R. Li *et al*. incorporated cultivation of *S. nigrum* with two domesticated, major food plants, tomato (*S. lycopersicum*) and eggplant (*S.*

melongena). The three plant species were planted together and stressed with cadmium contamination ($CdCl_2$).[673] Researchers measured potassium content, and they found that this incorporated cultivation, increases the content in tomato and eggplant, aerial parts and roots, repectively. This means that the domesticated and the wild plant are more resistant to heavy metal stress. Another study was published by J. Xu *et al*. where they cultivated the plant under the stress of zinc contamination ($ZnCl_2$). While it was known that such stress results in programmed cell death (PCD), it was not clear what is the role of nitric oxide (NO) in this process. Researchers found out that zinc stress elevate the concentration of NO that causes, and if treated with either 2-phenyl-4,4,5,5-tetramethyl-imidazoline-1-oxyl-3-oxide (NO scavenger) or N^G-nitro-L-arginine-methyl ester (NO synthase inhibitor); PCD process decreases.[674] Incorporated cultivation was also used by W. Huo *et al*., where they cultivated maize (*Zea mays*) with *S. nigrum*, under cadmium ($CdCl_2$) stress. They studied the effect of N-fertilizers (ammonium sulfate and calcium nitrate) on the hyperaccumulation of the contaminating metal in the plants. Their finding indicated clearly that this incorporated cultivation accumulated the metal in *S. nigrum*, resulting in safety to grow maize in Cd-contaminated soils.[675]

As in agricultural crops, C. de Matos and his colleagues, reported that cultivation of *Nicandra physalodes*, was enhanced by chemical fertilizers (NPK, ammonium sulfate, monocalciumphosphate, ptassium chloride, respectively).[676] In a closely related study, N. Panayotov and A. Popova investigated the effect of various culivation conditions on the productivity and the storability of *Physalis peruviana*.[677] They found that the productivity under cultivation by non pricking seedlings or by direct outdoor sowing was higher. Fruits from plants grown by direct outdoor sowing, were characterized with the highest storability, and with the weaker one were those grown by pricking out. Similarly, the effect of nitrogen supply (Calcium ammonium nitrate, $5Ca(NO_3)_2{\cdot}NH_4NO_3{\cdot}10H_2O$) on plant growth and leaf N content of *Solanum villosum*, was studied by P. Masinde and his colleagues of a multinational research group.[678] Expectedly, with N supply, plant growth was enhanced, leaf area was increased and total nitrogen content on a dry weight basis was significantly higher.

Nicotine is one of the major defence natural products in the plant kingdom. So, a very interesting study was carried out by I. Baldwin and P. Callahan. They supplied two some *Solanaceae* plants, two of them of our concern, *Nicotiana glauca*, a nicotine producer, and *Datura stramonium*, that does not produce nicotine.[679] They tested the accumulation and tolerance of the plants towards this supply. They discovered that *N. glauca* accumulated nicotine but its photosynthesis process was not decreased, despite the fact that nicotine is known for its photosynthesis suppression capacity. As for *D. stramonium*, nicotine was not accumulated and physiological damages were not observed.

When we presented the literature about *Solanum elaeagnifolium* above (see information and Figure 23), we mentioned the fact that until approximately two decades ago, this plant was not very widespread or even common. But in recent years, it is spreading very rapidly, and now it threatens agricultural fields and farmlands, and it also invading areas outside of its usual habitat. This problem exists also in Australia, and H. Wu and his colleagues, considered the plant "as one of the worst weeds of crop and pasture systems".[680] They studied the herbicidal effect of different combinations of chemicals in growth inhibition of the plant, as well as the optimal timing for performing this activity. They concluded that using two combinations was most effective, and application at early flowering followed by a late application in autumn is necessary to effectively control the seedset (seedbank) and the root regrowth (rootbank).

The main objective of most cultivation researches of *Solanaceae* plants, is as mentioned earlier, production of active natural products and/or enhancement of important medicinal activities. A summary of some carefully selected (out of the vast number) publications is presented in **Table 20**, but some of them will be presented in details (as text and figures) since they include additional value of information such as synthesis, biosynthesis or corrections of previous knowledge. It is important to emphasize that the presentation of this very important literature as a table, will not be enough for the interested readers and researchers who wish to apply this information into their practical work. It is highly recommended for these to follow the citations. Another important note that should be made, is that some of these articles mention some *Solanaceae* plants and other families and genera that are not included in this review, and consequently, they will not be mentioned in **Table 20**. So, it is highly recommended to interested researchers to follow the cited literature.

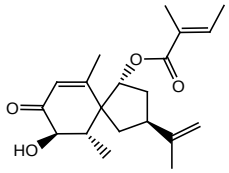
Table 20. Cultivation of *Solanaceae* plants for production of active compounds and/or properties.

Plant species	Cultivation conditions, results, reference
Datura innoxia	Hairy roots were infected with *A. rhizogenes* and treated with elicitors salicylic acid and acetyl salicylic acid. Hyoscyamine content increased.[681] $AlCl_3$ enhanced the production of hyoscyamine and scopolamine and antioxidant enzyme superoxide dismutase.[682] Total alkaloid content increased in young leaves when plants were cultivated under salt stress (with a miskae of NaCl amount in abstract, 153.8 mol/m^{-3} that should be 153.8 mg).[683] Plants were cultivated with supply of triadimefon (fungicidal, $C_{14}H_{16}ClN_3O_2$). Total indole alkaloid, antioxidant phenolics and antioxidant enzymes contents, all were significantly increased.[684]
Datura stramonium	Hairy roots were infected with *A. rhizogenes* and treated with elicitors salicylic acid and acetyl salicylic acid. Hyoscyamine content increased.[681] Plants were grown in Mexico, original habitate of them, and in Spain, in which they were introduced, under the same conditions. The plants in Mexico produced about 36 times more atropine and around 21 times more scopolamine, in leaves, than in Spain. In their natural habitate (Mexico), plants have natural enemies (herbivores) that do not exist in

	Spain.[685] A very comprehensive research that studied the relation between irrigation and production of tropane alkaloids in the plant. The study measured the quantitative (direct proportion), and very broad presentation of the qualitative relation. Researchers present very detailed analysis of tropane content, including changes of isomers ratios as a result of different iirigation conditions. They also present quantitative and qualitative analysis of different plant parts. Moreover, a mechanism of isomers ratio is proposed.[686] Plants were grown under salt stress (NaCl and $CaCl_2$,1:1 w/w), and supplied with nutrients $Ca(NO3)_2$, KCl, KH_2PO_4 and $MgSO_4$. Concent-rations of insoluble and total carbohydrate, insoluble protein. Free amino acids (not)proline and total alkaloid increased significantly, while soluble carbohydrate, soluble and total protein, and proline contents decreased.[687] The effect of three parameters was tested, on plant growth but mainly on hyoscyamine production: Gamborg's B5 salts (mixture of 14 compounds) supply, nutrition with sucrose and temperature. Results indicated that high concentratios of material supply was needed and T= 25-30 °C, to achieve maximum yield of the alkaloid.[688]
Hyoscyamus albus	Plants were cultivated under Fe-ddeficiency condition, and as result, the production of hyoscyamine and scopolamine was reduced. The mechanism of this reduction was studied, and researchers discovered gene expression changes, that led to reduction of key enzyme for tropane alkaloids biosynthesis, such as hyoscyamine 6β-hydroxylase, that involves iron in the conversion of hyoscyamine to scopolamine.[689] Treatment of hairy roots with $CuSO_4$ and methyl jasmonate enhanced the production of three known phytoalexines and four new, which were isolated and characterized. One of them is presented in Figure 28.[690]
Hyoscyamus aureus	Twenty seven nutrients were used to cultivate plants for tropane alkaloids. Results were comapired with wild plant yiels, to reveal higher production of hyscyamine in cultivated plants and higher production of scopolamine in wild plants. Genetic variation were also observed in cultivated plants.[691]
Hyoscyamus muticus	Seeds were collected from wild plants, sterilized and cultured with gibberellic acid, in 25 °C and high concentrations of NaCl. Contents of alkaloids, antioxidant enzymes and pigments, were increased.[692] The same research group reports the effect of UV-C radiation (253.7 nm) on the growth, total alkaloid and hyscyamine contents. The optimal time period they found is 2 h of exposure.[693]
Hyoscyamus reticulatus	The effect of ammonium nitrate fertilization on the following variables was studied: plant height, stem diameter, number of branch per plant, number of capsules per plant, capsule length, capsule width, number seed per capsule, seed yield per plant, thousand seed weight and alkaloid content. Fertilizer supplementation was done in various courses, and alkaloid content was increased.[694] Hairy roots were treated with Zinc oxide nanoparticles (ZnO-NPs). Growth was decreased but antioxidant activity of the enzymes catalase, guaiacol peroxidase and ascorbate peroxidase was significantly higher. Contents of hyoscyamine, scopolamine and biosynthetic *h6h* gene were increased.[695] Hairy roots were genetically modified *Agrobacterium rhizogenes* and supplied with iron oxide nanoparticles (FeO-NPs). Antioxidant enzyme activity and hyoscyamine and scopolamine production were significantly increased.[696]
Physalis angulata	Methyl jasmonate was supplemented to hairy roots, resulting increase of the production of physalins D and H. Researchers propose that this supplement increases in the levels of a number of terpenoid backbone biosynthesis and steroid biosynthesis related enzymes.[697] Cultivation season has major effect on phenolic compounds content, antioxidant capacity and many agricultural qualities of the plant. April is the best cultivation time period.[698]
Physalis peruviana	Plants were supplied with commercial fertilizer (Torped®, N,P,K and 9 other elements), which increased the number, average mass and total productivity of fruits. It also promoted antioxidant activity (DPPH).[699]
Solanum nigrum	Leaves slices were grown in nutritive medium (general description). Production of glycoalkaloids (solasodine and solanidine) was increased by 2-5 folds. They were also tested for biological activities and found active: antiviral, cytotoxic anti-inflammatory and antiparasitic.[700] Contents of proline and solasodine were increased in plants under salt (NaCl, 150 mM).[701,g] Production of solasodine was increased by 5 folds under NaCl stress, 150 mM.[702]
Solanum villosum	Plants were cultivated under 100 mM

Withania somnifera	NaCl stress. Leaf caffeic acid, lutein, and beta-carotene contents were considerably increased, along with the up regulation of some related enzymes and genes. The leaf contents of β-solamargine and α-solasonine also increased significantly.[703] Accumulation of withaferin A and withanone was increased in leaves when plants were supplemented with saccharides or their combinations. The highest increase recorded when 4 % sucrose and glucose (2:1) was supplied. No control was mentioned.[704] Enhanced production of withanolide A was recorded when plants were supplied with 4 % mixture of sucrose and glucose (3:4) and with optimal pH of 5.8.[705]

(g) The increase of solasodine in *S. nigrum* that was reported by J. Sutkovic *et al.*, is not clear. They present an unlear bar graph (page 45 in reference 701). They also direct readers to "table 1" for these results (page 46), but "table one" does not exist in the publication, supporting materials are not provided.



Hyoscyamus albus
Ref. 690

Figure 28. Strutures of a new compound isolated from cultivated *Hyoscyamus albus.*

T. Hashimoto and Y. Yamada, performed a thorough research to reveal the mechanism of the biosynthetic path from L-hysoscyamine to scopolamine.[706] They chose to study cultured root of *Hyoscyamus niger* which is not one of the plants included in this review, but they indicate that this mechanism is common for many *Solanaceae* plants of the genera *Atropa*, *Datura*, *Duboisia*,*Hyoscyamus*, and *Nicotiana*.

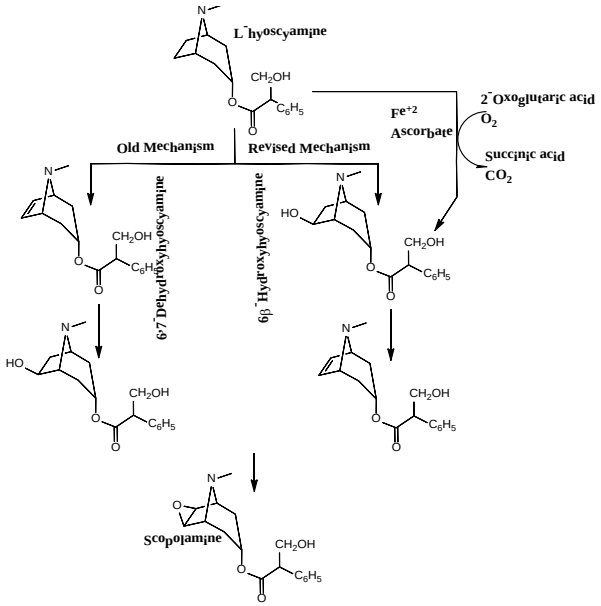


Figure 29. Mechanism of biosynthesis of scopolamine from L-hyoscyamine (Ref. 706).

They argue with older proposed mechanisms which state that L-hyoscaymine is dehydrogenated to 6,7-dehydrohyoscyamine, which is converted to scopolamine (see Figure 29). But by chemoenzymatic study, they prove that between L-hyoscaymine and 6,7-dehydrohyoscyamine, there is an intermediate: 6β-hydroxyhyoscyamine.

Swiss group of A. Lanoue and his colleagues studied the rearrangement of L-littorine to L-hyoscyamine in the biosynthesis of scopolamine.[707] For this purpose, they cultured hairy roots of *Datura innoxia* that were genetically modified by *Agrobacterium rhizogenes*. The supplemented the roots with labeled (*RS*)-phenyl[1,3-$^{13}C_2$]lactic acid. This molecule reacted (in roots) with tropine yielding L-littorine, which rearranged to L-hyoscyamine (Figure 30). The carbon-carbon coupling constant that was calculated from ^{13}C-NMR spectra of the three compounds was almost the same, 55 Hz.

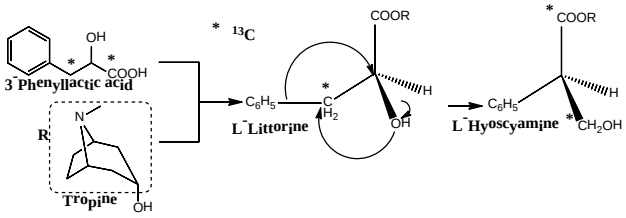


Figure 30. Part of the biosynthesis of Scopolamine (Ref. 707).

The last research that we will cite in this section was published by R.J. Robins and his colleagues.[708] They studied the biosynthetic path of tropane alkaloids in cultured roots of *Datura stramonium*. For this objective, they have labled strating materials with ^{14}C and ^{13}C, in order to decide which of the proposed biosynthesis paths in literature is/are true. Their work provided an evidence that hygrine is not a direct precursor of tropane alkaloids, while cyclization occurres to give 2-carboxytropinone, that forms tropinone decarboxylation. This is shown path B in a scheme that they present in their publication, which we present here as Figure 31.

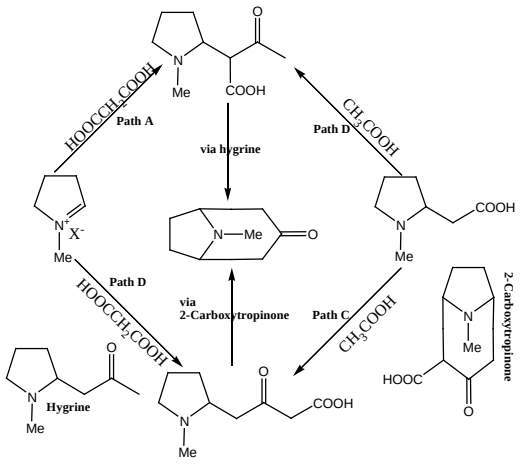


Figure 31. Proposed biosynthesis paths of tropinone (Ref. 708).

Researchers used a special method named protin-noise decoupled ^{13}C-NMR, where coupling and splitting of peaks of ^{13}C atoms is clear, but peaks heights are not proportional to the number of atoms that produced this peak. They present ^{13}C-NMR spectra of hyoscyamine that was produced in the roots of *D. stramonium*, and derive their conclutions from this outstanding work.

SELECTED PUBLICATIONS OF SYNTHESIS AND CHEMISTRY OF *SOLANACEAE* NATURAL PRODUCTS

Active natural products found in plants of *Solanaceae* family have drawn notable attention for their medicinal and other properties. Attempts of their large scale production were and are done continuously. In the previous section, we presented a brief summary of carefully selected articles of the biogeneses of these compounds in plants (or plant parts) of this family.

Naturally, there are many attempts to prepare these compounds through pure synthetic work. Many of these synthetic works focused on few compounds such as atropine, scopolamine and withanolide A. The laboratory syntheses of some of these compounds, such as hyoscyamine, were published.

Many synthetic works have limited value since the final product of the synthesis is racemic modification, while in most plants, the synthesis target is pure enantiomer, in the vast majority of cases. So, in this sense, the work of J-H. Lee *et al*. has additional importance because they prepared 97 % enantiopure hygrine.[709] The managed to achieve this by using asymmetric phase-transfer catalytic alkylation, as shown in figure 32.

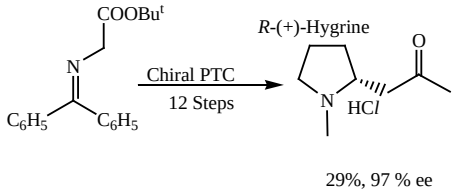


Figure 32. Synthesis of hygrine by J-H. Lee *et al*. (ref. 709).

The earliest synthesis of atropine was published by A. Landenburg in 1879.[710] Since then, this synthesis was published in several atricles. One of the latest describe semi-industrial, continuous flow synthesis and purification (Figure 33).[711]

Researchers (ref. 711) report that the best reaction conditions were: DMA, buffer (pH=10) in a ratio of 5:1, isolated yield of atropine was 79 % and A:B ratio was 16:1.

An outstanding synthesis of scopolamine (hyoscine) was published by P-A. Nocquet and T. Opatz.[712] But since it included many starting materials preperation reactions, and since the synthesis itself is of a very multiple step type, it will be very partial presentation if were introduce it here with one scheme figure. In our humble opinion, interested readers should use the original publication (ref. 712).

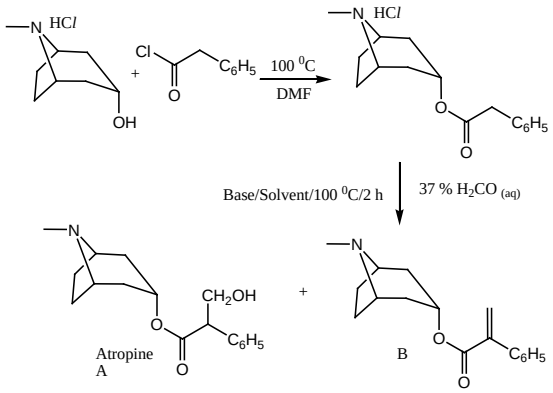


Figure 33. Continuous flow synthesis of atropine (ref. 711).

Withanolides and structurally related natural products are among the most medicinally active compounds and they are major ingredients of *Withania somnifera*. Withanolide A, was isolated among the first compounds of this unique compound family. It is also one of the most studied. It had significant activity against several bacteria species,[713] and has antioxidant activity (DPPH).[714] But according to published literature about withanolide A, it is clear that neuroprotection is its most important activity. It prevents neurodegeneration by modulating hippocampal glutathione biosynthesis during hypoxia,[715] attenuation of glutamate-induced excitotoxicity in neuron-like cells,[716] and by induction of neurite outgrowth.[717]

Several syntheses of withanolide A have been reported so far. One of the best reports was published by C. K. Jana *et al*.[718] In addition to synthesis, some biological activities of the compound were tested, especially nueroprotection. But the work that we chose to present was published by R. Liffert and his colleagues.[719] It is a very comprehensive work of synthesis of withanolide A, preparation of 28 of its derivatives, out of which we will present three of them in Figure 34.

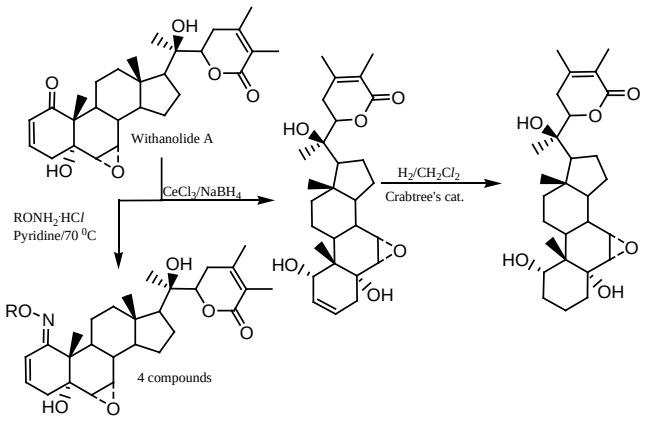


Figure 34. Withanolide A derivatives (ref. 719)

In the work of P-A. Nocquet and T. Opatz that we cited above (ref. 712), they prepared scopolamine by epoxidation of 6,7-dehydrohyscyamine (see Figure 35).

Since the biosynthesis of in hairy roots of *Solanaceae* plants involves also 6β-hydroxyhyoscyamine, T. Hashimoto and his colleagues, investigated the mechanism of the epoxide (scopolamine) biosynthesis, using ^{18}O labeling.[720] They discovered that the epoxide biosynthesis is a result of a very unique step of dehydrogenation of the hydroxy compound and not epoxidation of the alkene (Figure 35).

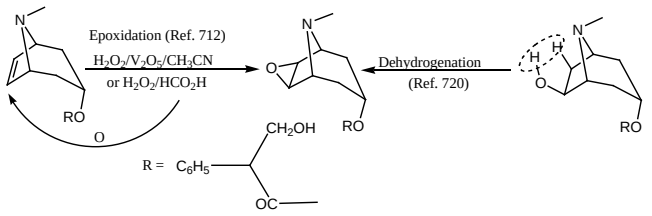


Figure 35. Biosynthesis vs. synthesis of scopolamine (ref. 720 and 712).

DISCUSSION

Finally, interested thiiranes (epoxide-like three membered ring of CSC) were prepared from epoxide moiety (C5-C6) of witholides.[721] P. Joshi and his colleagues prepared four different thiiranes from four different starting withanolides.

One of the major aspects that we noticed very clearly while scanning the published article about *Solanaceae* plants of the reviewd region, is the large number of review articles. As we have already mentioned, some of them were not cited. Those were of two classes. First, those focus on ethnomedicine and ethobotany of these plants. Despite being very interesting topic that sparked many of modern studies, in this review we decided to focus on medicinal activities. Second, those reviews that in our humble opinion had no additional value and/or knowledge compared to the review articles that we presented.

But there were eight review articles that we chose to present in this section because we think that they deserve special attention, in terms of their contents. A very recently published review by A. Kerchner and A. Farkas, analyzes the poisons of the plants of *Datura* and *Brugmansia* genera.[722] Even though *Brugmansia* is not one the plants reviewed in our article, it is closely related to *Datura* plants, and in most cases, it is grown as an ornamental plant. They present statistics of 25 years as tables and graphs. They devide their analysis to continents but present detailed information about Hungary, their homeland. They conclude that data of poison information centers from all over the world indicate that most exposures to *Brugmansia* and *Datura* are related to abuse, in connection with their hallucinogenic property, mostly in the age group of adolescents. Anticholinergic intoxication may also result from the improper use of traditional herbal medicines containing *Datura*. More recently, the use of *Brugmansia* and *Datura* as incapacitating drug in sexual crimes and robberies has caught the attention of authorities.

Psychoactivity of *Datura* plants has drawn the attention and use by humans since early times (ref. 4 and 5) and as mentioned in the previous citation. The review article published by T. Debnath and R. Chakraverty, focuses mainly on this aspect of biological and medicinal activities of *Datura stramonium*.[723] This is a very short document that very briefly presents traditional uses, phytochemistry and medicinal activities of this plant. But right in the beginning in this article, we found a taxonomic mistake, that might easily mislead readers: in addition to using scientific name (*D. stramonium*), authors mistakenly use a common name of another plant: Angels' trumpet. We have already expressed our opinion on this issue (see note f), and as far as we are concerened, these names should not be used in scientific publications. This common name is for *Brugmansia* and not *Datura* plants.[724]

F. Elisante and P.A. Ndakidemi published and interesting review article about the allelopathic effects of *D. stramonium* on plants of Tanzania.[725] Allelopathy of this plant has been widely studied (see ref. 148-153), but the special interest of this review article is that it focuses on allelopathic effects of this plant on legumes, that are major nutrient plants for wild and domestic animals in natural reserves.

Review articles of chemical compositions of plants are very common literature. But some of them possess special importance. One of these unique review articles was published by D. Qian *et al*.[726] It is one of the most comprehensive reviews that were published about plant chemical composition in general and about the *Lycium* genus in particular. It presents 355 natural products of different compound family, with structure, tables and graphs. This article is a very important resource for readers and researchers who are interested in this genus. Similar but way smaller review article was published by Y-J. Zhang *et al.* about the chemical composition of *Physalis peruviana*.[727] Along with using its common name (Cape Gooseberry), they use the scientific name, and their work consists two major issues, chemical composition and some medicinal activities of the plant. Their special contribution is listing the systematic (IUPAC) names of major natural products. Since they did not present structures of these compounds, scholars can easily convert these names to structures.

Withanolides were reviewed in several publications, but very few of them were reviewed as single compounds. On this basis, the review article of M. Dom and his colleagues has special importance.[728] It presents broad perspective of antitumor activities of withaferin A (Figure 6). The article presents excellent figures of mechanism of action and pharmacokinetics against different types of tumors.

Poisoning of humans and animals by *Salanaceae* plants, their products and pure natural products, was extensively studied and reviewed as we cited earlier. But the review article of T.Y. Chan has very special relevance and importance.[729] It presents an issue of health concern, poisoning of humans by tropane alkaloids that are found as contaminations in herbal medicines. These medicines are supposed to help cure health disorders, and these contaminations make these products life threatening. One of the wost types of this poisoning, is that can be caused by herbal teas (page 3 in article). Another dangerous poisoning

caused by these contamination, occurres after use of different slimming pills, which is becoming more and more a global trend, in the course of combating overweight and obesity, as well as fashion and modeling goals. Even prescribed herbal products are listed among these contaminated commercially used medications.

Last review article that we found as having special value, was published by F. Albouchi and her colleagues.[730] Its importance emerges from the fact that icludes, in brief, all aspects that are needed about *Solanum nigrum*. The article presents taxonomy and morphology, ecology (including cultivation under different stress conditions), distribution and habitat (including introduction in different regions), reproduction, traditional and ethnobotanical uses, toxicty, chemical composition (major active compounds), essential oils and their uses; and medicinal activities (detailed).

In addition to the selected review articles there are some research articles that in our opinion possess the same attribute and deserve special attention,. One of the earliest publications of production of alkaloids in cultivated *Solanaceae* plants, was published by G.H. Gerlach in 1948.[731] It discusses the production of scopolamine in cultivated *Datura innoxia*. One of the major claims in this article is that scopolamine accumulation in cultivated *D. innoxia*, an originally "new world" plant, is higher than in cultivated *Datura metel*, the similar plant of the "old world". In fact, this is not only not trure, scopolamine or other alkaloid content in cultivated plats, may vary over a wide range and is mainly a result of cultivation conditions.[732]

A. H. El-Said and his colleagues prepared the chloroform extract of cultivated endophytic fungi that was growing on *Datura innoxia* and *Hyoscyamus muticus*.[733] They report that this extract had clear activity against several types of bacteria, as well as L-asparaginase inhibition. Interestingly, the chloroform extract of the *D. iinoxia* itself or parts of it, were not tested for antibacterial activity (see Table 2) and it could be interesting to compare the plant extracts with those of endopythic fungi that grow on the plant. Contrary to that, the chloroform extract of *H. muticus* was prepared and tested for antibacterial activity (ref. 232) and it is less active than the fungi extract.

The role of alkaloids as defense matabolites, extensively studied in alkaloid-containing plants in general,[734] in *Solanaceae* plants,[44,45,735] and specifically in *Datura stramonium*,[84] are well known and published. But I. Shonle and J. Bergelson published an interesting research, which actually proposes that *D. stramonium* alkaloids have another opposite role.[736] When insects feed on *D. stramonium* leaves that have low content of scopolamine and hyscyamine, they practically help plants in the natural selection and evolution, by extermination of defenseless "weak" plants. Further, it is evident that endophytic fungi can tolerate these toxic alkaloids and live on *D. stramonium* as a host plant. So, K. I. Tapfuma *et al*, have investigated the anticancer activity of the fungi extracts gainst two cancer cell lines.[737] They performed LC-QTOF-MS/MS analysis of the active extracts, and the major natural products that they found were: 1,8-dihydroxynaphthalene, anserinone B, phelligridin B, metacytofilin, phomopsidin and vermixocin A. Interestingly, none of these compounds is an alkaloid.

Chlorophyll a or b, are two of the most challenging natural products for every researcher who desires to extract them. The major reason for this difficuly is their instability. Not only the classical extraction sequence (collection of plant or plant parts, drying, powdering and then extraction with a solvent, cold or hot) but even modern methods such as ultrasound-assisted or use of supercritical CO_2 extractions, are destructive and modifying the sensitive pigments. For this reason, there was a need for two important tools. First, an adjustment of a solvent/s for the pigment extraction of plants and second, developing methods and technologies for field conditions extraction/determination of pigments in plants, in order to minimize the time that tese natural products are exposed to external effects, that can lead to their decomposition or modification.[738-742] On this basis, T.T. Tanan and her colleagues described the methods used to determine the pigment content of *Physalis angulata*.[743] They concluded that the use of the 80 % aqueous acetone tissue maceration protocol followed by filtration was the most efficient for use in the laboratory, while in field conditions, the immersion technique of foliar disks in 95 % aqueous ethanol and 24 h incubation is best method.

B. Bibhuti and A. K. Yadav discuss the production and use of digestive pills from *Solanum nigrum*.[744] In our view, their article have two disadvantages. The minor one is language mistakes ("and Makoi are the common name for it"). But the major one is their statement, "fruits of black colour are not used as they possess toxicity, therefore they are not used for medicinal purposes. Reddish- brown coloured fruits are used for edible purpose". Ripe fruits are black, and from this very fact, emerges the name of this plant. This statement completely contradicts other reports that unripe fuits (green or other colors but black) are toxic and not edible, while black, ripe fruits are.[56,544,745] Another strange fact about this article is that it was published (exactly same article, with only a different title) in another journal in the same year.[746]

Solasodine, a steroidal alkaloid, is one of the most active natural products found in the *Solanaeae* plants (see figure 8). In addition to the publications that we have already cited about this important compound (ref. 414, 433, 459, 560, 672, 700-702), numerous articles have been published about it.[747,748] Because of their importance, several methods (and many publications) were developed for the separation, extraction, quantification and validation of this compound.[749-751]

CONCLUSIONS

1. Plants of the *Solanaceae* family, in the reviewd region, are very rich with active natural products.

2. Some of these 24 plants are extensively studied but some of them are moderately studied.

3. There very few published studies about some of the plants. More research of these plants is needed.

4. There are no publications about medicinal, biological and other activities of *Solanum cornutum*. There is an immediate need for comprehensive study of this species.

5. Some of the natural products isolated from these plants were reasonably investigated for their medicinal activities, while others were either not or very partially studied. So, these studies should be expanded.

6. The cultivation of some of these plants for the purpose of active natural products accumulation was done under various conditions, while other plants were very limitedly or not studied. It is important to expand this research.

7. It is very highly recommended to avoid using common name of plants in scientific publications. This use is inaccurate and misleading.

8. Global climate changes are seemingly responsible for the rapid habitat expansion of some of these plants. Careful approach is needed to understand this phenomenon, and to try to utilize the results for combating the plants weed spreading.

REFERENCES

[1]Gebhardt, C., The historical role of species from the *Solanaceae* plant family in genetic research, *Theor. Appl. Genet*., **2016**, *129*, 2281-2294. DOI: 10.1007/s00122-016-2804-1

[2]Ganaie, M. M., Raja, V., Reshi, Z. A., Verma, V., Family Solanaceae: Taxonomy and modern trends, *Ann. Plant Sci*., **2018**, *7*, 2403-2414.

http://dx.doi.org/10.21746/aps.2018.7.9.1

[3]Cagnato, C., Shedding Light on the Nightshades (Solanaceae) Used by the Ancient Maya: a Review of Existing Data, and New Archeobotanical (Macro- and Microbotanical) Evidence from Archeological Sites in Guatemala, *Econ. Bot*., **2018**, *72*, 180-195. DOI: 10.1007/s12231-018-9412-8

[4]Emboden, W., The sacred journey in dynastic Egypt: shamanistic trance in the context of narcotic water lily and mandrake, *J. Psychoactive Drugs*, **1989**, *21*, 61-75. DOI: 10.1080/02791072.1989.10472144

[5]Dannaway, F. R., Strange fires, weird smokes and psychoactive combustibles: entheogens and incense in ancient traditions, *J. Psychoactive Drugs*, **2010**, *42*, 485-497. DOI: 10.1080/02791072.2010.10400711

[6]Dafni, A., Yaniv, Z., *Solanaceae* as medicinal plants in Israel, *J. Ethnopharmacol*., **1994**, *44*, 11-18. DOI: 10.1016/0378-8741(94)90093-0

[7]Azaizeh, H., Fulder, S., Khalil, K., Said, O., Ethnobotanical knowledge of local Arab practitioners in the Middle Eastern region, *Fitoterapia*, 2003, *74*, 98–108. DOI: 10.1016/s0367-326x(02)00285-x

[8]Azaizeh, H., Saad, B., Khalil, K., Said, O., The State of the Art of Traditional Arab Herbal Medicine in the Eastern Region of the Mediterranean: A Review, *Evid. Based Complement. Alternat. Med*., *2006*, *3*, 229–235. DOI: 10.1093/ecam/nel034

[9]Wild Flowers of Israel: https://www.wildflowers.co.il/english/familyID.asp?id=8&titlepage=Solanaceae

[10]Kadam, S. D., Chavhan, S. A., Shinde, S. A., Sapkal, P. N., Pharmacognostic Review on *Datura*, *Int. J. Pharmacogn. Chinese Med*., **2018**, *2*, 1-9.

https://medwinpublishers.com/IPCM/IPCM16000145.pdf

[11]Benítez, G., March-Salas, M., Villa-Kamel, A., Chaves-Jimenez, U., Hernandez, J., Montes-Osuna, N., Moreno-Chocano, J., Carinanos, P., The genus *Datura* L. (Solanaceae) in Mexico and Spain – Ethnobotanical perspective at the interface of medical and illicit uses, *J. Ethnopharmacol*., **2018**, *219*, 133-151. https://doi.org/10.1016/j.jep.2018.03.007

[12] Tandon, C., Mathur, P., Sen, M., Antibacterial compounds in different species of *Datura*: A review, *Afr. J. Microbiol. Res*., **2014**, *8*, 2090-2098. DOI: 10.5897/AJMR2014.6805

[13]Maheshwari, N. O., Khan, A., Balu A. Chopade, B. A., Rediscovering the medicinal properties of *Datura* sp.: A review, *J. Med. Plants Res*., **2013**, *7*, 2885-2897. DOI: 10.5897/JMPR11.1657

[14]Scientific Opinion of the Panel on Contaminants in the Food Chain on a request from the European Commission on Tropane alkaloids (from *Datura* sp.) as undesirable substances in animal feed. *EFSA J*., **2008**, *691*, 1-55. DOI: 10.2903/j.efsa.2008.691

[15]Krenzelok, E. P., Aspects of Datura poisoning and treatment, *Clin. Toxicol*., **2010**, 48, 104-110. DOI: 10.3109/15563651003630672

[16]Triggle, D. J., John M. Mitchell, J. M., Filler, R., The Pharmacology of Physostigmine, *CNS Drug Rev*., **1998**, *4*, 87–136. DOI: 10.1111/j.1527-3458.1998.tb00059.x

[17]Burns, M.J., Linden, C.H., Gradins, A., Brown, R. M., Fletcher, K. E., A comparison of physostigmine and benzodiazepines for the treatment of anticholinergic poisoning. *Ann. Emerg. Med*., **2000**, *35*, 374-381. https://doi.org/10.1016/s0196-0644(00)70057-6

[18]Al-Snafi, A. E., Medical importance of *Datura fastuosa* (syn: *Datura metel*) and *Datura stramonium* - A review**,** *IOSR J. Pharm*., **2017**, *7*, 43-58. http://iosrphr.org/papers/v7i2V1/E0702014358.pdf

[19] Soni, P., Siddiqui, A. A., Dwivedi, J., Soni, V., Pharmacological properties of *Datura stramonium* L. as a potential medicinal tree: An overview, *Asian Pac. J. Trop. Biomed*., **2012**, *2*, 1002-1008. DOI: 10.1016/S2221-1691(13)60014-3

[20]Gaire, B. P., Subedi, L., A review on the pharmacological and toxicological aspects of *Datura stramonium* L. *J. Integr. Med*., **2013**, *11*, 73-79. DOI: 10.3736/jintegrmed2013016

[21]Sanjita, D., Kumar, P., Basu, S. P., Phytoconstituents and Therapeutic Potentials of *Datura stramonium* LINN, *J. Drug Deliv. Ther*., **2012**, *2*, 4-7. DOI: 10.22270/jddt.v2i3.141

[22]Singh, L.R., Singh, O. M., *Datura stramonium*: An overview of its phytochemistry and pharmacognosy, *Res. J. Pharmacog. Phytochem*., **2013**, *5*, 143-148. https://www.researchgate.net/publication/249650218

[23]Sayyed, A., Shah, M., Phytochemistry, pharmacological and traditional uses of *Datura stramonium* L. review, *J. Pharmacog. Phytochem*., **2014**, *2*, 123-125. https://www.researchgate.net/publication/274063446

[24]Debnath, T., Raja Chakraverty, R., Newer Insights into the Pharmacological activities of *Datura stramonium* LINN: A Review. *Indo-Am. J. Pharm*., **2017**, *7*, 441-444. https://www.researchgate.net/publication/322138040

[25]Naik,V.K., Babu, K. S., Latha, J., Kolluru, B., A review on Phytochemical and Pharmacological activity of *Datura Stramonium*. (Medicinal Plant), *Res. J. Pharmacog. Phytochem*., **2018**, *10*, 77-80. DOI: 10.5958/0975-4385.2018.00013.4

[26]Cornelius, G., Lohiya, G., Sharma, R., Chemical Constituents and Pharmacological Properties of *Datura Stramonium* (Thorn Apple) - A Review, *Int. J. Eng. Res. Technol*., **2019**, *8*, 512-515. https://www.ijert.org/IJERTV8IS110259.pdf

[27]Devi, M.R., Bawari, M., Paul, S. B., Sharma, G. D., Neurotoxic and Medicinal Properties of *Datura stramonium* L. – Review, *Assam Univ. J. Sci. Technol*., **2011**, *7*, 139-144. https://www.researchgate.net/publication/285309310

[28]Jonasson, M., Afshari, R., Chronicle of Datura Toxicity in 18th and 19th Century. *Asia-Pac. J. Med. Toxicol*., **2016**, 5, 101-6. http://apjmt.mums.ac.ir/article_8134.html

[29]Al-Snafi, A. E., Therapeutic importance of *Hyoscyamus* species grown in Iraq (*Hyoscyamus albus*, *Hyoscyamus niger* and *Hyoscyamus reticulates*)- A review**,** *IOSR J. Pharm*., **2018**, *8*, 18-32. https://www.researchgate.net/publication/325809536

[30]Hanus, L. O., Rezanka, T., Spizek, J., Dembitsky, V. M., Substances isolated from *Mandragora* species, *Phytochemistry*, **2005**, *66*, 2408-2417. DOI: 10.1016/j.phytochem.2005.07.016

[31]Gupta, A., Singh, P., Trivedi, M., Jha, K. K., Kumar, S., Singh, B., A review on pharmacognostical and pharmacological activities of plant *Nicandra physalodes*, *Pharma Res*., **2014**, *11*, 42-47. https://www.researchgate.net/publication/287324309

[32]Rengifo-Salgado, E., Vargas, Arana, G., *Physalis angulata* L. (Bolsa Mullaca): A Review of its Traditional Uses, Chemistry and Pharmacology, *Bol. Latinoam. Caribe Plant Med. Aromat*., **2013**, *12*, 431-445 . https://www.researchgate.net/publication/260284500

[33]Sharma, N., Bano, A., Dhaliwal, H. S., Sharma, V., A Pharmacological Comprehensive Review on 'Rassbhary' *Physalis angulata* (L.), *Int. J. Pharm. Pharm. Sci*., **2015**, *7*, 30-34. https://www.researchgate.net/publication/296461005

[34]Rathi, V., Rathi, J. C., Patel, K., Kanojia, S. S., Tamizharasi, S., Acomprehensive Review of *Physalis angulata*, *World J. Pharm. Res*., **2017**, *6*, 1503-1512. DOI: 10.20959/wjpr20174-8251

[35]Mirzaee, F., Hosseini, A. S., Askian, R., Azadbakht, M., Therapeutic Activities and Phytochemistry of *Physalis* Species Based on Traditional and Modern Medicine, *Res. J. Pharmacogn*., **2019**, *6*, 79-96. DOI: 10.22127/rjp.2019.93529

[36]Shah, P., Bora, K. S., Phytochemical and Therapeutic Potential of *Physalis* species: a Review, *IOSR J. Pharm. Biol. Sci*., **2019**, *14*, 34-51. DOI: 10.9790/3008-1404033451

[37]Hassanien, M. F., *Physalis peruviana*: A Rich Source of Bioactive Phytochemicals for Functional Foods and Pharmaceuticals. *Food Rev. Int*., **2011**, *27*, 259-273. DOI: 10.1080/87559129.2011.563391

[38]Ramadan, M .F., Bioactive phytochemicals, nutritional value, and functional properties of cape gooseberry (*Physalis peruviana*): An overview, *Food Res. Int*., **2011**, *44*, 1830-1836. DOI: 10.1016/j.foodres.2010.12.042

[39]Puente, L. A., Pinto-Munoz, C. A., Castro, E. S., Cortes, M., *Physalis peruviana* Linnaeus, the multiple properties of a highly functional fruit: A review, *Food Res. Int*., **2011**, *44*, 1733-1740. DOI: 10.1016/j.foodres.2010.09.034

[40]Elshama, S. S., Protective and Therapeutic Effect of *Physalis peruviana* L. in the Intoxicated Cases, *Trends Appl. Sci. Res*., **2019**, *14*, 36-40. DOI: 10.3923/tasr.2019.36.40

[41]Milner, S. E., Brunton, N. P., Jones, P. W., O' Brien, N. M., Collins, S. G., Maguire, A. R., Bioactivities of Glycoalkaloids and Their Aglyconesfrom Solanum Species, *J. Agric. Food Chem*., **2011**, *59*, 3454–3484. DOI: 10.1021/jf200439q

[42]Jayakumar, K., Murugan, K., Solanum Alkaloids and their Pharmaceutical Roles: A Review. *J. Anal. Pharm. Res*., **2016**, *3*, 14 pages. DOI: 10.15406/japlr.2016.03.00075

[43]Al Sinani, S. S., Eltayeb, E. A., The steroidal glycoalkaloids solamargine and solasonine in *Solanum* plants, *South Afr. J. Bot*., **2017**, *112*, 253–269. http://dx.doi.org/10.1016/j.sajb.2017.06.002

[44]Pomilio, A. B., Falzoni, E. M., Vitale, A. A., Toxic Chemical Compounds of the *Solanaceae*, *Nat. Prod. Commun*., **2008**, *3*, 593-628. https://doi.org/10.1177/1934578X0800300420

[45]Chowanski, S., Adamski, Z., Marciniak, P., Rosinski, G., Buyukguzel, E., Buyukguzel, K., Falabella , P., Scrano, L., Ventrella, E., Lelario, F., Bufo, S. A., A Review of Bioinsecticidal Activity of *Solanaceae* Alkaloids, *Toxins*, **2016**, *8*, 60-87. DOI: 10.3390/toxins8030060

[46]Uludag, A., Gbehounou, G., Kashefi, J., Bouhache, M., Bon, M.-C., Bell, C. Lagopodi, A. L., Review of the current situation for *Solanum elaeagnifolium* in the Mediterranean Basin, *EPPO Bull*., **2016**, *46*, 139-147. DOI: 10.1111/epp.12266

[47]Mwonjoria, J. K., Ngeranwa, J. J., Kariuki, H. N., Githinji, C. G., Sagini, M. N., Wambugu, S. N., Ethno medicinal, phytochemical and pharmacological aspects of *Solanum incanum* (lin.), *Int. J. Pharmacol. Toxicol*., **2014**, *2*, 17-20. DOI: 10.14419/ijpt.v2i2.1454

[48]Dakone, D., Guadie, A., A review on ethnomedicinal use, nutritional value, phytochemistry and pharmacological characteristics of *Solanum incanum* L. An important medicinal plant, *Int. J. Sci. Technol. Res*., **2016**, *5*, 350-354. https://www.researchgate.net/publication/318463932

[49]Jain, R., Sharma, A., Gupta, S., Sarethy, I. P., Gabrani, R., *Solanum nigrum*: Current Perspectives on Therapeutic Properties, *Altern. Med. Rev*., **2011**, *16*, 78-85. https://www.researchgate.net/publication/50865162

[50]Atanu, F. O., Ebiloma, U. G., Ajayi, E. I., A review of the pharmacological aspects of *Solanum nigrum* Linn., *Biotechnol. Mol. Biol. Rev*., **2011**, *6*, 1-7. https://www.researchgate.net/publication/228621131

[51]Miraj, S., *Solanum nigrum*: A review study with anti-cancer and antitumor perspective, *Der Pharma Chem*., **2016**, *8*, 62-68. https://www.researchgate.net/publication/309922413

[52]Saleem, T. S., Chetty, C. M., Ramkanth, S., Alagusundaram, M., Gnanaprakash, M.K., Rajan, V.S., Angalaparameswari, S., *Solanum nigrum* Linn.–A Review, *Pharmacog. Rev*., **2009**, *3*, 342-345. https://www.researchgate.net/publication/286038929

[53]Potawale, S. E., Sinha, S. D., Shroff, K. K., Dhalawat, H. J., Boraste, S. S., Gandhi, S. P., Tondare, A. D., *Solanum Nigrum* Linn: A Phytopharmacological Review. *Pharmacology online*, **2008**, *3*, 140-163. https://scinapse.io/papers/2188237570

[54] Kumar, A., Niketa, S. S, Rani, S., An Updated Review on Molecular Genetics, Phytochemistry, Pharmacology and Physiology of Black Nightshade (*Solanum nigrum*), *Int. J. Pharmacut. Sci Res*., **2012**, *3*, 2956-2977. http://dx.doi.org/10.13040/IJPSR.0975-8232.3(9).2955-77

[55]Rani, Y. S., Reddy, V. J., Basha, S .J., Koshma, M., Hanumanthu, G., Swaroopa, P., A Review on *Solanum nigrum*, *World J. Pharm. Pharmaceut. Sci*., **2017**, *6*, 293-303. https://www.researchgate.net/publication/322797670

[56]Pallavi, S. S., Shivappa, N. N., Vikram, S. S., Krishna, R. S., Systematic Review on *Solanum nigrum*, *World J. Pharmaceut. Life Sci*., **2019**, *5*, 109-112. https://www.wjpls.org/admin/assets/article_issue/35012019/1548912621.pdf

[57]Rehman, M. Z., Rizwan, M., Ali, S., Ok, Y. S., Ishaque, W., Saifullah, Nawaz, M.F., Akmal, F., Waqar, M., Remediation of heavy metal contaminated soils by using *Solanum nigrum*: A review, *Ecotoxicol. Environ. Safety*, **2017**, *143*, 236-248. DOI: 10.1016/j.ecoenv.2017.05.038

[58]Zahara, K., Ahmad, N., Bibi, Y., Bibi, F., Sadaf, H. M., Sardar, N., An insight to therapeutic potential and phytochemical profile of *Solanum villosum* (L), *Med. Drug Discov*., **2019**, *2*, 6 pages. https://doi.org/10.1016/j.medidd.2019.100007

[59]Alam, K., Hoq, O., Uddin, S., Therapeutic use of *Withania somnifera*. *Asian J. Med. Biol. Res*., **2016**, *2*, 148-155. DOI: 10.3329/ajmbr.v2i2.29004

[60]Khanchandani, N., Shah, P., Kalwani, T., Ardeshna, A., Dharajiya, D., Antibacterial and Antifungal Activity of Ashwagandha (*Withania somnifera* L.): A review , **2019**, *9*, 154-161. http://dx.doi.org/10.22270/jddt.v9i5-s.3573

[61]Shah, D. R., Palaskar, S. J., Pawar, R. B., Punse, R. R., *Withania Somnifera*: A New Approach to Cancer, Ann. Appl. BioSci., **2018**, *5*, 1-8. DOI: 10.21276/AABS.1838

[62]Mirjalili, M. H., Moyano, E., Bonfill, M., Cusido, R. M., Palazon, M., Steroidal Lactones from *Withania somnifera*, an Ancient Plant for Novel Medicine, *Molecules*, **2009**, *14*, 2373-2393. DOI: 10.3390/molecules14072373

[63]Verma, S. K., Kumar, A., Therapeutic Uses of *Withania somnifera* (Ashwagandha) with a Note on Withanolides and its Pharmacological Actions, *Asian J. Pharm. Clin. Res*., **2011**, *4*, 1-4. https://www.researchgate.net/publication/260419415

[64]Tiwari, R., Chakraborty, S., Saminathan, M., Dhama, K., Singh, S. V., Ashwagandha (*Withania somnifera*): Role in Safeguarding Health, Immunomodulatory Effects, Combating Infections and Therapeutic Applications: A Review, *J. Biol. Sci*., **2014**, *14*, 77-94. DOI: 10.3923/jbs.2014.77.94

[65]Gavande, K., Jain, K., Jain, B., Rakesh Mehta, R., Comprehensive Report on Phytochemistry and Pharmacological Prominence of *Withania somnifera*, *UK J. Pharm. Biosci*., **2015**, *3*, 15-23. https://ukjpb.com/article_details.php?id=107

[66]Betsy B. Singh, Simon Dagenais, S., Singh, B. B., Mishra, L. R., Scientific Basis for the Therapeutic Use of *Withania somnifera* (Ashwagandha): A Review, *Altern. Med. Rev*., **2000**, *5*, 334-346. https://www.researchgate.net/publication/12365397

[67]Gupta, G. L., Rana, A. C., Withania somnifera (Ashwagandha): A Review. *Pharmacog. Rev*., **2007**, *1*, 129-136. https://www.researchgate.net/publication/284801881

[68] Vyas, V. K., Bhandari, P., Patidar, R., A Comprehensive Review on *Withania somnifera* Dunal, *J. Nat. Remedies*, **2011**, *11*, 1-13. http://www.informaticsjournals.com/index.php/jnr/article/view/43

[69] Mir, B. A., Khazir, J., Mir, N. A., Hasan, T., Koul, S., Botanical, chemical and pharmacological review of *Withania somnifera* (Indian ginseng): an ayurvedic medicinal plant, *Indian J. Drugs Diseas*., **2012**, *1*, 147-160.

http://ijdd.informaticspublishing.com/index.php/ijdd/article/view/31369

[70]Gaurav, N., Review: Pharmacological and Medicinal Activity of Active Compounds of *Withania somnifera*, *J. Engin. Technol*., **2013**, *3*, 7 pages.

https://www.researchgate.net/publication/328699653

[71]Jinu, J., Therapeutic Potential of *Withania somnifera*: A Report on Phyto-Pharmacological Properties, *Int. J. Pharmaceut. Sci., Res*., **2014**, *5*, 2131-2148. DOI: 10.13040/IJPSR.0975-8232.5(6).2131-48

[72]Jana, S. N., Charan, S. M., Health Benefits and Medicinal Potency of *Withania somnifera*: A Review, *Int. J. Pharm. Sci. Rev. Res*., **2018**, *48*, 22-29. http://globalresearchonline.net/journalcontents/v48-1/08.pdf

[73]Dhar, N., Razdan, S., Rana, S., Bhat, W. W., Vishwakarma, R., Lattoo, S. K., A Decade of Molecular Understanding of Withanolide Biosynthesis and *In vitro* Studies in *Withania somnifera* (L.) Dunal: Prospects and Perspectives for Pathway Engineering, *Front. Plant Sci*., **2015**, *6*, 20 pages. DOI: 10.3389/fpls.2015.01031

[74]Jain, R., Kachhwaha, S., Kothari, S. L., Phytochemistry, pharmacology, and biotechnology of *Withania somnifera* and *Withania coagulans*: A review, *J. Med. Plants Res*., **2012**, *6*, 5388-5399. DOI: 10.5897/JMPR12.704

[75]Kumar, V., Dey, A., Hadimani, M.B., Marcovic, T., Emerald, M., Chemistry and pharmacology of *Withania somnifera*: An update, *TANG*, **2015**, *5*, 13 pages. http://dx.doi.org/10.5667/tang.2014.0030

[76]Kalra, R., Kaushik, N., *Withania somnifera* (Linn.): a review of chemical and pharmacological diversity. *Phytochem. Rev*., **2017**, *16*, 953-987. DOI: 10.1007/s11101-017-9504-6

[77]Dutta, R., Khalil R., Green, R., Mohapatra, S.S., Mohapatra, S., *Withania Somnifera* (Ashwagandha) and Withaferin A: Potential in Integrative Oncology, *Int. J. Mol. Sci*., **2019**, *20*, 5310-5348. DOI: 10.3390/ijms20215310

[78]Azgomi, R. N., Zomorrodi, A., Nazemyieh, H., Fazljou, S. M., Bazargani , H. S., Nejatbakhsh, F. Jazani, A. M., AsrBadr, Y. A., Effects of *Withania somnifera* on Reproductive System: A Systematic Review of the Available Evidence, *BioMed. Res. Int*., **2018**, Article ID 4076430, 17 pages. https://doi.org/10.1155/2018/4076430

[79]Sengupta, P., Agarwal, A., Pogrebetskaya, M., Roychoudhury, S., Durairajanayagam, D., Henkel, R., Role of *Withania somnifera* (Ashwagandha) in the management of male infertility, *Reprod. Biomed. Online*, **2018**, *36*, 311-326. https://doi.org/10.1016/j.rbmo.2017.11.007

[80]EFSA CONTAM Panel, Tropane alkaloids in food and feed, *EFSA J*., **2013**, *11*, 3386-3498, DOI: 10.2903/j.efsa.2013.3386

[81]Gadzikowska, M., Grynkiewicz G., Tropane alkaloids in pharmaceutical and phytochemical analysis, *Acta Pol. Pharm.*, **2002**, *59*, 149-60. https://www.ptfarm.pl/pub/File/Acta_Poloniae/2002/2/149.pdf

[82]Grynkiewicz, G., Gadzikowska, M., Tropane alkaloids as medicinally useful natural products and their synthetic derivatives as new drugs, *Pharmacol. Rep*., **2008**, *60*, 439-463. http://www.if-pan.krakow.pl/pjp/pdf/2008/4_439.pdf

[83]Kohnen-Johannsen, K. L., Kayser, O., Tropane Alkaloids: Chemistry, Pharmacology, Biosynthesis and Production, *Molecules*, **2019**, *24*, 796-818,

DOI: 10.3390/molecules24040796

[84]Karinho-Betancourt, E., Agrawal, A. A., Halitschke, R., Nunez-Farfan, J., Phylogenetic correlations among chemical and physical plant defenses change with ontogeny, *New Phytol*., **2015**, *206*, 796-806. DOI: 10.1111/nph.13300

[85]Padula, L. Z., Bandoni, A. L., Rondina, R. V., Coussio, J. D., Quantitative determination of total alkaloids and scopolamine in *Datura ferox* growing in Argentina, *Planta Med*., **1976**, *29*, 357-360. DOI: 10.1055/s-0028-1097676

[86]Houmani, Z., Cosson, L., Composition in tropanic alkaloids of two Datura species from Algeria: *Datura ferox* L. and *Datura quercifolia* H.B.K., *Acta Bot. Gallica*, **1998**, *145*, 195-198. https://eurekamag.com/research/010/368/010368451.php

[87]Vitale, A. A., Acher, A., Pomilio, A. B., Alkaloids of *Datura ferox* from Argentina. *J. Ethnopharmacol*., **1995**, *49*, 81-89. DOI: 10.1016/0378-8741(95)90035-7

[88]Houmani, Z., Cosson, L., Houmani, M., *Datura ferox* L. and *D. quercifolia* Kunth *(Solanaceae)* in Algeria, *Flora Mediterr*., **1999**, *9*, 57-60. http://www.herbmedit.org/flora/9-057.pdf

[89]Kovatsis, A., Kotsaki-Kovatsi, V. P., Nikolaidis, E., Flaskos, J., Tzika, S., Tzotzas, G., The influence of *Datura ferox* alkaloids on egg-laying hens, *Vet. Hum. Toxicol*., *1994*, *36*, 89-92. https://www.ncbi.nlm.nih.gov/pubmed/8197722

[90]Kovatsis, A., Flaskos, J., Nikolaidis, E., Kotsaki-Kovatsi, V. P., Papaioannou, N., Tsafaris, F., Toxicity study of the main alkaloids of Datura ferox in broilers, *Food Chem. Toxicol*., **1993**, *31*, 841-845. DOI: 10.1016/0278-6915(93)90222-k

[91]Padma Rao, P., Subramanian, P., Sudhakar, P., Reddy, P. R., Pharmacognostic studies on seed of *Datura ferox*, *Ind. J. Nat. Prod. Resor*., **2014**, *5*, 326-331.

https://pdfs.semanticscholar.org/4642/ac7430818a9a8fee9e8ec8da7cc753dbff2b.pdf

[92]Gerber, R., Naude, T.W., de Kock, S. S., Confirmed Datura poisoning in a horse most probably due to *D. ferox* in contaminated tef hay, *S. Afr. Vet.Ver*., **2006**, *77*, 86–89. DOI: 10.4102/jsava.v77i2.350

[93]Steenkamp, P. A., Harding, N. M., van Heerden, F. R., van Wyk, B. E., Fatal *Datura* poisoning: identification of atropine and scopolamine by high performance liquid chromatography/photodiode array/mass spectrometry, *Forensic Sci. Int*., **2004**, *145*, 31-39. DOI: 10.1016/j.forsciint.2004.03.011

[94]Piva, G., Piva, A., Anti-nutritional factors of Datura in feedstuffs. *Nat. Toxins*, **1995**, *3*, 238-241. DOI: 10.1002/nt.2620030413.

[95]Plank, K-H., Wagner, K. G., Determination of Hyoscyamine and Scopolamine in *Datura innoxia* Plants by High Performance Liquid Chromatography, *Z. Naturforsch. C*, **1986**, *41*, 391-395. https://doi.org/10.1515/znc-1986-0404

[96]Malinowska, I., Studzinski, M., Niezabitowska, K., Malinowski, H., Planar electrochromatography and thin layer chromatography of tropane alkaloids from *Datura innoxia* Mill. extract in pseudo-reversed phase systems, *J. Planar Chromat.*, **2016**, *29*, 38-44. DOI: 10.1556/1006.2016.29.1.5

[97]Berkov, S., Zayed, R., Comparison of tropane alkaloid spectra between *Datura innoxia* grown in Egypt and Bulgaria, *Z. Naturforsch. C J. Biosci*., **2004**, *59*, 184-186. DOI: 10.1515/znc-2004-3-409

[98]Zayed, R., Wink, M., El-Shamy, H., *In vitro* organogenesis and alkaloid accumulation in *Datura innoxia*, *Z. Naturforsch. C-J. Biosci*., **2006**, *61*, 560-564. DOI: 10.1515/znc-2006-7-815

[99]Al-Humaid, A.I., Effects of Compound Fertilization on Growth and Alkaloids of Datura Plants, *J. Plant Nutr*., **2005**, *27*, 2203-2219, DOI: 10.1081/PLN-200034685

[100]El Bazaoui, A., Bellimam, M. A., Soulaymani, A., Tropane alkaloids of *Datura innoxia* from Morocco, *Z. Naturforsch. C J. Biosci*., **2012**, *67*, 8-14. DOI: 10.1515/znc-2012-1-202

[101]Oniszczuzuk, A., Waksmundzka-Hajnos, M., Gadzikowska, M., Podgorski, R., Oniszczuk, T., Influence of Sample Preparation Methods on the Quantitation of Selected Tropane Alkaloids from Herb of *Datura innoxia* Mill. by HPTLC, *Acta Chromat*., **2013**, *25*, 545–554. DOI: 10.1556/AChrom.25.2013.3.10

[102]McGaw, B. A., Woolley, J. G., Stereochemistry of tropane alkaloid formation in *Datura innoxia*, *Phytochemistry*, **1978**, *17*, 257-259. https://doi.org/10.1016/S0031-9422(00)94158-X

[103]Jaafar, F. R., Ajeena, S. J., Mehdy, S. S., Anti-inflammatory impacts and analgesiac activity of aqueous extract *Datura innoxia* leaves against induced pain and inflammation in mice, *J. Entomol. Zool. Stud*., **2018**, *6*, 1894-1899. http://www.entomoljournal.com/archives/2018/vol6issue2/PartT/6-1-169-611.pdf

[104]Kaushik, P., Goyal, P., *In vitro* evaluation of *Datura innoxia* (thorn-apple) for potential antibacterial activity, *Indian J. Microbiol*., **2008**, *48*, 353–357. DOI: 10.1007/s12088-008-0020-7

[105]Rajeshkanna, A., Senthamilselvi, M. M., Prabhakaran, D., Muruganantham, N., Solomon, S., Antimicrobial Activity of *Datura innoxia* (Flowers), *Int. J. Pharm. Pharmaceut. Res*., **2017**, *9*, 85-92. http://ijppr.humanjournals.com/wp-content/uploads/2017/07/9

[106]Adam, S. I., Abd-Kreem, Y. M., Fadowa, A. A., Samar, R. M., Sabahelkhier, M. K., *In vitro* antibacterial and antifungal activity of *Datura innoxia* extracts, *Int. J. Environ*., **2014**, *3*, 173-185. https://doi.org/10.3126/ije.v3i3.11077

[107]Al-Sarai, A.A., Abbas, D.A., Al-Rekabi, F. M., Some toxicological impacts and *in vitro* antibacterial activity of *Datura innoxia* extract in rats. Kufa *J. Vet. Med. Sci*., 2011, *2*, 132-145. https://www.iasj.net/iasj?func=fulltext&aId=32418

[108] Singh, R., Suresh, C. G., Purification and Characterization of a Small Chito-specific Lectin from *Datura innoxia* Seeds Possessing Anti-microbial Properties, *Int. J. Biochem. Res. Rev*., **2016**, *9*, 1-17. DOI: 10.9734/IJBCRR/2016/22157

[109]Gachande, B. D., Khillare, E. M., *In-vitro* Evaluation of *Datura* Species for Potential Antimicrobial Activity, *Biosci. Discov*., **2013**, *4*, 78-81. https://jbsd.in/Volume%204%20No1%20Jan%2013/Gachande%2078-81.pdf

[110]Fatima, H., Khan, K., Zia, M., Ur-Rehman, T., Mirza, B., Haq, I., Extraction optimization of medicinally important metabolites from *Datura innoxia* Mill.: an *in vitro* biological and phytochemical investigation, *BMC Complement. Alternat. Med*., **2015**, *15*, 376-393. DOI 10.1186/s12906-015-0891-1

[111]Arulvasu, C., Babu, G., Manikandan, R., Srinivasan, P., Sellamuthu, S., Prabhu, D., Dinesh, D., Anti-Cancer Effect of *Datura innoxia* P.mill. Leaf Extract *in vitro* through Induction of Apoptosis in Human Colon Adenocarcinoma and Larynx Cancer Cell Lines, *J. Pharm. Res*., **2010**, *3*,1485-1488. http://jprsolutions.info/article_detail.php?article_id=816

[112]Khoshkhoo, B., Motamed, M. S., Hamzeloo-Moghadam, M., *Datura innoxia* anti-angiogenesis properties, *Res. J. Pharmacog*., **2017**, *4*, 39-44. http://www.rjpharmacognosy.ir/article_44252.html

[113]Vermillion, K., Holguin, F. O., Berhow, M. A., Richins, R. D., Redhouse, T., O'Connell, M.A., Posakony, J., Mahajan, S. S., Kelly, S. M., Simon, J. A., Dinoxin B, a Withanolide from *Datura inoxia* Leaves with Specific Cytotoxic Activities, *J. Nat. Prod*., **2011**, *74*, 267–271. DOI: 10.1021/np1004714

[114]Bhardwaj, K., Kumar, S., Ojha, S., Anioxidant Activity FT-IR Analysis of *Datura innoxia* and *Datura metel*, *Afr. J. Tradit. Complement. Altern. Med*., **2016**, *13*, 7-16. DOI: 10.21010/ajtcam.v13i5.2

[115]Togola, I., Dembele, A. A., Tounkara, F., Diarra, N., Konare, M. A., Karembe, M., Maiga, S .Z., Dembele, D., Evaluation of *in vitro* Antioxidant Activities of Ethanol Extracts of *Datura innoxia* Mill. Leaves and Seeds Harvested in Mali, *Ann. Res. Rev. Biol*., **2019**, *33*, 1-8.

DOI: 10.9734/ARRB/2019/v33i230115

[116]Sandhya, S., Prathyusha, V., Govardhan, S., Sridhar, D., Vinod, K. R., David, B., Pharmacognostical standardization and in vitro pediculocidal activity of *Datura innoxia* and *Cyclea peltata*, *Curr. Bot*., **2011**, *2*, 31-39. https://updatepublishing.com/journal/index.php/cb/article/view/1372

[117]Nandakumar, A., Vaganan, M. V., Sundararaju, P., Udayakumar, R., Nematicidal Activity of Aqueous Leaf Extracts of *Datura metel*, *Datura innoxia* and *Brugmansia suaveolens*, *Am. J. Entomol*., **2017**, *1*, 39-45. DOI: 10.11648/j.aje.20170102.13

[118]El-Massad, H. A., Satti, A. A., Alabjar, Z. A., Insecticidal potentiality of *Datura innoxia* leaf extracts against the cluster bug (*Agonoscelis pubescens* (Thunberg), *Glo. Adv. Res. J. Environ. Sci. Toxicol*., **2012**, *1*, 172-177. https://www.researchgate.net/publication/271510558

[119]Theurkar, S. V., Toxicity of Biopesticide *Datura Innoxia* against the Mortality of *Holotrichia Serrata* (Fab) Adults, *Int. J. IT Eng. App. Sci. Res*., **2013**, *2*, 8-11. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.403.7640&rep=rep1&type=pdf

[120]Boubekka, A., Belmadani, K, Mouhouche, F., Insecticide Activity of *Datura innoxia* on Migratory Locust: *Locusta Migratoria* (LINNE, 1758) (Oedipodinae, Acrididae), *Int. J. Agricul. Sci. Res*., **2014**, *4*, 1-8. https://www.academia.edu/10470996

[121]Rawal, V., Sharma, A. V., Vats, T. K., Singh, A. K., Antifeedant Activity of Methanol and Hexane Extracts of Datura Innoxia (Mill.) (Solanaceae) in the Management of Spodoptera Litura (F.) (Lepidoptera: Noctuidae) Larvae, *Int. J. Bioengin. Life Sci*., **2015**, *9*, 8 pages. https://publications.waset.org/abstracts/37846

[122]Nandakumar, A., Vaganan, M. M., Sundararaju, P., Phytochemical Analysis and Nematicidal Activity of Ethanolic Leaf Extracts of *Datura metel*, *Datura innoxia* and *Brugmansia suaveolens* Against *Meloidogyne incognita*. *Asian J. Biol*., **2017**, *2*, 1-11. DOI: 10.9734/AJOB/2017/34241

[123]Partap, M., Gupta, R. C., Pradhan, S. K., Comparative Aanalysis of Morphology and Phytochemical Constituents in Different Populations and Morphotypes of *Datura innoxia* Mill. and *Datura metel* L. from Punjab Plains, *Asian J. Pharm. Clin. Res*., **2019**, *12*, 193-199. http://dx.doi.org/10.22159/ajpcr.2019.v12i1.27720

[124]Ayuba, V. O., Ojobe, T. O., Ayuba, S. A., Phytochemical and proximate composition of *Datura innoxia* leaf, seed, stem, pod and root, *J. Med. Plants Res*., **2011**, *5*, 2952-2955. https://academicjournals.org/journal/JMPR/article-stat/C2E161418683

[125]Christiana, K. A., Sunday, I. G., Samalia, B. J., Dayil, D. A., Chemical composition of the seeds of *Datura innoxia*, *Int. J. Innov. Sci. Engin. Technol*., **2016**, *3*, 35-41. http://ijiset.com/vol3/v3s2/IJISET_V3_I2_06.pdf

[126]Biswasroy, P., Pradhan, D., Pradhan, R., Quantitative analysis of Hyoscine in different extracts obtained from the seeds of *Datura innoxia* by RP- HPLC, *J. Ayur. Herb. Med*., **2017**, *3*, 192-195. http://www.ayurvedjournal.com/JAHM_201734_04.pdf

[127]Berkov, S., Size and Alkaloid Content of Seeds in Induced Autotetraploids of *Datura innoxia*, *Datura stramonium* and *Hyoscyamus niger*, *Pharmaceut. Biol*., **2011**, *39*, 329-331. DOI: 10.1076/phbi.39.5.329.5896

[128]Nuhu, H., Ghani, A., Alkaloids Content of the Leaves of Three Nigerian Datura Species, *Nig. J. Nat. Prod. Med*., **2002**, *6*, 15-18. http://dx.doi.org/10.4314/njnpm.v6i1.11685

[129]Rahmoune, B., Zerrouk, I. Z., Morsli, A., Khelifi-Slaoui, M., Khelifi, L., Amarante, D. L., Phenylpropanoids and Fatty Acids Levels in Roots and Leaves of *Datura stramonium* and *Datura innoxia*, *Int. J. Pharm. Pharmaceut. Sci*., **2017**, *9*, 150-154. http://dx.doi.org/10.22159/ijpps.2017v9i7.15946

[130]Fanna, A. G., Yadji, G., Tankari, D. A., Boubacar, S., Ousseini, I. Z., Ambouta, J. M., Phytoextraction of Cd, Cu, Pb and Zn by the Plant Species *Datura innoxia*, *Int. J. Curr. Res*., **2018**, *10*, 70749-70755. https://www.journalcra.com/sites/default/files/issue-pdf/31063.pdf

[131]Adam., S. I., Abd-Kreem., Y. M., Fadowa, A. A., Samar, R. M., Biochemical and Histopathological study of aqueous and methanolic extracts of *Datura innoxia* on Wistar rats, *Int. J. Adv. Res*., **2014**, *2*, 878-887. http://www.journalijar.com/article/1680

[132]Philipov, S., Berkov, S., GC-MS investigation of tropane alkaloids in *Datura stramonium*, *Z .Naturforsch. C - J. Biosci*., **2002**, *57*, 559-561.DOI: 10.1515/znc-2002-5-627

[133]Philipov, S., Berkov, S., Doncheva, T., GC-MS Survey of *Datura stramonium* Alkaloids, *Cr. Acad. Bulg. Sci*., **2007**, *60*, 239-250. https://www.researchgate.net/publication/272160587

[134]Babiker, F., Jamal, P., Mirghani, M. E., Ansari, A. H., Characterization, purification and identification of some Alkaloids in *Datura stramonium*, Int. *Food Res. J*., **2017**, *24*, S540-S543. https://www.researchgate.net/publication/324154034

[135]Ademiluyi, A. O., Ogunsuyi, O. B., Oboh, G., Alkaloid extracts from Jimson weed (Datura stramonium L.) modulate purinergic enzymes in rat brain, *Neurotoxicology*, **2016,** *56*, 107-117. DOI: 10.1016/j.neuro.2016.06.012

[136]Demeyer, K., Dejaegere, R., Nitrogen and Alkaloid Accumulation and Partitioning in *Datura stramonium* L., *J. Herbs, Spices Med. Plants*, **1998**, *5*, 15-23. DOI: 10.1300/J044v05n03_03

[137]Iranbakhsh, A. R., Oshagi, M. A., Ebadi, M., Growth and Production Optimization of Tropane Alkaloids in *Datura stramonium* Cell Suspension Culture, *Pak. J. Biol. Sci*., **2007**, *10*, 1236-1242. DOI: 10.3923/pjbs.2007.1236.1242

[138]Maldonado-Mendoza, I. E., Ayora-Talavera, T. R., Loyola-Vargas, V. M., Tropane Alkaloid Production in *Datura stramonium* Root Cultures, *In Vitro Cell. Dev. Biol*., **1992**, *28*, 67-72. DOI: 10.1007/BF02823021

[139]Ballica, R., Ryu, D. D., Kado, C. I., Tropane alkaloid production in *Datura stramonium* suspension cultures: elicitor and precursor effects, *Biotechnol. Bioeng*., **1993**, *41*, 1075-1081. DOI: 10.1002/bit.260411110

[140]Eftekhar, F., Yousefzadi, M., Tafakori, V., Antimicrobial activity of *Datura innoxia* and *Datura stramonium*, *Fitoterapia*, **2005**, *76*, 118-120. DOI: 10.1016/j.fitote.2004.10.004

[141]Uma Reddy, B., Antimicrobial Activity of *Datura stramonium* and *Tylophora Indica* (Burm. F.) Merr., *Pharmacol. Online*, **2009**, *1*, 1293-1300. https://pharmacologyonline.silae.it/files/archives/2009/vol1/138.Reddy.pdf

[142]Nagesh, M., Samreen, A., Antimicrobial Activity of *Carica papaya*, *Piper nigrum* and *Datura stramonium* Plants on Drug Resistant Pathogens Isolated from Clinical Specimens, *IOSR J. Biotechnol. Biochem*., **2016**, *2*, 56-61. https://www.iosrjournals.org/iosr-jbb/papers/Vol2-issue6/Version-1/K02065661.pdf

[143]Baynesagne, S., Berhane, N., Sendeku, W., Ai, L., Antibacterial activity of *Datura stramonium* against standard and clinical isolate pathogenic microorganisms. *J. Med. Plants Res*., **2017**, *11*, 501-506. DOI: 10.5897/JMPR2017.6381

[144]Ndayambaje, J. B., Nteziyaremye, B. E., Ange, S. I., Habinshuti, J.,, Ingabire, A., Munyampundu, J. P., Comparative bacterial inhibition by bioactive extracts from *Datura stramonium* and *Phytolacca dodecandra*, *Virol. Res. J*., **2018**, *2*, 1-5. https://www.alliedacademies.org/articles/10662.html

[145]Atef, N. M., Badr, H., Amer, W. M., Abd EL-Raheem, L. F., Efficiency of Egyptian Plant Extracts on the Antibiotic Susceptibleand Resistant Pathogenic bacterial Isolates, *Egypt. J. Bot*., **2017**, *57*, 457-467. https://ejbo.journals.ekb.eg/article_4030.html

[146]Saeidi, S., Nezhad, N. M., Sharifi-Rad, M., Javadian, F., Javadian, E., Antimicrobial Activity of *Prosopisfarcta* L. and *Datura stramonium* L. Extracts Against *Staphylococcus aureus*, *J. Herbal Drugs*, **2018**, *9*, 29-32. http://jhd.iaushk.ac.ir/article_662010.html

[147]Soundaryadevi, V., Jeyamanikandan, V., Evaluation of antibacterial and antioxidant activities of *Abutilon indicum* and *Datura stramonium*, *J. Chem. Pharmaceut. Res*., **2015**, *7*, 964-969. http://www.jocpr.com/abstract/8064.html

[148]Levitt, J., Lovett, J. V., Activity of allelochemicals of *Datura stramonium* L. (Thorn-apple) in contrasting soil types, *Plant Soil*, **1984**, *79*, 181–189. https://www.jstor.org/stable/42934622

[149]Lovett, J. V., Levitt, J., Duffield, A. M., Smith, N. G., Allelopathic potential of *Datura stramonium* L. (Thorn-apple), *Weed Res*., **2006**, *21*, 165-170. https://doi.org/10.1111/j.1365-3180.1981.tb00112.x

[150]Butnariu, M., An analysis of Sorghum halepense's behavior in presence of tropane alkaloids from *Datura stramonium* extracts, *Chem. Cent. J*., **2012**, *6*, 7 pages. http://journal.chemistrycentral.com/content/6/1/75

[151]Pacanoski, Z., Velkoska, V., Tyr, S., Veres, T., Allelopathic potential of Jimsonweed (*Datura stramonium* L.) on the early growth of maize (*Zea mays* L.) and sunflower (*Helianthus annuus* L.), *J. Cent. Eur. Agric*., **2014**, *15*, 198-208. DOI: 10.5513/JCEA01/15.3.1474

[152]Sakadzo, N., Innocent,P., Simbarashe, M., Ronald, M., Kasirayi, M., Thorn apple (*Datura stramonium* L.) allelopathy on cowpeas (*Vigna unguiculata* L.) and wheat (*Triticum aestivum* L.) in Zimbabwe, *Afr. J. Agric. Res*., **2018**, *13*, 1460-1467. DOI: 10.5897/AJAR2018.13226

[153]Dafaallah, A. B., Mustafa, W. N., Hussein, Y. H., Allelopathic Effects of Jimsonweed (*Datua Stramonium* L.) Seed on Seed Germination and Seedling Growth of Some Leguminous Crops, *Int. J. Innov. Appr. Agric. Res*., **2019**, *3*, 321-331. https://doi.org/10.29329/ijiaar.2019.194.17

[154]Gul, H., Qaisrani, R. N., Khan, M. A., Hassan, S., Younis, N., Antibacterial and antifungal activity of different extracts of *Datura stramonium* (branches and leaves sample), *E3 J. Biotechnol. Pharmaceut. Res*., **2012**, *3*, 141-148. https://www.researchgate.net/publication/291022471

[155]Usha, K., Singh, B., Praseetha, P., Deepa, N., Agarwal, D. K., Agarwal, R., Nagaraja, A., Antifungal activity of *Datura stramonium*, *Calotropis gigantea* and *Azadirachta indica* against *Fusarium mangiferae* and floral malformation in mango, *Eur. J. Plant Pathol*., **2009**, *124*, 637-657. DOI 10.1007/s10658-009-9450-2

[156]Frías-Escalante, M. P., Burgos-Hernández, A., Plascencia-Jatomea, M., Aldana-Madrid, M. L., Cortez-Rocha, M. O., Antifungal, acute toxicity and mutagenicity activity of extracts from *Datura stramonium*, *Jacquinia macrocarpa* and *Krameria erecta* on *Fusarium verticillioides*, *Afr. J. Biotechnol*., **2015**, *14*, 2251-2257. DOI: 10.5897/AJB2014.14365

[157]Shobha, G., Soumya, C., Shashidhara, K. S., Moses, V., Phytochemical Profile, Antibacterial and Antidiabetic Effects of Crude Aqueous Leaf Extract of *Datura stramonium*, *Pharmacophore*, **2014**, *5*, 273-278. https://www.researchgate.net/publication/264936217

[158]Gomathi, M., Rajkumar, P. V., Prakasam, A., Ravichandran, K., Green synthesis of silver nanoparticles using *Datura stramonium* leaf extract and assessment of their antibacterial activity, *Resource-Efficient Technol*., **2017**, *3*, 280–284. https://doi.org/10.1016/j.reffit.2016.12.005

[159]Gupta, A. K., Ahirwar , N. K., Shinde, N., Choudhary, M., Rajput, Y. S., Singh, A., Phytochemical Screening and Antimicrobial Assessment of Leaves of *Adhatoda vasica*, *Azadirachta indica* and *Datura stramonium*, *UK J. Pharmaceut. Biosci*., **2013**, *1*, 42-47. http://ukjpb.com/pdf/UKJPB08.pdf

[160] Altameme, H. J., Hameed, I. H., Kareem, M. A., Analysis of alkaloid phytochemical compounds in the ethanolic extract of *Datura stramonium* and evaluation of antimicrobial activity, *Afr. J. Biotechnol*., **2015**, *14*, 1668-1674. DOI: 10.5897/AJB2015.14536

[161]Oyeleke, S. B., Adeyemi, H. R., Abijogun, A. S., Phytochemical and Antimicrobial Property of *Datura stramonium* on Some Oral Pathigenic Microorganisms, *Glob. J. Bio-Sci. Biotechnol*., **2015**, *4*, 139-144. http://scienceandnature.org/GJBB_Vol4(2)2015/GJBB-V4(2)2015-1.pdf

[162]Banso, A., Adeyemo, S., Phytochemical screening and antimicrobial assessment of *Abutilon mauritianum*, *Bacopa monnifera* and *Datura stramonium*, *Biokemistri*, **2006**, *18*, 39-44. http://www.bioline.org.br/pdf?bk06007

[163]Kumar, A., Garg, B. R., Rajput, G., Chandel, D., Muwalia, A. Bala, I., Singh, S., Antibacterial Activity and Quantitative Determination of Protein from Leaf of *Datura stramonium* and *Piper betle* Plants, *Pharmacophore*, **2010**, *1*, 184-195. https://pharmacophorejournal.com/en/article/antibacterial-activity-and-quantitative-determination-of-protein-from-leaf-of-datura-stramonium-and-piper-betle-plants

[164]Sharma, P., Sharma, R. A., Comparative Antimicrobial Activity and Phytochemical Analysis of *Datura stramonium* L. Plant Extracts and Callus *In vitro*, *Eur. J. Med. Plants*., **2013**, *3*, 281-287. http://journalejmp.com/index.php/EJMP/article/view/14075/25843

[165]Girmay, S., Preliminary Phytochemical Screening and *in vitro* Antimicrobial Activity of *Datura stramonium* Leaves Extracts Collected from Eastern Ethiopia, *Int. Res. J. Biological Sci*., **2015**, *4*, 55-59.

https://www.researchgate.net/publication/327069599

[166]Carpa, R., Dumitru, D-V., Burtescu, R. F., Maior, M. C., Dobrota, C., Olah, N-K., Bio-chemical analysis of *Datura stramonium* extract, *Studia UBB Biologia*, **2017**, *LXII*, 5-19. DOI: 10.24193/subbbiol.2017.2.01

[167]Sreenivasa, S., Vinay, K., Mohan, N. R., Phytochemical Analysis, Antibacterial and Antioxidant Activity of Leaf Extract of *Datura Stramonium*, *Int. J. Sci. Res*., **2012**, *1*, 83-86. https://www.academia.edu/5782838

[168]Waza, S. A., Anthony, P., Dar, S., Phytochemical Analysis, Antioxidant and Antimicrobial Activities of Methanolic Extract of *Datura stramonium* seeds, *Int. J. Pharmaceut. Sci. Res*., **2015**, *6*, 3021-3026. DOI: 10.13040/IJPSR.0975-8232.6(7).3021-26

[169]You, L. X., Wang, S. J., Chemical Composition and Allelopathic Potential of the Essential Oil from *Datura Stramonium* L., *Adv. Mater. Res*., **2011**, *233–235*, 2472–2475. https://doi.org/10.4028/www.scientific.net/amr.233-235.2472

[170]Rajeshkanna, A., Prabhakaran, D., Senthamilselvi, M. M., Muruganantham, N., http://iajps.com/pdf/june2016/4.Anti-Cancer-activity-of-Datura-stramonium.pdf

[171]Iqbal, S., Sivaraj, C., Gunasekaran, K., Antioxidant and Anticancer Activities of Methanol Extract of Seeds of *Datura stramonium* l., *Free Rad. Antiox.*, **2017**, *7*, 184-189. DOI: 10.5530/fra.2017.2.28

[172]Gupta, A., Kumar, S., Mahindroo, N., Saini, R. V., Bioactive Fraction from *Datura stramonium* Linn. Promotes Human immune Cells Mediated Cytotoxicity towards Lung and Breast Cancer Cells, *Pharmacogn. J*., **2016**, *8*, 435-439. DOI : 10.5530/pj.2016.5.4

[173]Karmakar, U. K., Toume, K., Ishikawa, N., Arai, M. A., Sadhub, S. K., Ahmed, F., Ishibashi, M., Bioassay-Guided Isolation of Compounds from *Datura stramonium* with TRAIL-Resistance Overcoming Activity, *Nat. Prod. Commun*., **2016**, *11*, 185-187. DOI: 10.1177/1934578x1601100213

[174]Belayneh, Y. M., Birhanu, Z., Birru, E. M., Getenet, G., Evaluation of in vivo antidiabetic, antidyslipidemic, and in vitro antioxidant activities of hydromethanolic root extract of *Datura stramonium L.* (Solanaceae), *J. Exper. Pharmacol*., **2019**, *11*, 29–38. http://dx.doi.org/10.2147/JEP.S192264

[175]Bodade, A. B., Wankhade, A. S., Kale, P. D., Chaudhari, G. N., Preparation and Characterization of Nanocrystaline Magnesium Oxide Using Datura Stramonium Leaves and Its Antibacterial Activity, *Int. J. Innov. Stud. Sci. Eng. Technol*., **2019**, *8*, 42-45.

http://ijisset.org/wp-content/uploads/2019/08/IJISSET-050821.pdf

[176]Sarkar, S., Bagchi, A., Raha, A., Mukherjee, P., Paul, M., Roy, S., Mamud, R.M., *In vitro* anticoagulant activity of *Datura stramonium* flower extracts on blood plasma of poultry bird, *Pharma Innov. J*., **2019**, *8*, 1146-1148. http://www.thepharmajournal.com/archives/2019/vol8issue4/PartR/8-4-69-641.pdf

[177]Agarwal, P., Gupta, R., Yadav, R., Asati, V., Rathi, J. C., Anti-Inflammatory activity of seeds extract of datura stramonium against carrageenan induced paw edema on albino wistar rats, *J. Pharmaceut. Biol. Sci*., **2019**, *7*, 41-46. http://doi.org/10.18231/j.jpbs.2019.007

[178]Sharma, R. A., Yadav, A., Bhardwaj, R., Sharma, P., Study of Antioxidant Activity of *Datura stramonium* Linn., *Res. J. Phytochem*., **2014**, *8*, 112-118. DOI: 10.3923/rjphyto.2014.112.118

[179]Ananth, A., Rajan, S., *In-vitro* antioxidant activity of *Datura stramonium* L. leaves, *Adv. Appl. Sci. Res*., **2015**, *6*, 147-151. http://www.imedpub.com/articles/invitro-antioxidant-activity-of-datura-stramonium-l-leaves.pdf

[180]Veeraragavan, A., Sultan, H., Ali, S. J., Hathi, A., Ismail, M., *In – vitro* antioxidant activity of leaves on *Datura stramonium*, L.and *Datura metal*, L. Solanaceae – A comparative studies, *IJRDO-J. Biol. Sci*., **2017**, *3*, 32-43. https://www.ijrdo.org/index.php/bs/article/view/1583

[181]Variyar, J., Premrajan, P., Free radical scavenging and protease inhibitory activities of *Datura stramonium*, *Int. J. Res. Pharmacol. Pharmaceut*., **2015**, *4*, 334-340. https://www.researchgate.net/publication/304443968

[182]Aboluwodi, A. S., Avoseh, O. N., Lawal, O. A., Ogunwande, I. A., Giwa, A. A., Chemical constituents and anti-inflammatory activity of essential oils of *Datura stramonium* L., *J. Med. Plants Stud*., **2017**, *5*, 21-25.

http://www.plantsjournal.com/archives/2017/vol5issue1/PartA/4-6-33-110.pdf

[183]Mekap, S. K., Rana, R. N., Acharya, B., Sarangi, D., Mahapatra, M., Ahmed, N., Ghose, D., Preliminary Phytochemical Screening and Analgesic Activity of *Datura stramonium* L. var. Tatula Leaf Extract Collected from Coastal Belt of Odisha, *Res. J. Life Sci. Bioinform. Phamaceut. Chem.Sci*., **2018**, *4*, 312-321. DOI: 10.26479/2018.0402.24

[184]Merza, A. H., Al- Jeboori, K. Z., Yaseen, N. Y., Investigation of the Phytochemicals Present in the Local *Datura stramonium* Seeds by Using Two Extraction Methods, *Iraqi J. Vet. Med*., **2010**, *34*, 138-142. https://www.iasj.net/iasj?func=fulltext&aId=2457

[185]Oseni, O. A., Olarinoye, C. O., Amoo, I. A., Studies on chemical compositions and functional properties of thorn apple (*Datura stramonium L*) *Solanaceae*, *Afr. J. Food Sci*., **2011**, *5*, 40-44. https://www.researchgate.net/publication/285309524

[186]Friedman, M., Levin, C. E., Composition of jimson weed (*Datura stramonium*) seeds, *J. Agric. Food Chem*., **1989**, 37, *4*, 998-1005. DOI: 10.1021/jf00088a040

[187]Li, J., Lin, B., Wang, G., Gao, H., Qin M., Chemical constituents of *Datura stramonium* seeds, *Chin. Mater. Med*., **2012**, *37*, 319-322. DOI: 10.4268/cjcmm20120313

[188]Namdeo, A., Tembhre, M., Banerjee, S., Gour, S., Ahirwar, S., Inhibitory efficacy of Chlorpyriphos and *Datura stramonium* on Acetylcholinesterase activity, Kinetics and Histology of Brain of *Catla catla*, *Asian J. Exp. Sci*., **2013**, *27*, 47-56. https://www.researchgate.net/publication/320557923

[189]Ademiluyi, A. O., Ogunsuyi, O. B., Oboh, G., Agbebi, O. J., Jimson weed (*Datura stramonium* L.) alkaloid extracts modulate cholinesterase and monoamine oxidase activities in vitro: possible modulatory effect on neuronal function. *Com. Clin. Pathol*., **2016**, *25*, 733-741. DOI: 10.1007/s00580-016-2257-6

[190]Malami, I., Halilu, M. E., Mathias, S., Alhassan, M. A., Phytochemical evaluation and investigations in to sedative properties of *Datura stramonium* (Linn) seeds in experimental mice, *IOSR J. Pharm. Biol. Sci*., **2014**, *9*, 1-3. https://www.researchgate.net/publication/314445920

[191]Soni, P., Siddiqui, A. A., Dwivedi, J., Soni, V., Antiovulatory and Estrogenic Activity of Leaves of *Datura stramonium* Linn. In Female Albino Rats, *Asian J. Pharmaceut. Res. Health Care*, **2016**, *5*, 65-71. http://www.informaticsjournals.com/index.php/ajprhc/article/view/532

[192]Shekhar, P., Joshi, A., Malviya, S., Kharia, A., Wound healing activity of the hydro-alcoholic extract of datura stramonium leaves in wistar albino rats, *J. Drug Deliv. Therapeut*., **2017**, *7*, 214-215. http://jddtonline.info/index.php/jddt/article/view/1641

[193]Swathi, S., Murugananthan, G., Ghosh, S. K., Oviposition deterrent activity from the ethanolic extract of *Pongamia pinnata*, *Coleus forskohlii*, and *Datura stramonium* leaves against *Aedes aegypti* and *Culex quinquefaciatus*, *Pharmacogn. Mag*., **2010**, *6*, 320–322. DOI: 10.4103/0973-1296.71796

[194]Abbsipour, H., Mahmoudvand, M., Rastegar, F., Hosseinpour, M. H., Bioactivities of jimsonweed extract, *Datura stramonium* L. (Solanaceae), against *Tribolium castaneum* (Coleoptera: Tenebrionidae), *Turk. J. Agric. For*., **2011**, *35*, 623-629. DOI: 10.3906/tar-1004-874

[195]Abbasipour, H., Rastegar, F., Mahmoudvand, M., Hosseinpour, H. M., Insecticidal activity of extract from *Datura stramonium* (F.) (Solanaceae) against *Callosobruchus maculatus*, *IOBC-wprs Bull*., **2011**, *69*, 251-256. https://www.researchgate.net/publication/259148123

[196]Chintem, D. G., Nzelibe, H. C., James, D. B., Albaba, S. U., Grillo, H. T., Larvicidal Pootential of Leaf Extracts and Purified Fraction of *Datura stramonium* Against *Culex quinquefasciatu* Mosquitoes, *Int. J. Nat. Sci. Res*., **2014**, *2*, 284-293. https://ideas.repec.org/a/pkp/ijonsr/2014p284-293.html

[197]Jawalkar, N., Zambare, S., Zanke, S., Insecticidal property of *Datura stramonium* L. seed extracts against *Sitophilus oryzae* L. (Coleoptera: Curculionidae) in stored wheat grains, *J. Entomol. Zool. Stud*., **2016**, *4*, 92-96. http://www.entomoljournal.com/archives/2016/vol4issue6/PartB/4-5-142-966.pdf

[198]Oplos, C., Eloh, K., Spiroudi, U. M., Pierluigi, C., Ntalli, N., Nematicidal Weeds, *Solanum nigrum* and *Datura stramonium*, *J. Nematol*., **2018**, *50*, 317-328. DOI: 10.21307/jofnem-2018-017

[199]Day, E. J., Dilworth, B. C., Toxicity of jimson weed seed and cocoa shell meal to broilers, *Poult. Sci*., **1984**, *63*, 466-8. DOI: 10.3382/ps.0630466

[200]Benouadah, Z., Mahdeb, N., Bouzidi, A., Evaluation of Acute and Sub-Acute Toxicity of Alkaloids from *Datura stramonium* Sp. in Mice. *Int. J. Pharmacog. Phytochem. Res*., **2016**, *8*, 1759-1766. http://impactfactor.org/PDF/IJPPR/8/IJPPR,Vol8,Issue11,Article2.pdf

[201]Tostes, R. A., , Accidental Poisoning by *Datura stramonium* in Dog, *Vet. Hum. Toxicol*., **2002**, *44*, 33-34. https://www.researchgate.net/publication/11535065

[202]Fatoba1, T. A., Adeloye, A. A., Soladoye, A. O., Effect of *Datura stramonium* seed extracts on haematological parameters of West African Dwarf (WAD) bucks, *Eur. J. Exp. Biol*., **2013**, *3*, 1-6. http://www.imedpub.com/articles/php?aid=14676

[203]Fatoba, T. A., Adeloye, A. A., Soladoye, A. O., Effect of aqueous extract of *Datura stramonium* on spermatogenesis of West African Dwarf bucks, *Eur. J. Zool. Res*., **2012**, *1*, 77-79. https://www.scholarsresearchlibrary.com/abstract/583.html

[204]Daramola, J. O., Adeloye, A. A., Komolafe, S. E., Azeez, O. K., Effect of Aqueous Extract of *Datura Stramonium* Seed on Spermiograms of West African Dwarf Bucks, *J. Agric. Res. Develop*., **2009**, *7*, 5 pages. http://dx.doi.org/10.4314/jard.v7i1.48676

[205]Worthington, T. R., Nelson, E. P., Bryant, M. J., Toxicity of thornapple (*Datura stramonium* L) seeds to the pig. *Vet. Rec*., **1981**, *108*, 208-11. DOI: 10.1136/vr.108.10.208

[206]Naude, T. W., Gerber, R., Smith, R. J., Botha, C., Datura contamination of hay as the suspected cause of an extensive outbreak of impaction colic in horses, C.J., *J. S. Afr. Vet. Ass*., **2005**, *76*, 107–112. https://www.researchgate.net/publication/7651282

[207]Binev, R., Valchev, I., Nikolov, J., Haematological Studies on Jimson Weed (*Datura stramonium*) Intoxication in Horses, *Trakia J. Sci*., **2006**, *4*, 43-48. https://www.researchgate.net/publication/228688531

[208]Chan, K., Jimson Weed Poisoning-A Case Report, *Perm. J*., **2002**, 6, 28-30. https://doi.org/10.7812/TPP/02-058

[209]Adegoke, S. A., Alo, L. A., *Datura stramonium* poisoning in children, *Niger. J. Clin. Pract*., **2013**, *16*, 116-118. DOI: 10.4103/1119-3077.106783

[210]Arefi, M., Barzegari, N., Asgari, M., Soltani, S., Farhidnia, N., Fallah, F., Datura poisoning, clinical and laboratory findings. Report of five cases, *Rom. J. Leg. Med*., **2016**, *24*, 308-311. DOI: 10.4323/rjlm.2016.308

[211]Tranca, S. D., Szabo, R., Cocis, M., Acute poisoning due to ingestion of Datura stramonium – a case report, *Rom. J. Anaesth. Intensive Care*, **2017**, *24*, 65-68. DOI: 10.21454/rjaic.7518.241.szb

[212]Hashimoto, T., Yukimune, Y., Yamada, Y., Tropane Alkaloid Production in *Hyoscyamus* Root Cultures, *J. Plant Physiol*., **1986**, *124*, 61-75. DOI: 10.1016/S0176-1617(86)80178-X

[213]Doerk-Schmitz, K., Witte, L., Alfermann, A. W., Tropane alkaloid patterns in plants and hairy roots of *Hyoscyamus*

albus, *Phytochemistry*, **1993**, *35*, 107-110. DOI: 10.1016/S0031-9422(00)90517-X

[214]El-Shazly, A., Tei, A., Witte, L., El-Domiaty, M., Wink, M., Tropane Alkaloids of *Hyoscyamus boveanus*, *H. desertorum*, *H. muticus* and *H. albus* from Egypt, *Z. Naturforsch. C*, **1997**, *52*, 729-739. https://doi.org/10.1515/znc-1997-11-1203

[215]El Bazaoui, A., Bellimam, M. A., Lancar, I. T., Soulaymani, A., Gas-Liquid Chromatography-Mass Spectrometry Investigation of Tropane Alkaloids in *Hyoscyamus albus* L. from Morocco, *Z. Naturforsch. C*, **2012**, *57*, 461-465. DOI: 10.1515/znc-2012-9-1003

[216] Kebaili, Z., Hameurlaine, S., Fellah, O., Djermane, M., Gherraf, N., Zellagui, A., Abidi, A., Derouiche, K., Assessment of Alkaloid Content and Antibacterial Activity of *Hyoscyamus Albus* and *Hyoscyamus Muticus* Collected in Two Different Climatic Regions in Algeria, *J. Biochem. Tech.*, **2019**, *10*, 1-6. https://www.researchgate.net/publication/332278206

[217]Massinissa, Y., Benhouda, A., Yahia, M., Toxicity, Analgesic, and Anti-Pyretic Activities of Methanolic Extract from *Hyoscyamus albus*' Leaves in Albinos Rats, *Int. J. Biotechnol. Bioengin.*, **2016**, *10*, 121-127. https://www.researchgate.net/publication/287287809

[218]Benhouda, A., Yahia, M., Benhouda, D., Bousnane, N. E., Benbia, S., Hannachi, N. E., Ghecham, A., Antimicrobial and Antioxidant activities of various extracts of Hyoscyamus albus L. and Umbilicus rupestris L. leaves, *Algerian J. Nat. Prod.*, **2014**, *2*, 4-17. https://www.asjp.cerist.dz/en/article/10391

[219]Yahia, M., Yahia, M., Benhouda, A., Antitumor Activity of Methanolic Fractions Extracted From the Aerial Part of Algerian Hyoscyamus albus and apoptotic cell aspect screening, *Ind. J. Pharmaceut. Edu. Res.*, **2018**, **52**, 262-267. DOI: 10.5530/ijper.52.2.30

[220]Bourebaba, L., Saci, S., Touguit, D., Gali, L., Terkmane, S., Oukil, N., Bedjou, F., Evaluation of antidiabetic effect of total calystegines extracted from *Hyoscyamus albus*, *Biomed. Pharmacother.*, **2016**, *82*, 337-344. DOI: 10.1016/j.biopha.2016.05.011

[221]Bourebaba, L., Sullini, G., Mendiola, J., Bourebaba, Y., Deghima, A., Oukil, N., Bedjou, F., *In-vivo* edema inhibition of *Hyoscyamus albus* antioxidant extracts rich in calystegines, *Ind. Crops Prod.*, **2016**, *89*, 316-322, DOI: 10.1016/j.indcrop.2016.04.067

[222]Massinissa, Y., Mouloud, Y., Benhouda, A., Hamada, H., New biological anticancer activities of atropine isolated from algerian hyoscyamus albus's leaves, *Pharmacologyonline*, **2018**, *3*, 286-296. https://pharmacologyonline.silae.it/files/archives/2018/vol3/PhOL_2018_3_A031_Yahia.pdf

[223]Massinissa, Y., Mouloud, Y., Benhouda, A., Benbia, S., Khadraoui, H., Ulcer Healing and Gastroprotective Activity of Methanolic Extracts of *Hyoscyamus Albus* and *Umbilicus Rupestris* Leaves against Gastric Injury Caused by Ethanol in Rats, *Glob. J. Res. Rev.*, **2017**, *4*, 1-8. DOI: 10.21767/2393-8854.10008

[224]Massinissa, Y., Mouloud, Y., Benhouda, A., Nassiba, C., Khadraoui, H., Benhouda, D., Boutaghrine, S., Hepatoprotective effect of *hyoscyamus albus* leaves on carbon tetrachloride-induced an acute hepatotoxicity on rats, *Eur. J. Biotechnol. Biosci.*, **2016**, *4*, 8-12. http://www.biosciencejournals.com/archives/2016/vol4/issue11/4-10-20

[225]Keskin, C., Yavuz, M., Kacar, S., Determination of fatty acid compositions of total lipid, phospholipid and triacylglycerol fractions of aboveground parts of four species of the genus *Hyoscyamus*, *Chem. Res. J.*, **2016**, *1*, 1-8. https://www.researchgate.net/publication/311509624

[226]Muhammad, A., Manzoor, A., Hanif, A., Shujaat, A., Phytochemical investigation of *Hyoscyamus albus*, *Pak. J. Pharm. Sci.*, **2019**, *32*, 661-667. https://www.researchgate.net/publication/331412170

[227]Hibi, N., Fujita, T., Hatano, M., Hashimoto, T., Yamada, Y., Putrescine N-Methyltransferase in Cultured Roots of *Hyoscyamus albus*, *Plant Physiol.*, **1992**, *100*, 826-835. DOI: 10.1104/pp.100.2.826

[228]Khater, M. A., Elashtokhy, M. M, Effect of growth regulators on in vitro production of *Hyoscyamus aureus* L. and tropane alkaloids, *Int. J. ChemTech. Res.*, **2015**, *8*, 113-119. http://www.sphinxsai.com/2015/ch_vol8_no11/1/(113-119)V8N11CT.pdf

[229]Atalla, A., Dardona, A., Pesticidal Effects of *Hyoscyamus aureus* L., J. Nat. Ayurvedic Med., **2019**, *3*, 1-3. DOI: 10.23880/jonam-16000214

[230]Sabri, N. N., el-Masry, S., Khafagy, S. M., Phytochemical investigation of *Hyoscyamus desertorum*, *Planta Med.*, **1973**, *23*, 4-9. DOI: 10.1055/s-0028-1099408

[231]Abdel-Motaal, F. F., Nassar, M .S., El-Zayat, S. A., El-Sayed, M. A., Ito, S., Responses of fungi to tropane alkaloids produced by a medicinal plant *Hyoscyamus muticus* (Egyptian henbane). *Folia Microbiol. (Praha)*, **2009**, *54*, 207-712. DOI: 10.1007/s12223-009-0033-6

[232]Mohd, I., Nudrat, F., Phytochemical and Antimicrobial Screening of *Hyoscyamus muticus*, a Plant Found in the Northern Border of Saudi Arabia, *Ind. Am. J. Phamaceut. Sci.*, **2017**, *4*, 1216-1220. http://oaji.net/articles/2017/1210-1496682223.pdf

[233]Elsharkawy, E. R., Ed-dra, A., Abdallah, E. M., Ali, A. M., Antioxidant, antimicrobial and antifeedant activity of phenolic compounds accumulated in *Hyoscyamus muticus* L., *Afr. J. Biotechnol.*, **2018**, *17*, 311-321. DOI: 10.5897/AJB2017.16316

[234]Ayari-Guentri, S., Djemouai, N., Gaceb-Terrak, R., Rahmania, F., Chemical Composition and Antioxidant Activity of *Hyoscyamus muticus* L. subsp. *falezlez* (Coss.) Maire from Algeria, *J. Essent. Oil-Bear. Plants*, **2017**, *20*, 1370-1379. DOI: 10.1080/0972060X.2017.1396930

[235]Elsharkawy, E. R., Allelopathic effects of alkaloid contents of *Hyoscyamus muticus* and *Withania somnifera* on the germination of Cichorium intybus seeds, *Biosc. Biotech. Res. Comm.*, **2019**, *12*, 8 pages. https://bit.ly/2MKSFnw

[236]Dawidar, A. M., Abdel-Mogib, M., El-Naggar, M. E., Mostafa, M. E., Acaricidal Activity and Chemical Constituents of *Hyoscyamus muticus* against *Tetranychus urticae* KOCH, *Rev. Latinoamer. Quím.*, **2009**, *37*, 45-55. https://www.researchgate.net/publication/237699696

[237]Aripova, S. F., Alkaloids of *Hyoscyamus pusillus*, *Chem. Nat. Compd.*, **1985**, *21*, 260-265. DOI: 10.1007/BF00714933

[238]Deylamghani, K. A., Khavarinezhad, R. A., Fahimi, V., Hekmat, S. H., Extraction and Determination of Tropane Alkaloids, Hyoscyamine and Scopolamine, from Different Parts of *Hyoscyamus pusillus* L. in Different Stages of Plant Growth, *Iran. J. Med. Aromat. Plants*, **2006**, *1*, 1-10. https://www.sid.ir/en/Journal/ViewPaper.aspx?ID=112155

[239]Nejadhabibvash, F., Rahmani, F., Heidari, R., Jamei, R., Azimi, F., Study of inheritance and environment on tropane alkaloids within *Hyoscyamus* species, *Aust. J. Crop Sci.*, **2012**, *6*, 1428-1434.

http://www.cropj.com/pour_6_10_2012_1428_1434.pdf

[240]Bahmanzadegan, A., Sefidkon, F., Sonboli, A., Determination of Hyoscyamine and Scopolamine in Four *Hyoscyamus* Species from Iran, *Iran. J. Pharmaceut. Res.*, **2009**, *8*, 65-70. http://ijpr.sbmu.ac.ir/article_790.html

[241]Jeppesen, A. S., Soelberg, J., Jager, A. K., Antibacterial and COX-1 Inhibitory Effect of Medicinal Plants from the Pamir Mountains, Afghanistan, *Plants*, **2012**, *1*, 74-81. DOI: 10.3390/plants1020074

[242]Moradi, B., Delfan, B., Hashemi, P., Mousavi, A., Rahnama, H., Matrix solid phase dispersion extraction for Tropane alkaloid detection in cultured and collected *Hyoscyamus reticulatus* plants, *Int. J. Adv. Res.*, **2015**, *3*, 78-82. http://www.journalijar.com/uploads/282_IJAR-7276.pdf

[243]Oto, G., Ozdemir, H., Yaren, B., Yetkin, Y., Tas, A., Tanritanir, P., Ozturk, F., Antinociceptive activity of methanol extract of *Hyoscyamus reticulatus L.* in mice, *Am. J. Phytomed. Clin. Therapeut*., **2013**, *1*, 117-123. http://www.imedpub.com/abstract/10180.html

[244]Mohammad, M. K., Almasri, I. M., Tawaha, K., Issa, A., Al-Nadaf, A., Hudaib, M., AlKhatib, H. S, Abu-Gharbieh, E., Bustanji, Y., Antioxidant, antihyperuricemic and xanthine oxidase inhibitory activities of *Hyoscyamus reticulatus*, *Pharmaceut. Biol*., **2010**, *48*,1363-1776. DOI: 10.3109/13880209.2010.483521

[245]Urkin, J., Shalev, H., Sofer, S., Witztum A., Henbane (*Hyoscyamus reticulatus*) poisoning in children in the Negev, *Harefuah*, **1991**, *120*, 714-716. (Article in Hebrew) https://www.ncbi.nlm.nih.gov/pubmed/1959806

[246]Aslan, S., Cakir, Z., Emet, M., Aksakal, E., Akoz, A., Uzkeser, M., Wildflower (*Hyoscyamus reticulatus*) causes QT prolongation, *Bratisl. Lek. Listy*, **2013**, *114*, 333 – 336. DOI: 10.4149/BLL_2013_070

[247]Tabaraki, R., Nateghi, A., Ahmady-Asbchin, S., *In Vitro* Assessment of Antioxidant and Antibacterial Activities of Six Edible Plants from Iran, *J. Acupunct. Meridian Stud*., **2013**, *6*, 159-162. http://dx.doi.org/10.1016/j.jams.2013.01.016

[248]Naji, S., Zarei, L., Pourjabali, M., Mohammadi, R., The Extract of Lycium depressum Stocks Enhances Wound Healing in Streptozotocin-Induced Diabetic Rats, *Int. J. Low. Extrem. Wounds*, **2017**, *16*, 85-93. DOI: 10.1177/1534734617700538

[249]Ghali, W., Vaudry, D., Jouenne, T., Marzouki, M. N., *Lycium europaeum* fruit extract: antiproliferative activity on A549 human lung carcinoma cells and PC12 rat adrenal medulla cancer cells and assessment of its cytotoxicity on cerebellum granule cells, *Nutr. Cancer*, **2015**, *67*, 637-646. DOI: 10.1080/01635581.2015.1017054

[250]Tej, R., Hamdi, A.. Serairi Beji, R., Aidi Wannes, W., Bettaieb Rebey, I., Oueslati, S., Ksouri, R., Saidani Tounsi, M., Lachaal, M., Karray Bouraoui, N., Does *Lycium europaeum* leaf have antihyperglycemic, antihyperlipidemic and antioxidant effects, *Braz. J. Pharm. Sci*., **2019**, *55*, 13 pages. http://dx.doi.org/10.1590/s2175-97902019000118064

[251]Rjeibi , I., Feriani, A., Ben Saad, A., Sdayria, J., Saidi, I., Ncib, S., Souid, S., Allagui, M. S., Hfaiedh, N., *Lycium europaeum* Extract: A New Potential Antioxidant Source against Cisplatin-Induced Liver and Kidney Injuries in Mice, *Oxid. Med. Cell. Longev*., **2018**, Article ID 1630751, 9 pages. https://doi.org/10.1155/2018/1630751

[252]Rosa, A., Maxia, A., Putzu, D., Atzeri, A., Era, B., Fais, A., Sanna, C., Piras, A., Chemical composition of *Lycium europaeum* fruit oil obtained by supercritical CO2 extraction and evaluation of its antioxidant activity, cytotoxicity and cell absorption, *Food Chem*., **2017**, *230*, 82-90. DOI: 10.1016/j.foodchem.2017.03.019

[253]Rjeibi I., Feriani, A., Ben Saad, A., Ncib, S., Sdayria, J., Saidi, I., Souid, S., Hfaiedh, N., Allagui, M. S., Phytochemical characterization and bioactivity of *Lycium europaeum*: A focus on antioxidant, antinociceptive, hepatoprotective and nephroprotective effects. *Biomed. Pharmacother*., **2017**, *95*, 1441-1450. DOI: 10.1016/j.biopha.2017.09.035

[254]Rjeibi, I., Feriani, A., Saad, A. B., Ncib, S., Sdayria, J., Hfaiedh, N., Allagui, M. S., *Lycium europaeum* Linn as a source of polysaccharide with in vitro antioxidant activities and in vivo anti-inflammatory and hepato-nephroprotective potentials, *J. Ethnopharmacol*., **2018**, *225*, 116-127. DOI: 10.1016/j.jep.2018.06.036

[255]Bendjedou, H., Barboni, L., Maggi, F., Bennaceur, M., Benamar, H., Alkaloids and sesquiterpenes from roots and leaves of *Lycium europaeum* L. (Solanaceae) with antioxidant and anti-acetylcholinesterase activities, *Nat. Prod. Res*. **2019**, *33*, 1-5. DOI: 10.1080/14786419.2019.1666386

[256]Touati, J., Artib, M., Mouria, A., Selmaoui, K., Ouazzani Touhami, A., Benkirane, R., Douira, A., *Lycium europaeum*: vegetative species with a multiple use, *Int. J. Innov. Sci. Res*., **2017**, *32*, 30-36. http://www.ijisr.issr-journals.org/abstract.php?article=IJISR-17-015-01

[257] Ewais, E. A., Abd El-Maboud, M. M., Elhaw, M. H., Haggag, M. I., Extraction, separation and identification of compounds from leaves of *Lycium schweinfurthii var.schweinfurthii* (Solanaceae), *Int J. Innov. Sci. Engin. Technol*., **2016**, *3*, 273-315. https://www.researchgate.net/publication/311992383

[258] Elbermawi, A., Halim, A.F., Mansour, E. S., Ahmad, K. F., Ashour, A., Amen, Y., Shimizu, K., A new glucoside with a potent α-glucosidase inhibitory activity from *Lycium Schweinfurthii*, *Nat. Prod. Res*., **2019**, *33*, 1-8. DOI: 10.1080/14786419.2019.1616730

[259]Dasmal Alkuwari, A., Al-Naemi, M. Y., Vito, P., Stilo, R., Ahmed, T. A., Al Naemi, H., Biological activities of *Lycium shawii* Leaves Extract, *Int. J. Pharmaceut. Biol. Arch*., **2012,** *3*, 697-700. https://www.ijpba.info/ijpba/index.php/ijpba/article/view/712

[260]Ali, S. S., El-Zawawy, N. A., Al-Tohamy, R., El-Sapagh, S., Mustafa, A. M., Sun, J., *Lycium shawii* Roem. & Schult.: A new bioactive antimicrobial and antioxidant agent to combat multi-drug/pan-drug resistant pathogens of wound burn infections, *J. Trad. Complement. Med*., **2020**, *10*, 13-25. https://doi.org/10.1016/j.jtcme.2019.01.004

[261]Tayel, A. A., Shaban, S. M., Moussa, S. H., Elguindy, N. M., Diab, A. M., Mazrou, K., Ghanem, R. A., El-Sabbagh, S. M., Bioactivity and application of plant seeds' extracts to fight resistant strains of *Staphylococcus aureus*, *Ann. Agric. Sci*., **2018**, *63*, 47-53. DOI: 10.1016/j.aoas.2018.04.006

[262]Dahech, I., Farah, W., Trigui, M., Ben Hssouna, A., Belghith, H., Belghith, K. S., Ben Abdallah, F., Antioxidant and antimicrobial activities of *Lycium shawii* fruits extract. *Int. J. Biol. Macromol*., **2013**, *60*, 328-333. DOI: 10.1016/j.ijbiomac.2013.05.020

[263]Gaweesh, A., Aenb, S., El-Hefnawy, H. M., Osman, S. M., Abdou, A. M., Phytoconstituents, Cytotoxic, Antioxidant and Hepatoprotective Activities of the Aerial Parts of *Lycium shawii* R. Growing in Egypt., *Med. Aromat. Plants*, **2015**, *4*, 7 pages. DOI: 10.4172/2167-0412.1000180

[264]Rehman, N. U., Hussain, H., Al-Riyami, S. A., Csuk, R., Khiat, M., Abbas, G., Al-Rawahi, A., Green, I. R., Ahmed, I. and Al-Harrasi, A., Lyciumaside and Lyciumate: A New Diacylglycoside and Sesquiterpene Lactone from *Lycium shawii*, *Helv. Chim. Acta*, **2016**, *99*, 632-635. DOI: 10.1002/hlca.201600066

[265]Ahmed, F. A., Abdallah, N. M., Ezz, M. K., El-Azab, M. M., Seasonal Variations and Identification of Biologically Active Constituents of *Lycium Shawii* Plant Roem. & Shult. (Family Solanaceae), *Int. J. Innov. Sci. Engin. Technol*., **2017**, *4*, 34-47. DOI: 10.13140/RG.2.2.14010.49601

[266]Rehman, N. U., Hussain, H., Al-Riyami, S. A., Green, I. R., Al-Harrasi, A., Chemical Constituents Isolated from *Lycium shawii* and their Chemotaxonomic Significance, *Rec. Nat. Prod*., **2018**, *12*, 380-384. http://doi.org/10.25135/rnp.34.17.09.160

[267]Rehman, N. U., Khan, A., Al-Harrasi, A., Khiat, M., Hussain, H., Wadood, A., Riaz, M., Natural urease inhibitors from Aloe vera resin and Lycium shawii and their structuralactivity relationship and molecular docking study, *Bioorg. Chem*., **2019**, *88*, 102955-102961. DOI: 10.1016/j.bioorg.2019.102955

[268]Uysal, S., Zengin, G., Aktumsek, A., Antioxidant properties and enzyme inhibitory effects of extracts from *Mandragora autumnalis* and its fatty acid composition, *Marmara Pharmaceut. J*., **2016**, *20*, 144-151. DOI: 10.12991/mpj.201620206523

[269]Jackson, B. P., Berry, M. I., Hydroxytropane tiglates in the roots of *Mandragora* species, *Phytochemistry*, **1973**, *12*, 1165-1166. https://doi.org/10.1016/0031-9422(73)85035-6

[270]Fleisher, Z., Fleisher, A., The Odoriferous Principles of Mandrake, *Mandragora officinarum* L., *J. Essent. Oil Res*., **1992**, *4*, 187-188. DOI: 10.1080/10412905.1992.9698041

[271]Fleisher, A., Fleisher, Z. The fragrance of Biblical Mandrake, *Econ. Bot*., **1994**, *48*, 243–251. https://doi.org/10.1007/BF02862323

[272]Baser, K. H., Kurkcuoglu, M., Demirci, B., Erdogmus, H., Composition of the Essential Oil and the Headspace Sample of *Mandragora autumnalis* Bertol. Fruits, *J. Essent. Oil Res*., **1998**, *10*, 632-634. https://doi.org/10.1080/10412905.1998.9700991

[273]Hanus, L. O., Dembitsky, V. M., Moussaieff, A., Comparative Study of Volatile Compounds in the Fresh Fruits of *Mandragora autumnalis*, *Acta Chromatogr*., **2006**, *17*, 151-160. https://www.researchgate.net/publication/237806241

[274]Arbia, F., Ayari-Gribaa, O., Souilem, F., Chiboub,W., Zardi-Berguaoui, A., Ben Jannet, H., Ascrizzi, R., Flamini, G., Harzallah-Skhiri, F., Profiles of the Essential Oils and Headspace Analysis of Volatiles from *Mandragora autumnalis* Growing Wild in Tunisia, *Chem. Biodiver*., **2019**, *16*, 14 pages. DOI: 10.1002/cbdv.201900345

[275]Cornara, L., Smeriglio, A., Frigerio, J., Labra, M., Di Gristina, E., Denaro, M., Mora, E., Trombetta, D., The problem of misidentification between edible and poisonous wild plants: Reports from the Mediterranean area, *Food Chem. Toxicol*., **2018**, *119*, 112-121. DOI: 10.1016/j.fct.2018.04.066

[276]Piccillo, G. A., Miele, L., Mondati, E., Moro, P. A., Musco, A., Forgione, A., Gasbarrini, G., Grieco, A., Anticholinergic syndrome due to 'Devil's herb': when risks come from the ancient Time, *Int. J. Clin. Pract*., **2006**, *60*, 492-494. DOI: 10.1111/j.1368-5031.2006.00864.x

[277]Tsiligianni, I .G., Vasilopoulos, T. K., Papadokostakis, P. K., Arseni, G. K., Eleni, A., Lionis, C. D., A two cases clinical report of mandragora poisoning in primary care in Crete, Greece: two case report, *Cases J*., **2009**, *2*, 3 pages. DOI:10.1186/1757-1626-2-9331

[278]Jimenez, M. E., Montano, M., Lopez, F., Campos,, E., Martín, M. C., Ayuso, M. J., Puente, G., Atropine poisoning by Mandragora autumnalis. A report of 15 cases, *Med. Clin. (Barc)*., **1990**, *95*, 689-92. (Article in Spanish). https://www.researchgate.net/publication/21069139

[279]Devi, P., Meera, R., Muthumani, P.,, Chilakalapudi, R., Thota, V., Murthy, D. V., Jeyasundari, K., Evaluation of Alcoholic and Aqueous Extracts of *Nicandra Physalodes* Leaves for Diuretic Activity, *Int. J. Pharmaceut. Biol. Arch*., **2010**, *1*, 331-334. http://www.ijpba.info/ijpba/index.php/ijpba/article/view/117

[280]Dimetry, N. Z., Amer, S. A., El-Gengaihi, S., Toxicological evaluation and biological potency of petroleum ether extract of two plants and their isolates towards the two spotted spider mite *Tetranychus urticae* Koch, *Acarologia***,** 2003, *43*, 67-73. https://www1.montpellier.inra.fr/CBGP/acarologia/article.php?id=55

[281]Govindarajan, M., Khater, H. F., Panneerselvam, C., Benelli, G., One-pot fabrication of silver nanocrystals using *Nicandra physalodes*: A novel route for mosquito vector control with moderate toxicity on non-target water bugs, *Res. Vet. Sci*., **2016**, *107*, 95–101. http://dx.doi.org/10.1016/j.rvsc.2016.05.017

[282]Kshirsagar, P. P., Bhogaonkar, P. Y., *Nicandra physaloides* (L.) Gaertn – A Less Known Wild Edible Fruit, *Int. J. Curr. Pharm. Res*., **2015**, *7*, 60-63. https://innovareacademics.in/journals/index.php/ijcpr/article/view/6295

[283]Nalbandov, O., Yamamoto, R. T., Fraenkel, G. S., Insecticides from Plants, Nicandrenone, A New Compound with Insecticidal Properties, Isolated From *Nicandra Physalodes*, *J. Agric. Food Chem.*, **1964**, *12*, 55-59. https://doi.org/10.1021/jf60131a017

[284]Liu, Y., Jiang, H-B., Xu, Z-P., Cheng, Y-G., Lv, S-W., Yang, B-Y., Guo, H-W., Kuang, H-X., New Glycosides from the Fruits of *Nicandra physaloides*, *Molecules*, **2017**, 22, 828-835, DOI: 10.3390/molecules22050828

[285]Xiao, Q., Wang, C. F., Chen, J., Lian, C. L., Xu, Y., Xiao, L., Liu, J. Q., Three new withanolides from the calyces of *Nicandra physaloides*, *Steroids*, **2018**, *131*, 32-36. DOI: 10.1016/j.steroids.2018.01.003

[286]Yu, M-Y., Zhao, G-T., Liu, J., Khan, A., Peng, X., Zhou, L., Dong, J-R., Li, H-Z., Qiu, M-H., Withanolides from aerial parts of *Nicandra physalodes*, *Phytochemistry*, **2017**, *137*, 148-155. https://doi.org/10.1016/j.phytochem.2017.02.009

[287]Carrero, D. A., Batista, P. H., Souza, L. G., Pinto, F. C., de Vasconcelos, M. A., Teixeira, E. H., Canuto, K. M., Santiago, G. M., Silveira, E. R., Pessoa, O. D., Withanolides from Leaves of *Nicandra physalodes*, *J. Braz. Chem. Soc.*, **2018**, *29*, 11-16. http://dx.doi.org/10.21577/0103-5053.20170105

[288]Effect of aqueous extract of the invasive species Tobacco (*Nicotiana glauca* L.*)* on seedlings growth of Juniper (*Juniperus procera* L.), *Emir. J. Food Agric*., **2008**, *20*, 10-17. https://www.ejfa.me/index.php/journal/article/view/445

[289]Aldesuquy, H. S., Mashaly, I. A., Abd El-Aal, M., Mahdee, B. A., Phytochemical Constituents, Antibacterial and Antioxidant Activities of some Medicinal Plants, *Curr. Trends Biomed. Eng. Biosci*., **2018**, *16*, 47-55. DOI: 10.19080/CTBEB.2018.16.555933

[290]Gutierrez, A. D., Moustapha, B., María, L., Garduno, R., Sandra, O., Mendoza, D., Serrano, C. V., Anti-inflammatory and Antioxidant Activities of Methanol Extracts and Alkaloid Fractions of Four Medicinal Plants of *Solanaceae*, *Afr. J. Tradit. Complement. Altern. Med*., **2014**, *11*, 259-267. http://dx.doi.org/10.4314/ajtcam.v11i3.36

[291]Zammit, M., Shoemake, C., Attard, E., Azzopardi, L. M., The Effects of Anabasine and the Alkaloid Extract of *Nicotiana glauca* on Lepidopterous Larvae, *Int. J. Biol*., **2014**, *6*, 46-53. DOI: 10.5539/ijb.v6n3p46

[292]Rindl, M., Sapiro, M. L., De Kock, G. W., A chemical investigation of the constituents of Nicotiana glauca R. Grah. (Solanaceae) (Wild tobacco), *Ondertepoort J. Vet. Sci. Anim. Ind*., **1949**, *22*, 301-312. https://repository.up.ac.za/handle/2263/59230?show=full

[293]Mortimer, C. L., Bramley, P. M., Fraser, P. D., The identification and rapid extraction of hydrocarbons from Nicotiana glauca : A potential advanced renewable biofuel source, *Phytochem. Lett*., **2012**, *5*, 455-458. DOI: 10.1016/j.phytol.2012.04.004

[294]Cherif, A., Ammar, S., Boukhchina, S., 2019. Composition and characterization by GC-MS of the essential oil extracted from *Nicotiana glauca* Graham, *Grasas Aceites*, **2019**, *70*, 5 pages. https://doi.org/10.3989/gya.0927182

[295]Abd-El-Khalek, D. E., Abd-El-Nabey, B. A., Abdel-Gaber, A. M., Evaluation of *Nicotiana* Leaves Extract as Corrosion., *Port. Electrochim. Acta*, **2012**, *30*, 247-259. DOI: 10.4152/pea.201204247

[296]Najah, Z., Elsherif, K. M., Kawan, E., Farah, N., Phytochemical Screening and Heavy Metals Contents of *Nicotiana glauca* Plant, *Int. J. Pharm. Pharmaceut. Res*., **2015**, *4*, 82-91. https://ijppr.humanjournals.com/19-3

[297]Plumlee, K. H., Holstege, D. M., Blanchard, P. C., Fiser, K. M., Galey, F. D., *Nicotiana glauca* toxicosis of cattle, *J. Vet. Diagn. Invest*., **1993**, *5*, 498-499. DOI: 10.1177/104063879300500340

[298]Both, C. J., Steenkamp P. A., Olivier, A., Bekker, L. C., *Nicotiana glauca* poisoning in ostriches (Struthio camelus). *J. S. Afr. Vet. Assoc*., **2011**, *82*, 116-119. DOI: 10.4102/jsava.v82i2.44

[299]Castorena, J. L., Garriott, J. C., Barnhardt, F. E., Shaw, R. F., A fatal poisoning from *Nicotiana glauca*, *J. Toxicol. Clin. Toxicol*., **1987**, *25*, 429-435. DOI: 10.3109/15563658708992646

[300]Mellick, L. B., Makowski, T., Mellick, G. A., Borger, R., Neuromuscular blockade after ingestion of tree tobacco (*Nicotiana glauca*), *Ann. Emerg. Med*., **1999**, *3*, 101-104. DOI: 10.1016/s0196-0644(99)70280-5

[301]Furer, V., Hersch, M., Silvetzki, N., Breuer, G. S., Zevin, S., *Nicotiana glauca* (Tree Tobacco) Intoxication—Two Cases in One Family, *J. Med. Toxicol*., **2011**, *7*, 47–51. DOI: 10.1007/s13181-010-0102-x

[302]Hassen, F. M., Sik Ali, B. H., Jaoued, O., Ayed, S., Tilouche, N., Gharbi, R., Elatrous, S., Severe *Nicotiana glauca* Poisoning: A Case Report, *J. Clin. Toxicol*., **2014**, *4*, 2 pages. DOI:10.4172/2161-0495.1000216

[303]Musso, F., Lincor, D., Vasconsuelo, A., Pronsato, L., Faraoni, B., Milanesi, L., Adverse Effects in Skeletal Muscle Following the Medicinal Use of *Nicotiana glauca*, *Biol. Pharm. Bull*., **2019**, *42*, 671–679. DOI: 10.1248/bpb.b18-00424

[304]Donkor, A. M., Glover, R. L., Boateng, J. K., Gakpo, V. Y., Antibacterial activity of the fruit extract of Physalis angulata and its formulation, *J. Med. Biomed. Sci*., **2012**, *1*, 21-26. https://www.researchgate.net/publication/317036079

[305]Osho, A., Adetunji, T., Fayemi, S. O., Moronkola, D. O., Antimicrobial Activity of Essential Oils of *Physalis angulata* L., *Afr. J. Tradit. Complement. Altern. Med*., **2010**, *7*, 303-306. DOI: 10.4314/ajtcam.v7i4.56696

[306]Silva, M. T., Simas, S., Batista, T. G., Cardarelli, P., Tomassini, T. C., Studies on antimicrobial activity, in vitro, of *Physalis angulata* L. (Solanaceae) fraction and physalin B bringing out the importance of assay determination, *Mem. Inst. Oswaldo Cruz*, **2005**, *100*, 779-782.DOI: 10.1590/S0074-02762005000700018

[307]Hsieh, W. T., Huang, K. Y., Lin, H. Y., Chung, J. G., *Physalis angulata* induced G2/M phase arrest in human breast cancer cells, *Food Chem. Toxicol*., **2006**, *44*, 974-983 DOI: 10.1016/j.fct.2005.11.013

[308]Hidayat, T., Priyandoko, D., Perdana, F. S., Insan, A. M., Hernawati, F., Cytotoxicity effects of leaf extracts of Ciplukan (*Physalis angulata*; Solanaceae) on human blood and ovary cancer cell lines, *J. Phys. Conf. Ser*., **2019**, *1280*, 6 pages. DOI: 10.1088/1742-6596/1280/2/022009

[309]Maryati, A., Sutrisna, E., Saifudin, A., Kusumaningrum, I. D., Abu Bakar, M. F., Extract of ceplukan (*Physalis angulata L.*) inhibited proliferation and induced apoptosis in myeloma cell line, *Food Res*., **2019**, *3*, 755-760. https://doi.org/10.26656/fr.2017.3(6).169

[310]Kusumaningtyas, R. W., Laily, N., Limandha, P., Potential of Ciplukan (*Physalis angulata* L.) as Source of Functional Ingredient, *Procedia Chem*., **2015**, *14*, 367-372. DOI: 10.1016/j.proche.2015.03.050

[311]Chiang, H. C., Jaw, S. M., Chen, C. F., Kan, W. S., Antitumor agent, physalin F from *Physalis angulata* L., Anticancer Res., **1992**, *12*, 837-843. https://www.researchgate.net/publication/21533876

[312]Magalhaes, H. I., Veras, M. L., Torres, M. R., Alves, A. P., Pessoa, O. D., Silveira, E. R., Lotufo, L. V., de Moraes, M. O., Pessoa, C., In-vitro and in-vivo antitumour activity of physalins B and D from *Physalis angulata*, *J. Pharm. Pharmacol*., **2006**, *58*, 235-241. DOI: 10.1211/jpp.58.2.0011

[313]Damu, A.G., Kuo, P-C., Su, C-R., Kuo, T-H., Chen, T-H., Bastow, K.F., Lee, K-H., Wu, T-S., Isolation, Structures, and Structure−Cytotoxic Activity Relationships of Withanolides and Physalins from *Physalis angulata*, *J. Nat. Prod*., 2007, *70*, 1146-1152. https://doi.org/10.1021/np0701374

[314]Wu, S-Y., Leu, Y-L., Chang, Y-L., Wu, T-S., Kuo, P-C., Liao, Y-R., Teng, C-M., Pan, S-L., Physalin F Induces Cell Apoptosis in Human Renal Carcinoma Cells by Targeting NF-kappaB and Generating Reactive Oxygen Species, *PLOS ONE*, **2012**, *7*, e40727. DOI: 10.1371/journal.pone.0040727

[315]Ma, Y-M., Han, W., Li, J., Hu, L-H., Zhou, Y-B., Physalin B not only inhibits the ubiquitin-proteasome pathway but also induces incomplete autophagic response in human colon cancer cells *in vitro*, *Acta Pharmacol. Sin*., **2015**, *36*, 517–527, DOI: 10.1038/aps.2014.157

[316] He, Q. P., Ma ,L., Luo, J.Y., He, F. Y., Lou, L. G., Hu, L. H., Cytotoxic withanolides from *Physalis angulata* L., *Chem. Biodivers*., **2007**, *4*, 443-449. DOI: 10.1002/cbdv.200790036

[317]Anh, H. L., Cytotoxic withanolides from Vietnamese ethnomedicinal plant *Physalis angulata*, *J. Multidis. Engin. Sci. Technol*., **2017**, *4*, 8150-8152. http://www.jmest.org/wp-content/uploads/JMESTN42352388.pdf

[318]Gao, C., Li, R., Zhou, M., Yang, Y., Kong, L., Luo, J., Cytotoxic withanolides from *Physalis angulata*, *Nat. Prod. Res*., **2018**, *32*, 676-681. DOI: 10.1080/14786419.2017.1338281

[319]Meng, Q., Fan, J., Liu, Z., Li, X., Zhang, F., Zhang, Y., Sun, Y., Li, L., Liu, X., Hua, E., Cytotoxic Withanolides from the Whole Herb of *Physalis angulata* L., *Molecules*, **2019**, *24*, 1608-1616, DOI: 10.3390/molecules24081608

[320]Ukwubile, C. A., Oise, I. E., Analgesic and Anti-inflammatory Activity of *Physalis angulata* Linn. (Solanaceae) Leaf Methanolic Extract in Swiss Albino Mice**,** *Int. Biol. Biomed. J*., **2016**, *2*, 167-170. http://ibbj.org/article-1-89-en.pdf

[321]Junior, L. D, Quaglio, A. E., Costa, C. A., Di Stasi, L. C., Intestinal anti-inflammatory activity of Ground Cherry (*Physalis angulata* L.) standardized CO_2 phytopharmaceutical preparation, *World J. Gastroenterol*., **2017**, *23*, 4369-4380. DOI: 10.3748/wjg.v23.i24.4369

[322]Sri, L., Ressi, S., Dan, E. A., Antiinflammatory Activity Test of Aqueous Extracts Herb of Ciplukan (*Physalis angulata* L.) in Caragenan Inducted Wistar Rat (*Rattus norvegicus* L.), *Trad. Med. J*., **2017**, *22*, 199-205. DOI: 10.22146/mot.31556

[323]Shravan, N., Kishore, G., Siva, G., Sindhu, E. S., In vitro anti-inflammatory and anti-arthritic activity of leaves of *Physalis angulata* L. *Int. J. Pharm. Ind. Res*., **2011**, *1*, 211-213. http://www.ijpir.com/view_content.php?quat=1&date=2011&issue=3

[324]Ribeiro, I. M., Silva, M. T., Soares, R. D., Stutz, C. M., Bozza, M., Tomassini, T. C., *Physalis angulata* L. antineoplasic activity, *in vitro*, evaluation fromit's stems and fruit capsules, *Rev. Bras. Farmacogn*., **2002**, *12*, 21-23. http://dx.doi.org/10.1590/S0102-695X2002000300011

[325]Bastos, G. N., Santos, A. R., Ferreira, V. M., Costa, A. M., Bispo, C. I., Silveira, A. J., Nascimento, J. L., Antinociceptive effect of the aqueous extract obtained from roots of *Physalis angulata* L. on mice, *J. Ethnopharmacol*., **2006**, *103*, 241-245. DOI: 10.1016/j.jep.2005.08.008

[326] Murali Krishna, T., Vadluri, R., Manoj Kumar, E., *In vitro* determination of antioxidant activity of *Physalis angulata* Linn., *Int. J. Pharm. Bio Sci*., **2013**, *4*, 541-549. https://www.researchgate.net/publication/267036284

[327]Horn, R. C., Gelatti, G. T., Koefender, J., Golle, D. P., Mayer, M. S., Heringer, T. A., Pasini, M. B., Tissiani, A. C., Arruda, A. C., Rubin, L., Recktenwald, R., Moreira, P. R., Alegransi, C.,Antioxidant effect of *Physalis angulata* fruit on cells exposed to 2,4- dichlorophenoxyacetic acid, *Int. J. Innov. Edu. Res*., **2019**, *7*, 374-386. https://doi.org/10.31686/ijier.Vol7.Iss8.1696

[328]Pinto, N. B., Morais, T. C., Carvalho, K. M., Silva, C. R., Andrade, G. M., Brito, G. A., Veras, M. L., Pessoa, O. D., Rao, V. S., Santos, F. A., Topical anti-inflammatory potential of Physalin E from *Physalis angulata* on experimental dermatitis in mice, *Phytomedicine*, **2010**, *17*, 740–743. DOI: 10.1016/j.phymed.2010.01.006

[329]Sun, C-P., Yuan, T., Wang, L., Kang, N., Zhao, F., Chen, L-X., Qiu, F., Anti-inflammatory labdane-type diterpenoids from *Physalis angulata*, *RSC Adv*., **2016**, *6*, 76838-76847. DOI: 10.1039/C6RA16424B

[330]Yang,Y., Yi, L., Wang, Q., Xie, B., Sha, C., Dong, Y., Physalin B Suppresses Inflammatory Response to Lipopolysaccharide in RAW264.7 Cells by Inhibiting NF-*κ*B Signaling, *J. Chem*., **2018**, Article ID 7943140, 6 pages. https://doi.org/10.1155/2018/7943140

[331]Cobaleda-Velasco, M., Alanis-Banuelos, R. E., Almaraz-Abarca, N., Rojas-Lopez, M., Gonzalez-Valdez, L., Avila-Reyes, J. A., Rodrigo, S., Phenolic profiles and antioxidant properties of *Physalis angulata* L. as quality indicators, *J. Pharm. Pharmacog. Res.*, **2017**, *5*, 114-128. https://www.researchgate.net/publication/311969744

[332]Lima, L. G., Montenegro, J., Abreu, J. P., Nascimento, T. P., Santos, M., Ferreira, A. G., Cameron, L C., Ferreira, M. S., Teodoro, A. J., Metabolite Profiling by UPLC-MSE, NMR, and Antioxidant Properties of Amazonian Fruits: Mamey Apple (*Mammea Americana*), Camapu (*Physalis Angulata*), and Uxi (*Endopleura Uchi*), *Molecules*, **2020**, *25*, 342-359. DOI: 10.3390/molecules25020342

[333]Nanumala, S. K., Kannadhasan, R., Gunda, K., Sivakumar, G., Somasekhar, P., Anti ulcer activity of the ethanolic extract of leaves *Physalis angulata* L.*Int. J. Pharm. Pharm. Sci*., **2012**, *4*, 226-228. https://www.researchgate.net/publication/262023773

[334]Kimpende M. P., Lusakibanza, M., Mesia, K., Tona, L., Tits, M., Angenot, L., Frederich M., Van Meervelt, L., Isolation, pharmacological activity and structure determination of physalin B and 5β,6β-epoxyphysalin B isolated from Congolese *Physalis angulata* L., *Acta Crystallogr. C*., **2013**, *69*, 1557-1562. DOI: 10.1107/S010827011303117X

[335]Ogundajo, A. L., Akpome, A. S., Tijani, N. A., Ogunwande, I. A., Chemical Constituents of the Leaf Essential Oil of *Physalis angulata* L., *Asian J. Appl. Sci*., **2015**, *3*, 652-655. https://www.yumpu.com/en/document/view/54826012

[336]Huong, T. N., Van, L. A., Thanh, N. D., Suong, N. T., Phuong, N. H., Tien, N. D., Chemical Constituents of *Physalis angulata* L. (Family Solanaceae), *Can Tho Univ. J. Sci*., **2016**, *2*, 46-49. DOI: 10.22144/ctu.2016.jen.015

[337]Brar, R., Gupta, R. C., Phytochemical Analysis of Two Cytotypes (2x and 4x) of *Physalis angulata* an Important Medicinal Plant, Collected from Rajasthan, *Biochem. Mol. Biol. J*., **2017**, *3*, 7 pages. DOI: 10.21767/2471-8084.100043

[338]Ferreira, L. M., do Vale, A. E., de Souza, A. J., Leite, K. B., Sacramento, C., Moreno, M. L., Araujo, T. H., Soares, M. B., Grassi, M. F., Anatomical and phytochemical characterization of *Physalis angulata* L.: A plant with therapeutic potential, *Pharmacog. Res*., **2019**, *11*, 171-177. DOI: 10.4103/pr.pr_97_18

[339]Ushie, O. A., Iyen, S. I., Abeng, F. E., Azuaga, T. I., Okpaegbe, U. C., Aikhoje, E. F., Quantification of Alkaloids, Flavonoids Physalis angulata and Mucuna pruriens and Saponins in *Physalis angulata* and *Mucuna pruriens*, *Fudma Rec. Chem. Sci*., **2019**, *1*, 86-89. http://journal.fudutsinma.edu.ng/index.php/rcs/article/view/1075/pdf

[340]Ekeke, C., Obute, G. C., Ogazie, C. A., HPLC Evaluation of Phenolic Compounds in *Physalis angulata* Linn. and *Physalis micrantha* Linn. (Solanaceae), *Eur. J. Med. Plants*, **2019**, *29*, 1-9. DOI: 10.9734/EJMP/2019/v29i230151

[341]Pinto, L. A., Meira, C. S., Villarreal, C. F., Vannier-Santos, M. A., de Souza, C. V., Ribeiro, I. M., Tomassini, T. C., Galvao-Castroa, B., Soares, M. B., Grassi, M. F., Physalin F, a seco-steroid from *Physalis angulata* L., has immunosuppressive activity in peripheral blood mononuclear cells from patients with HTLV1-associated myelopathy, *Biomed. Pharmacother*., 2016, *79*, 129–134. http://dx.doi.org/10.1016/j.biopha.2016.01.041

[342]Sun, C-P., Qiu, C-Y., Zhao, F., Kang, N., Chen, L-X., Qiu, F., Physalins V-IX, 16,24-*cyclo*-13,14-*seco* withanolides from *Physalis angulata* and their antiproliferative and anti-inflammatory activities, *Sci. Rep*., **2017**, *7*, 10 pages. DOI: 10.1038/s41598-017-03849-9

[343]Januario, A. H., Filho, E. R., Pietro, R. C., Kashima, S., Sato, D. N., Franca, S. C., Antimycobacterial physalins from *Physalis angulata* L. (Solanaceae), *Phytother. Res*., **2002**, *16*, 445-448. DOI: 10.1002/ptr.939

[344]Shingu, K., Yahara, S., Nohara, T., Okabe, H., Three New Withanolides, Physagulins A, B and D from *Physalis angulata* L., *Chem. Pharm. Bull*., **1992**, *40*, 2088-2091. DOI: 10.1248/cpb.40.2088

[345]Zhang, Y., Chen, C., Zhang, Y.L., Kong L. Y., Luo, J. G., Target discovery of cytotoxic withanolides from *Physalis angulata* var. villosa via reactivity-based screening, *J. Pharm. Biomed. Anal*., **2018**, *20*, 194-199. DOI: 10.1016/j.jpba.2017.12.047

[346]Yu, P., Zhang, C., Gao, C-Y., Ma, T., Zhang, H., Zhou, M-M., Yang, Y-W., Yang, L., Kong, L-Y., Anti-proliferation of triple-negative breast cancer cells with physagulide P: ROS/JNK signaling pathway induces apoptosis and autophagic cell death, *Oncotarget*, **2017**, *8*, 64032-64049. DOI: 10.18632/oncotarget.19299

[347]Yang, Y-W., Yang, L., Zhang, C., Gao, C-Y., Ma, T., Kong, L-Y., Physagulide Q suppresses proliferation and induces apoptosis in human hepatocellular carcinoma cells by regulating the ROS-JAK2/Src-STAT3 signaling pathway, *RSC Adv*., **2017**, *7*, 12793-12804. DOI: 10.1039/C6RA25032G

[348]Gao, C-Y., Ma, T., Luo, J., Kong, L-Y., Three New Cytotoxic Withanolides from the Chinese Folk Medicine *Physalis angulata*, *Nat. Prod. Commun*.,**2015**, *10*, 2059-2062. https://doi.org/10.1177/1934578X1501001211

[349]Gao, C., Li, R., Zhou, M., Yang, Y., Kong, L., Luo, L., Cytotoxic withanolides from *Physalis angulata*, *Nat. Prod. Res*., **2018**, *32*, 676-681. DOI: 10.1080/14786419.2017.1338281

[350]Onyegeme-Okerenta, B. M., Essien, E. B., Esin, J. I., Anti-sickling Properties of Aqueous Extracts of *Dennettia tripetala* and *Physalis angulata*, *Asian J. Biol. Sci*., **2019**, *12*, 772-778. DOI: 10.3923/ajbs.2019.772.778

[351]Lin ,Y. S., Chiang, H. C., Kan, W. S., Hone, E., Shih, S. J., Won, M. H., Immunomodulatory activity of various fractions derived from Physalis angulata L extract, *Am. J. Chin. Med*., **1992**, *20*, 233-43. DOI: 10.1142/S0192415X92000242

[352]Guimaraes, E. T., Lima, M. S., Santos, L. A., Ribeiro, I. M., Tomassini, T. B., dos Santos, R. R., dos Santos, W. L., Soares, M. B., Activity of physalins purified from *Physalis angulata* in *in vitro* and *in vivo* models of cutaneous leishmaniasis, *J. Antimic. Chemother*., **2009**, *64*, 84–87. DOI: 10.1093/jac/dkp170

[353]Guimaraes, E. T., Lima, M. S., Santos, L. A., Ribeiro, I. M., Tomassini, T. B., dos Santos, R. R., dos Santos, W. L., Soares, M. B., Effects of seco-steroids purified from *Physalis angulata* L., Solanaceae, on the viability of *Leishmania* sp. *Rev. Bras. Farmacogn*., **2010**, *20*, 945-949 DOI: 10.1590/S0102-695X2010005000036

[354]Da Silva, B. J., Pereira, S. W., Rodrigues, A. P., Do Nascimento, J. L., Silva, E. O., *In vitro* antileishmanial effects of *Physalis angulata* root extract on *Leishmania infantum*, *J. Integr. Med*., **2018**, *16*, 404-410. DOI: 10.1016/j.joim.2018.08.004

[355]dos Santos, J. A., Tomassini, T. C., Xavier, D. C., Ribeiro, I. M., da Silva, M. T., Filho, Z. B., Molluscicidal Activity of *Physalis angulata* L. Extracts and Fractions on *Biomphalaria tenagophila* (d'Orbigny, 1835) under Laboratory Conditions, *Mem. Inst. Oswaldo Cruz*, **2003**, *98*, 425-428. DOI: 10.1590/S0074-02762003000300024

[356]Najmawati, S., Yoki, Y., Spectroscopic, structural, and morphology of nickel oxide nanoparticles prepared using *Physalis angulata* leaf extract, *Mater. Sci. Forum*, **2018**, *917*, 167-171. DOI: 10.4028/www.scientific.net/MSF.917.167

[357]Sukandar, E. Y., Sheba, S. H., Acute and Sub-chronic Toxicity Studies of Combination of *Physalis angulata L.* (*Cecendet*) Extract and Methylprednisolone on Animals, *Int. J. Integ. Health Sci*., **2019**, *7*, 48-55. http://doi.org/10.15850/ijihs.v7n1.1619

[358]Goztok, F., Fikriye Zengin, F., The antimicrobial activity of *Physalis peruviana* L., *Bitlis Eren Univ. J. Sci. Technol*., **2013**, *3*, 15-17. DOI: 10.17678/beuscitech.47134

[359]Cueva, B. R., Leon, R. A., Lopez, M., Yanchaliquín, A., Morejon, I. F., Salguero, H. S., Antibacterial Effects of Uvilla (*Physalis peruviana* L.) extracts against *Listeria* spp.

Isolated from Meat in Ecuador, *Int. J. Curr. Microbiol. App. Sci*., **2017**, *6*, 1146-1153. https://doi.org/10.20546/ijcmas.2017.604.141

[360]Morejon, F., Tiger, A., Ruilova, B., Merino, O., Merino, M., Arreguin, M., Salazar, S., Ramon, O., Morales, J., Verdezoto, L., Moreno, I., Gomez, C., Antibacterial Activity of Uvilla (*Physalis peruviana* L.) Extracts Against *Salmonella* sp. Strains, *Asian J. Microbiol. Biotechnol. Environ. Sci*., **2019**, *21*, S32-S37. https://www.researchgate.net/publication/337946608

[361]El-Beltagi, H. S., Mohamed, H. I., Safwat, G., Gamal, M., Megahed, B. M., Chemical Composition and Biological Activity of *Physalis peruviana* L., *Gesunde Pflanzen*, **2019**, *71*, 113-122. DOI: 10.1007/s10343-019-00456-8

[362]Wahdan, O. A., Aly, B. S., Abdelfattah, M. S., Phytochemical Analysis, Antibacterial and Anticancer Activities of the *Physalis Peruviana* Calyces Growing in Egypt, *Food Nutr. J*., *2019*, *9*, 6 pages. DOI: 10.29011/2575-7091.100097

[363]Erturk, O., Col, A. M., Can, K. U., Korkmaz, K., Antioxidant, Antimicrobial Activities and Phenolic and Chemical Contents of *Physalis peruviana* L. from Trabzon, Turkey. *Ind. J. Pharmaceut. Edu. Res*., **2017**, *51*, 213-216. DOI: 10.5530/ijper.51.3s.15

[364]El-Kenawy, A. E., Elshama, S. S., Osman, H. H., Effects of *Physalis peruviana* L on Toxicity and Lung Cancer Induction by Nicotine Derived Nitrosamine Ketone in Rats, *Asian Pac. J. Cancer Prev*., **2015**, *16*, 5863-5868. http://dx.doi.org/10.7314/APJCP.2015.16.14.5863

[365]Peng, C. Y., You, B. J., Lee, C. L., Wu, Y. C., Lin, W. H., Lu, T. L., Chang, F. C., Lee, H. Z., The Roles of 4β-Hydroxywithanolide E from *Physalis peruviana* on the Nrf2-Anti-Oxidant System and the Cell Cycle in Breast Cancer Cells, *Am, J. Chin. Med*., **2016**, *44*, 617-636. DOI: 10.1142/S0192415X16500348

[366]Yen, C-Y, Chiu, C-C., Chang, F-R., Chen, J.Y., Hwang, C-C., Hseu, Y-C., Yang, H-L., Lee, A. Y, Tsai, M-T., Guo, Z-L., Cheng, Y-S., Liu, Y-C., Lan, Y-H., Chang, Y-C., Ko, Y-C., Chang, H-W., Wu, Y-C., 4β-Hydroxywithanolide E from *Physalis peruviana* (golden berry) inhibits growth of human lung cancer cells through DNA damage, apoptosis and G2/M arrest, *BMC Cancer*, **2010**, *10*, 8 pages. DOI: 10.1186/1471-2407-10-46

[367]Chiu, C-C., Haung, J-W., Chang, F-R., Huang, K-J., Huang, H-M., Huang, H-W., Chou, C-K., Wu, Y-C., Chang, H-W., Golden Berry-Derived 4β-hydroxywithanolide E for Selectively Killing Oral Cancer Cells by Generating ROS, DNA Damage, and Apoptotic Pathways, *PLOS ONE*, **2013**, *8*, 9 pages. DOI: 10.1371/journal.pone.0064739

[368]Ye, Z-N., Yuan, F., Liu, J-Q., Peng, X-R., An, T., Li, X., Kong, L-M., Qiu, M-H., Li, Y., *Physalis peruviana*-Derived 4β-Hydroxywithanolide E, a Novel Antagonist of Wnt Signaling, Inhibits

Colorectal Cancer *In Vitro* and *In Vivo*, *Molecules*, **2019**, *24*, 1146-1158. DOI: 10.3390/molecules24061146

[369]Ramadan, M. M., El-Ghorab, A.H., Ghanem, K. Z., Volatile compounds, antioxidants, and anticancer activities of Cape gooseberry fruit (*Physalis peruviana* L.): an *in-vitro* study, *J. Arab Soc. Med. Res*., **2015**, *10*, 56–64. DOI: 10.4103/1687-4293.175556

[370]Sathyadevi, M., Suchithra, E. R., Subramanian, S., *Physalis peruviana Linn.* fruit extract improves insulin sensitivity and ameliorates hyperglycemia in high-fat diet low dose STZ-induced type 2 diabetic rats, *J. Pharm. Res*., **2014**, *8*, 625-635. http://jprsolutions.info/files/final-file-56c0926c9f04c7.36196864.pdf

[371]Kirecci, O. A., Erman, F., Ozsahin, A. D., Erman, O., Kaya, T., Yilmaz, O., Influences of *Physalis peruviana* L. and *Lupinus albus* L. fruits extracts on the levels of some biochemical parameters in brain and muscle tissues of type II diabetic rats, *Prog. Nutr*., **2018**, *20*, 279-289. DOI: 10.23751/pn.v20i2.6047

[372]Echeverry, S. M., Valderrama, I. H., Costa, G. M., Ospina-Giraldo, L. F., Aragon, D. M., Development and optimization of microparticles containing a hypoglycemic fraction of calyces from *Physalis peruviana*, *J. App. Pharm. Sci*., **2018**, *8*, 010-018. DOI: 10.7324/JAPS.2018.8502

[373]Bernal, C. A., Ramos, F. A., Baena, Y., Dry Powder Formulation from *Physalis peruviana* Fruits Extract with Antidiabetic Activity Formulated Via Co-Spray Drying, *Int. J. App. Pharm*., **2019**, *11*, 109-117. http://dx.doi.org/10.22159/ijap.2019v11i3.29520

[374]Soliman, G. Z., Soliman, A. S., Abbas, M. S., Abdallah, S. M., Egyptian *Physalis peruviana* L. as Anti-diabetic and Hypolipidemic Natural Herb: A Promising Treatment of Alloxan-Induced Diabetic Rats, *Case Stud. J*., **2019**, *8*, 62-73. http://www.casestudiesjournal.com/Volume%208%20Issue%204%20Paper%205.pdf

[375]Dewi, L., Sulchan, M., Kisdjamiatun, M., Potency of Cape Gooseberry (*Physalis peruviana*) Juice in Improving Antioxidant and Adiponectin Level of High Fat Diet Streptozotocin Rat Model, *Rom. J. Diabetes Nutr. Metab. Dis*., **2018**, *25*, 253-260. DOI: 10.2478/rjdnmd-2018-0029

[376]Ramadan, M. F., *Physalis peruviana* pomace suppresses high-cholesterol diet-induced hypercholesterolemia in rats, *Grasas y Aceites*, **2012**, *63*, 411-422. DOI: 10.3989/gya.047412

[377]Pardo, J. M., Fontanilla, M. R., Ospina, L. F., Espinosa, L., Determining the pharmacological activity of *Physalis peruviana* fruit juice on rabbit eyes and fibroblast primary cultures, *Invest. Ophthalmol. Vis. Sci*., **2008**, *49*, 3074-3079. DOI: 10.1167/iovs.07-0633

[378]Castro, J., Ocampo, Y., Franco, L., Cape Gooseberry [*Physalis peruviana* L.] Calyces Ameliorate TNBS Acid-induced Colitis in Rats, *J. Crohns Colitis*, **2015**, *9*, 1004–1015. DOI: 10.1093/ecco-jcc/jjv132

[379]Park, H. A., Kwon, O-K., Ryu, H. W., Min, J-H., Park, M-W., Park, M-H., Paik, J-H., Choi, S., Paryanto, I., Yuniato, P., Oh, S-R., Ahn, K-S., Lee, J-W., *Physalis peruviana* L. inhibits ovalbumin‑induced airway inflammation by attenuating the activation of NF‑κB and inflammatory molecules, *Int. J. Molec. Med*., **2019**, *43*, 1830-1838. DOI: 10.3892/ijmm.2019.4110

[380]Takimoto, T., Kanbayashi, Y., Toyoda, T., Adachi, Y., Furuta, C., Suzuki, K., Miwa, T., Bannai, M., 4β-Hydroxywithanolide E isolated from *Physalis pruinosa* calyx decreases inflammatory responses by inhibiting the NF-κB signaling in diabetic mouse adipose tissue, *Int. J. Obes*., **2014**, *38*, 1432–1439. DOI: 10.1038/ijo.2014.33

[381]Park, E-J., Sang-Ngern, M., Chang, L. C., Pezzuto, J. M., Physalactone and 4β-Hydroxywithanolide E Isolated from *Physalis peruviana* Inhibit LPS-Induced Expression of COX-2 and iNOS Accompanied by Abatement of Akt and STAT1, *J. Nat. Prod*., **2019**, *82*, 492-499. DOI: 10.1021/acs.jnatprod.8b00861

[382]Wum S-J., Nig, L-T., Huang, Y-M., Lin, D-L., Wang, S-S., Huang, S-N., Lin, C-C., Antioxidant Activities of *Physalis peruviana*, *Biol. Pharm. Bull*., **2005**, *28*, 963—966. DOI: 10.1248/bpb.28.963

[383]Hassan, H. A., Ghareb, N. E., Azhari, G. F., Antioxidant activity and free radical-scavenging of cape gooseberry (*Physalis peruviana* L.) in hepatocellular carcinoma rats model, *Hepatoma Res*., **2017**, 3, 27-33. DOI: 10.20517/2394-5079.2016.33

[384]Areiza-Mazo, N., Robles, J., Zamudio-Rodriguez, J. A., Giraldez, L., Echeverria, V., Barrera-Bailon, B., Aliev, G., Sahebkar, A., Ashraf, G. M., Barreto, G. E., Extracts of *Physalis peruviana* Protect Astrocytic Cells Under Oxidative Stress With Rotenone. *Front. Chem*., **2018**, *6*, 13 pages. DOI: 10.3389/fchem.2018.00276

[385]Bazalar Pereda, M. S., Nazareno, M. A., Viturro, C. I., Nutritional and Antioxidant Properties of *Physalis peruviana* L. Fruits from the Argentinean Northern Andean Region, *Plant Foods Hum. Nutr*., **2019**, *74*, 68-75. DOI: 10.1007/s11130-018-0702-1

[386]Kirson, I., Abraham, A., Sethi, P.D., Subramanian, S.S., Glotter, E., 4β-Hydroxywithanolide E, a new natural steroid with a 17α-oriented side-chain, *Phytochemistry*, **1976**, *15*, 340-342. https://doi.org/10.1016/S0031-9422(00)89029-9

[387]Gottlieb, H. E., Kirson, I., Glotter, E., Ray, A. B., Sahai, M., Ali, A., Perulactone, a new ergostane-type steroid from *Physalis peruviana* (Solanaceae), *J. Chem. Soc. Perkin Trans. 1*, **1980**, *0*, 2700-2704. https://doi.org/10.1039/P19800002700

[388]Baumann, T. W., Meier, C. M., Chemical Defence by Withanolides During Fruit Development in *Physalis peruviana*, *Phytochemistry*, **1993**, *33*, 17-321. https://doi.org/10.1016/0031-9422(93)85510-X

[389]Ramadan, M. F., Morsel, J-T., Oil Goldenberry (*Physalis peruviana* L.), *J. Agric. Food Chem.*, **2003**, *51*, 969-974. DOI: 10.1021/jf020778z

[390]Gautam, S. K., Dwivedi, D. H., Kumar, P., Preliminary studies on the bioactive phytochemicals in extract of Cape gooseberry (*Physalis Peruviana* L.) fruits and their Products, *J. Pharmacog. Phytochem.*, **2015**, *3*, 93-95. http://www.phytojournal.com/vol3Issue5/24.1.html

[391]Lashin, I. I., Elhaw, M. H., Evaluation of Secondary Metabolites in Callus and Tissues of *Physalis peruviana*, *Int. J. Mod. Bot.*, **2016**, *6*, 10-17. DOI: 10.5923/j.ijmb.20160601.03

[392]Sahai, M., Ray, A. B., Secotropane alkaloids of *Physalis peruviana*, *J. Org. Chem.*, **1980**, *45*, 3265-3268. https://doi.org/10.1021/jo01304a024

[393]Kubwabo, C., Rollmann, B., Tilquin, B., Analysis of Alkaloids from Physalis peruviana by Capillary GC, Capillary GC-MS, and GC-FTIR, *Planta Med.*, **1993**, *59*, 161-163. DOI: 10.1055/s-2006-959634

[394]Majcher, M. A., Scheibe, M., Jelen, H. H., Identification of Odor Active Compounds in *Physalis peruviana* L., *Molecules*, **2020**, *25*, 245-253. DOI: 10.3390/molecules25020245

[395]Mier-Giraldo, H., Diaz-Barrera, L. E., Delgado-Murcia, L. G., Valero-Valdivieso, M. F., Caez-Ramirez, G., Cytotoxic and Immunomodulatory Potential Activity of *Physalis peruviana* Fruit Extracts on Cervical Cancer (HeLa) and Fibroblast (L929) Cells, *J. Evid. Based Complement. Alter. Med.*, **2017**, *22*, 777-787. DOI: 10.1177/2156587217718751

[396]Medina, S., Collado-Gonzalez, J., Ferreres, F., Londono, J., Jimenez-Cartagena, C., Guy, A., Durand, T., Galano, J. M., Gil-Izquierdo, A., Potential of *Physalis peruviana* calyces as a low-cost valuable resource of phytoprostanes and phenolic compounds, *J. Sci. Food Agric.*, **2019**, *99*, 2194-2204. DOI: 10.1002/jsfa.9413

[397]Stein, A., Compera, D., Karge, B., Bronstrup, M., Franke, J., Isolation and characterisation of irinans, androstane-type withanolides from *Physalis peruviana* L., *Beilstein J. Org. Chem.*, **2019,** *15*, 2003–2012. DOI: 10.3762/bjoc.15.196

[398]El-Gengaihi, S. E., Hassan, E. E., Hamed, M. A., Zahran, H. G., Mohammed, M. A., Chemical Composition and Biological Evaluation of *Physalis peruviana* Root as Hepato-renal Protective Agent, *J. Diet. Suppl.*, **2013**, *10*, 39–53. DOI: 10.3109/19390211.2012.760509

[399]Al-Olayan, E. M., El-Khadragy, M. F., Aref, A. M., Othman, M. S., Kassab, R. B., Abdel Moneim, A. E., The Potential Protective Effect of *Physalis peruviana* L. against Carbon Tetrachloride-Induced Hepatotoxicity in Rats Is Mediated by Suppression of Oxidative Stress and Downregulation of MMP-9 Expression, *Oxid. Med. Cell. Longev.*, **2014**, Article ID 381413, 12 pages. http://dx.doi.org/10.1155/2014/381413

[400]Ascher, K. R., Nemny, N. E., Eliyahu, M., Kirson, I., Abraham, A., Glotter, E.,Insect antifeedant properties of withanolides and related steroids from Solanaceae, *Experientia*, **1980**, *36*, 998–999. DOI: 10.1007/BF01953844

[401]Perk, B. O., Ilgin, S., Atli, O., Duymus, H. G., Sirmagul, B., Acute and Subchronic Toxic Effects of the Fruits of *Physalis peruviana* L., *Evid. Based Complement. Alter. Med.*, **2013**, Article ID 707285, 10 pages. http://dx.doi.org/10.1155/2013/707285

[402]Balah, M. A., Herbicidal activity of constituents isolated from *Solanum elaeagnifolium* (Solanaceae), *J. Crop Prot.*, **2015**, *4*, 487-496. https://jcp.modares.ac.ir/article-3-3802-en.html

[403]Balah, M. A., AbdelRazek, G. H., Pesticidal activity of *Solanum elaeagnifolium* Cav. Leaves against nematodes and perennial weeds, *Acta Ecol. Sin.*, **2019**, *In Press*, https://doi.org/10.1016/j.chnaes.2019.07.001

[404]Amer, W. M., Abouwarda, A. M., El Garf, I. A., Dawoud, G. T., Abdelmohsen, G., Phytochemical Composition of *Solanum elaeagnifolium cav.* and Its Antibacterial Activity, *Int. J. Biol. Pharm. Allied Sci.*, **2013**, *2*, 1282-1306. https://www.researchgate.net/publication/323073939

[405]Mellouk, K., Soualeh, N., Meziani, S., Linder, M., Boughrara, B., Soulimani, R., Legseir, B., Evaluation of the biological activity of plant extracts of Algerian *Solanum elaeagnifolium*, *Res. J. Pharmaceut. Biol. Chem. Sci.*, **2017**, *8*, 64-74. https://www.rjpbcs.com/pdf/2017_8(1)/[9].pdf

[406]Radwan, M. M., Badawy, A., Zayed, R., Hassanin, H., ElSohly, M., Ahmed, S. A., Cytotoxic flavone glycosides from *Solanum elaeagnifolium*, *Med. Chem. Res.*, **2015**, *24*, 1326–1330. DOI 10.1007/s00044-014-1219-2

[407]Hernandez, L., Carranza, P., Cobos, L.E., Lopez, L. I., Ascasio, J. A., Silva, S.Y ., Bioguided Fractionation from *Solanum elaeagnifolium* to evaluate Toxicity on Cellular Lines and Breast Tumor Explants, *Vitae*, **2017**, *24*, 124-131. http://dx.doi.org/10.17533/udea.vitae.v24n1a05

[408]Mejri, H., Derbre, S., Jedy, A., Tlili, N., Legault, J., Richomme, P., Limam, F., Saidani-Tounsi, M., Combined anti-ages and antioxidant activities of different solvent extracts of *Solanum elaeagnifolium* Cav (Solanacea) fruits during ripening and related to their phytochemical compositions, *Excli J.*, **2014**, *13*, 1029-1042. https://www.ncbi.nlm.nih.gov/pubmed/26417319

[409]Feki, H., Koubaa, I., Damak, M., Secondary metabolites and antioxidant activity of seed extracts from *Solanum elaeagnifolium* Cav., *Mediterr. J. Chem.*, **2014**, *2*, 639-647. DOI: 10.13171/mjc.2014.05.01.22

[410]Hawas, U. W., Soliman, G. M., Abou El-Kassem, L. T., Farrag, A. H., Mahmoud, K., Leon, F., A New Flavonoid *C*-Glycoside from *Solanum elaeagnifolium* with Hepatoprotective and Curative Activities against Paracetamol-Induced Liver Injury in Mice, *Z. Naturforsch. C J. Biosci.*, **2013**, *68*, 19-28. https://doi.org/10.1515/znc-2013-1-204

[411]Ben Hamouda, A., Zarrad, K., Laarif, A., Chaieb, I., Insecticidal effect of *Solanum elaeagnifolium* extracts under laboratory conditions, *J. Entomol. Zool. Stud.*, **2015**, *3*, 187-190. http://www.entomoljournal.com/vol3Issue3/pdf/3-3-81.1.pdf

[412]Ben Hamouda, A., Chaieb, I., Zarrad, K., Laarif, A., Insecticidal Activity of Methanolic Extract of Silverleaf Nightshade Against *Tribolium castaneum*, *Int. J. Entomol. Res.*, **2015**, *03*, 23-28. https://journals.esciencepress.net/index.php/IJER/article/view/1002/530

[413]Njeh, F., Feki, H., Koubaa, I., Hamed, N., Damak, M., Ayadi, A., Hammami, H., Mezghani-Jarraya, R., Molluscicidal activity of Solanum elaeagnifolium seeds against *Galba truncatula* intermediate host of Fasciola hepatica: Identification of β-solamarine, *Pharmaceut. Biol.*, **2015**, *54*, 726-731. DOI: 10.3109/13880209.2015.1073332

[414]Keeler, R. F., Baker, D. C., Gaffield, W., Spirosolane-containing Solanum species and induction of congenital craniofacial malformations, *Toxicon*, **1990**, *28*, 873-884. DOI: 10.1016/0041-0101(90)90017-2

[415]Feki, H., Koubaa, I., Jaber, H., Makni, J., Damak, M., Characteristics and Chemical Composition of *Solanum elaeagnifolium* Seed Oil, *J. Engin. App. Sci.*, **2013**, *8*, 708-712. http://www.arpnjournals.com/jeas/research_papers/rp_2013/jeas_0913_941.pdf

[416]Elabbar, F. A., Bozkeha, N. M., El-Tuonsia, A. T., Extraction, separation and identification of compounds from leaves of *Solanum elaeagnifolium* Cav. (Solanaceae), *Int. Curr. Pharmaceut. J*., **2014**, *3*, 234-239. http://www.icpjonline.com/documents/Vol3Issue3/01.pdf

[417]John, B., Senthikumar, S., Antibacterial activity of *Solanum incanum* L. leaf extracts, *Asian J. Microbiol. Biotechnol. Environ. Sci*., **2001**, *3*, 65-66. https://www.researchgate.net/publication/292826622

[418]Pavithra, P. S., Janani, V. S., Charumathi, K. H., Indumathy, R., Potala, S., Verma, R. S., Antibacterial activity of plants used in Indian herbal medicine, *Int. J. Green Pharm*., **2010** , *4*, 22-29. DOI: 10.4103/0973-8258.62161

[419]Indhumathi, T., Mohandass, S., Efficacy of Ethanolic extract of *Solanum incanum* fruit extract for its antimicrobial activity, *Int. J. Curr. Microbiol. App. Sci*., **2014**, *3*, 939-949. https://www.ijcmas.com/vol-3-6/T.Indhumathi%20and%20S.Mohandass.pdf

[420]Owino, J., Omundi, J., Ngoci, N. S., Antibacterial Activity of Methanolic Crude Extract of *Solanum incanum*: Kenyan Traditional Medicinal Plant, *Int. J. Sci. Res*., **2015**, *2*, 560-563. https://www.researchgate.net/publication/272531511

[421]Mukami, N. A., Wanzala, W., A Study of Bioactivity of *Solanum incanum* L. Fruit Extracts on Microorganisms of the Oral Cavity, *Oral Health Dent. Manag*., **2017**, *16*, 9 pages. https://www.researchgate.net/publication/320131247

[422]Jepkoech, K. E., Gakunga, N. J., Antimicrobial activity and phytochemical screening of *Solanum incanum* fruit extract against clinical samples of *Staphylococcus aureus* collecting from Nakuru Provincial General Hospital Laboratory, Kenya, *Int. Res. J. Med. Biomed. Sci*., **2017**, *2*,pp. 1-8. https://doi.org/10.15739/irjmbs.17.001

[423]Akanmu, A. O., Bulama, Y. A., Balogun, S. T., Musa, S., Antibacterial activities of aqueous and methanol leaf extracts of *Solanum incanum* Linn. (Solanaceae) against multi-drug resistant bacterial isolates, *Afr. J. Microbiol. Res*., **2019**, *13*, 70-76. DOI: 10.5897/AJMR2018.8969

[424]Sbhatu, D, B., Abraha, H. B., Preliminary Antimicrobial Profile of *Solanum incanum* L.: A Common Medicinal Plant, *Evid. Based Complement. Alter. Med*., **2020**, Article ID 3647065, 6 pages. https://doi.org/10.1155/2020/3647065

[425]Beaman-Mbaya, V., Muhammed, S. I., Antibiotic Action of Solanum incanum Linnaeus, *Antimicrob. Agents Chemother*., **1976**, *9*, 920-924. DOI: 10.1128/aac.9.6.920

[426]Manal, A. H., Eltohami, M. S., Ahmad, G. M., The phytochemical screening and antimicrobial activity of *Solanum incanum* L., *Int. J. Innov. Pharmaceut. Sci. Res*., **2016**, *4*, 87-92. https://www.ijipsr.com/sites/default/files/articles/IJIPSRMNR-415.pdf

[427]Sahle, T., Okbatinsae, G., Phytochemical investigation and antimicrobial activity of the fruit extract of *Solanum incanum* grown in Eritrea, *Ornament. Med. Plants*, **2017**, *1*, 15-25. http://www.iaees.org/2017-1(1)/antimicrobial-activity-of-fruit-extract-of-Solanum-incanum.pdf

[428]Kipngeno, C. D., Mshimba, S. M., Cheruiyot, G., Adongo, J. O., Antimicrobial activity and phytochemical investigation of crude extracts of the fruits of *Solanum incanum* (Solananceae) and *Dovyalis abbysinica* (Flacourtiaceae), *Sci. J. Microbiol*., **2014**, Article ID: sjmb-193, 4 Pages. DOI: 10.7237/sjmb/193

[429]Griffin S., Tittikpina, N. K., Al-marby, A., Alkhayer, R., Denezhkin, P., Witek, K., Gbogbo, K. A., Batawila, K., Duval, R. E., Nasim, M. J., Awadh-Ali, N. A., Kirsch, G., Chaimbault, P., Schafer, K-H., Keck, C. M., Handzlik, J., Claus Jacob, C., Turning Waste into Value: Nanosized Natural Plant Materials of *Solanum incanum* L. and *Pterocarpus erinaceus* Poir with Promising Antimicrobial Activities, *Pharmaceutics*, **2016**, *8*, 12 pages. DOI: 10.3390/pharmaceutics8020011

[430]Wu, Y-H., Chiu, W-T., Young, M-J., Chang, T-H., Huang, Y-F., Chou, C-Y., *Solanum Incanum* Extract Downregulates Aldehyde Dehydrogenase 1-Mediated Stemness and Inhibits Tumor Formation in Ovarian Cancer Cells, *J. Cancer*, **2015**, *6*, 1011-1019. DOI: 10.7150/jca.12738

[431]Yu, S., Sheu, H-M., Lee, C-H., *Solanum incanum* extract (SR-T100) induces melanoma cell apoptosis and inhibits established lung metastasis, *Oncotarget*, 2017, *8*, 103509-103517. DOI: 10.18632/oncotarget.21508

[432]Al-Emam, A., Al-Shraim, M., Eid, R., Alfaifi, M., Al-Shehri, M., Moustafa, M. F., Radad, K., Ultrastructural changes induced by Solanum incanum aqueous extract on HCT 116 colon cancer cells. *Ultrastruct. Pathol*., **2018**, *42*, 255-261. DOI: 10.1080/01913123.2018.1447623

[433]Lin, C-N., Lu, C-M., Cheng, M-K., Gan, K-H., The Cytotoxic Principles of *Solanum incanum*, *J. Nat. Prod*., **1990**, *53*, 513-516. https://doi.org/10.1021/np50068a041

[434]Sabiu, S., Ajani, E. O., Aladodo, R. A., Garuba, T., Agnubiade, M. O., Alimi, A. A., Lekena, N., Abdulrazaq, M., Membrane stabilization and probable mechanisms of hypoglycemic activity of fruit extract of *Solanum incanum* L.(Solanaceae), *Comp. Clin. Pathol*., **2018**, *27*, 1611-1619. DOI: 10.1007/s00580-018-2782-6

[435]Tsenum, J. L., Antihyperlipidemic Effect of Solanum incanum on Alloxan Induced Diabetic Wistar Albino Rats, *Cardiovasc. Pharm*., **2018**, *7*, 14 pages. DOI: 10.4172/2329-6607.1000239

[436]Mwonjoria, J. K., Ngeranwa, J. J., Githinji, C. G., Kahiga, T., Kariuki, H. N., Waweru, F. N., Suppression of nociception by *Solanum incanum* (Lin.) Diclomethane root extract is associated anti-inflammatory activity, *J. Phytopharmacol*., **2014**, *3*, 156-162. http://www.phytopharmajournal.com/Vol3_Issue3_01.pdf

[437]Abera, B., Hailu, A. E., Evaluation of Analgesic Activities of 80 % Methanol Leaf Extract of *Solanum incanum* L. (Solanaceae) in Mice, *J. Drug Deliv. Ther*., **2019**, *9*, 9-14. http://dx.doi.org/10.22270/jddt.v9i5.3235

[438]Enoc, W. N., Daisy, M. G., Wilbroda, O. A., Alphonse, W. W., Joseph, N. J., Maina, M. K., Antinociceptive and anti-inflammatory effects of flavonoids rich fraction of *Solanum incanum* (Lin) root extracts in mice. *J. Phytopharmacol*., **2018**, *7*, 399-403. http://www.phytopharmajournal.com/Vol7_Issue4_08.pdf

[439]Anwar, S., Pharmacological Investigation of *Solanum incanum* against *P. falciparum, L. infantum, T. cruzi and T. brucei* : A Role of Antioxidant Effect and Clinical Overview, *Biomed. Pharmacol. J*.., **2018**, *11*, 653-660. http://dx.doi.org/10.13005/bpj/1418

[440]Qureshi, Z., Khan, T., Shah, A., Wahid, F., *Solanum incanum* extract enhances wound healing and tissue regeneration in burn mice model, *Bangladesh J. Pharmacol*., **2019**, *14*, 101-106. DOI: 10.3329/bjp.v14i2.40098

[441]Mose, J. M., Kutima, H. L., Muchira, P. N., Muna, K. K., Waihenya, R., Yole, D. S., The Evaluation of the Effects of an Aqueous and Methanol Extracts of Solanum incanum on Schistosoma mansoni Infected Mice, *Asian J. Pharmaceut. Health Sci*., **2012**, *2*, 278-282. http://www.ajphs.com/sites/default/files/AsianJPharmHealthSci-2-1-278.pdf

[442]Waweru, C. M., Muthamia, J. M., Otaye, D. O., Potential of Sodom Apple (*Solanum incanum* L.) Fruit Extracts in the Management of Chilli Root Knot Disease in Nakuru County, Kenya, *Adv. Agric*., **2017**, Article ID 3849829, 5 pages. https://doi.org/10.1155/2017/3849829

[443]Madzimure, J., Nyahangare, E.T., Hamudikuwanda, H., Hove, T., Belmain, S. R., Stevenson, P. C., Mvumi, B. M., Efficacy of Strychnos spinosa (Lam.) and Solanum incanum L. aqueous fruit extracts against cattle ticks, *Trop. Anim. Health Prod*., **2013**, *45*, 1341-1347. DOI: 10.1007/s11250-013-0367-6

[444]Mvumi, C., Efficacy of Bitter Apple (*Solanum incanum*) in Relation to Contact Time for Controlling Cabbage Aphids (*Brevicoryne brassicae*), *Asian J. Crop Sci*., **2019**, *11*, 71-76. DOI: 10.3923/ajcs.2019.71.76

[445]Patel, R., Tyagi, V., Singh, R. K., Mallesha, Raju, P. S., Nutritional analysis of *Solanum incanum* L. (Bitter Brinjal) cultivated in north east region of India, *Int. J. Adv. Edu. Res*., **2018**, *3*, 130-134. http://www.educationjournal.org/archives/2018/vol3/issue2/3-2-42

[446]Auta, R., James, S. A., Auta, T., Sofa, E. M., Nutrative Value and Phytochemical Composition of Processed *Solanum incanum* (Bitter Garden Egg). *Sci. World J*., **2011**, *6*, 5-6. https://www.scienceworldjournal.org/article/view/10282

[447]Ziade, A., Alemayehu, T., Mekonnen, Y., Emiru, B., Gebremedhn, B., Milk clotting characteristics of *Solanum incanum*, *Ficus carica* and *Rhus natalensis* for cheese making in Tigray, Northern Ethiopia, *Livest. Res. Rural Dev*., **2018**, *30*, 9 pages. http://www.lrrd.org/lrrd30/4/gebrem30074.html

[448]Thaiyah, A. G., Nyaga, P. N., Maribei, J. M., Nduati, D., Mbuthia, P. G., Ngatia, T. A., Experimental *Solanum incanum* L poisoning in goats, *Bull. Anim. Health Prod. Afr*., **2010**, *58*, 35-43. DOI: 10.4314/bahpa.v58i1.57048

[449]Desta, A. H., Livestock Poisoning Plants: Identification and its Veterinary Importance in Afar Region of Ethiopia, *Open Agric. J*., **2019**, *13*, 107-115. DOI: 10.2174/1874331501913010107

[450]Indhumathi, T., Mohandass, S., Shibi, A., Acute Toxicity Study of Ethanolic Extract of *Solanum incanum*. L Fruit, *Asian J. Pharm. Clin. Res*., **2014**, *7*, 98-100. https://innovareacademics.in/journals/index.php/ajpcr/article/view/963

[451]Abebe, H., Gebre, T., Haile, A., Phytochemical Investigation on the Roots of *Solanum incanum*, Hadiya Zone, Ethiopia, *J. Med. Plants Stud*., **2014**, *2*, 83-93. http://www.plantsjournal.com/vol2Issue2/Issue_feb_2014/html/18.1.html

[452]Sundar, S., Pillai, Y. J., Phytochemical Screening and Gas Chromatograph-Mass Spectrometer Profiling in the Leaves of *Solanum incanum* L., *Asian J. Pharm. Clin. Res*., **2015**, *8*, 179-188. https://innovareacademics.in/journals/index.php/ajpcr/article/view/5246

[453]Sambo, H. S., Olatunde, A., Kiyawa, A. S., Phytochemical, Proximate and Mineral Analyses of *Solanum incanum* Fruit, *Int. J. Chem. Mater. Environ. Res*., **2016**, *3*, 8-13. https://www.ijcmer.org/IJCMER-2016-0102_Sambo%20et%20al.pdf

[454]Kumar, K., Henry, D. C., Sivakumar, K., Bioprofiling of phytochemicals and phytonutritional potentials of *Solanum incanum* L., *World Sci. News*, **2019**, *128*, 328-347. http://www.worldscientificnews.com/wp-content/uploads/2019/04/WSN-1282-2019-328-347.pdf

[455]Sundar, S., Koil, P. Y., Physicochemical Evaluation of *Solanum incanum* L, *Res. J. Pharm. Technol*., **2016**, *9*, 415-418. DOI: 10.5958/0974-360X.2016.00076.7

[456]Ahmed, I., Sahle, T., Hiya, A., Berhane, A., Melda, S., Manna, B., Phytochemical Investigation and Thin Layer Chromatographic Studies on the Fruits of *Solanum incanum* In Areza sub-zone, Zoba Debub, Eritrea, *J. Appl. Chem*., **2019**, *8*, 2142-2150. http://www.joac.info/AbstractPaper/2019/15-8-5-8A.pdf

[457]Fukuhara, K., Kubo, I., Isolation of steroidal glycoalkaloids from Solanum incanum by two countercurrent chromatographic methods, *Phytochemistry*, **1991**, *30*, 685-687. DOI: 10.1016/0031-9422(91)83753-8

[458]Al Sinani, S. S., Eltayeb, E. A., Kamal, Y. T., Khan, M. S., Ahmad, S., Variations in the cytotoxic glycoalkaloids solamargine and solasonine in different parts of the *Solanum incanum* plant during its growth and development in Oman, *J. Taibah Univ. Sci*., **2016**, *10*, 813-822. DOI: 10.1016/j.jtusci.2014.11.013

[459]Eltayeb, E. A., Al-Ansari, A. A., Roddick, J. G., Changes in the steroidal alkaloid solasodine during development of *Solanum* nigrum and *Solanum incanum*, *Phytochemistry*, **1997**, *46*, 489-494. https://doi.org/10.1016/S0031-9422(97)00323-3

[460]Afolaya, A. J., Bvenura, C., Essential Oil and Phytotoxicity Effects of *Solanum nigrum* L. on Seeds Germination of Some Vegetables, *Appl. Ecol. Environ. Res*., **2018**, *16*, 553-561. http://dx.doi.org/10.15666/aeer/1601_553561

[461]Parameswari, K., Aluru, S., Kishori, B., *In Vitro* Antibacterial Activity In The Extracts Of *Solanum Nigrum*, *Ind. Streams Res. J*., **2012**, *2*, 4 pages. DOI : 10.9780/22307850

[462]Abbas, K., Niaz, U., Hussaini, T., Saeed, M. A., Javaid, Z., Idrees, A., Rasool, S., Antimicrobial Activity of Fruits of *Solanum nigrum* and *Solanum xanthocarpum*, *Acta Pol. Pharmaceut*., **2014**, *71*, 415-421. https://www.researchgate.net/publication/262258531

[463]Rahnama, M., Fakheri, B. A., Mashhady, M. A., Saeidi, S., Jahani, S., The Antimicrobial Effects of Medicinal Plants on Pathogenic Food Bacteria, *Int. J. Infect*., **2017**, *4*, 3 pages. DOI: 10.5812/iji.40238

[464]Javadian, E., Forgani, F., Javadian, F., Investigation of Antimicrobial Activity of *Solanum nigrum* and *Saponaria officinalis* Extracts Against *Acinetobacter baumannii*, *Gene Cell Tissue*, **2019**, *6*, 5 pages. DOI: 10.5812/gct.93096

[465]Arun, T., Omprakash, S., Saravanan, P., Tadele, A., Abawa, G., Karthikeyan, M., Evaluation of Preliminary Phytochemical Constituents and Antibacterial Activity of Edible Plants against Urinary Tract Infection Causing Bacteria in Children, *J. Clin. Microbiol. Biochem. Technol*., **2017**, *3*, 024-030. https://www.peertechz.com/articles/doi10.17352-jcmbt.000022.php

[466]Venkat Kumar, S., Karpagambigai, S., JRosy P. J.,, Rajeshkumar, S., Phyto-Assisted Synthesis of Silver Nanoparticles using *Solanum Nigrum* andAntibacterial Activity Against *Salmonella Typhi* and *Staphylococcus Aureus*, *Mech. Mater. Sci. Engin. J*., **2017**, *9*, 8 pages. DOI: 10.2412/mmse.86.22.967

[467]Rajalakshmi, A., Jayachitra, A., Antioxidant, Antibacterial Effects of Solanine Isolated from *Solanum nigrum* and its Cytotoxic Activity on the HEP-2 and AGS Cell Lines, *Int. J. Pharmaceut. Sci. Res*., **2017**, *8*, 2932-2939. DOI: 10.13040/IJPSR.0975-8232.8(7).2932-39

[468]Alajmi, M. F., Alam , P., Rehman, T., Husain , F. M., Khan, A. A., Siddiqui , N. A., Hussain, A., Kalam ,A., Parvez, M. K., Interspecies Anticancer and Antimicrobial Activities of Genus *Solanum* and Estimation of Rutin by Validated UPLC-PDA Method, *Evid. Based Complement. Alter. Med*., **2018**, Article ID 6040815, 13 pages. https://doi.org/10.1155/2018/6040815

[469]Dar, K. B., Bhat, A. H., Amin, S., Zargar, M. A., Masood, A., Malik, A. H., Ganie, S. A., Evaluation of Antibacterial, Antifungal and Phytochemical Screening of *Solanum nigrum*, *Biochem. Anal. Biochem*., **2017**, *6*, 6 pages. DOI: 10.4172/2161-1009.1000309

[470]Modilal, M. R., Anandan, R., Sindhu, R., Logeshwari, M. N., Screening of *Solanum nigrum* for Its Phytochemical and Antimicrobial Activity Against Respiratory Tract Pathogens, *Int. J. Pure Appl. Zool*., **2015**, *3*, 210-215. https://www.alliedacademies.org/abstract/3619.html

[471]Muthuvel, A., Adavallan, K., Balamurugan, K., Krishnakumar, N., Biosynthesis of gold nanoparticles using *Solanum nigrum* leaf extract and screening their free radical scavenging and antibacterial properties, *Biomed. Prev. Nutr*., **2014**, *4*, 325-332. DOI: 10.1016/j.bionut.2014.03.004

[472]Venkatesan, D., Karrunakaran, C. M., Selvakumar, S., Studies on Phytochemical constituents, Functional Group Identification and Antimicrobial Activity of *Solanum nigrum* (Solanaceae), *Ethnobot. Leaflets*, **2009**, *13*, 1485-1503. https://www.researchgate.net/publication/275708665

[473]Subramanian, R., Gopinath, K., Ramaraj, J., Nagoorgani, P., Aruna, D., Bioprospecting *Solanum nigrum* Linn. (Solanaceae) as a potential source of Anti-Microbial agents against selected Bacterial strains, *Asian J. Biomed. Pharmaceut. Sci*., **2012**, *2*, 65-68. https://www.alliedacademies.org/4820.html

[474]Jasim H., Hussein, A. O., Hameed, I. H., Kareem, M. A., Characterization of alkaloid constitution and evaluation of antimicrobial activity of Solanum nigrum using gas chromatography mass spectrometry (GC-MS), *J. Pharmacog. Phytother*., **2015**, *7*, 56-72. DOI: 10.5897/JPP2015.0346

[475]Kalwar, K., Rizvi, S. A., Estimation of Total Falvonoid Contents and Antibacterial Activity from Various Parts of *Solanum nigrum* L, *Sci.Int.(Lahore)*, **2016**, *28*, 3935-3937. https://www.researchgate.net/publication/315728255

[476]Dargili, P. A., Shibi, P. A., Priya, F. S., Shazhni, J. R., Phytochemical Analysis and Assessment of Antimicrobial Activity of *Solanum nigrum*, *Int. J. Pharm. Pharmaceut. Res*., **2017**, *11*, 135-141. https://ijppr.humanjournals.com/phytochemical-analysis-and-assessment-of-antimicrobial-activity-of-solanum-nigrum/

[477]Musto, M., Potenza, G., Cellini, F., Inhibition of *Penicillium digitatum* by a crude extract from *Solanum nigrum* leaves, *Biotechnol. Agron. Soc. Environ.*, **2014**, *18*, 174-180. https://popups.uliege.be/1780-4507/index.php?id=10980

[478]Musto, M., Preliminary report on antifungal activity of a *Solanum nigrum* extract against five mycotoxin-producing fungi, *Emirates J. Food Agric*., **2015**, *27*, 825-830. DOI: 10.9755/ejfa.2015.08.578

[479]Lin, T-C., Fan, M-C.,Wang, S-Y., Huang, J-W., Identification of the Solanum nigrum Extract Component Involved in Controlling Cabbage Black Leaf Spot Disease, *J. Agric. Food Chem*., **2011**, *59*, 1667–1672. DOI: 10.1021/jf103698b

[480]Javed, T., Ashfaq, U. A., Riaz, S., Rehman, S., Riazuddin, S., In-vitro antiviral activity of *Solanum nigrum* against Hepatitis C Virus, *Virol. J*., **2011**, *8*, 7 pages. DOI: 10.1186/1743-422X-8-26

[481]Gabrani, R., Jain, R., Sharma, A., Sarethy, A. P., Dang, S., Gupta, S., Antiproliferative Effect of *Solanum nigrum* on Human Leukemic Cell Lines, *Indian J. Pharm. Sci*., **2012**, *74*, 451-453. DOI: 10.4103/0250-474X.108421

[482]Moglad, E.H., Abdalla, O.M., Koko, W.S., Saadabi, A.M., *In vitro* Anticancer Activity and Cytotoxicity of *Solanum nigrum* on Cancers and Normal Cell Lines, *Int. J. Cancer Res*., **2014**, *10*, 74-80. DOI: 10.3923/ijcr.2014.74.80

[483]Lai, Y-J., Tai, C-J., Wang, C-W., Choong, C-Y., Lee, B-H., Shi, Y-C., Tai, C-J., Anti-Cancer Activity of *Solanum nigrum* (AESN) through Suppression of Mitochondrial Function and Epithelial Mesenchymal Transition (EMT) in Breast Cancer Cells, *Molecules*, **2016**, *21*, 553-563, DOI: 10.3390/molecules21050553

[484]Jagadeeshan, S., David, D., Jisha, S., Manjula, S., Nair, S.A., *Solanum nigrum* Unripe fruit fraction attenuates Adriamycin resistance by downregulating multi-drug resistance protein (Mdr)-1 through Jak-STAT pathway, *BMC Complement. Alter. Med*., **2017**, *17*, 9 pages. DOI: 10.1186/s12906-017-1872-3

[485]Shirkavand, A., Boroujeni, Z. N., Aleyasin, S. A., *Solanum Nigrum* Anticancer Effect Through Epigenetic Modulations in Breast Cancer Cell Lines, *Curr. Cancer Ther. Rev*., **2019**, *15*, 6 pages. DOI: 10.2174/1573394715666190101114541

[486]Ling, B., Xiao, S., Yang, J., Wei, Y., Sakharkar, M.K., Yang, J., Probing the Antitumor Mechanism of *Solanum nigrum* L. Aqueous Extract against Human Breast Cancer MCF7 Cells, *Bioengineering*, **2019**, *6*, 112-125. DOI: 10.3390/bioengineering6040112

[487]Gu, X. Y., Shen, X. F., Wang, L., Wu, Z. W., Li, F., Chen, B., Zhang, G. L., Wang, M. K., Bioactive steroidal alkaloids from the fruits of *Solanum nigrum*, *Phytochemistry*, **2018**, *147*, 125-131. DOI: 10.1016/j.phytochem.2017.12.020

[488]Xiang, L., Wang, Y., Yi, X., He, X., Steroidal alkaloid glycosides and phenolics from the immature fruits of *Solanum nigrum*, *Fitoterapia*, **2019**, *137*, Article 104268, DOI: 10.1016/j.fitote.2019.104268

[489]Aboul-Enein, A. M., Abu El-Ela, F., Shalaby, E., El-Shamy, H., Potent Anticancer and Antioxidant Activities of Active Ingredients Separated from *Solanum nigrum* and *Cassia italica* Extracts, *J. Arid Land Stud*., **2014**, *24*, 145-152. https://www.researchgate.net/publication/281811206

[490]Zhang, X., Yan, Z., Xu, T., An, Z., Chen, W., Wang, X., Huang, M., Zhu, F., Solamargine derived from *Solanum nigrum* induces apoptosis of human cholangiocarcinoma QBC939 cells, *Oncolog. Lett*., **2018**, *15*, 6329-6335. DOI: 10.3892/ol.2018.8171

[491]Ahmad, R., Steroidal glycoalkaloids from *Solanum nigrum* target cytoskeletal proteins: an *in silico* analysis, *PeerJ*, **2019**, *7*, e6012, 39 pages. DOI: 10.7717/peerj.6012

[492]Huang, H. C., Syu, K.Y ., Lin, J. K., Chemical composition of *Solanum nigrum* linn extract and induction of autophagy by leaf water extract and its major flavonoids in AU565 breast cancer cells, *J. Agric. Food Chem*., **2010**, *58*, 8699-8708. DOI: 10.1021/jf101003v

[493]Ding, X., Zhu, F., Yang, Y., Li, M., Purification, antitumor activity in vitro of steroidal glycoalkaloids from black nightshade (*Solanum nigrum* L.), *Food Chem*., **2013**, *141*, 1181-1186. DOI: 10.1016/j.foodchem.2013.03.062

[494]Razali, F. N., Ismail, A., Abidin, N. Z., Shuib, A. S., Stimulatory Effects of Polysaccharide Fraction from Solanum nigrum on RAW 264.7 Murine Macrophage Cells, *PLOS ONE*, **2014**, 9, 8 pages. DOI: 10.1371/journal.pone.0108988

[495]Nath, L. R., Gorantla, J. N., Thulasidasan, A. K., Vijayakurup, V., Shah, S., Shabna, A., Joseph, S. M., Antony, J., Veena, K. S., Sundaram, S., Marelli, U. K., Lankalapalli, R. S., Anto, R. J., Evaluation of uttroside B, a saponin from *Solanum nigrum* Linn, as a promising chemotherapeutic agent against hepatocellular carcinoma, *Sci. Rep*., **2016**, *6*, 13 pages. DOI: 10.1038/srep36318

[496]Huang, Y., Yin, M., Pan, L., Yu, Q., Zhu, Q., Xu, W., Ding, B., Ji, Y., Zhou, J., *Solanum nigrum* polysaccharide inhibits tumor growth in H22-bearing mice through regulation of caspase-3 and bcl-2, *J. Cancer Res. Ther*., **2018**, *14*, S232-S236. DOI: 10.4103/0973-1482.206862

[497]Zhou, X., He, X., Wang, G., Gao, H., Zhou, G., Ye, W., Yao, X., Steroidal saponins from *Solanum nigrum*, *J. Nat. Prod*., **2006**, *69*, 1158-1163. DOI: 10.1021/np060091z

[498]Zhao, Z., Jia, Q., Wu, M-S., Xie, X., Wang, Y., Song, G., Zou, C-Y., Tang, Q., Lu, J., Huang, G., Wang, J., Lin, D-C., Koeffler, H.P., Yin J-Q., Jingnan Shen, J., Degalactotigonin, a Natural Compound from *Solanum nigrum* L., Inhibits Growth and Metastasis of Osteosarcoma through GSK3b Inactivation–Mediated Repression of the Hedgehog/Gli1 Pathway, *Clin. Cancer Res*., **2017**, *24*, 130–144. DOI: 10.1158/1078-0432.CCR-17-0692

[499]Tai, C-J., Wang, C-K., Tai, C-J., Lin, Y-F., Lin, C-S., Jian, J-Y., Chang, Y-J., Chang, C-C., Aqueous Extract of *Solanum nigrum* Leaves Induces Autophagy and Enhances Cytotoxicity of Cisplatin, Doxorubicin, Docetaxel, and 5-Fluorouracil in Human Colorectal Carcinoma Cells, *Evid. Based Complement. Alter. Med*., **2013**, Article ID 514719, 12 pages. http://dx.doi.org/10.1155/2013/514719

[500]Arai, M. A., Uchida, K., Sadhu, S. K., Ahmed, F., Ishibashi, M., Physalin H from *Solanum nigrum* as an Hh signaling inhibitor blocks GLI1–DNA-complex formation, *Beilstein J. Org. Chem*., **2014**, *10*, 134–140. DOI: 10.3762/bjoc.10.10

[501]Fu, R., Wang, X., Hu, Y., Du, H., Dong, B., Ao, S., Zhang, L., Sun, Z., Zhang, L., Lv, G., Ji, J., Solamargine inhibits gastric cancer progression by regulating the expression of lncNEAT1_2 via the MAPK signaling pathway, *Int. J. Oncol*., **2019**, *54*, 1545-1554. DOI: 10.3892/ijo.2019.4744

[502]Ravi, V., Saleem, T. S., Maiti, P. P., Gauthaman, K., Ramamurthy, J., Phytochemical and pharmacological

evaluation of *Solanum nigrum* Linn., *Afr. J. Pharm. Pharmacol*., **2009**, *3*, 454-457. https://www.researchgate.net/publication/228498255

[503]Sohrabipour, S., Kharazmi, F., Soltani, N., Kamalinejad, M., Biphasic effect of *Solanum nigrum* fruit aqueous extract on vascular mesenteric beds in non‐diabetic and streptozotocin‐induced diabetic rats, *Pharmacog. Res*., **2014**, *6*, 148-152. DOI: 10.4103/0974-8490.129036

[504]Azarkish, F., Hashemi, K., Talebi, A., Kamalinejad, M., Soltani, N.,Pouladian, N., Effect of the administration of *Solanum nigrum* fruit on prevention of diabetic nephropathy in streptozotocin-induced diabetic rats, *Pharmacog. Res*., **2017**, *9*, 325-332. DOI: 10.4103/pr.pr_47_17

[505]Sohrabipour, S., Kharazmi, F., Soltani, N., Kamalinejad, M., Effect of the administration of *Solanum nigrum* fruit on blood glucose, lipid profiles, and sensitivity of the vascular mesenteric bed to phenylephrine in streptozotocin-induced diabetic rats, *Med. Sci. Monit. Basic Res*., **2013**, *19*, 133-140. DOI: 10.12659/MSMBR.883892

[506]Dasgupta, N., Muthukumar, S. P., Murthy, P. S., *Solanum nigrum* Leaf: Natural Food Against Diabetes and its Bioactive Compounds, *Res. J. Med. Plant*, **2016**, *10*, 181-193. DOI: 10.3923/rjmp.2016.181.193

[507]Arulmozhi, V., Krishnaveni, M., Karthishwaran, K., Dhamodharan, G., Mirunalini, S., Antioxidant and antihyperlipidemic effect of *Solanum nigrum* fruit extract on the experimental model against chronic ethanol toxicity, *Pharmacog. Mag*., **2010**, *6*, 42–50. DOI: 10.4103/0973-1296.59965

[508]Peng, C-H., Cheng, J-J., Yu, M-H., Chung, D-J., Huang, C-N., Wang, C-J., *Solanum nigrum* polyphenols reduce body weight and body fat by affecting adipocyte and lipid metabolism, *Food Funct*., **2020**, *11*, 483–492. DOI: 10.1039/c9fo02240f

[509]Arunachalam, G., Subramanian, N., Pazhani, G., Karunanithi, M., Ravichandran, V., Evaluation of Anti-inflammatory Activity of Methanolic Extractof *Solanum nigrum*(Solanaceae), *Iran. J. Pharmaceut. Sci*., *2009*, 5, 151-156. http://www.ijps.ir/article_2117.html

[510]Zakaria, Z. A., Gopalan, H. K., Zainal, H., Mohd Pojan, N. H., Morsid, N. A., Aris, A., Sulaiman, M. R., Antinociceptive, anti-inflammatory and antipyretic effects of Solanum nigrum chloroform extract in animal models, *Yakugaku Zasshi*, **2006**, *126*, 1171-1178. DOI: 10.1248/yakushi.126.1171

[511]Cai, X-F., Chin, Y-W., Oh, S-R., Kwon, O-K., Ahn, K-S., Lee, H-K., Anti-inflammatory Constituents from *Solanum nigrum*, *Bull. Korean Chem. Soc*., **2010**, *31*, 199-201. DOI: 10.5012/bkcs.2010.31.01.199

[512]Patel, A., Biswas, S., Shoja, M.H., Ramalingayya, G. V., Nandakumar, K., Protective Effects of Aqueous Extract of *Solanum nigrum* Linn. Leaves in Rat Models of Oral Mucositis, *Sci. World J*., **2014**, Article ID 345939, 10 pages. http://dx.doi.org/10.1155/2014/345939

[513]Alam, M. N., Roy, S., Anisuzzaman, S. M., Rafiquzzaman, M., Antioxidant activity of the ethanolic extracts of leaves, stems and fruits of *Solanum nigrum*, *Pharmacog. Commun*., **2012**, *2*, 67-71. DOI: 10.5530/pc.2012.3.14

[514]Sharma, M., Romana, M., Menaria, J., Devi, S., Sheikh, M. A., *In Vitro* Antioxidant Potential of Various Extracts of *Solanum Nigrum* L, *Pharmaceut. Chem. J*., **2014**, *1*, 6-9. http://tpcj.org/download/Vol-1-iss-1-2014/TPCJ2014-01-01-06-09.pdf

[515]Maharana, L., Kar, D. M., Pattnaik, S., Sahua, P. K., Sudam, C. S., *In Vitro* Antioxidant Activity of Aqueous Leaf Extract of *Solanum nigrum* Linn., *Pharmacologyonline*, **2010**, *3*, 333-345. https://www.researchgate.net/publication/287465888

[516]Veerapagu, M., Jeya, K. R., Sankaranarayanan, A., Rathika, A., *In vitro* antioxidant properties of methanolic extract of *Solanum nigrum* L. fruit, *Pharm. Innov. J*., **2018**, *7*, 371-374. https://www.researchgate.net/publication/325923462

[517]Campisi, A., Acquaviva, R., Raciti, G., Duro, A., Rizzo, M., Santagati, N.A., Antioxidant Activities of Solanum nigrum L. Leaf Extracts Determined in In Vitro Cellular Models, *Foods*, **2019**, *8*, 63-74. DOI:10.3390/foods8020063

[518]Padmashree, A., Sharma, G. K., Semwal, A. D., Mahesh, C., Antioxygenic Activity of *Solanum nigrum L.* Leaves in Sunflower Oil Model System and Its Thermal Stability, *Food Nutr. Sci*., **2014**, *5*, 1022-1029. http://dx.doi.org/10.4236/fns.2014.511113

[519]El-Meligy, R. M., Awaad, A. S., Soliman, G. A., Bacha, A. B., Alafeefy, A. M., Kenawy, S. A., Prophylactic and curative anti-ulcerative colitis activity and the possible mechanisms of action of some desert plants, *J. Enzyme Inhib. Med. Chem*., **2015**, *30*, 250–258. DOI: 10.3109/14756366.2014.915394

[520]Zaidi, S. K., Ansari, S. A., Tabrez, S., Naseer, M. I., Shahwan, M. J., Banu, N., Al-Qahtani, M. H., Antioxidant Potential of *Solanum nigrum* Aqueous Leaves Extract in Modulating Restraint Stress-Induced Changes in Rat's Liver, *J. Pharm. Bioallied Sci*., **2019**, *11*, 60-68. DOI: 10.4103/jpbs.JPBS_58_18

[521]Reck, I. M., Vagula, J. M., Kwiatkowski, A., Edmar, C., Physicochemical Evaluation and Bioactive Compounds in Fruits of Solanum Nigrum L., *Int. J. Sci*., **2014**, *3*, 46-49. https://ssrn.com/abstract=2573659

[522]Sriram, P. G., Archana, P., Srinivasan, P. T., Subramanian, S., Studies on the Phytochemical Screening and Free Radical Scavenging of *Solanum nigrum* Leaves Extract, *Asian J. Pharm. Clin. Res*., **2016**, *9*, 316-321. DOI: 10.22159/ajpcr.2016.v9i6.14506

[523]Wang, S., Chu, Z., Ren, M., Jia, R., Zhao, C., Fei, D., Su, H., Fan, X., Zhang, X., Li, Y., Wang, Y., Ding, X., Identification of Anthocyanin Composition and Functional Analysis of an Anthocyanin Activator in *Solanum nigrum* Fruits, *Molecules*, **2017**, *22*, 876-889. DOI: 10.3390/molecules22060876

[524]Fahimi, S., Abdollahi, M., Mortazavi, S. A., Hajimehdipoor, H., Abdolghaffari, A. H., Rezvanfar, M. A., Wound Healing Activity of a Traditionally Used Poly Herbal Product in a Burn Wound Model in Rats, *Iran. Red Crescent Med. J*., **2015**, *17*, 8 pages. DOI: 10.5812/ircmj.19960

[525]Zaidi, S. K., Nasrul, H., Tabrez, S., Ansari, S. A., Jafri, M. A., Khan, M. S., Hasan, S., Alqahtani, M. H., Abuzenadah, A. M., Banu, N., Protective Effect of *Solanum nigrum* Leaves Extract on Immobilization Stress Induced Changes in Rat's Brain, *Evid. Based Complement. Alter. Med*., **2014**, Article ID 912450, 7 pages. http://dx.doi.org/10.1155/2014/912450

[526]Raju, K., Anbuganapathi, G., Gokulakrishnan, V., Rajkapoor, B., Jayakar, B., Manian, S., Effect of Dried Fruits of *Solanum nigrum* LINN against CCl_4-Induced Hepatic Damage in Rats, *Biol. Pharm. Bull*., **2003**, *26*, 1618-1619. DOI: 10.1248/bpb.26.1618

[527]Subash, K. R., Ramesh, K. S., Charian, B. V., Britto, F., Rao, N. J., Vijaykumar, S., Study of Hepatoprotective Activity of *Solanum nigrum* and *Cichorium intybus*, *Int. J. Pharmacol*., **2011**, *7*, 504-509. DOI: 10.3923/ijp.2011.504.509

[528]Krithika, R., Verma, R. J., Hypolipidemic and Hypoglycemic Effects of Hydroalcoholic Extract of *Solanum nigrum* Linn. in CCl_4-induced Hepatotoxicity in Mice. *Toxicol. Environ. Health Sci*., **2018**, *10*, 268–277. DOI: 10.1007/s13530-018-0375-z

[529]Krithika, R., Verma, R. J., *Solanum nigrum* confers protection against CCl_4-induced experimental hepatotoxicity by increasing hepatic protein synthesis and regulation of energy metabolism, *Clin. Phytosci*., **2019**, *5*, 8 pages. https://doi.org/10.1186/s40816-018-0096-5

[530]Sultana, S., Perwaiz, S., Iqbal, M., Athar, M., Crude extracts of hepatoprotective plants, Solanum nigrum and Cichorium intybus inhibit free radical-mediated DNA damage, *J. Ethnopharmacol*., **1995**, *45*, 189-92. DOI: 10.1016/0378-8741(94)01214-k

[531]Tai, C-J., Choong, C-Y., Shi, Y-C., Lin, Y-C., Wang, C-W., Lee, B-H., Tai, C-J., *Solanum nigrum* Protects against Hepatic

Fibrosis via Suppression of Hyperglycemia in High-Fat/Ethanol Diet-Induced Rats, *Molecules*, **2016**, *21*, 269-280. DOI: 10.3390/molecules21030269

[532]Al-Ashaal, H. A., Abduallah, H. F., Farghaly, A. A., Ali, S. A., EL-regal, N. S., Hamed, M. A., *In vitro* produced glycoalkaloids from *Solanum nigrum* L. and evaluation of their potential role as Antibilharziasis, *Asian Pac. J. Trop. Dis*., **2017**, *7*, 169-180. DOI: 10.12980/apjtd.7.2017D6-336

[533]Hammami, H., Mezghani-Jarraya, R., Damak, M., Ayadi, A., Molluscicidal Activity of Various Solvent Extracts from *Solanum nigrum* var. *villosum* Aerial Parts Against *Galba truncatula*, *Parasite*, **2011**, *18*, 63-70. http://dx.doi.org/10.1051/parasite/2011181063

[534]Mutoro, C. N., Kinyua, J., Nganga, J., Kariuki, D., Ingonga, J. M., Anjili, C. O., Efficacy of the combination of crude extracts of *Solanum nigrum* and *Plumbago capensis* on *Leishmania major*, F1000 *Res*., **2018**, *7*, 14 pages, https://doi.org/10.12688/f1000research.15955.1

[535]Rawani, A., Ghosh, A., Chandra, G., Laboratory evaluation of molluscicidal & mosquito larvicidal

activities of leaves of *Solanum nigrum* L., *Indian J. Med. Res*., **2014**, *140*, 285-295. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4216504/

[536]Rawani, A., Chowdhury, N., Ghosh, A., Laskar, S., Chandra, G., Mosquito larvicidal activity of *Solanum nigrum* berry extracts, *Indian J. Med. Res*., **2013**, *137*, 972-976. https://www.ncbi.nlm.nih.gov/pubmed/23760385

[537]Rathi, M. H., Abdulhay, H. S., The effects of alkaloid extracted of *Solanum nigrum* leaves on the biological performance of *Dialerodus citri*, *Int. J. Adv. Res*., **2013**, *1*, 794-799. http://www.journalijar.com/uploads/2013-12-04_024858_69.pdf

[538]Rawani, A., Ray, A. S., Ghosh, A., Sakar, M., Chandra, G.,Larvicidal activity of phytosteroid compounds from leaf extract of *Solanum nigrum* against *Culex vishnui* group and *Anopheles subpictus*, *BMC Res. Notes*, **2017**, *10*, 8 pages. DOI 10.1186/s13104-017-2460-9

[539]Vidhya, S., Rose, L. A., Evaluation of *Solanum nigrum* leaf extract as a corrosion inhibitor and reductant for the green synthesis of gold nanoparticles, *Int. J. Res. Dev. Pharm. L. Sci*., **2014**, *3*, 1011-1021. https://www.omicsonline.org/peer-reviewed/53620.html

[540]Dwivedi, G. K., Upadhyay, S. K., Mishra, A. K., Singh, A. K., Hyper accumulation of Cadmium in *Solanum nigrum* L. and their effects on phyto-chemicals and antioxidant enzymatic activities. *Int. J. Pharm. Sci. Res*., **2014**, *5*, 1424-1430. DOI: 10.13040/IJPSR.0975-8232.5(4).1424-30

[541]Pisco, R. R., Jimenez, D. G., Cruz, D. B., Cadmium phytoextraction with mulberry grass (*Solanum nigrum* L.) in soils grown with cocoa (*Theobroma* cacao L.), *Acta Agron*., **2018**, *67*, 420-424. https://doi.org/10.15446/acag.v67n3.68536

[542]Li, K., Yang, B., Wang, H., Xu, X., Gao, Y., Zhu, Y., Dual effects of biochar and hyperaccumulator *Solanum nigrum* L. on the remediation of Cd-contaminated soil, *PeerJ*, **2019**, *7*, 19 pages. http://doi.org/10.7717/peerj.6631

[543]Nzikou, J. M., Mvoula-Tsieri, M., Matos, L., Matouba, E., Ngakegni-Limbili, A. C., Linder, M., Desobry, S., *Solanum nigrum* L. Seeds as an Alternative Source of Edible Lipids and Nutriment in Congo Brazzaville, *J. Appl. Sci*., **2007**, *7*, 1107-1115. DOI: 10.3923/jas.2007.1107.1115

[544]Yuan, B., Byrnes, D., Giurleo, D., Villani, T., Simon, J. E., Wu, Q., Rapid screening of toxic glycoalkaloids and micronutrients in edible nightshades (*Solanum* spp.), *J. Food Drug Anal*., **2018**, *26*, 751-760. DOI: 10.1016/j.jfda.2017.10.005

[545]Ben-Abdallah, S., Caceres, L. A., Wang, Z., Renaud, B. J., Lachaal, M., Karray-Bouraoui, N., Hannoufa, A., Scott, I. M., Host plant defenses of black (*Solanum nigrum* L.) and red nightshade (*Solanum villosum* Mill.) against specialist *Solanaceae* herbivore *Leptinotarsa decemlineata* (Say). *Arch. Insect Biochem. Physiol*., **2019**; *101*, e21550. https://doi.org/10.1002/arch.21550

[546]Zhao, Y., Liu, F., Lou, H. X., Studies on the chemical constituents of *Solanum nigrum*, *J. Chin. Med. Mater*., **2010**, *33*, 555-556. https://www.researchgate.net/publication/46286978

[547]Sarma, H., Sarma, A., *Solanum nigrum* L., a Nutraceutical Enriched Herb or Invasive Weed? *Int. Conf. Environ. BioSci*., **2011**, *21*, 105-109. http://www.ipcbee.com/vol21/20--ICEBS2011P00005.pdf

[548]Aburjai, T. A., Oun, I. M., Auzi, A. A., Hudaib, M. M., Volatile Oil Constituents of Fruits and Leaves of *Solanum nigrum* L. Growing in Libya, *J. Essent. Oil-Bear. Plants*, **2014**, *17*, 397-404. DOI: 10.1080/0972060X.2014.895194

[549]Guo, S-B., Tian, Y., Jian, L-Y., Optimization of Ethanol Extraction Process of *Solanum nigrum* Linn. and Structural Confirmation of its Compounds, *Asian J. Chem*., **2014**, *26*, 4615-4618. http://dx.doi.org/10.14233/ajchem.2014.16139A

[550]Zemali, D., Ouahrani, R. M., Phytochemical Study of Selected Medicinal plant, Solanum Nigrum, the Algerian Desert, *Int. Lett. Chem. Phys. Astron*., **2014**, *1*, 25-30. https://www.scipress.com/ILCPA.20.25

[551]Udoulla, A., Bellah, F., Alam, F., Faisal, S. S., Kafi, A. H., Fuad, F., Phytochemical screening of *Solanum nigrum* L, *S. myriacanthus Dunal*, *Solanum melongena* and *Averrhoa bilimbi* in Bangladesh, *J. Med. Plants Stud*., **2016**, *4*, 35-38. http://www.plantsjournal.com/archives/ArticleId=285

[552]Taherpour, A., Khodaei, M. M., Ameen, B. A., Ghaitouli, M., Mahdizadeh, N., Amjadian, H. R., Larijani, K., Chemical composition analysis of the essential oil of *Solanum nigrum* L. by HS/SPME method and calculation of the biochemical coefficients of the components, *Arab. J. Chem*., **2017**, *10*, S2372–S2375. http://dx.doi.org/10.1016/j.arabjc.2013.08.015

[553]Mohy-Ud-Din, A., Khan, Z., Ahmad, M., Kashmiri, M. A, Chemotaxonomic Value of Alkaloids in *Solanum nigrum* Complex, *Pak. J. Bot*., **2010**, *42*, 653-660. http://www.pakbs.org/pjbot/PDFs/42(1)/PJB42(1)653.pdf

[554]Jagtap, C. Y., Prajapati, P. K., Rudrappa, H. C., Shukla, V. J., Pharmacognostic and phytochemical investigation of root of *Solanum nigrum* Linn.: An ethnomedicinally important herb, *Int. J. Green Pharm*., **2013**, *7*, 46-49. DOI: 10.4103/0973-8258.111612

[555]Gayathri, V., Karthika, A., Preliminary phytochemical screening of two medicinal plants- *Solanum nigrum* Linn. and *Leucas aspera* (Willd.) Linn, *Int. J. Pharmacog*., **2016**, *3*, 517-520. http://dx.doi.org/10.13040/IJPSR.0975-8232.IJP.3(12).517-20

[556]El-Shaboury, G. A., Haroun, S. A., Shaker, K., Badr, A**.,** Systematics Implications of GC-MS Analysis of Secondary Metabolites in the Ethanol Extract of *Solanum* Species from South West Saudi Arabia, *Egypt J. Bot*., **2017**, *57*, 429- 444. DOI: 10.21608/ejbo.2017.520.1019

[557]Chester, K., Paliwal, S., Khan, W., Ahmad, S., UPLC-ESI-MS/MS and HPTLC Method for Quantitative Estimation of Cytotoxic Glycosides and Aglycone in Bioactivity Guided Fractions of *Solanum nigrum* L., *Front. Pharmacol*., **2017**, *8*, 434-448. DOI: 10.3389/fphar.2017.00434

[558]Ramanpreet, C., Gupta, R. C., Kaur, M., Determination of Lupeol and β-Sitosterol from *Solanum nigrum* L., *J. Genet. Cell Biol*., **2019**, *2*, 68-71. https://www.researchgate.net/publication/334388809

[559]Huan, Y., Huang, Y., Zhang, H., Zhou, H., Jiu, Z., Liao, M., Study on selenium accumulation characteristics of different ploidies *Solanum nigrum*, *E3S Web Conf*., **2019**, *136*, 3 pages. https://doi.org/10.1051/e3sconf/201913607014

[560]Lin, L., Yang, W., Wei, X., Wang, Y., Zhang, L., Zhang, Y., Zhang, Z., Zhao, Y., Zhao, M., Enhancement of Solasodine Extracted from Fruits of *Solanum nigrum* L. by Microwave-Assisted Aqueous Two-Phase Extraction and Analysis by

High-Performance Liquid Chromatography, *Molecules*, **2019**, *24*, 2294-2305. DOI: 10.3390/molecules24122294

[561]Tai, B. H., Nhiem, N. X., Doan, V. V., Yen, P. H., Quang, T. H., Trang, D. T., Yen, D. T., Cuc, N. T., Kiem, P. V., Isolation of spirostanol glycosides from *Solanum nigrum*, *Vietnam J. Chem*., **2018**, *56*, 548-552. DOI: 10.1002/vjch.201800045

[562]Sammani, A., Shammaa, E., Chehna, F., Rahmo, A., The *In-Vitro* Toxic Effect of The Glycoalkaloids for Some *Solanum* Species Against The *LIM-1863* Cell Line, *Pharmacog. J*., **2014**, *6*, 23-31. https://www.researchgate.net/publication/287308774

[563]Nawwar, M.A., El-Mousallamy, A.M., Barakat, H.H., Quercetin 3-glycosides from the leaves of *Solanum nigrum*, *Phytochemistry*, **1989**, *28*, 1755-1757. DOI: 10.1016/S0031-9422(00)97839-7

[564]Tai, B. H., Doan, V. V., Yen, P. H., Nhiem, N. X., Cuc, N. T., Trang, D. T., Hang, D. T., Dung, D. T., Yen, D. T., Quang, T. H., Dang, N. H., Mai, N. T., Minh, C. V., Kiem, P. V., Two New Steroidal Alkaloid Saponins from the Whole Plants of *Solanum nigrum*, *Nat. Prod. Commun*., **2018**, *13*, 1457-1460. https://doi.org/10.1177/1934578X1801301111

[565]Sabudak, T., Ozturk, M., Alpay, E., New Bioflavonoids from *Solanum nigrum* L. by Anticholinesterase and Anti-tyrosinase Activities-guided Fractionation, *Rec. Nat. Prod*., **2017**, *11*, 130-140. https://www.researchgate.net/publication/319254383

[566]Venkatesh, R., Kalaivani, K., Bioactivity based evaluation of medicinal plant *Solanum villosum* (Mill.) in south India against diethylnitrosamine induced hepatocellular carcinoma (Funded Work), *Int. J. Pharm. BioSci*., **2019**, *10*, 90-103. http://dx.doi.org/10.22376/ijpbs.2019.10.1.b90-103

[567]Venkatesh, R., Kalaivani, K., Attenuation of DEN induced hepatocellular carcinoma by a novel synthesis of silver nanoparticles using *Solanum villosum* (Mill.) leaves, *J. Adv. Biothechnol*., **2016**, *6*, 867-881. https://rajpub.com/index.php/jbt/article/view/66

[568]Venkatesh, R., Kalaivani, K., Effect of *Solanum villosum* (Mill.) Extract and its silver nanoparticles on hematopoietic system of diethylnitrosamine-induced Hepatocellular Carcinoma in rats. *Innovare J. Health Sci*., **2017**, *5*, 13-16. https://innovareacademics.in/journals/index.php/ijhs/article/view/15459

[569]Nyaga, S. N., Mathiu, P. M., Onyango, C. M., Areba, G. O., Antidiabetic properties of *Solanum villosum* and *Solanum nigrum var sarrachoides* in a streptozotocin-induced diabetic mice model, *Int. J. Basic Clin. Pharmacol*., **2019**, *8*, 2396-2402. http://dx.doi.org/10.18203/2319-2003.ijbcp20194774

[570]Venkatesh, R., Kalaivani, K., Vidya, R., Analysis of Phytochemicals and Free Radical Scavenging Activity of *Solanu, villosum* (Mill).- A Traditional Medicinal Plant in Southern India, *World J. Pharm. Pharmaceut. Sci*., **2014**, *3*, 741-755. https://www.wjpps.com/Wjpps_controller/abstract_id/1984

[571]Rajendran, V., Rasu, V., Krishnasamy, K., Sundaram, S.K., *In vivo* Simulated *In vitro* Model of *Solanum villosum* (MILL) Using Mammalian Liver Slice Technique, *Int. J. Recent Adv. Multidisc. Res*., **2015**, *2*, 732-736. https://www.ijramr.com/sites/default/files/issues-pdf/354.pdf

[572]Chowdhury, N., Laskar, S., Chandra, G., Mosquito larvicidal and antimicrobial activity of protein of *Solanum villosum* leaves, *BMC Complement. Alternat. Med*., **2008**, *8*, 6 pages. DOI: 10.1186/1472-6882-8-62

[573]Chowdhury, N., Paramanik, M., Sarkar, N., Laskar, S., Chandra, G., Fatty Acid Analysis of Leaf and Berry of *Solanum villosum* Mill. And its Prospect as Diet and Bactericide, *Analyt. Chem. Lett*., **2015**, *5*, 260-266. DOI: 10.1080/22297928.2015.11

[574]Abdel‐Hamid, A. E., El-Dine, R.S ., Sendker, J., El-Zalabani, S. M., Meselhy, M. R., Jimenez‐Negro, E., Abdel-Naim, A. B., Metabolic Profiling of *Solanum villosum* Mill subsp. *miniatum* (bernh. ex willd.): Hepatoprotective and Antifibrotic Activity in a Rat Model of Liver Fibrosis, *Pharmacog. Mag*., **2019**, *15*, 659-670. DOI: 10.4103/pm.pm_547_18

[575]Chowdhury, N., Bhattacharjee, I., Laskar, S., Chandra, G., Efficacy of *Solanum villosum* Mill. (Solanaceae: Solanales) as a Biocontrol Agent against Fourth Instar Larvae of *Culex quinquefasciatus* Say, *Turk. J. Zool*., **2007**, *31*, 365-370. https://www.researchgate.net/publication/224775842

[576] Chowdhury, N., Ghosh, A., Chandra, G., Mosquito larvicidal activities of *Solanum villosum* berry extract against the dengue vector *Stegomyia aegypti*, *BMC Complement. Alternat. Med*., **2008**, *8*, 8 pages. DOI: 10.1186/1472-6882-8-10

[577]Chowdhury, N., Chatterjee, S. K., Laskar, S., Chandra, G., Larvicidal activity of *Solanum villosum* Mill (Solanaceae: Solanales) leaves to *Anopheles subpictus* Grassi (Diptera: Culicidae) with effect on non-target *Chironomus circumdatus* Kieffer (Diptera: Chironomidae). *J. Pest Sci*., **2009**, *82*, 13–18. DOI: 10.1007/s10340-008-0213-1

[578]Venkatesh, R., Kalaivani, K., Toxicity Assessment of Biosynthesized Silver Nanoparticles from *Solanum villosum* MILL. (Solanaceae): *In vitro* and *In vivo* Study, *Innovare J. Health Sci*., **2017**, *5*, 15-20. https://innovareacademics.in/journals/index.php/ijms/article/view/15460/9025

[579]Venkatesh, R., Kalaivani, K., Vidya, R., Toxicity assessment of ethanol extract of *Solanum villosum* (Mill) on wistar albino rats, *Int. J. Pharm. Sci. Res*., **2014**, *5*, 406-412. https://www.ijpsr.info/docs/IJPSR14-05-07-020.pdf

[580]Venkatesh, R., Vidya, R., Kalaivani, K., Gas Chromatography and Mass Spectrometry Analysis of *Solanum Villosum* (Mill) (Solanaceae), *Int. J. Pharmaceut. Sci. Res*., **2014**, *5*, 5283-5287. DOI: 10.13040/IJPSR.0975-8232.5(12).5283-87

[581]Sundaram, S., Dwivedi, P., Purwar, S., *In vitro* Evaluation of Antibacterial Activities of Crude Extracts of *Withania somnifera* (Ashwagandha) to Becterial Pathogens, *Asian J. Biotechnol*. **2011**, *3*, 194-199. DOI: 10.3923/ajbkr.2011.194.199

[582]Bokaeian, M., Fakheri, B. A., Nejad, N. M., Zarei, H., Saeidi, S., Mohasseli, T., The Effect of *Withania somnifera* Extract on Drug Resistant Strains of *Escherichia coli*, *Int. J. Infect*., **2015**, *2*, 4 pages. DOI: 10.17795/iji-23036

[583]Marslin, G., Selvakesavan, R. K., Franklin, G., Sarmento, B., Dias, A. C., Antimicrobial activity of cream incorporated with silver nanoparticles biosynthesized from *Withania somnifera*, *Int. J.Nanomed*., **2015**, *10*, 5955–5963. http://dx.doi.org/10.2147/IJN.S81271

[584]John, T., Parmar, K. A., Kotval, S. C., Jadhav, J., Biosynthesis and Characterization of Silver Nanoparticles from *Withania Somnifera* (L.) Dunal (Ashwagandha) Root Extract, *Int. J. Green Herb. Chem*., **2018**, *8*, 43-54. DOI: 10.24214/IJGHC/GC/8/1/04354

[585]Singh, G., Kumar, P., Antibacterial activity of flavonoids of *Withania somnifera* L., *Int. J. Green Pharm*., **2014**, *8*, 114-118. DOI: 10.4103/0973-8258.129585

[586]B.M., Sulaiman, A. M., Zakaria, I. H., Abdul-Jalil, M. I., Muhammad, K. I., AOS14 Phase II clinical study of combination chemotherapy with herb *Withania somnifera* (ashwagandha) in breast cancer, *Eur. J. Cancer*, **2012**, *48*, S8-S9. https://doi.org/10.1016/j.ejca.2012.02.031

[587]Khazal, K. F., Hill, D. L., Grubbs, C. J., Effect of *Withania somnifera* root extract on spontaneous estrogen receptor-negative mammary cancer in MMTV/Neu mice, *Anticancer Res*., **2014**, *34*, 6327-6332. http://ar.iiarjournals.org/content/34/11/6327.full.pdf

[588]Khazal, K. F., Hill, D. L., *Withania somnifera* extract reduces the invasiveness of MDA-MB-231 breast cancer and inhibits cytokines associated with metastasis. *J. Cancer Metastasis Treat*., **2015**, *1*, 94-100. DOI: 10.4103/2394-4722.157601

[589]Ahmed, W., Mofed, D., Zekri, A., El-Sayed, N., Rahouma, M., Sabet, S., Antioxidant activity and apoptotic induction as mechanisms of action of *Withania somnifera* (Ashwagandha) against a hepatocellular carcinoma cell line, *J. Int. Med. Res*., **2018**, *46*, 1358–1369. DOI: 10.1177/0300060517752022

[590]Sudeep, H. V., Gouthamchandra, K., Venkatesh, B. J., Prasad, K. S., Viwithan, a Standardized *Withania somnifera* Root Extract Induces Apoptosis in Murine Melanoma Cells, *Pharmacog. Mag*., **2018**, *13*, S801-S806. DOI: 10.4103/pm.pm_121_17

[591]Kim, S., Yu, J. S., Lee, J. Y., Choi, S. U., Lee, J., Kim, K. H., Cytotoxic Withanolides from the Roots of Indian Ginseng (*Withania somnifera*), *J. Nat. Prod*., **2019**, *82*, 765-773. https://doi.org/10.1021/acs.jnatprod.8b00665

[592]Raju, S. K., Basavanna, P. L., Nagesh, H. N., Shanbhag, A. D., A study on the anticonvulsant activity of *Withania somnifera* (Dunal) in albino rats, *Natl. J. Physiol. Pharm. Pharmacol*., **2017**, *7*, 17-21. DOI: 10.5455/njppp.2016.6.0615112072016

[593]Jain, J., Narayanan, V., Chaturvedi, S., Pai, S., Sunil, S., *In Vivo* Evaluation of *Withania somnifera*–Based Indian Traditional Formulation (Amukkara Choornam), Against Chikungunya Virus–Induced Morbidity and Arthralgia, *J. Evid. Based Integ. Med*., **2018**, *23*, 1-7. DOI: 10.1177/2156587218757661

[594]Kulkarni, S. K., Akula, K. K., Dhir, A., Effect of *Withania somnifera* Dunal root extract against pentylenetetrazol seizure threshold in mice: possible involvement of GABAergic system,*Indian J. Exp. Biol*., **2008**, *46*, 465-469. http://nopr.niscair.res.in/handle/123456789/4502

[595]Babu, P. V., Gokulakrishnan, A., Dhandayuthabani, R., Ameethkhan, D., Kumar, C. V., Ahamed, M. I., Protective effect of *Withania somnifera* (Solanaceae) on collagen glycation and crosslinking, Comp. Biochem. Physiol. B Biochem. Mol. Biol., **2007**, *147*, 308-313. DOI: 10.1016/j.cbpb.2007.01.011

[596]Khalili, M., The Effect of Oral Administration of *Withania Somnifera* Root on Formalin-Induced Pain in Diabetic Rats, *Basic Clin. Neurosci*., **2009**, *1*, 29-31. https://www.researchgate.net/publication/266609422

[597]Anwer, T., Sharma, M., Khan, G., Alam, M. F., Alam, N., Ali, S., Alam, S., Preventive role of *Withania somnifera* on hyperlipidemia and cardiac oxidative stress in streptozotocin induced type 2 diabetic rats, *Trop. J. Pharm. Res*., **2017**, *16*, 119-125. http://dx.doi.org/10.4314/tjpr.v16i1.15

[598]Gupta, A., Singh, S., Evaluation of anti-inflammatory effect of *Withania somnifera* root on collageninduced arthritis in rats, *Pharm. Biol*., **2014**, *52*, 308-320. DOI: 10.3109/13880209.2013.835325

[599]Khan, M. A., Subramaneyaan, M., Arora, V. K., Banerjee, B. D., Ahmed, R. S., Effect of *Withania somnifera* (Ashwagandha) root extract on amelioration of oxidative stress and autoantibodies production in collagen-induced arthritic rats. *J. Complement. Integr. Med*., **2015**, *12*, 117-125. DOI: 10.1515/jcim-2014-0075.

[600]Palash, M., Mitali, G., Kumar, M. T., Prasad, D. A., Pharmacognostic and free-radical scavenging activity in the different parts of ashwagandha [*Withania somnifera* (L. Dunal)], *Int. J. Drug Dev. Res*., **2010**, *2*, 830-843. https://www.researchgate.net/publication/215573886

[601]Usharani, P., Fatima, N., Kumar, C. U., Kishan, P. V., Evaluation of a Highly Standardized *Withania somnifera* Extract on Endothelial Dysfunction and Biomarkers of Oxidative Stress in Patients with Type 2 Diabetes Mellitus: a Randomized, Double Blind, Placebo Controlled Study, *Int. J. Ayur. Pharm. Res*., **2014**, *2*, 22-32. https://ijapr.in/index.php/ijapr/article/view/240

[602]Bhattacharya, A., Ghosal, S., Bhattacharya, S. K., Anti-oxidant effect of *Withania somnifera* glycowithanolides in chronic footshock stress-induced perturbations of oxidative free radical scavenging enzymes and lipid peroxidation in rat frontal cortex and striatum, *J. Ethnopharmacol*., **2001**, *74*, 1-6. DOI: 10.1016/s0378-8741(00)00309-3

[603]Koushik, D., Tanushree, S., Pradip, S., Nandi, D. K., Effect of Extract of *Withania Somnifera* on Dehydration-Induced Oxidative Stress-Related Uremia in Male Rats, *Saudi J. Kidney Dis. Transpl*., **2010**, *21*, 75-80. http://www.sjkdt.org/temp/SaudiJKidneyDisTranspl21175-5258828_012738.pdf

[604]Jayaprakasam, B., Padmanabhan, K., Nair, M. G., Withanamides in *Withania somnifera* fruit protect PC-12 cells from beta-amyloid responsible for Alzheimer's disease, *Phytother. Res*., **2010**, 24, 859-863. DOI: 10.1002/ptr.3033

[605]Sehgal, N., Gupta, A., Valli, R. K., Joshi, S. D., Mills, J. T., Hamel, E., Khanna, P., Jain, S. C., Thakur, S. S., Ravindranath, V., *Withania somnifera* reverses Alzheimer's disease pathology by enhancing low-density lipoprotein receptor-related protein in liver, *PNAS*, **2012**, *109*, 3510–3515. DOI: 10.1073/pnas.1112209109

[606]Gupta, G. L., Rana, A. C., Effect of *Withania somnifera* Dunal in ethanol-induced anxiolysis and withdrawal anxiety in rats, Indian *J. of Exp. Biol*., **2008**, *46*, 470-475. https://www.researchgate.net/publication/23165437

[607]Bhattacharya, S. K., Bhattacharya, A., Sairam, K., Ghosal S., Anxiolytic-antidepressant activity of *Withania somnifera* glycowithanolides: an experimental study, *Phytomedicine*, *2000*, *7*, 463-469. DOI: 10.1016/S0944-7113(00)80030-6

[608]Chandrasekhar, K., Kapoor, J., Anishetty, S., A Prospective, Randomized Double-Blind, Placebo-Controlled Study of Safety and Efficacy of High Concentration Full Spectrum Extract of *Aswagandha* Root in Reducing Stress and Anxiety in Adults, *Indian J. Psychol. Med*., **2012**, *34*, 255–262. DOI: 10.4103/0253-7176.106022

[609]Jayanthi, M. K.,, Prathima, C., Huralikuppi, J. C., Suresha, R. N., Dhar, D., Anti-Depressant Effects Of *Withania Somnifera* Fat (Ashwagandha Ghrutha) Extract In Experimental Mice, *Int. J. Pharm. BioSci*., **2012**, *3*, 33-42.

https://www.researchgate.net/publication/249656563

[610]Dumore, N. G., Umekar, M. J., Taksande B. G., Aglawe M. M., Nandkishor, R. R., *Withania somnifera* Attenuates Nicotine Induced Conditioned Place Preference in Mice, *Pharmacog. J*., **2019**, *11*, 43-47. DOI: 10.5530/pj.2019.1.8

[611]Lopresti, A. L., Smith, S. J., Malvi, H., Kodgule, R., An investigation into the stress-relieving and pharmacological actions of an ashwagandha (*Withania somnifera*) extract, *Medicine*, **2019**, *98*, 9 pages.

http://dx.doi.org/10.1097/MD.0000000000017186

[612]Gannon, J. M., Brar, J., Rai, A., Chengappa, K. N., Effects of a standardized extract of Withania somnifera (Ashwagandha) on depression and anxiety symptoms in persons with schizophrenia participating in a randomized, placebo-controlled clinical trial, *Ann. Clin. Psychiatry*, **2019**, *31*, 123-129. https://www.aacp.com/article/buy_now/?id=581

[613]Langade, D., Kanchi, S., Salve, J., Debnath, K., Ambegaokar, D., Efficacy and Safety of Ashwagandha (*Withania somnifera*) Root Extract in Insomnia and Anxiety: A Double-blind, Randomized, Placebo-controlled Study, *Cureus*, **2019**, *11*, 22 pages. DOI 10.7759/cureus.5797

[614]Bhattacharya, S. K., Goel, P. K., Kaur, R., Ghosal,S., Anti-stress activity of sitoindosides VII and VIII, new acylsteryl glycosides from *Withania somnifera*, *Phytother. Res*., **1987**, *1*, 32—37. DOI: 10.1002/ptr.2650010108

[615]Manjunath, M. J., Muralidhara, M., Standardized extract of *Withania somnifera* (Ashwagandha) markedly offsets rotenone-induced locomotor deficits, oxidative impairments and neurotoxicity in *Drosophila melanogaster*, *J. Food Sci. Technol*., **2015**, *52*, 1971–1981. DOI: 10.1007/s13197-013-1219-0

[616]Baitharu, I., Jain, V., Deep, S. N., Hota, K. B., Hota, S. K., Prasad, D., Ilavazhagan, G., *Withania somnifera* root extract ameliorates hypobaric hypoxia induced memory impairment in rats, *J. Ethnopharmacol*., *2013*, *145*, 431-441. DOI: 10.1016/j.jep.2012.10.063

[617]Shivamurthy, S., Manchukonda, R., Ramadas, D., Evaluation of learning and memory enhancing activities of protein extract of *Withania somnifera* (Ashwagandha) in Wistar albino rats, *Int. J. Basic Clin. Pharmacol*., **2016**, *5*, 453-457. http://dx.doi.org/10.18203/2319-2003.ijbcp20160761

[618]Choudhary, D., Bhattacharyya, S., Bose, S., Efficacy and Safety of Ashwagandha (*Withania somnifera* (L.) Dunal) Root Extract in Improving Memory and Cognitive Functions, *J. Diet. Suppl*., **2017**, *14*, 599-612. DOI: 10.1080/19390211.2017.1284970

[619]Girdhari, L. G., Avtar, C. R., Synergistic effect of *Withania somnifera* Dunal and L-dopa in the inhiition of haloperidol-induced catalepsy in mice, *Pharmacog. Mag*., **2009**, *5*, 46-50. http://www.phcog.com/text.asp?2009/5/19/46/59782

[620]Maheswari, T., Vijayraja, D., Natchiyar, R. K., Kalaivani, K., Rajasankar, S., Tamilselvam, K., Manivasagam, T., Synergitic Neuroprotective Effect of *Withania somnifera* Root Powder and *Mucuna pruriens* Seed Powder in Parkinsonic Mice Model, *J. Herb. Med. Toxicol*., **2010**, *4*, 63-69. https://www.researchgate.net/publication/267834352

[621]Prakash, J., Yadav, S. K., Chouhan, S., Prakash, S., Singh, S. P., Synergistic effect of *Mucuna pruriens* and *Withania somnifera* in a paraquat induced Parkinsonian mouse model, *Adv. Biosci. Biotechnol*., **2013**, *4*, 1-9. http://dx.doi.org/10.4236/abb.2013.411A2001

[622]Ahmad, M., Saleem, S., Ahmad, A. S., Ansari, M. A., Yousuf, S., Hoda, M. N., Islam, F., Neuroprotective effects of Withania somnifera on 6-hydroxydopamine induced Parkinsonism in rats, *Hum. Exp. Toxicol*., **2005**, *24*, 137-47. DOI: 10.1191/0960327105ht509oa

[623]Kuboyama, T., Tohda, C., Zhao, J., Nakamura, N., Hattori, M., Komatsu, K., Axon- or dendrite-predominant outgrowth induced by constituents from Ashwagandha, *Neuroreport*, **2002**, *13*, 1715-1720. DOI: 10.1097/00001756-200210070-00005

[624]Prakash, J., Yadav, S. K., Chouhan, S., Singh, S. P., Neuroprotective Role of *Withania somnifera* Root Extract in Maneb–Paraquat Induced Mouse Model of Parkinsonism, *Neurochem. Res*., **2013**, *38*, 972-980. DOI: 10.1007/s11064-013-1005-4

[625]Singh, M., Ramassamy, C., *In vitro* screening of neuroprotective activity of Indian medicinal plant *Withania somnifera*, *J. Nutr. Sci*., **2017**, *6*, 5 pages. DOI: 10.1017/jns.2017.48

[626]Elhadidy, M. E., Sawie, H. G., Meguid, N. A., Khadrawy, Y. A., Protective effect of ashwagandha (*Withania somnifera*) against neurotoxicity induced by aluminum chloride in rats. *Asian Pac. J. Trop. Biomed*., **2018**, *8*, 59-66. DOI: 10.4103/2221-1691.221139

[627]Gupta, M., Kaur, G., *Withania somnifera* (L.) Dunal ameliorates neurodegeneration and cognitive impairments associated with systemic inflammation, *BMC Complement. Alter. Med*., **2019**, *19*, 18 pages. https://doi.org/10.1186/s12906-019-2635-0

[628]Raja, S. S., Manivasagam, T., Sankar, V., Prakash, S., Muthusamy, R., Krishnamurti, A., Surendran S., *Withania somnifera* root extract improves catecholamines and physiological abnormalities seen in a Parkinson's disease model mouse, *J. Ethnopharmacol*., **2009**, *125*, 369-373. DOI: 10.1016/j.jep.2009.08.003

[629]Prakash, J., Chouhan, S., Yadav, S. K., Westfall, S., Rai, S. N., Singh, S. P., *Withania somnifera* Alleviates Parkinsonian Phenotypes by Inhibiting Apoptotic Pathways in Dopaminergic Neurons, *Neurochem. Res*., **2014**, *39*, 2527-2536. DOI: 10.1007/s11064-014-1443-7

[630]Chengappa, K. N., Brar, J. S., Gannon, J. M., Schlicht, P. J., Adjunctive Use of a Standardized Extract of *Withania somnifera* (Ashwagandha) to Treat Symptom Exacerbation in Schizophrenia: A Randomized, Double-Blind, Placebo-Controlled Study, *J. Clin. Psychiatry*, **2018**, *79*, 17 pages. DOI: 10.4088/JCP.17m11826

[631]Kumar, A., Meena, S., Pottabathini, R., Effect of Ashwagandha (*Withania somnifera*) against chronic constriction injury induced behavioral and biochemical alterations: Possible involvement of nitric oxide mechanism, *Int. J. Nutr. Pharmacol. Neurol*. Dis., **2014**, *4*, 131-138. DOI: 10.4103/2231-0738.132664

[632]Jahanbakhsh, S. P., Manteghi, A. A., Emami, S. A., Mahyari, S., Gholampour, B., Mohammadpour, A. H., Sahebkar, A.,Evaluation of the efficacy of *Withania somnifera* (Ashwagandha) root extract in patients with obsessive-compulsive disorder: A randomized double-blind placebocontrolled trial, *Complement. Ther. Med*., **2016**, *27*, 25-29. DOI: 10.1016/j.ctim.2016.03.018

[633]Manchanda, S., Mishra, R., Singh, S., Kaur, T., Kaur, G., Aqueous Leaf Extract of *Withania somnifera* as a Potential Neuroprotective Agent in Sleep-deprived Rats: a Mechanistic Study, *Mol. Neurobiol*., **2017**, *54*, 3050-3061. DOI: 10.1007/s12035-016-9883-5

[634]Deshpande, A., Irani, N., Balakrishnan, R., Study protocol and rationale for a prospective, randomized, double-blind, placebo-controlled study to evaluate the effects of Ashwagandha (*Withania somnifera*) extract on nonrestorative sleep, *Medicine*, **2018**, 97, 7 pages. DOI: 10.1097/MD.0000000000011299

[635]Bhattacharya, S. K., Muruganandam, A. V., Adaptogenic activity of *Withania somnifera*: an experimental study using a rat model of chronic stress, *Pharmacol. Biochem. Behav*., **2003**, *75*, 547-555. DOI: 10.1016/s0091-3057(03)00110-2

[636]Mohanty, I., Arya, D. S., Dinda, A., Talwar, K. K., Joshi, S., Gupta, S. K., Mechanisms of cardioprotective effect of *Withania somnifera* in experimentally induced myocardial infarction, *Basic Clin. Pharmacol. Toxicol*., **2004**, *94*, 184-90. DOI: 10.1111/j.1742-7843.2004.pto940405.x

[637]Gupta, S. K., Mohanty, I., Talwar, K. K., Dinda, A., Joshi, S., Bansal, P., Saxena, A., Arya, D. S., Cardioprotection from ischemia and reperfusion injury by *Withania somnifera*: A hemodynamic, biochemical and histopathological assessment, *Mol. Cell. Biochem*., **2004**, *260*, 39–47. DOI: 10.1023/b:mcbi.0000026051.16803.03

[638]Mohanty, I. R., Arya, D. S., Gupta, S. K., *Withania somnifera* provides cardioprotection and attenuates ischemia-reperfusion induced apoptosis, *Clin. Nutr*., **2008**, *7*, 635-642. DOI: 10.1016/j.clnu.2008.05.006

[639]Mohanty, I. R., Gupta, S. K., Arya, D. S., Mohanty, N., Deshmukh, Y., Medicinal Herbs can Play Significant Role in Attenuation of Ischemia and Reperfusion Injury, *J. Homeop. Ayurv. Med*., **2013**, *2*, 11 pages. DOI: 10.4172/2167-1206.1000138

[640]Hamza, A., Amin, A., Daoud, S., The protective effect of a purified extract of *Withania somnifera* against doxorubicin-induced cardiac toxicity in rats, *Cell Biol. Toxicol*., **2008**, *24*, 63–73. DOI: 10.1007/s10565-007-9016-z

[641]Choudhary, B., Shetty, A., Langade, D. G., Efficacy of *Ashwagandha* (*Withania somnifera* [L.] Dunal) in improving cardiorespiratory endurance in healthy athletic adults, *Ayu*, *2015*, *36*, 63-38. DOI: 10.4103/0974-8520.169002

[642]Kushwaha, S., Betsy, A., Chawla, P., Effect of *Ashwagandha* (*Withania somnifera*) Root Powder Supplementation in Treatment of Hypertension, *Stud. Ethno-Med*., **2012**, *6*, 111-115. DOI: 10.1080/09735070.2012.11886427

[643]Wankhede, S., Langade, D., Joshi, K., Sinha, S. R., Bhattacharyya, S., Examining the effect of *Withania somnifera* supplementation on muscle strength and recovery: a randomized controlled trial, *J. Int. Soc. Sports Nutr*., **2015**, *12*, 11 pages. DOI: 10.1186/s12970-015-0104-9

[644]Ziegenfuss, T. N., Kedia, A. W., Sandrock, J. E., Raub, B. J., Kerksick, C. M., Lopez, H. L., Effects of an Aqueous Extract of *Withania somnifera* on Strength Training Adaptations and Recovery: The STAR Trial, *Nutrients*, **2018**, *10*, 1807-1824. DOI: 10.3390/nu10111807

[645]Raj J. P., D'Cruz, J. M., Toms, T., Muralidharan, P., Rao, M., Physical endurance enhancing capacity of *Withania somnifera* root powder post-water extraction in mice, *Pharmacog. Res*., **2018**, *10*, 250-252. DOI: 10.4103/pr.pr_153_17

[646]Henley, A. B., Yang, L., Chuang, K-L., Sahuri-Arisoylu, M., Wu, L-H., Bligh, S. W., A, Bell, J.D., *Withania somnifera* Root Extract Enhances Chemotherapy through `Priming', *PLOS ONE*, **2017**, 12, 13 pages. DOI: 10.1371/journal.pone.0170917

[647]Andallu, B., Radhika B., Hypoglycemic, diuretic and hypocholesterolemic effect of winter cherry (*Withania somnifera*, Dunal) root, *Indian J. Exp. Biol*., **2000**, *38*, 607-609. https://www.researchgate.net/publication/12211068

[648]Purohit, A., Purohit, A., Eltroxin Like Mimic Action of *Withanis somnifera* Leaf Extract in Hypothyroid-Induced Rats, *Asian J. Pharm. Clin. Res*., **2018**, *11*, 280-284. http://dx.doi.org/10.22159/ajpcr.2018.v11i11.27424

[649]Choudhary, M. I., Yousuf, S., Nawaz, S.A ., Ahmed, S., ur-Rahman, A., Cholinesterase inhibiting withanolides from *Withania somnifera*, *Chem. Pharm. Bull*., **2004**, *52*, 1358-1361.DOI: 10.1248/cpb.52.1358

[650]Lopresti, A. L., Drummond, P. D., Smith, S. J., A Randomized, Double-Blind, Placebo-Controlled, Crossover Study Examining the Hormonal and Vitality Effects of Ashwagandha (*Withania somnifera*) in Aging, Overweight Males, *Am. J. Men's Health*, **2019**, *13*, 1-15. DOI: 10.1177/1557988319835985

[651]Ahmad, M. K., Mahdi, A. A., Shukla, K. K., Islam, N., Rajender, S., Madhukar, D., Shankhwar, S. N., Ahmad, S., *Withania somnifera* improves semen quality by regulating reproductive hormone levels and oxidative stress in seminal plasma of infertile males, *Fertil. Steril*., **2010**, *94*, 989-996. DOI: 10.1016/j.fertnstert.2009.04.046

[652]Mahdi, A. A., Shukla, K. K., Ahmad, M. K., Rajender, S., Shankhwar, S. N., Singh, V., Dalela, D., *Withania somnifera* Improves Semen Quality in Stress-Related Male Fertility, *Evid. Based Complement. Alter. Med*., **2011**, Article ID 576962, 9 pages. DOI: 10.1093/ecam/nep138

[653]Dongre, S., Langade, D., Bhattacharyya, S., Efficacy and Safety of Ashwagandha (*Withania somnifera*) Root Extract in Improving Sexual Function in Women: A Pilot Study, *BioMed Res.Int*., **2015**, Article ID 284154, 9 pages. http://dx.doi.org/10.1155/2015/284154

[654]Lee, D-H., Ahn, J., Jang, Y-J., Seo, H-D., Ha, T-Y., Kim, M. J., Huh, Y. H., Jung, C. H., *Withania somnifera* Extract Enhances Energy Expenditure via Improving Mitochondrial Function in Adipose Tissue and Skeletal Muscle, *Nutrients*, **2020**, *12*, 431-445. DOI: 10.3390/nu12020431

[655]Kaur, S., Chauhan, K., Sachdeva, H., Protection against experimental visceral leishmaniasis by immunostimulation with herbal drugs derived from *Withania somnifera* and *Asparagus racemosus*, *J. Med. Microbiol*., **2014**, *63*, 1328–1338. DOI: 10.1099/jmm.0.072694-0

[656]Kumar, P., Singh, R., Nazmi, A., Lakhanpal, D., Kataria, H., Kaur, G., Glioprotective Effects of Ashwagandha Leaf Extract against Lead Induced Toxicity, *BioMed Res. Int*., Volume 2014, Article ID 182029, 15 pages. http://dx.doi.org/10.1155/2014/182029

[657]Sharada, A. C., Solomon, F. E., Devi, P. U., Toxicity of *Withania Somnifera* Root Extract in Rats and Mice, *Int. J. Pharmacog*., **1993**, *31*, 205-212. DOI: 10.3109/13880209309082943

[658]Patel, S. B., Rao, N. J., Hingorani, L. L., Safety assessment of *Withania somnifera* extract standardized for Withaferin A: Acute and sub-acute toxicity study, *J. Ayurveda Integr. Med*., **2016**, *7*, 30-37. DOI: 10.1016/j.jaim.2015.08.001

[659]Antony, B., Benny, M., Kuruvilla, B. T., Gupta, N. K., Sebastian, A., Jacob, S., Acute and Sub Chronic Toxicity Studies of Purified *Withania somnifera* Extract in Rats, *Int. J. Pharm. Pharm. Sci*., **2018**, *10*, 41-46, http://dx.doi.org/10.22159/ijpps.2018v10i12.29493

[660]Birla, H., Keswani, C., Rai, S. N., Singh, S. S., Zahra, W., Dilnashin, H., Rathore, A. S., Singh, S. P., Neuroprotective effects of Withania somnifera in BPA induced-cognitive dysfunction and oxidative stress in mice, *Behav. Brain Funct., 2019*, *15*, 9 pages. DOI: 10.1186/s12993-019-0160-4

[661]Sangwan, R. S., Chaurasiya, N. D., Misra, L. N., Lal, P., Uniyal, G. C., Sharma, R., Sangwan, N. S., Suri, K. A., Qazi, G. N., Tuli, R., Phytochemical variability in commercial herbal products and preparations of *Withania somnifera* (Ashwagandha), *Curr. Sci*., **2004**, *86*, 461-465. https://www.researchgate.net/publication/235733546

[662]Khanna, P. K., Kumar, A., Ahuja, A., Kaul, M. K., Biochemical Composition of Roots of *Withania somnifera* (L.) Dunal, *Asian J. Plant Sci*., **2006**, *5*, 1061-1063. DOI: 10.3923/ajps.2006.1061.1063

[663]Gajbhiye, N. A., Makasana, J., Kumar, S., Accumulation of Three Important Bioactive Compounds in Different Plant Parts of *Withania somnifera* and its Determination by the LC–ESI-MS-MS (MRM) Method, *J. Chromatogr. Sci*., **2015**, *53*, 1749–1756. DOI: 10.1093/chromsci/bmv088

[664]Gulati, S., Madan, V. K., Singh, S., Singh, I., Dusyant, D., Chemical and Phytochemical Composition of Ashwagandha (*Withania somnifera* L.) Roots. *Asian J. Chem*., **2017**, *29*, 1683-1686. https://doi.org/10.14233/ajchem.2017.20536

[665]Khanna, K. L., Schwarting, A. E., Bobbitt, J. M., The occurrence of *iso*Pelletierine in *Withania somnifera*, *J. Pharm. Sci*., **1962**, *51*, 1194. DOI: 10.1002/jps.2600511218

[666]Kasture, S.,, Vinci, S., Ibba, F., Puddu, A., Marongiu, M., Murali, B., Pisanu, A., Lecca, D., Zernig, G., Acquas, E., *Withania somnifera* prevents morphine withdrawal-induced decrease in spine density in nucleus accumbens shell of rats: a confocal laser scanning microscopy study, *Neurotox. Res*., **2009**, *16*, 343-355. DOI: 10.1007/s12640-009-9069-2

[667]Matsuda, H., Murakami, T., Kishi, A., Yoshikawa, M., Structures of withanosides I, II, III, IV, V, VI, and VII, new withanolide glycosides, from the roots of Indian *Withania somnifera* DUNAL. and inhibitory activity for tachyphylaxis to clonidine in isolated guinea-pig ileum, *Bioorg., Med. Chem*., **2001**, *9*, 1499-1507. DOI: 10.1016/s0968-0896(01)00024-4

[668]Devkar, S.T., Kandhare, A. D., Sloley, B. D., Jagtap, S. D., Lin, J., Tam, Y. K., Katyare, S. S., Bodhankar, S. L., Hegde, M. V., Evaluation of the bioavailability of major withanolides of *Withania somnifera* using an in vitro absorption model system, *J. Adv. Pharm. Technol*. Res., **2015**, *6*, 159-164. DOI: 10.4103/2231-4040.165023.

[669]Ganzera, M., Choudhary, M. I., Khan, I. A., Quantitative HPLC analysis of withanolides in *Withania somnifera*, *Fitoterapia*, **2003**, *74*, 68-76. DOI: 10.1016/s0367-326x(02)00325-8

[670]Shalini, R., Eapen, J. K., Deepa, M. S., Physical and Phytochemical Screening of Market Samples of Ashwagandha [*Withania somnifera (Linn)* Dunal] in Kerala, *Int. J. Adv. Res*., **2018**, *5*, 2018-2024. DOI: 10.21474/IJAR01/5268

[671]de Sousa, A., AbdElgawad, H., Asard, H., Pinto, A., Soares, C., Branco-Neves, S., Braga, T., Azenha, M., Selim, S., Al Jaouni, S., Fidalgo, F., Teixeira, J., Metalaxyl Effects on Antioxidant Defenses in Leaves and Roots of *Solanum nigrum* L., *Front. Plant Sci*., **2017**, *8*, 13 pages. DOI: 10.3389/fpls.2017.01967

[672]Sun, Y., Zhao, Y., Wang, L., Lou, H., Cheng, A., Cloning and expression analysis of squalene synthase, a key enzyme involved in antifungal steroidal glycoalkaloids biosynthesis from *Solanum nigrum*, *Drug Discov. Ther*., **2012**, *6*, 242-248. DOI: 10.5582/ddt.2012.v6.5.242

[673]Li, R., Sun, G., Tang, Y., Effect of Intercropping of *Solanum nigrum* L., Tomato and Eggplant on Potassium Content under

Cadmium Stress, *IOP Conf. Ser. Earth Environ. Sci*., **2019**, *233*, 4 pages. DOI: 10.1088/1755-1315/233/4/042024

[674]Xu, J., Yin, H., Li, Y., Liu, X., Nitric Oxide Is Associated with Long-Term Zinc Tolerance in *Solanum nigrum*, *Plant Physiol*., **2010**, *154*, 1319–1334. DOI: 10.1104/pp.110.162982

[675]Huo, W., Zou, R., Wang, L., Guo, W., Zhang, D., Fan, H., Effect of different forms of N fertilizers on the hyperaccumulator *Solanum nigrum* L. and maize in intercropping mode under Cd stress, *RSC Adv*., **2018**, *8*, 40210–40218. DOI: 10.1039/c8ra07151a

[676]de Matos, C., Silva, C. T., Cunha, P. T., Gandini, E. M., Silva, D. V., Barbosa, E. A., dos Santos, J. B., Ferreira, E. A., *Nicandra physalodes* growth at different concentrations of N, P and K, *Semin. Cienc. Agrar*., **2015**, *36*, DOI: 10.5433/1679-0359.2015v36n3p1307

[677]Panayotov, N., Popova, A., Investigation of the Options to Extend the Period of Market Supply with Fruits of Cape Gooseberry (*Physalis peruviana* L.), *Acta Hort. Regiotect*., **2016**, *19*, 18-24. DOI: 10.1515/ahr-2016-0018

[678]Masinde, P. W., Wesonga, J. M., Ojiewo, C. O., Agong, S. G., Masuda, M., Plant Growth and Leaf N Content of *Solanum villosum* Genotypes in Response to Nitrogen Supply, *Dyn. Soil Dyn. Plant*., **2009**, *3*, 36-47. https://www.researchgate.net/publication/253341564

[679]Baldwin, I. T., Callahan, P. Autotoxicity and chemical defense: nicotine accumulation and carbon gain in solanaceous plants, *Oecologia*, **1993**, *94*, 534–541. DOI: 10.1007/BF00566969

[680]Wu, H., Stanton, R., Lemerle, D., Herbicidal control of *Solanum elaeagnifolium* Cav. in Australia, *Crop Prot*., **2016**, *88*, 58-64. http://dx.doi.org/10.1016/j.cropro.2016.06.001

[681]Harfi, B., Khelifi, L., Khelifi-Slaoui, M., Assaf-Ducrocq, C., Gontier, E., Tropane alkaloids GC/MS analysis and low dose elicitors' effects on hyoscyamine biosynthetic pathway in hairy roots of Algerian *Datura* species, *Sci. Rep*., **2018**, *8*, 8 pages. DOI:10.1038/s41598-018-36625-4

[682]Karimi, F., Khataee, E., Aluminum Elicits Tropane Alkaloid Production and Antioxidant System Activity in Micropropagated *Datura innoxia* Plantlets, *Acta Physiol. Plant*., **2012**, *34*, 1035-1041. DOI: 10.1007/s11738-011-0900-z

[683]Brachet, J., Cosson, L., Changes in the Total Alkaloid Content of *Datura innoxia* Mill. Subjected to Salt Stress, *J. Exp. Bot*., **1986**, 37, 650-656. https://doi.org/10.1093/jxb/37.5.650

[684]Sivakumar, T., Panneerselvam, R., Triadimefon Mediated Changes in Antioxidant and Indole Alkaloid Content it Two Species of *Datura*, *Am. J. Plant Physiol*., **2011**, *6*, 252-260. DOI: 10.3923/ajpp.2011.252.260

[685]Castillo, G., Calahorra-Oliart, A., Nunez-Farfan, J., Valverde, P. L., Arroyo, J., Cruz, L. L., Tapia-Lopez, R., Selection on tropane alkaloids in native and non-native populations of *Datura stramonium*, *Ecol. Evol*., **2019**, *9*, 10176–10184. DOI: 10.1002/ece3.5520

[686]Moreno-Pedraza, A., Gabriel, J., Treutler, H., Winkler, R., Vergara, F., Effects of Water Availability in the Soil on Tropane Alkaloid Production in Cultivated *Datura stramonium*, *Metabolites*, **2019**, *9*, 131-143. DOI: 10.3390/metabo9070131

[687]Ali, R. M, Changes in Chemical Composition of Fruits of Salinized *Datura stramonium*, *J. Islam. Acad. Sci*., **1991**, *4*, 289-292. https://www.journalagent.com/ias/pdfs/IAS_4_4_289_292.pdf

[688]Hilton, M. G., Rhodes, M. J., Factors Affecting the Growth and Hyoscyamine Production during Batch Culture of Transformed Roots of *Datura stramonium*., *Planta Med*., **1993**, *59*, 340-344. DOI: 10.1055/s-2006-959696

[689]Khandakar, J., Haraguchi, I., Yamaguchi, K., Kitamura, Y., A small-scale proteomic approach reveals a survival strategy, including a reduction in alkaloid biosynthesis, in *Hyoscyamus albus* roots subjected to iron deficiency, *Front. Plant Sci*., **2013**, *4*, 13 pages. DOI: 10.3389/fpls.2013.00331

[690]Kuroyanagi, M., Arakawa, T., Mikami, Y., Yoshida, K., Kawahar, N., Hayashi, T., Ishimaru H., Phytoalexins from hairy roots of Hyoscyamus albus treated with methyl jasmonate, *J. Nat. Prod*., **1998**, *61*, 1516-1519. DOI: 10.1021/np980214i

[691]Besher, S., Al-Ammouri, Y., Murshed, R., Production of tropan alkaloids in the in vitro and callus cultures of *Hyoscyamus aureus* and their genetic stability assessment using ISSR markers, *Physiol. Mol. Biol. Plants*, **2014**, *20*, 343–349. DOI: 10.1007/s12298-014-0242-6

[692]Abdelrazik, E., El-hamahmy, M. A., Eltamany, E. E., Abo-Elsoud, I. H., Ali, E. M., Aboseidah, A. A., Enhancement of Growth and Alkaloids Accumulation in *Hyoscyamus muticus* L. Callus Cultures by High Salt Concentration, *Rec. Pharm. Biomed. Sci*., **2019**, *3*, 26-37. DOI: 10.21608/RPBS.2019.9807.1022

[693]Abdelrazik E., El-hamahmy, M. A., Abo-Elsoud, I., Ali, E. M., Aboseidah, A. A., Effect of UV-C Radiation on Egyptian Henbane (*Hyoscyamus muticus* L.) Callus Growth and Biochemical Components, DOI: 10.21608/hjsc.2019.59845

[694]Kizil, S., Toncer, O., Sogut, T., Effect of Different Nitrogen Doses on Some Agricultural Characteristics and Alkaloid Content of *Hyoscyamus reticulatus* L. and *Hyoscyamus niger* L., *Cercetari Agronomice în Moldova*, **2017**, *50*, 83-90. DOI: 10.1515/cerce-2017-0017

[695]Asl, K. R., Hosseini, B., Sharafi, A., Palazon, J., Influence of nano-zinc oxide on tropane alkaloid production, *h6h* gene transcription and antioxidant enzyme activity in *Hyoscyamus reticulatus* L. hairy roots, *Eng. Life Sci*., **2019**, *19*, 73–89. DOI: 10.1002/elsc.201800087

[696]Moharrami, F., Hosseini, B. B., Sharafi, A., Farjaminezhad, M., Enhanced production of hyoscyamine and scopolamine from genetically transformed root culture of *Hyoscyamus reticulatus* L. elicited by iron oxide nanoparticles, *In Vitro Cell Dev. Biol. Plant*, **2017**, *53*, 104-111. DOI: 10.1007/s11627-017-9802-0

[697]Zhan, X., Liao, X., Luo, X., Zhu, Y., Feng, S., Yu, C., Lu, J., Shen, C., Wang, H., Comparative Metabolomic and Proteomic Analyses Reveal the Regulation Mechanism Underlying MeJA-Induced Bioactive Compound Accumulation in Cutleaf Groundcherry (*Physalis angulata* L.) Hairy Roots, *J. Agric. Food Chem*., **2018**, *66*, 6336-6347. DOI: 10.1021/acs.jafc.8b02502

[698]de Abreu, C. B., de Souza, M. O., Miranda, F. M., Rodrigues, T. G., Dias, F., Growth and Evaluation of Phenolic Compounds in *Physalis angulata* L. at Two Different Periods in the Bahia Reconcavo, Brazil, *J. Agric. Sci*., **2017,** *9*, 145-155. DOI: 10.5539/jas.v9n10p145

[699]Pedo, T., Carvalho, I. R., Szareski, V.J ., Troyjack, C., Pimentel, J. R., Escalera, R. A., da Silva, F. L., Peter, M., Aumonde, T. Z., Oliveira, L., Villela, F. A., Nora, L., Mauch, C. R., Physiological Growth Attributes, Productivity, Chemical Quality of the Fruits of *Physalis peruviana* Under a Foliar Mineral Supplementationm, *J. Agric. Sci*., **2019**, *11*, 561-568. DOI: 10.5539/jas.v11n1p561

[700]Al-Ashaal, H. A., Glycoalkaloids as medicinal agents from callus and regenerated plants of *Solanum nigrum* var. *judiacium*, *Comun. Sci*., *2019*, *10*, 325-337. DOI: 10.14295/CS.v10i3.2840

[701]Sutkovic, J., Ler, D., Gawwad, M. R., In vitro Production of Solasodine Alkaloid in *Solanum nigrum* Under Salinity Stress, *J. Phytol*., **2011**, *3*, 43-49. https://www.researchgate.net/publication/224282157

[702]Bhat, M. A., Ahmad, S., Aslam, J., Mujib, A., Uzzfar, M., Salinity stress enhances production of solasodine in *Solanum nigrum* L., *Chem. Pharm. Bull*., **2008**, *56*, 17-21. DOI: 10.1248/cpb.56.17

[703]Ben-Abdallah, S., Zorrig, W., Amyot, L., Renaud, J., Hannoufa, A., Lachaal, M., Karray-Bouraoui, N., Potential production of polyphenols, carotenoids and glycoalkaloids in *Solanum villosum* Mill. under salt stress, *Biologia*, **2019**, *74*, 309–324. DOI: 10.2478/s11756-018-00166-y

[704]Sivanandhan, G., Rajesh, M., Arun, M., Jeyaraj, M., Dev, G. K., Manickavasagam, M., Selvaraj, N., Ganapathi A., Optimization of carbon source for hairy root growth and withaferin A and withanone production in *Withania somnifera*, *Nat. Prod. Commun*., **2012**, *7*, 1271-1272. DOI: 10.1177/1934578x1200701005

[705]Praveen, N., Murthy, H. N., Synthesis of withanolide A depends on carbon source and medium pH in hairy root cultures of *Withania somnifera*, *Indust. Crops Prod*., **2012**, *35*, 241-243. https://doi.org/10.1016/j.indcrop.2011.07.009

[706]Hashimoto, T., Yamada, Y., Hyoscyamine 6β-Hydroxylase, a 2-Oxoglutarate-Dependent Dioxygenase, in Alkaloid-Producing Root Cultures, *Plant Physiol*., **1986**, *81*, 619-625. DOI: 10.1104/pp.81.2.619

[707]Lanoue, A., Boitel-Conti, M., Portais, J. C., Laberche, J. C., Barbotin, J. N., Christen, P., Sangwan-Norreel, B., Kinetic study of littorine rearrangement in *Datura innoxia* hairy roots by ^{13}C NMR spectroscopy, *J. Nat. Prod*., **2002**, *5*, 1131-1135. DOI: 10.1021/np010612c

[708]Robins, R. J., Abraham, T. W., Parr, A. J., Eagles, J., Walton, N. J., The Biosynthesis of Tropane Alkaloids in *Datura stramonium:* The Identity of the Intermediates between *N*-Methylpyrrolinium Salt and Tropinone, *J. Am. Chem. Soc*., **1997**, *119*, 10929-10934. DOI: 10.1021/ja964461p

[709]Lee, J-H., Jeong, B-S., Ku, J-M., Jew, S-S., Park, H-G., Total Synthesis of (+)-Hygrine via Asymmetric Phase-Transfer Catalytic Alkylation, *J. Org. Chem*., **2006**, *71*, 6690-6692. DOI: 10.1021/jo061108l

[710]Ladenburg, A.. Kunstliches Atropin, *Berichte der Dtsch. Chem. Gesellschaft*, **1879**, *12*, 941-944. https://doi.org/10.1002/cber.187901201241

[711]Dai, C., Snead, D. R., Zhang, P., Jamison, T. F., Continuous-Flow Synthesis and Purification of Atropine with Sequential In-Line Separations of Structurally Similar Impurities, *J. Flow Chem*., **2015**, *5*, 133-138. DOI: 10.1556/1846.2015.00013

[712]Nocquet, P-A., Opatz, T., Total Synthesis of (±)-Scopolamine: Challenges of the Tropane, Ring, *Eur. J. Org. Chem*., **2016**, 1156-1164. DOI: 10.1002/ejoc.201501430

[713]Mali, P. C., Singh, A. R., Isolation, characterization and evaluation of antimicrobial activity of Withanolide-A of *Withania somnifera*, *Int. J. Pharmacol. Res*., **2013**, *3*, 48-52. DOI: 10.7439/ijpr.v3i3.54

[714]Devkar, S. T., Jagtap, S. D., Katyare, S. S., Hedge, M. V., Estimation of Antioxidant Potential of Individual Components Present in Complex Mixture of *Withania somnifera* (Ashwagandha) Root Fraction by Thin-Layer Chromatography—2,2-Diphenyl-1-Picrylhdrazyl Method, *JPC-J. Planar Chromat*., **2014**, *27*, 157–161. https://doi.org/10.1556/JPC.27.2014.3.2

[715]Baitharu, I., Jain, V., Deep, S. N., Shroff, S., Sahu, J. K., Naik, P. K., Ilavazhagan, G., Withanolide A Prevents Neurodegeneration by Modulating Hippocampal Glutathione Biosynthesis during Hypoxia, *PLOS ONE*, **2014**, *9*, 17 pages. DOI: 10.1371/journal.pone.0105311

[716]Dar, N. J., Satti, N. K., Dutt, P., Hamid, A., Ahmad, M., Attenuation of Glutamate-Induced Excitotoxicity by Withanolide-A in Neuron-Like Cells: Role for PI3K/Akt/MAPK Signaling Pathway, *Mol. Neurobiol*., **2018**, *55*, 2725-2739. DOI: 10.1007/s12035-017-0515-5

[717]Crane, E. A., Heydenreuter, W., Beck, K. R., Strajhar, P., Vomacka, J., Smiesko, M., Mons, E., Barth, L., Neuburger, M., Vedani, A., Odermatt, A., Sieber, S.A., Gademann, K., Profiling withanolide A for therapeutic targets in neurodegenerative diseases, *Bioorg. Med. Chem*., 2019 Jun 15;27(12):2508-2520. DOI: 10.1016/j.bmc.2019.03.022

[718]Jana, C. K., Hoecker, J., Woods, T. M., Jessen, H. J., Neuburger, M., Gademann, K., Synthesis of withanolide A, biological evaluation of its neuritogenic properties, and studies on secretase inhibition, *Angew. Chem. Int. Ed. Engl*., **2011**, *50*, 8407-8411. DOI: 10.1002/anie.201101869

[719]Liffert, R., Hoecker, J., Jana, C. K., Woods, T. M., Burch, P., Jessen, H. J., Neuburgerb, M., Gademann, K., Withanolide A: synthesis and structural requirements for neurite outgrowth, *Chem. Sci*., **2013**, *4*, 2851-2857. DOI: 10.1039/c3sc50653c

[720]Hashimoto, T., Kohno, J., Yamada, Y., Epoxidation *in Vivo* of Hyoscyamine to Scopolamine Does Not Involve a Dehydration Step, *Plant Physiol*., **1987**, *84*, 144-147. DOI: 10.1104/pp.84.1.144

[721]Joshi, P., Misra, L., Siddique, A. A., Srivastava, M., Kumar, S., Darokar, M. P., Epoxide group relationship with cytotoxicity in withanolide derivatives from *Withania somnifera*, *Steroids*, **2014**, *79*, 19-27. http://dx.doi.org/10.1016/j.steroids.2013.10.008

[722]Kerchner, A., Frakas, A., Worldwide poisoning potential of *Brugmansia* and *Datura*, *Forensic Toxicol*., **2020**, *38*, 30-41. https://doi.org/10.1007/s11419-019-00500-2

[723]Debnath, T., Chakraverty, R., Newer insights into the Psychoactive and Pharmacological Properties of *Datura stramonium* Linn, *Glob. J. Add. Rehab. Med*., **2017**, *4*, 4 pages. DOI: 10.19080/GJARM.2017.04.555638

[724]Dhanya, C., Rather, S. A., Devipriya, V., Molecular Systematic Study of Two Solanaceous Genera Datura L. and Brugmansia Pres. Based on Its Sequences of NRDNA, *Int. J. Adv. Res*., **2018**, *6*, 1123-1133. DOI: 10.21474/IJAR01/7916

[725]Elisante, F., Ndakidemi, P. A, Allelopathic effect of *Datura stramonium* on the survival of grass and legume species in the conservation areas, *Am. J. Res. Commun*., **2014**, *2*, 27-43. http://www.usa-journals.com/wp-content/uploads/2014/01/Elisante_Vol21.pdf

[726]Qian, D., Zhao, Y., Yang, G., Huang, L., Systematic Review of Chemical Constituents in the Genus *Lycium* (Solanaceae), *Molecules*, **2017**, *22*, 911-943. DOI: 10.3390/molecules22060911

[727]Zhang, Y-J., Deng, G-F., Xu, X-R., Wu, S., Li, S., Li, H-B., Chemical Components and Bioactivities of Cape Gooseberry (*Physalis peruviana*), *Int. J. Food Nutr. Saf*., **2013**, *3*, 15-24. https://www.researchgate.net/publication/285023738

[728]Dom, M., Berghe, W. V., Ostade, X. V., Broad-spectrum antitumor properties of Withaferin A: a proteomic perspective, *RSC Med. Chem*., **2020**, *11*, 30–50. DOI: 10.1039/c9md00296k

[729]Chan, T. Y., Worldwide Occurrence and Investigations of Contamination of Herbal Medicines by Tropane Alkaloids, *Toxins*, **2017**, *9*, 284-293. DOI: 10.3390/toxins9090284

[730]Albouchi, F., Attia, M., Hanana, M., Hamrouni, L., Ethnobotanical Notes and Phytopharmacologiques on *Solanum nigrum* Linn. (Family: *Solanaceae*), *Am. J. Phytomed. Clin. Ther*., **2018**, *6*, 9 pages. DOI: 10.21767/2321-2748.100341

[731]Gerlach, G. H., *Datura innoxia* - A Potential Commercial Source of Scopolamine, *Econ. Bot*., **1948**, *2*, 436-454. DOI: 10.1007/BF02859498

[732]Raoufa, A. E., El-Wakil, H. E., Abou-Gabal, A. E., Khlifa, H. D., Production of Scopolamine and Hyoscyamine in Calli and Regenerate Cultures of *Datura metel* (L.), *J. App. Sci. Res*., **2008**, *4*, 1858-1866. https://www.researchgate.net/publication/228774119

[733]El-Said, A. H., Shebany, Y. M., Hussein, M. A., El-Dawy, E. G., Antimicrobial and L-asparaginase activities of endophytic fungi isolated from *Datura innoxia* and *Hyoscyamus muticus* medicinal plants, *Eur. J. Biol. Res*., **2016**, *6*, 135-144. http://dx.doi.org/10.5281/zenodo.56056

[734]Mazid, M., Khan, T. A., Mohammad, F., Role of secondary metabolites in defense mechanisms of plants, *Biol. Med*.,

2011, *3*, 232-249. http://www.biolmedonline.com/Articles/MAASCON-1/Vol3_2_232-249.pdf

[735]Jerzykiewicz, J., Alkaloids of Solanaceae (nightshade plants), *Postepy Biochem.*, **2007**, *53*, 280-286. https://www.researchgate.net/publication/5454091

[736]Shonle, I., Bergelson, J., Evolutionary ecology of the tropane alkaloids of *Datura stramonium* L. (*Solanaceae*), *Evolution*, **2000**, *54*, 778-788. DOI: 10.1111/j.0014-3820.2000.tb00079.x

[737]Tapfuma, K. I., Uche-Okereafor, N., Sebola, T. E., Hussan, R., Mekuto, L., Makatini, M. M., Green, E., Mavumengwana, V., Cytotoxic activity of crude extracts from *Datura stramonium*'s fungal endophytes against A549 lung carcinoma and UMG87 glioblastoma cell lines and LC-QTOF-MS/MS based metabolite profilin, *BMC Complement. Alter. Med.*, **2019**, *19*, 12 pages. https://doi.org/10.1186/s12906-019-2752-9

[738]Linder, S., A Proposal for the Use of Standardized Methods for Chlorophyll Determinations in Ecological and Eco-physiological Investigations, *Physiol. Plant.*, **1974**, *32*, 154-156. DOI: 10.1111/j.1399-3054.1974.tb03743.x

[739]Tait, M. A., Hik, D. S., Is dimethylsulfoxide a reliable solvent for extracting chlorophyll under field conditions?, *Photosynth. Res.*, **2003**, *78*, 87–91.DOI: 10.1023/A:1026045624155

[740]Goncalves, J. F., Junior, U. M., da Silva, E. A., Evaluation of a portable chlorophyll meter to estimate chlorophyll concentrations in leaves of tropical wood species from Amazonian forest, *Hoehnea*, **2008**, *35*, 185-188. https://doi.org/10.1590/S2236-89062008000200002

[741]Brito, G. G., Sofiatti, V., Brandao, Z. N., Silva, V. B., Silva, F. M., Silva, D. A., Non-destructive analysis of photosynthetic pigments in cotton plants, *Acta Sci. Agron.*, **2011**, *33*, 671-678. https://doi.org/10.4025/actasciagron.v33i4.10926

[742]Hu, X., Tanaka, A., Tanaka, R., Simple extraction methods that prevent the artifactual conversion of chlorophyll to chlorophyllide during pigment isolation from leaf samples, *Plant Methods*, **2013**, *9*, 13 pages. http://www.plantmethods.com/content/9/1/19

[743]Tanan, T. T., do Nascimento, M. N., Leite, R., Guimaraes, D. S., Spectrophotometric Determinations of Chloroplastidic Pigments in *Physalis angulata* L. Leaves Using Different Methodologies, *J. Agric. Sci.*, 2017, *9*, 117-122. DOI: 10.5539/jas.v9n11p117

[744]Bibhuti, B., Yadav, A. K., Study the Sensory Attributes and Shelf Life of Developed Digestive Pills from Makoi (*Solanum nigrum*), *J. Food Process Technol.*, **2016**, 7, 5 pages. DOI: 10.4172/2157-7110.1000622

[745]Eskandari, M., Assadi, M., Shirzadian, S., Mehregan, I., Ethnobotanical Study and Distribution of the *Solanum* Section *Solanum* Species (Solanaceae) in Iran, *J. Med. Plants*, **2019**, *18*, 85-98. https://www.researchgate.net/publication/334645320

[746]Bibhuti, B., Development and Physico-chemical analysis of digestive pills from *Makoi (Solanum nigrum)*, *IOSR J. Environ. Sci. Toxicol. Food Technol.*, **2016**, *10*, 64-68. DOI: 10.9790/2402-1008016468

[747]Zhuang, Y-W., Wu, C-E., Zhou, J-Y., Chen, X., Wu, J., Jiang, S., Peng, Y-Y., Zou, X., Liu, J-Y., Wu, D-P., Gong, T., Qi, M-H., Xue, T., Liu, S-L., Cai, H., Solasodine inhibits human colorectal cancer cells through suppression of the AKT/glycogen synthase kinase-3b/b-catenin pathway, *Cancer Sci.*, 2017, *108*, 2248–2264. DOI: 10.1111/cas.13354

[748]Patel, K., Singh, R. B., Patel, D. K., Medicinal significance, pharmacological activities, and analytical aspects of solasodine: A concise report of current scientific literature, *J. Acute Dis.*, **2013**, 92-98. DOI: 10.1016/S2221-6189(13)60106-7

[749]Putalun, W., Tanaka, H., Shoyama, Y., Rapid separation of solasodine glycosides by an immunoaffinity column using anti-solamargine monoclonal antibody, *Cytotechnology*, **1999**, *31*, 151-156. DOI: 10.1023/A:1008032524419

[750]Khandani, S. K., Mehrabani, M., Sharififar, F., Pardakhty, A., Pournamdari, M., Development of an Efficient Extraction Method for Separating Solasodine, an Steroidal Alkaloid, From an Oily Matrix: A Comparison Between LLE and SPE, *J. Pharmaceut. Res. Int.*, **2019**, *27*, Article: JPRI.48217. DOI: 10.9734/JPRI/2019/v27i230163

[751]Khandani, S. K., Mehrabani, M., Sharififar, F., Pardakhty, A., Pournamdari, M., Pakravanan, M., Development and Validation of an RP-HPLC Method for Determination of Solasodine, a Steroidal Alkaloid, *J. Young Pharm.*, **2019**, *11*, 21-25. DOI: 10.5530/jyp.2019.11.5

[752]Fuente, F. P., Nocetti, D., Sacristan, C., Ruiz, P., Guerrero, J., Jorquera, G., Uribe, E., Bucarey, J. L., Espinosa, A., Puente, L., *Physalis peruviana* L. Pulp Prevents Liver Inflammation and Insulin Resistance in Skeletal Muscles of Diet-Induced Obese Mice, *Nutrients*, **2020**, *12*, 700-710. DOI: 10.3390/nu12030700

Received: 29.04.2020.
Accepted: 04.06.2020.