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Phytochemical and Therapeutic Potential of *Physalis* species: a Review

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ABSTRACT: *The present review article disclosed the importance of specific species of genus Physalis Linn which are spreaded in all over the world and this considerable research details on different species is noteworthy for worldwide future researchers. In this article morphological, therapeutic activities phytochemicals and ethnobotanical data have been considerable records for important species of the genus Physalis L. In this extensive exploration on morphologic and phytochemical particulars for important medicinal species of Physalis, the aim of this article is to provide detailed, faithful and comprehensive information of precise species of the genus Physalis L. like; P. peruviana L., P. angulata L., P. pubescens L., P. minima L., P. longifolia Nutt., P. ixocarpa Brot , P. hispida Waterf. P. alkekengi L. According to our awareness, there is no any single or combined, helpful review details available about the specific species of genus Physalis L. estimated by using morphological, phytochemical, ethnobotanical, and therapeutic activities based aspects.*
Keywords: *Physalis species, Morphology, Phytochemicals, Therapeutic activities, Ethno-botany.*

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I. Introduction

Physalis is a genus of perennial, herbaceous or annual plant, which is mostly local plant of tropical North and South America. Few species of *Physalis* are wildly distributed in the warmer parts of the world. Some species of *Physalis* grow for its edible fruits. One or two species occur wildly in India, while three other species are cultivated (Bertoncelli *et al.*, 2017; Wealth of India, 1998). *Physalis* is the genus with great importance in the family solanaceae, due to the production of withanolides, carotenoids, polyphenols, ascorbic acid (Bertoncelli *et al.,* 2017), between them the physalins, which holds significant pharmacological activities (El-Sheikha *et al.*, 2008; Hassanien, 2011).

The name of *Physalis* is derived from the Greek word '*phusa*' which have meaning 'a bladder' after the corolla falls off the five cleft calyx greatly increases in size, thus the fruit enclose in a large, leafy bladder. The plant carries smooth dark green leaves and yellowish white flower. The fruit of *Physalis* is a round in shape and red or orange colored berry containing many flat seeds which have kidney like shaped. It grows grown freely in any garden but sufficient is found growing wild for medicinal purpose (Wealth of India, 1998).

About 120 species of genus *Physalis* spreaded all over the world and out of which six species of it are distributed in India within different geographical regions According to different literature (Sharma *at. al*., 2015; Ahmed *et. al*., 2014).

A wide variety of the different species of *Physalis* are used for hypertension, rheumatic disorder, asthma, urinary problems, tumors and mental disorders like anxiety. Specific species of it used in food, ornamental, local crafts and most common use is in the preparation of sauces (Elsa *et al*., 2013). According to the literature survey, there is no single or combined useful review report present about the specific species of genus *Physalis* L. assessed by using morphological, phytochemical, ethnobotanical and therapeutic activities based aspects from Indian (Wealth of India, 1998; Sharma *at el.* 2015).

So the present study is a prolongation of existing labours of researchers to explore the traditional knowledge, cultural practices, cytomorphological, biological and biochemical importance in these study areas with the ultimate aim of evaluating medicinal plants for diversity and utilization pattern and also to protect from disappearance of this treasure. Therefore, due to importance of different species of the genus *Physalis* L., it has been taken in to consideration for future exploration and evaluation.

II. Morphological Description of Different Species of *Physalis*

Species	Part of plant /Picture	Morphological description	References
P. peruviana	 **Flower**	Color-Yellow Shaped- bell/star & five dark brown spots near throat base – densely pubescent Length & width- (1.2-1.5×1.2-2) cm.	Bhat *et al*., 2018; Ganapathi *et al*., 1991; Fischer *et al*., 2011.
	 **Leaves**	Shape- blade cordate Length & width (5-15×3-8) cm Leaf-pubescent, base chordate, apex Acuminate	Bhat *et al*., 2018; Fischer *et al*., 2011.
	 **Fruits**	Shape-Berry, fleshy Color- yellow Diameter- (1-2)cm	Bhat *et al*., 2018; Fischer *et al*., 2011.
	 **Calyx**	Shape- Broadly campanulate Length- (4-8 mm) pubescent	Bhat *et al*., 2018; Fischer *et al*., 2011.
P. angulata	 **Flower**	Color- Yellow Shape- bell/star & five dark brown spots near throat Texture- glabrescent Size-(1.5-2×2-2.5) mm.	Bhat *et al* ., 2018; Sharma *et al*., 2015.
	 **Fruit**	Shape- Berry & fleshy Color- yellow Diameter-1.2 cm.	Bhat *et al*., 2018; Sharma *et al*., 2015.

	 **Leaves**	Shape- blade ovate-lanceolate Length & width- (4-5.5×1.5-2.5 cm) Texture- glabrescent base- oblique, wavy margins, apex- acuminate	Bhat *et al*., 2018; Sharma *et al*., 2015.
	 **Calyx**	Shape- bell, Campanulate, Length- (5-6.5)mm Texture- glabrous	Bhat *et al*., 2018; Sharma *et al*., 2015.
P. minima	 **Flower**	Color- yellow Shape- shortly tubular& pubescent Diameter- 5mm	Kumari *et al*., 2018; Ganapathi *et al*., 1991; Bhat *et al* ., 2018
	 **Fruits**	Shape- Berry, fleshy Color- orange Diameter- 6 mm in	Bhat *et al*., 2018; Ganapathi *et al*., 1991.
	 **Leaves**	Shape- blade ovate or ovate-lanceolate Size- (2-3 × 1-1.5) cm Texture- pubescent along veins Base- cuneate Apex- acuminate.	Bhat *et al*., 2018; Kumari *et al*., 2018.
	 **Calyx**	Shape- Campanulate Size-2.5-3 mm long Texture- pubescent, lobes deltate	Bhat *et al*., 2018; Kumari *et al*., 2018.
P. alkekengi	 **Flower**	Color- white, with a five-lobed Width- corolla 10–15 mm across with an inflated basal calyx.	Bahmani *et al*., 2016; https://en.wikipedia.org/wiki/*Physalis*_alkekengi

	 **Fruit**	Size- big Color- bright orange to red fruit-papery covering over it.	Bahmani *et al*., 2016; https://en.wikipedia.org/wiki/*Physalis*_alkekengi
	 **Leaves**	Color- Green Size- (6–12) cm long and (4–9) cm broad	Bahmani *et al*., 2016; https://en.wikipedia.org/wiki/*Physalis*_alkekengi
	 **Calyx**	Matures into the papery orange fruit covering Size-(4–5)cm long and broad.	Bahmani *et al*., 2016; https://en.wikipedia.org/wiki/*Physalis*_alkekengi
P. longifolia	 **Flower**	Color- Pale yellow, dark yellow or green to purple-brown spots on the base of throat. Shape- bell shaped with 5 shallow lobes. Texture- sparsely hairy on the outer surface.	Frederick., 2016; Kindscher *et al*., 2012; https://www.minnesotawildflowers.info/flower/long-leaf-ground-cherry
	 **Fruits**	Color- green turns yellow in ripen. Shape – round into a papery shell shaped, and dries as the fruit matures.	Frederick 2016; Kindscher *et al*., 2012; https://www.minnesotawildflowers.info/flower/long-leaf-ground-cherry
	 **Leaves**	Color- Medium to dark green Shape- lance-elliptic, blunt at the tip Size- (1 to 5) inches long, up to 3 inches wide Shape- toothless to irregularly toothed around the edge. Texture- hairless but may have scattered, appressed hairs especially along major veins.	Frederick 2016; Kindscher *et al*., 2012; https://www.minnesotawildflowers.info/flower/long-leaf-ground-cherry
	 **Calyx**	5 pointed lobes, is 10-veined with Hairs- minute appressed mostly just along the veins and edge.	Frederick 2016; Kindscher *et al*., 2012; https://www.minnesotawildflowers.info/flower/long-leaf-ground-cherry

P. pubescens	 **Flower**	Color- Yellow with maroon maculations with 5 distinct purple-brown spots towards base. Size- Corolla 5–angled, (1.0-1.30) mm Diameter. Anthers (1.5–2) mm long. Style (4–5) mm long.	Ganapathi *et al*., 1991; Beest *et al*., 2014.
	 **Fruit**	Shape-Berry globular to ovoid, Size-(12–15) mm diam. Seeds disc-shaped, 1.5 mm long, light brown. Pedicels 5–10 mm long	Ganapathi *et al*., 1991; Beest *et al*., 2014.
	 **Leaves**	Shape- Ovate with wavy margin, leaves alternate, lamina ovate to ovate-elliptic, cordate at base. Size- up to 10 cm long, toothed or with obtuse, triangular lobes; petiole to 7 cm long. Color- green.	Ganapathi *et al*., 1991; Beest *et al*., 2014.
	 **Calyx**	Sharply 5 angled longer than broad Size- (2.2-2.6)cm long, width (1.1-1.5)cm.	Ganapathi *et al*., 1991; Beest *et al*., 2014.
P. hispida	 **Flower**	Shape- campanulate Color- Pale yellow, center with faint or no dark spots, 5-angled to entire Size- 0.5 to 0.7 inch. stamens 5, included.	Frederick Hinton 2016; http://www.kswildflower.org/flower_details.php?flowerID=695; Dyki *et al*., 1998.
	 **Fruits**	Fruiting calyx bladdery-inflated, loose-fitting around berry, Size- 0.4 to 0.6 inch diam. Seeds numerous, reniform to ovate, somewhat flattened, minutely pitted.	Frederick Hinton 2016; Dyki *et al*., 1998; http://www.kswildflower.org/flower_details.php?flowerID=695
	 **Leaves**	Shape- Thick leaves, Cauline, alternate; petiole 0.2 to 1 inch, blade elliptic to oblanceolate Size- (1 to 2.8) inches long, width (0.16-1) inch Base & margins- attenuate entire to slightly irregularly, dentate Apex acute to obtuse.	Frederick 2016; Dyki *et al*., 1998; http://www.kswildflower.org/flower_details.php?flowerID=695

	 **Calyx**	Shape- campanulate, 5-lobed Size- (0.4- 0.6) inch, sometimes only along veins, lobes. Texture- Pubescence with long nvillous.	Frederick Hinton 2016; Dyki *et al*., 1998; http://www.kswildflower.org/flower_details.php?flowerID=695
P. ixocarpa	 **Flower**	Color- Sympetalous corolla of five bright yellow petals with a dark blue or brownish patch near the base. Stamens- Five with different height. Style- Long and thick.	Dyki *et al*., 1998; Beest *et al*., 2014.
	 **Fruits**	Shape- berry similar to tomato fruit. Size- 3-7cm diameter. Color- green, yellow or dark violet or dark purple.	Dyki *et al*., 1996; Beest *et al*., 2014.
	 **Leaf**	Shape- Leaves alternate, 1 or 2 per node (but not opposite); lamina ovate-lanceolate, cuneate at base. Size- 6 cm long, 3 cm wide, sometimes larger irregularly toothed or lobed; petiole to 6 cm long.	Dyki *et al*., 1998; Beest *et al*., 2014.
	 **Calyx**	Color- pale yellow with five dull brownish blotches. Pale green when dry. Shape- Fruiting calyx circular in section, Shape - lobes triangular, 1–2 mm long. Corolla broadly stellate to 5–angled, Size- (6–10) mm long, Anthers (1–1.5) mm long. Style (2–2.5) mm long.	Dyki *et al*., 1996; Beest *et al*., 2014.

III. Ethnobotanical Aspects of Different Species Of *Physalis*

The leaves of specific species of *Physalis* are sometimes used for treatment in inflammations of the bladder, liver and spleen. The whole cooked plant is recommended in the treatment of inflammatory processes, such as rheumatism (Hinton, 1976). Most of Amazon valleys, the juice of its fruits are used in treatment of rheumatism, fever as sedative, depurative, and also for relief of earache (Pogan, *et al*., 1989). In Taiwan, traditionally, it was used to prepare the medicine for diabetes, hepatitis, asthma and malaria. In western Africa this herb used as a traditional medicine for the treatment of cancer (Bir *et al*.,1978). It is also considered that extracts of the whole plant of *Physalis* showed antipyretic, analgesic, diuretic, anti-inflammatory, anti-rheumatic activity and in the treatment of hepatitis, sore throat, abdominal pain and cervicitis (Rao *et al.*, 197; Pedrosa., 1999). The numerous evidence proved that the different species of *Physalis* plant is traditionally used for the treatment of gout, fever, malaria, asthma, kidney and bladder diseases, jaundice, etc. (Kumar *et al*., 1989; Gupta

et al., 1981).The fruit and other aerial parts of *Physalis* used in the treatment of boils, wounds, constipation and digestive problems (Shibata *et al*., 1962).

There are six species of *Physalis* found in India and they used for various medicinal properties. *P. alkekengi* (L.) exert various medicinal values like diuretic, antimicrobial in skin and urinary disease like urinary tract infection, as abortifacient (Sharma *et al*., 2015). It is also used in kidney and bladder stone, inflammation, febrile disease, constipation, general edema, arthritis and rheumatism. *P. alkekengi* has also anti-neoplastic and anti-cancer activity.

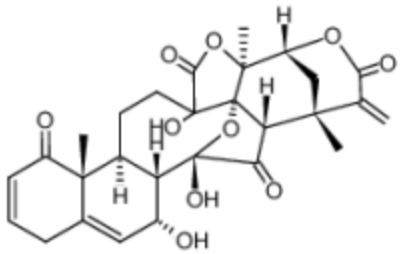
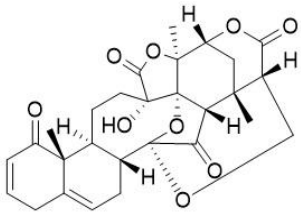
P. ixocarpa fruits are very rich in vitamin C and these fruits have antiseptic properties (Chopra *et al*., 1956; Grzybek *et al*., 1986). *P.minima* has diuretic properties and used as a tonic purgative, antifertility and antitumor agent (Purushothaman *et al*., 1997). *Physalis* minima are also used in the cure of colic, earache and paste of roots is used in treatment of backache, edema treatment and gonorrhea (Das *et al*., 1991; Jain *et al*., 1984).

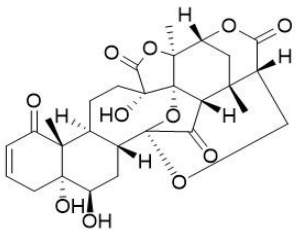
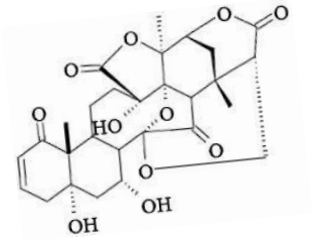
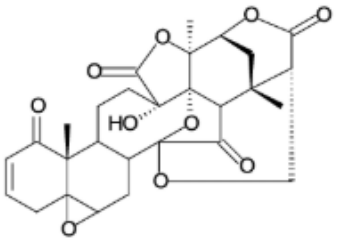
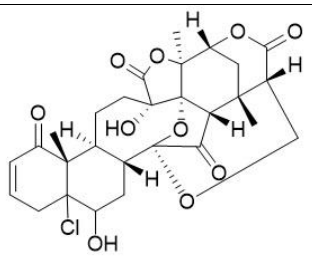
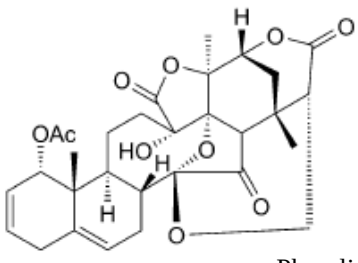
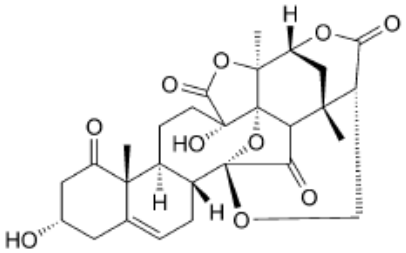
Many species of *Physalis* specially *P. longifolia* Nutt are used in the treatment of headache, stomach trouble and to cure the wounds and also used as food (Kindscher *et al*., 2012; Glimore *et al*., 1977). The leaves of *P. peruviana* reveal numerous medicinal properties, juice of the leaves used in the treatment of worm infection and the plant whole plant spacially leaves exert diuretic properties (Agarwal *et al*., 1997). *P. peruviana* is a plant with different traditional uses; the fruit juice of *P. peruviana* is directly used in the eye for treatment of common eye disease in Colombia (Garcia *et al*., 1975; Wong W. *et al*., 1978). The juice of aerial parts of *P. peruviana* has anti-diabetic activity (Sanchooli *et al*., 2011). *P. angulata* traditionally used as diuretic and cures the stomach troubles used as analgesic and anti-rheumatic. The aerial parts of *P. angulata* used in treatment of malaria, cancer and also use as anti-inflammatory for cervicitis and hepatitis (Bastos *et al*., 2006; Lin *et al*., 1992).

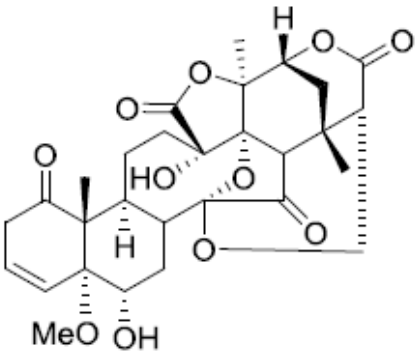
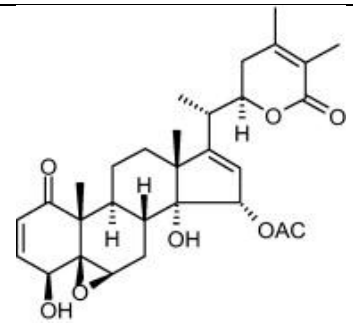
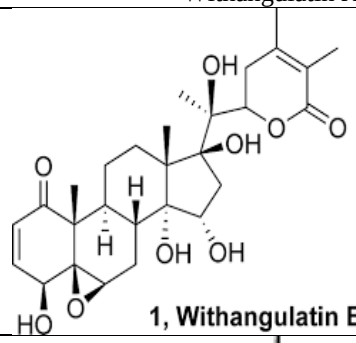
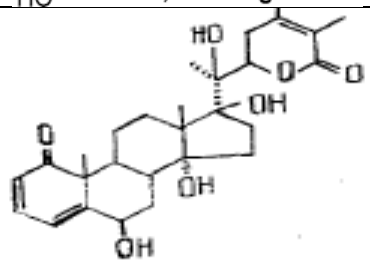
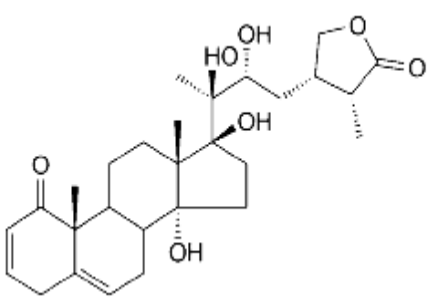
IV. Different Phytochemical Study On The Different Species Of *Physalis*

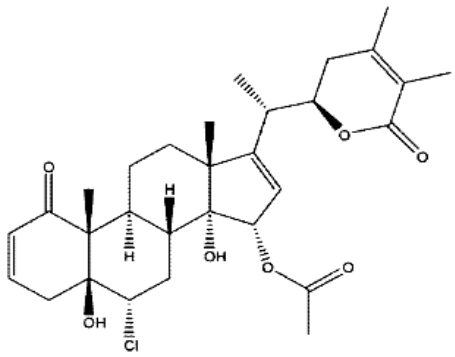
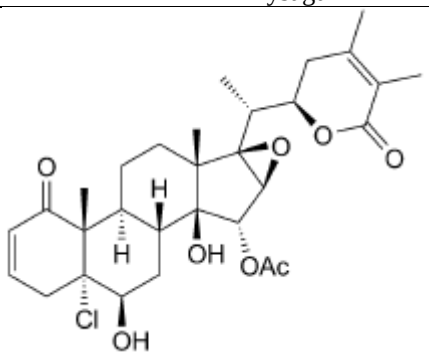
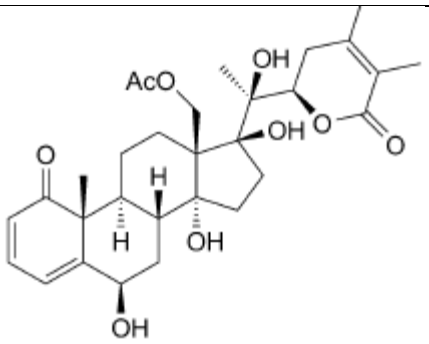
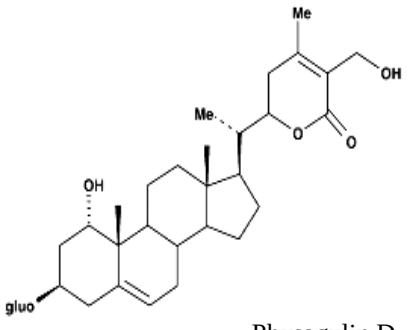
About 216 phytochemicals have been isolated from the different species of genus *Physalis* over the past two decades, including withanolides, sucrose esters, flavonoids, ceramides labdne diterpenes, and others (Zhang *et al*., 2016).

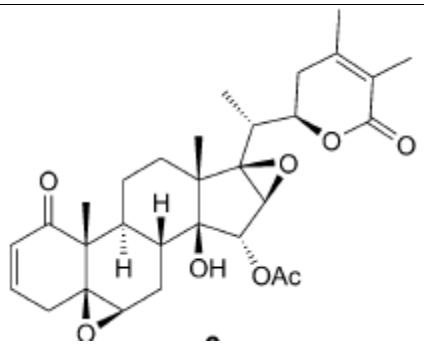
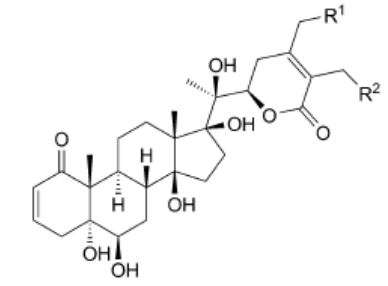
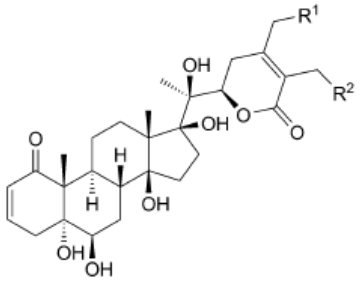
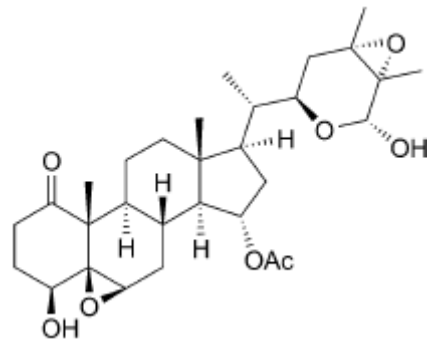
Different species of *Physalis* contain various carbohydrates, lipids, minerals, vitamins, phytosteroides etc and they contribute in the withanolide type structures. Withanolides are defined as a group of C_{28} ergostane type steroids with a C-22, 26 δ- lactone group, first isolated from genus Withania Linn. (Sharma *et al*., 2015).

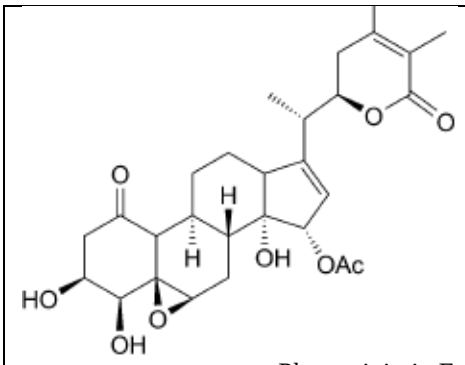
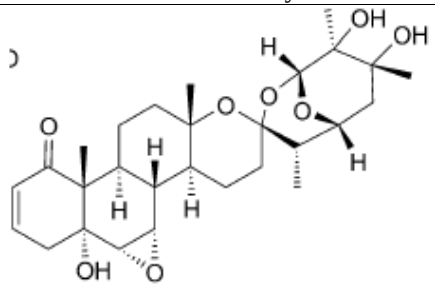
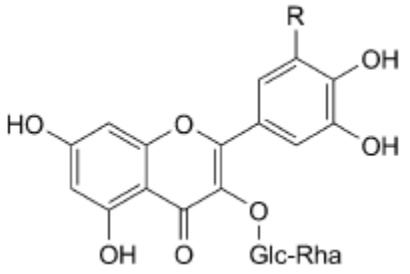
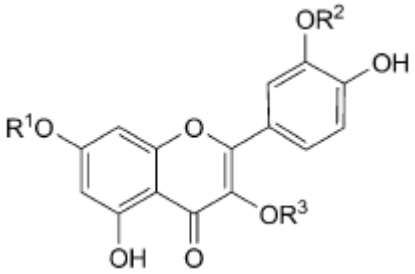
Name of chemical/Chemical Structure	Species	Activities	Reference
 Physalin A	*P. angulata*	Anti- tumor effect, anti-malarial activity, antileishmanial activity	Vasina *et al*., 1986; Wen *et al*., 2016; Fang *et al*., 2009.
 Physalin B	*P. angulata*, *P. alkekengi*	Anti-melanoma effect, antileishmanial activity, antitumor activity, antimalarial activity, anti-inflammatory effect.	Vasina *et al*., 1986; Zheng Li *et al*., 2008; Yang et al., 2016; Fang *et al*., 2009.

 Physalin D	*P. angulata*	Antitumour activity, antimicrobial activity, anti-malarial	Vasina *et al*., 1986; Magalhaes *et al*., 2005; Yang *et al*., 2016.
 Physalin E	*P. angulata*	Antitumour activity, antimicrobial activity against Gram-positive bacteria, in dermatitis.	Vasina *et al*., 1986; Anjaneyulu *et al*., 1998; Pinto *et al* 2010.
 Physalin F	*P. angulata*, *P. alkekengi*	Immunosuppressive, Antitumor effect against P388 lymphocytic leukemia, antimalarial activity, antileishmanial activity.	Cao *et al*.,; Vasina *et al*., 1986; 2014; Pinto *et al*., 2016.
 Physalin H	*P. angulata*	Immunosuppressive activity on T cells activation and proliferation both *in vitro* and *in vivo*	Vasina *et al*., 1986; Xia *et al*., 2016.
 Physalin V	*P. alkekengi*	Anti-ulcer, cytotoxic, anti- inflammatory activity.	Wang *et al*., 2018; Yang *et al*., 2016; Hong *et al*., 2014.
 Physalin Y	*P. alkekengi*	Anti-oxidant, hypoglycemic activity	Kun *et al*., 2008; Tong *et al*., 2008; Xia *et al*., 2016.

 Isophysalin	*P. alkekengi*	Cytotoxicity and antimicrobial, anti-inflammatory activity.	Yang *et al*., 2016; Li *et al*., 2017; Zold *et al*., 2017.
WHITHANOLIDES			
 Withangulatin A	*P. minima* *P. angulata*	Anticancer and Trypanocidal activity against epimastigotes.	Vasina *et al*., 1986; Lan *et al*., 2009; Guan *et al*., 2014
 1, Withangulatin B	*P. minima* *P. angulata*	Strong cytotoxic against multiple tumor cell lines, anti-inflammatory activity	Vasina *et al*., 1986; K. Abbas *et al* 2015; Guan *et al*., 2014
 Withaperuvin C	*P. minima*	Anti-inflammatory, antipyretic and cough relief, diuretic activity.	Vasina *et al*., 1986; Fang T. *et al*., 2009; Tammu *et al*., 2012.
 Perulactone B	*P. peruviana*	Cytotoxic, anti-hepatotoxic, anti-hepatoma activity.	Vasina *et al*., 1986; Karbowska *et al*., 1993; Ramadan et al., 2011.

 Physagulin A	*P. angulata*	Trypanocidal activity against epimastigotes and trypomastigotes	Vasina *et al*., 1986; Sang *et al*., 2014; Ngern *et al*., 2016.
 Physagulin I	*P. angulata*	Trypanocidal and antioxidant activity.	Sang *et al*., 2014; Rengifo *et al*., 2013; Zhang *et al*., 2016.
 Physacoztolide D	*P. coztomatl*	Antinociceptive activity, Anti malerial, Anti-trypanosoma cruzi activity.	Lin *et al*., 2016; Rengifo *et al*., 2013; Zhang *et al*., 2016.
 Physagulin D	*P. angulata*	Anti-HIV-1 protease and replicase activity.	Matsuda *et al.*, 2001; Rengifo *et al*., 2013; Keller *et al*., 2011.

 Physagulin H	*P. angulata*	Trypanocidal activity against epimastigotes and trypomastigotes of *T. cruzi in vitro*	Ding *et al*., 2014; Vasina *et al*., 1986; Ngern *et al*., 2016.
 R^1 = OH, R^2 = H Phyperunolide B	*P. peruviana*	Anti-proliferative, anti oxidant, antihipatoma, nephrotoxicity.	Ming *et al*., 2015; Hassan *et al*., 2013; Ngern *et al*., 2016.
 R^1 = H, R^2 = OH Phyperunolide D	*P. peruviana*	Antihipatoma, antitumor, anxiolytic, Anti-malarial activity.	Ming *et al*., 2015; Hassan *et al*., 2013; Xia *et al*., 2017.
 Physapubescin D	*P. pubescens*	Cytotoxic, anti- diabetic activity.	Ming *et al*., 2015; Xia *et al*., 2017; Amal *et al*., 2013.

 Physaminimin F	*P. minima*	Cough relief, CNS depressant, antileishmanial, antioxidant, diuretic activity.	Ding *et al*., 2014; Sudhakaran *et al*., 2008; Dharamveer *et al*., 2009.
 Withahisolide H	*P. hispida*	Anti-proliferative, anti-inflammatory activity.	Ding *et al*., 2014; Cao *et al*., 2014; Zhang *et al*., 2018.
FLAVONOIDS			
 R = H Rutin	*P. longifolia* *P. angulata* *P. peruviana*	Antioxidant, anti-microbial, anti-inflammatory and anti-allergic activity.	Gullon *et al*., 2017; Zhang *et al*., 2016; Choi *et al*., 2003.
 $R^1 = R^2 = R^3 = H$ Quercetin	*P. angulata, p. peruviana, p. hispida*	Antioxidant, protective effect against neurotoxicity, Hepatoprotective	Ahmed *et al*., 2014; Zhang *et al*., 2016; Ebtisam *et al*., 2014.

V. Pharmacological Activities On The Different Species Of *Physalis*

Anti-inflammatory activity: Anti-inflammatory activity of ethanolic extract of *P. alkekengi* L. calyxes studied by Ji Long and his various workers in 2012. They evaluated the anti-inflammatory activity by HRBC membrane stabilization method in different concentrations and found positive response shown by ethanolic extract (Ji Long *et al*., 2012). Khan *et al*. (2008) proven that methanolic extract of whole plant of *P. minima* shows the anti-inflammatory, antipyretic and analgesic activity. *P. angulata* L. aqueous extract prepared from the roots exhibited significant anti- inflammatory activity against Carrageenan induced inflammation (Bastos *et al*., 2008). Wu and co- workers (2006) reported that, the aqueous extract of the leaves of *P. peruviana* used for the treatment of inflammation in pterygium disease (Wu *et al*., 2006). further different fractions obtained from calyxes of *P. peruviana* showed anti-inflammatory activity in mice (Franco *et al*., 2007).

Antioxidant and cytotoxic activity- Anti-oxidant and cytotoxic activities of the aqueous and ethanolic extract of fruits and aerial parts of *P. peruviana* were estimated by using the assay methods of DPPH and MTT respectively. Aqueous extract exert potent anti oxidant activity and 0.43±0.003mg/ml the IC50 values were calculated (Horn Robeta *et al*., 2015) and for the cell lines HT-29 and SH-SY5Y for IC50 values of cytotoxicity were calculated as 40.79 and 44.24µg/ml respectively. According to these results the aerial part's extract of *P. peruviana* was found more cytotoxic than the whole plant extract (Lan *et al*., 2009). In one of the research investigation, the antioxidant properties of leaves of *P. angulata* using aqueous extract was also evaluated. The DPPH and H_2O_2 scavenging assay were used for the investigation. The leaf extracts were found to be effective (Kumar *et al*., 2017). The aqueous extract of the leaves of the *P. minima* was evaluated to study of in vitro antioxidant activity. DPPH radical scavenging assay and nitric oxide scavenging assay methods were used to investigate the antioxidant activity of this plant leaves and this plant showed significant anti- oxidant activity (Kumar *et al*., 2013). The aqueous extract of the fruits of *P. alkekengi* (Ying- Kum *et al*., 2008) and ethyl acetate extract of the fruits of *P. ixocarpa* also evaluated for their antioxidant potential (Khan *et al* ., 2018). Both the extracts exhibited potential antioxidant activity.

Diuretic activity- Jyotibasu and co-workers (2012) was proven that the methanolic extract of the *P. minima* produced significant diuretic activity in albino wister rats where furosemide was used as positive control (Jyothibasu *et al*., 2012). The diuretic activity was also evaluated in methanolic extract of *P. angulata* L leaves where extract was investigated in rats and furosemide was used as the positive control. Diuretic effect of the extract was estimated by calculating volume of urine and electrolytes viz; Na^+, K^+ & Cl^- ions content in urine and concluded results showed that *P. angulata* exert the notable diuretic activity (Nanumala *et al*., 2012).

Anti-diabetic activity- Kasali *et al*., (2013) reported that aqueous decoction prepared from the dried leaves of *P. peruviana* decrease the concentration of glucose against in the guinea pigs model as diabetes. The ethanolic extract of the entire plant of *P. pubescens* exhibited hypoglycemic effect against alloxan-induced diabetic albino rats (Hasan *et al*., 2013). Researcher and co- workers (2014), announced the *in-vitro* anti-diabetic activity of *P. angulata* fruits. Extract of fruits by powdered material of *P. angulata* were prepared by sequential maceration method by using solvents namely, *n*-hexane, $CHCl_3$, EtOAc, Ace and MeOH (Sateesh *et al*., 2014) The anti-diabetic activity was examined by inhibition of alpha amylase and alpha glucosidase enzymes and the study exposed that the methanolic extract of fruits inhibited both of the enzymes (Poojari *et al*., 2014). Haibin and co-workers proven that the aqueous extract of the fruits of *p. alkekengi* showed hypoglycemic effect on male adult Kunming mice (Tong *et al*., 2007).

Anti- bacterial activity- Melissa and co- workers compared the anti-microbial activity of *P. angulata* crude fruit extract with ZnO ointment against *Pseudomonas aeruginosa* and *Staphylococcus aureus* and ethanolic extract of plant fruits exhibited the highest inhibitory activity against *S. aureus (*Melissa *et al*., 2005). The result revealed that plant fruits extract is useful against the *S. aureus* infections (Silva T.G. Melissa *et al*., 2005). Nathiya and Dorcus worked on the antimicrobial activity of the extract of aerial parts and fruits of *P. minima* against *Bacillus cereus, Bacillus subtilis, Citrobacter* sp., *Enterobacter aerogenes, Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa, P. fluorescens* and *Staphylococcus aureus* bacterial strains. According to this study, agar well diffusion method was used. Researchers concluded the ethanolic extract of aerial parts was found to be more effective against their bacterial strains (Nathiya *et al*., 2012). The antifungal activity of the ethanolic extract of *P. alkekengi* (L.) calyces against *Microsporum canis, Candida albicans, Trichophyton mentagrophytes* and *Nocardia asteroids* were evaluated by Yang Kun and co- researchers. Ethanolic extracts showed the potent inhibition effect with minimum inhibition concentration of 15.62mg/mL for all tested fungus (Yang *et al*., 2016). The aqueous and methanolic extract of *p. longifolia* leaves were evaluated against *Bacillus subtilis, Pseudomonas aeruginosa, Klebsiella pneumonia* and *Staphylococcus aureus*. These fungal strains were found susceptible to the extract of the plant. This study rationalized the use of plant for treatment of cuts, sores and some skin diseases often reported in traditional medicine (Ghosh *et al*., 2008). Anti-microbial activity of aqueous and dichloromethane extract of whole plant of *P. peruviana* was evaluated. Both extracts of plant were tested against gram-positive and gram-negative bacteria and some *Candida* species. Disk diffusion and broth micro dilution methods were used to evaluate the antimicrobial activity of the extracts. The aqueous extract showed moderate activity against fungi and the dichloromethane extract had low activity against fungi (Kamau *et al*., 2017). Anti-microbial activity of *P. ixocarpa* calyx, fruits and aerial extract using solvents methanol and n-butanol against pathogenic bacteria and fungi, following broth dilution assay was evaluated (Khan *et al* . 2016).

Antileishmanial activity- The anti-leishmaniasis activity of methanolic extract of the aerial parts of *P. minima* was evaluated by Iqbal and co- workers. This activity of methanolic extract was tested against intracellular

amstigotes of *Leishmania amazonensis* and *Leishmania major*. Methanolic extract exhibited potent activity against leishimania (Choudhary *et al*., 2005). The leishmanicidal activity of *P. angulata* was evaluated by Renata and co- researchers. They used the ethanolic extract of stem of the plant. The results showed the potent leishmanicidal activity against the promastigoes of *Leishmania major* (Nogueira *et al*., 2013).

Anti- gastric ulcer- Effect of alcoholic extract of the leaves and fruits of *P. alkekengi* L. in rats with gastric ulcer was investigated and when compared to the aspirin, the methanolic extract of plant had significantly lower gastric ulcer formation (Wong *et at*., 2017).

CNS depressant- Dharamveer and co- researchers studied that ethanolic extract of the fruits of *p. minima* showed CNS depressant activity against actophotometer model on the male Albino mice. The locomotor activity was also studied. Ethanolic extract in doses of 50 and 100 mg/kg produced significant reduction in locomotor activity as compared to the control animals (Dharamveer *et al*., 2009).

Anti-asthmatic activity- Ethanolic extract of the *P. angulata* L. roots was used to evaluate the anti-asthmatic activity in albino mice by 'Jyothibasu *et al*.,' in 2012. Asthma was induced in rats with ovalbumin and the extract of plant inhibited ovalbumin induced asthma by decreasing the release of inflammatory mediators. The anti-asthmatic activity was due to depletion in inflammatory mediator release.

Anti-fertility activity- The anti-fertility activity of petroleum ether extract of the fresh leaves of *P. alkekengi* Linn. was studied. The extract of leaves was prepared using soxhlet extraction method with petroleum ether and the extract showed significant anti-fertility activity in Albino rats (Sudhakaran *et al*., 2008).

VI. Conclusion

The various species of *Physalis* is widely available in many areas of the world as weed and many species of *Physalis* cultivated for different purposes like medicinal, forage, ornamental, food, and other usages. The presentation can be shaped on the basis of this detailed examination of literature, that the *Physalis* species are being used traditionally, due to their broad remedial potential to treat various diseases. All species are found a rich source of bioactive compounds like different physalins, withanolides, steroids etc. with vast range of health benefits. The morphological data of described species of *Physalis* reveals that there is an massive need to find out new morphotypes for further germplasm maintenance and evaluation, because till today no attention of researchers towards these important aspects. As per all reported phytochemical data, it is concluded that there is a need to identify some more chemotypes for further herbal and allopathic drug formulations. There is huge need to isolate new bioactive components from unmarked species of the genus *Physalis* from many countries of the world. Many studies revealed noteworthy anti- oxidant, anti-asthmatic, anti-inflammatory, anti-cancer, anti-fertility, anti-bacterial, anti-diabetic activities etc. which are described in the different extracts developed from different parts of *Physalis* species. As per the recorded data and study it is cleared that eight species of *Physalis* have been immense studied on different parameters but need to do further extensive pharmacological activities on these species. Different studies and investigations exhibit that, these all species of *Physalis* mainly involved in the immunological effects. So, there pharmacological activities and identified compounds provide us a solid scientific evidence for some of the traditional therapeutic claims. A variety of phytochemicals has been isolated from the different parts of various species of *Physalis*. So, there is a very vast scope for further scientific investigation of *Physalis* species to fixed their therapeutic potency and commercial exploitation. Further, it is the first useful, short and appears to be more crucial review article for the genus *Physalis* L. from origin of India and other countries of world, which will surely help researchers for further exploration of various *Physalis* species.

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POOJA SHAH " Phytochemical and Therapeutic Potential of Physalis species: a Review. " IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 14.4 (2019): 34-51.