INTERNATIONAL JOURNAL OF APPLIED SCIENCE RESEARCH
FEDERAL POLYTECHNIC OKO, ANAMBRA STATE

Phytochemical Properties, Pharmacological Activities and Ethnomedicinal Uses of *Nicotiana tabacum* L.-A Comprehensive Review.

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Abstract

Nicotiana tabacum L. (tobacco) is a popular plant in human history and economy and it is a notable fumitory plant. Tobacco products include cigarettes, cigars, chewing tobacco, snuff, and loose pipe tobacco. All forms of tobacco contain the pyridine alkaloid, nicotine which is an extremely addictive drug that can act as both central nervous system stimulant and depressant. In addition to the alkaloid nicotine, tobacco contain other major phytochemicals such as flavonoid, tannins, saponins, terpenoids, cardiac glycosides, phenols, steroids, polypeptides, resins etc. These bioactive substances have a number of biological activities including antimicrobial, antibacterial, antifungal, antiviral, antioxidant, anthelmintic, antinociceptive, anti-Alzheimer's, peripheral nervous system activities, central nervous system and cardiovascular system activities. Various parts of *Nicotiana tabacum* such as roots, stem, leaves, flowers, fruits, and seeds are used in traditional medicine in the treatment of various human ailments such as skin diseases, bronchitis, asthma, ulcers, piles, worms, dysmenorrhea, constipation, gastrointestinal disorders, hydrocele, arthralgia, gout, lumbago etc. Therefore, the aim of this article is to comprehensively review the phytochemical properties, pharmacological activities and the ethnomedicinal uses of *Nicotiana tabacum* L.(tobacco) reported worldwide prior to end of 2020 .

Keywords: Photochemistry, Pharmacology, Ethnomedicine, Nicotine, Tobacco

Introduction

Plants have been exploited by man since time for basic necessities of life including food, clothing, shelter, landscaping, medicine, smoking and snuffing, and other numerous uses. The smoking or snuffing of plants and plant products for pleasure or narcotic or for psychological effects is predominant in various parts of the world including Nigeria. The use of leaves, seeds or latex of some plants as fumitories is common throughout the countries of the world .In fact, fumitories are plant parts or products mainly leaves and fruits which are smoked ,inhaled, chewed or snuffed for their stimulating or narcotic effects due to the presence of various alkaloids in them. Some of the fumitories are under government regulation in different countries in view of their narcotic effects.

These plants that yield fumitories are equally used in traditional medicine and as drug plants. One of the most important fumitory plants is *Nicotiana tabacum* L. It is commonly known as tobacco, and locally called "Utaba", "Anwuru" (Igbo),"Ewe taba", "Kataba", "Sobo"(Yoruba),and "Taba"(Hausa).It is an erect, perennial stout, glandular-pubescent, herbaceous plant; leaves large, pubescent, green, oblong-lanceolate ; flowers rosy or reddish, compact-shaped, in many –flowered inflorescence, usually panicled racemes; fruits capsules,1.5-1.8cm long. The plant is native to tropical and sub-tropical America and presently cultivated worldwide as a cash crop (Burkill, 2015).It grows to a height of 1 to 2m.The name tobacco is the dried and processed leaves of *Nicotiana tabacum* of the flowering plant family Solanaceae. The plant products are mainly consumed in the form of smoking, chewing, snuffing or dipping (Gilman and Xun,2004).The leaves are used in the manufacture of cigarettes, cigars, snuff, and pipe as well as chewing tobacco.

Cigarette smoking is the most common use of tobacco worldwide and it is practiced by more than 1.1 billion people with its attendant health problems. World Health Organization (WHO) proclaims tobacco use as the most simple most important preventable risk to human health in developed countries and an important cause of premature death worldwide (Ukaha *et al.*, 2012).Snuffing which is a form of smokeless tobacco involves nasal inhalation of tobacco processed into powder with addition of potassium permanganate and sometimes with mentholated products. Snuffing can also be orally by placing a pinch of it between the lower lip or cheek and gum and then suck it (Mesembe *et al.*,2008).The aim of this discourse is therefore to comprehensively review the phytochemical constituents ,pharmacological properties and the ethnomedicinal uses of *Nicotiana tabacum*(tobacco).

Methodology

Large volume of literature on the phytochemical, pharmacological and ethnomedicinal properties of *Nicotiana tabacum* L. (tobacco) was collected via electronic search engines and data bases including Science Direct, Med Grave, PubMed, Web Science, Research Gate, Google Scholar, Drug Bank, Cross Ref, MDPI, CABI Direct and World Wide Science. The materials published prior to December 2020 in the related areas of the review were accessed accordingly. The terms sought for from the search engines included "phytochemicals", "pharmacologicals" ,"ethnomedicinal", "*Nicotiana tabacum*"etc.The consulted publications were compiled as a list of References.

Phytochemical Properties of *Nicotiana tabacum* L.

Phytochemicals are certain non-nutritive plant chemicals which have some disease preventive and curative properties (Mathew *et al.*, 2012).Tremendous investigations have been carried out on the phytochemical constituents of leaves, stems, roots, flowers, seeds etc. of *Nicotiana tabacum*. Apart from nicotine alkaloids, numerous other secondary metabolites have been identified from various parts of tobacco.

With regard to leaves, Rawat and Mali (2013) reported that tobacco leaves contain several pyridine alkaloids, the principal one being a liquid alkaloid, nicotine. Okere *et al.* (2016) conducted the phytochemical screening of tobacco leaf extracts and found the presence of alkaloids, flavonoids, glycosides, reducing sugars, starch, and steroids, phenols, and tannins. Also, Sokunvary *et al.* (2017) studied the phytochemical analysis of different extracts of leaves of *Nicotiana tabacum* L. of Cambodia and reported the presence of multiple chemical constituents in the extracts. The extracts of the leaves tested positive for alkaloids, tannins, flavonoids, steroids ,terpenoids, phenols, quinines, saponins, cardiac glycosides, essential oils, resins, and polypeptides; its methanol extract gave the presence of alkaloids, phenolic compounds, tannins, flavonoids, steroids, terpenoids, cardiac glycosides, essential oils ,resins, saponins, and quinines; its ethanol extract was positively tested for alkaloids, phenolic compounds, flavonoids, steroids ,terpenoids ,essential oils, resins, saponins, quinines, and polypeptides .Oyekunle *et al.* (2019) in their investigation on the phytochemical, antimicrobial and proximate composition of *Nicotiana tabacum* leaves extracts reported the presence of high concentrations of alkaloids, phenolic compounds, flavonoids, tannins, quinines, saponins, steroids, terpenoids, and resins.

Sharma *et al.* (2016) investigating the antibacterial activity, phytochemical screening and antioxidant activity of the stem of *Nicotiana tabacum* ,revealed the presence of saponins, flavonoids, terpenoids, alkaloids, and inulin. According to them, the stem extracts also contained a high percentage of organic acids as well as glycosides, tahacinin, tahacilin, and iso-quercitrin, l-quinic, chlogenic, caffeic, and oxalic.

Roots of *Nicotiana tabacum* equally contain some bioactive compounds. For instance, Kaushik *et al.* (2012) investigated the comparative pharmacognostical evaluation and HPTL finger printing of *Nicotiana tabacum* Linn. root and found that the roots contained flavonoids, phytosterols, triterpenoids, and tannins.

Flowers of *Nicotiana tabacum* have equally been reported to be rich in bioactive substances. In this regard, quercetin-3, 3-dimethyl ether and quercetin-3-Me ether have been isolated from the flowers of tobacco and three gibberellins-nicotiana a, B, and gibberellins A and A3,have also been isolated from shoot apices and flower buds (Rawat and Mali,2013).

Seeds also contain a variety of chemical substances. Ezeja and Omeh (2010) reported that the seeds of *Nicotiana tabacum* contained cycloartanol, cycloartenol 24-daluradiol and solavetivone, cholesterol, cholest-7-enol, 24-methylene cholesterol, camp sterol, lanosterol, 31-norlanosterol, lanost-8-enol, obtusifoliol, 31-norcycloartenol, cyclo-eucalenol, granisterol, citrostadienol, β-amyrin, lupeol, cycloartanol, and 24-methylene cycloartanol.

Bioactive substances have also been isolated from the callus of *Nicotiana tabacum*. Chinnadurai *et al.* (2017) conducted the FFIR and GC-MS analysis of bioactive compounds in ethanol extract of tobacco callus. The results showed the presence of alkaloids, steroids, tannins, phenols, glycosides, and triterpenoids.

Pharmacological Activities of *Nicotiana tabacum*

The most prominent phytochemical found in tobacco as earlier noted is nicotine. The frequency and speed of tobacco consumption and abuse and the effects it has on human body is directly related to nicotine. All tobacco products, including smokeless tobacco, contain nicotine which is addictive (IARC, 2007).Moreover, among the major phytocontituents of tobacco, alkaloid was reported by Shekins *et al. (*2016) as the most biologically active component of the plant. In spite of the health challenges, the nicotine content of tobacco is reported to exhibit a number of pharmacological activities when properly used, some of which are reviewed hereunder.

Antimicrobial Activity

Reports abound on the antimicrobial activities of extracts of *Nicotiana tabacum* by being able to kill micro-organisms such as bacteria, fungi and viruses and reviewed subsequently.

1. Antibacterial Activity

Nicotiana tabacum extracts have been reported to possess potent antibacterial properties. In this perspective, Akinpelu and Obuator (2000) investigated the antibacterial activity of *Nicotiana tabacum* leaves and the results indicated that 60% methanol extract exhibited antibacterial activity against six out of nine bacterial isolates at a concentration of 25mg/l. Also, nicotine isolated from leaves of *Nicotiana tabacum* was complexed with zinc and studied for their antibacterial activity by Zaidi *et al.* (2012) against ten different strains of Gram-positive and Gram-negative bacteria. The results showed that nicotine and zinc complex are more effective against different types of bacterial strains as compared to zinc metal salt used for complexation and nicotine alone. Malik *et al.* (2015) conducted an investigation on the antibacterial activity of the extract of *Nicotiana tabacum* using three species of bacteria- *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. The findings showed that the tobacco inhibited the growth of the bacteria where *S.aureus* had the highest diameter of inhibition(26mm) at the highest plant concentration while the minimum plant extract concentration showed minimum inhibition of 11mm diameter, while *E.coli* showed highest and minimum inhibition at 20mm and 13mm,respectively.The antibacterial activity and phytochemical analysis of *Nicotiana tabacum* extracts in different solvents using nine pathogenic bacteria was carried out by Ameya *et al.*(2017).The overall results revealed that *N.tabacum* extracts had high antibacterial activities against biofilm-forming uropathogens.

2. Antifungal Activity

Extracts of *Nicotiana tabacum* are reported to be employed in the eradication of fungal pathogens. In this situation, Suleiman (2011) carried out studies to isolate, identify and control the fungi associated with fruit rot of tomato (*Lycopersicon esculentum*)-*Aspergillus viridae* ,*Penicillium digitatum*, and *Rhizopus spp*. using plant extracts of Neem (*Azadirachta indica*) and tobacco (*Nicotiana tabacum*).The *in vitro* application of the extracts for the control of the fungi showed that tobacco(*Nicotiana tabacum*) had fungitoxic effect that controlled the mycelia growth with complete inhibition (0.00 ±0.00) at 60% on *Aspergillus viridae* and *Penicillium digitatum*. Hossan (2015) investigated the antifungal activity of different plant extracts of *Nicotiana tabacum* (tobacco), *Azadirachta indica* (Neem) and *Calotropis procera* (Akondo) against some selected phytopathogenic fungi: *Rhizoctonia solani* AG2-1, *Rhizoctonia solani* AG2-2(MB), *Rhizoctonia solani* AG2-2(IV), *Trichoderma harzianum*, and *Corynespora cassiicola*. The results revealed that all the organic solvents of leaves extracts showed that all plant species including *N.tabacum* inhibited mycelia growth of the phytopathogens thereby exhibiting strong antifungal activity. The

antifungal activities of *Nicotiana tabacum* leaf extracts on selected dermatophytes was surveyed by Nwachukwu (2017).The results indicated that the crude extracts were acidic and exhibited antifungal activity against all the test organisms namely *Epidermophyton floccosum, Microsporum canis,* and *Trichophyton rubrum*.

3. Antiviral Activity

The antiviral properties of various compounds isolated from *Nicotiana tabacum* have been reported. Yuan *et al.* (2015) investigated the antiviral potential of flavones from leaves of *Nicotiana tabacum*. Three new flavones, taba-flavonesA-C (1-3), together with three known flavones (4-6), were isolated from the leaves of *N.tabacum*. Compounds 1-6 were evaluated for their anti-tobacco mosaic virus (anti-TMV) activities. The results showed that compound 1 exhibited moderate anti-TMV activity with inhibition rate of 29.2% which is close to that of positive control. The other compounds also showed the anti-TMV activities with inhibition rates in the range of 14.2%-20.8%.Shang *et al.* (2016) studied the antiviral activity of sesquiterpenes from leaves of *Nicotiana tabacum* involving three unreported sesquiterpenes possessing two new skeletons, tabasequiterpenes A-C (1-3), together with three known sesquiterpenes (3-5), were isolated from the leaves of *N.tabacum*. The compounds 1-6 were evaluated for their anti-tobacco mosaic virus (anti-TMV) activities. The results revealed that compound 2 exhibited high anti-TMV activity with inhibition rate of 35.2%, which were higher than that of positive control. The other compounds also showed potential anti-TMV activity with inhibition rates in the range of 20.5-28.6%.Moreover, Yonesi and Razazadeh (2020) reviewed some plants (including *N.tabacum*) as prospective sources of natural anti-viral compounds and oral vaccines against COVID-19 Corona virus. The review regards plant species including *N.tabacum* (tobacco) as suitable candidates as antiviral agents against new Corona virus.

Antioxidant Activity

Antioxidants are drugs that can prevent or slow down damage to cells caused by free radicals, unstable molecules that the body produces as a reaction to environmental and other pressures. Reports abound on the antioxidant activities of extracts of *Nicotiana tabacum*. Run *et al.*(2012) evaluated the antioxidant properties of flavonoids and polysaccharides from tobacco (*N.tabacum*) in several *in vitro* systems including scavenging activities on hydroxyl, superoxide anion,1,1-diphenyl-3-picrylhydrazyl(DPPH),and 2,2-Aazino=bis (3-ethylbenzthiazoline-6-sulphonic acid(ABTS) radicals, and reducing power. The results indicated that flavonoids from *N.tabacum* showed the more pronounced effect in antioxidant activity than polysaccarrides and that tobacco leaves could be considered a potential source of natural antioxidant. Also, Soumeya *et al.* (2014) investigated the phenolic content and antioxidant activity of different young and adult plant parts of tobacco. The results generally revealed that plant parts of *N.tabacum* have antioxidant properties. However, the results indicated that in young and adult plants, leaves generally had highest amounts of phenol (14.46-23.05mgGAEg^{-1}) than the other plant parts, independent of the temperature used. Generally, young plants had the best capacity for scavenging DPPH and hydroxyl free radicals.

Furthermore, Sharma (2015) studied the antibacterial activity, phytochemical screening and antioxidant activities of stem of *Nicotiana tabacum*. The antioxidant activity was observed in order to estimate the superoxide, catalase, glutathione content, glutathione s-transferase and lipid peroxidase, that is, melondialdehyde (MDA) content in the aqueous and methanol extracts where methanol extract has shown high level of antioxidant activity. The study suggests that the stems of *N.tabacum* can be utilized as a good source of herbal drug for antioxidant activity. The antioxidant, antimicrobial, and cytotoxic properties of four different extracts derived from the roots of *Nicotiana tabacum* was investigated by Al-Lahham *et al.*(2020).The antioxidant activity was assessed employing 2,2-diphenyl-1-picryl-hydrazyl-hydrate (DPPH) method. The results revealed that hexane, acetone, and methanol extracts and trolox exhibited o potent and significant antioxidant activity suggesting that extract from roots of *N.tabacum* possessed antioxidant properties.

Anthelmintic Activity

Anthelmintic substance is the one that has the potential to kill or expel worms from the body. Extracts of *Nicotiana tabacum* have been reported to have anthelmintic property. For instance, Nouri *et al.*(2014) investigated the in vitro anthelmintic effect of aqueous and alcoholic extracts of tobacco(*Nicotiana tabacum)* against *M.marshalli*.The results showed that compared with Levamisole 50mg/ml, dilution of 25

and 50mg/ml of the aqueous extract had the same anthelmintic effect(P>0.05),but 75mg/ml) dilution of the aqueous extract and dilutions of 25,50 and 75mg/ml of alcoholic extracts had more anthelmintic effect(P 0.05).Overall, the extracts of tobacco possess considerable anthelmintic activity. Also, Igbal *et al.* (2006) studied the *in vitro* and *in vivo* anthelmintic activity of *Nicotiana tabacum* L .leaves to rationalize its traditional use. *Haemonchus contortus* were used to assess the *in vitro* anthelmintic effect of crude aqueous extract (CAE) and methanol extract (ME) of *N.tabacum*. The findings revealed that the aqueous and methanol extracts of *N.tabacum* exhibited dose-dependent anthelmintic activity both in *vitro* and *in vivo*, thus justifying the use of the plant in the traditional medicine system for the elimination of worms.

Cytotoxic and Anticancer Activities

A substance with cytotoxic activity has the potential of being toxic to living cells. This capability is used in medicine to destroy malignant cells including cancer cells. In this perspective, *Nicotiana tabacum* has been proved to possess cytotoxic activity. For example, Al-Asady *et al.* (2014) carried out a survey to evaluate the cytotoxicity of aqueous and methanol crude extracts of locally cultivated *Nicotiana tabacum* leaves on two cell lines-Rhabdomyosarcoma (RD) tumor cell line, and Murine fibroblast (L20B) cell line *in vitro*. The results of the cytotoxic effect of aqueous and methanol crude extracts of *N.tabacum* revealed that both extracts had a cytotoxic effect against both RD and L20B cell lines in which a significant decrease in proliferation of RD tumor cell line was observed at 78.125to 10000µg/ml of methanol crude extracts after 72hrs treatment. Aqueous extract showed cytotoxic effect on both RD and L20B cell lines. Also, Kusumawardani *et al.*(2020) studied the screening of the flavonoid content of cultivated tobacco(*Nicotiana tabacum*) leaves for its cytotoxicity against MCF-7 human breast cancer cells and non-transformed Vero cells in different concentrations .The results obtained showed that flavonoid of tobacco leaves with concentrations of 160µg/ml decreased the MCF-7 cell viability more than 50% with an inhibitory concentration 50(IC_{50}) value of 148.41µg/ml. Also, it inhibited 50% of Vero cell viability at 225.35µg/ml. Therefore, the flavonoid of tobacco leaves has strong cytotoxic activity on MCF-7 cells and might be a potential alternative agent for breast cancer therapy.

Antiarthritic Activity

The extracts of *Nicotiana tabacum* have been shown to have anti-arthritic activity. In this regard, Choudhary *et al.* (2015) carried out a survey of some medicinal plants with antiarthritic activity including *Nicotiana tabacum* among the 485 plant species belonging to 100 families. The results showed that *N.tabacum* leaf extract had antiarthritic activity thereby justifying its traditional use in the treatment of arthritis.

Antinociceptive Activity

The action of a substance or drug to block the detection of a painful or injurious stimulus by sensory nervous system is said to be antinociceptive property. *Nicotiana tabacum* has antinociceptive active agent which is nicotine(Ibironke *et al* .,2006;Ibironke and Oyekunle,2011).However,Ezeja and Omeh 2010) evaluated the antinociceptive activities of methanolic leaf extract of *N.tabacum* using tail immersion, hot plate and acetic acid-induced abnormal constructions or writhing models in albino Wister mice. The results indicated that *N.tabacum* extracts exhibited good level of antinococeptive activity by significantly (P 0.01) increasing the pain reaction time(PRT) or latent period in the mice in a dose dependent manner. The methanolic leaf extract of *N.tabacum* showed significant antinociceptive activity and may be acting through both central and peripheral nociceptive mechanisms (Maxwell and Omeh, 2010).

Anti-Alzheimer's Activity

Alzheimer's disease is a progressive disease that destroys memory and other important mental functions. The most common cause of dementia, which is memory loss and judgement, is Alzheimer's disease. *Nicotiana tabacum* plant extracts show anti-Alzheimer's activity and improved memory (Scerri, 2005).Also, Chinnadurai *et al.*(2017) reported that tobacco plant extracts showed anti-Alzheimer's activity where its plant extracts improved memory.

Central Nervous System Activity

The extracts of *Nicotiana tabacum* exhibit various actions on the central nervous system(CNS).Nicotine alkaloid is the principal chemical compound in *N.tabacum* which shows several pharmacological activities including the stimulation of the CNS(Kamal,2014).The effects of nicotine are as a result of the summation of actions at ganglionic sites, motor and plates and smooth muscle. The CNS affected, initially by stimulation in low doses, resulting in tremor, progressing to depression in high doses, leading to convulsions at toxic doses (Maheshwari, 2012).The excitation of respiration is a pronounced action of nicotine and it induces vomiting by both central and peripheral actions (Rawat and Mali, 2013).The primary sites of action of nicotine in the CNS are the pre-junctional, causing the release of other neurotransmitters. The stimulatory and pleasure-reward actions of nicotine appear to result from the release of excitatory amino acids, dopamine, and other biogenic amines from various CNS centers (Charlton, 2004).

Peripheral Nervous System Activity

It has been noted that the pharmacological activity of *Nicotiana tabacum* is mostly due to its content of nicotine which stimulates the nicotine receptors leading to release of substances such as acetylcholine,nor-epinephrine,dopamine,serotonin,vasopressin,and growth hormone (Kamal,2014).*Nicotiana tabacum* has great activities on the peripheral nervous system(PNS).The major action of nicotine consists initially of transient stimulation and subsequently of a more persistent depression of all autonomous ganglia(Scerri,2005).Nicotine equally has a biphasic action on the adrenal medulla: small doses evoke the discharge of catecholamines and large doses prevent their release in response to splanchnic nerve stimulation(Kamal,2014).It has been reported that nicotine ,like acetylcholine, is known to stimulate a number of sensory receptors (Cheeta *et al.*,2000).

Cardiovascular System Activity

Extracts of *Nicotiana tabacum* have been shown to possess cardiovascular activity (Kamal, 2014) and this is due to its constituent, nicotine. The cardiovascular responses to nicotine are as a result of the stimulation of sympathetic ganglia and the adrenal medulla, together with the discharge of catecholamine from sympathetic nerve ends. Moreover, contributing to the sympathomimetic response to nicotine in the activation of chemoreceptors of the aortic and carotid bodies, these reflexes result in vasoconstriction, tachycardia, and elevated blood pressure (Francis *et al.*,1999;Kamal,2014).

Ethnomedicinal Uses of *Nicotiana tabacum*

Ethnomedicine is a study of the traditional medicine based on bioactive compounds in plants (and animals) and practiced by various ethnic groups who have little access to western medicines. Therefore, reports are versatile on the ethnomedicinal potentials of *Nicotiana tabacum* in traditional medicine. Tobacco has a long history of use by medicinal herbalists as a relaxant, though since it is a higher additive drug, it is used with great caution(Grieve,1998).The parts of the plant used include the leaves, stems, stem bark, flowers, fruits, seeds, roots but mainly leaves.

Leaves of tobacco are the major part utilized in traditional medicine whether fresh, dried or ground forms. They have been reported to be used in the treatment of human ailments since many decades now. For instance, the leaves are used externally in the treatment of rheumatic swelling, skin diseases, and scorpion sting(Chopra *et al.*,1996).Wet tobacco leaves can be applied to sting in order to relieve the pain(Weiner,1998).They are also a certain cure for painful piles(Grieve,1998).A poultice of the leaves has been used to treat headaches and the juice of green tobacco has been used as an eyewash(DeFilipps *et al.*,2004).The leave of tobacco are mixed with the stem and leaves of *Rhabdadenia biflora* to remedy the wound of sting rays(DeFilipps *et al.*,2004).A homeopathic remedy is made from the dried leaves and used in the treatment of nausea and travel sickness(Castro,1990).

Moreover, Sunil *et al.* (2010) reported that *Nicotiana tabacum* leaves are used to treat skin diseases, local infections, bronchitis, asthma, and inflammation. An ointment made by simmering the leaves in lard has been employed in curing old ulcers, and painful tumors(Nadkarni,1996 ;Sunil *et al.*,2012).Also, the decoction of leaves is rubbed over sprains and bruises; the leaf juice taken orally to induce vomiting and narcosis; and the herb used for ulcerated abscesses, fistulas, sores, invertebrate polyps, and many other ailments (Binorkar and Jani,2012).The leaves also act as antispasmodics,discutients,diuretics,emetics,expectorants,irritants,sedatives,and

siatogugues. Wet tobacco leaves are applied externally in the treatment of rheumatic swelling, skin diseases, and stings, and to cure painful piles (Rawat and Mali, 2013).The traditional medicine uses of *N.tabacum* include the use in the treatment of asthma, worms, wounds, and dysmenorrhea (Kamal, 2014).The decoction of leaves is reported to be applied for muscle relaxation and relieving pain (Zaidi *et al.*, 2012; Sharma *et al.*, 2016). Tobacco leaves are claimed to possess the potentials in healing various ailments such as abdominal discomfort, constipation, urinary tract obstruction, dental pain, gastrointestinal disorders and dermatitis (Chunping *et al.*, 2016; Samell *et al.*, 2017).

Some other medicinal uses of *Nicotiana tabacum* include the use of poultice of fresh leaves over boils and infected wounds and crushed leaves with oil from palms used to prevent baldness while dried leaves and *Securinega virosa* are mixed into a paste and used externally to destroy worms in sores(Gill,1992).The leaf juice is used for indisposition, chills, and snakebite in the treatment of pulmonary disorders, strangulated hernia, orchitis, and skin diseases (Kamal,2014).the warmed leaves are applied on testis to treat hydrocele and oil extracted from leaves is used in the treatment of arthralgia, gout, and lumbago (Zaidi *et al.*,2012).Other ethnomedicinal uses of *N.tabacum* are the use of dried leaves as an insecticide, for the treatment of nausea and motion sickness, scorpion bites, to treat distemper, in veterinary, and leaves are also applied externally for mycosis, headache and wounds, ringworms, ulcers, bruises, sores, and stomatitis (Martinez and Lujan,2011).The leaves are reported as excellent remedy for convulsions, giddiness and other nervous system diseases and also used to stop depression, lassitude and certain kinds of aches (Gill,1992).

Conclusion

Nicotiana tabacum (tobacco) is a popular fumitory plant with extraordinary uses which causes addiction, dependence and equally abused. However, it has many practical folklore traditional medicine uses. If tobacco is abused it has the power to harm but if used in positive ways, tobacco has the power to heal and protect. This review considered the phytochemical and pharmacological activities and ethnomedicinal uses of *Nicotiana tabacum*. Different parts of the plant have been implicated in these activities including leaves, roots, stem, flowers, fruits and seeds although the most important part is the leaf. *Nicotiana tabacum* possesses a variety of bioactive compounds but the major active chemical substance isolated from all parts of the plant is the pyridine alkaloid, nicotine, which is the principal substance responsible for most of the pharmacological activities and medicinal uses. Other major phytochemical constituents of *N.tabacum* include flavonoids, glycosides, steroids, phenols, tannins, saponins, terpenoids, organic acids, cardiac glycosides, essential oils, etc.

The review equally revealed that *Nicotiana tabacum* exhibit a number of pharmacological activities attributable to the constituent phytochemicals. The most important biological activities of *N.tabacum* include antimicrobial, antibacterial, antifungal, antiviral, antioxidant, anti-inflammatory, anthelmintic, cytotoxic and anticancer, antiarthritic, antinociceptive, anti-Alzheimer's, central nervous system, peripheral nervous system, cardiovascular activities etc.

Nicotiana tabacum has equally been shown to have a lot of medicinal applications which are also attributable to the phytochemical constituents of the plant. It is claimed to be used in the treatment of a diversity of human disease including skin diseases, bronchitis, inflammation, ulcers, rheumatism, painful piles, worms ,wounds, dysmenorrhea, abdominal discomfort, constipation, dermatitis, hydrocele, gout, lumbago, headaches, kidney disease, cough, convulsions, and so on. It is recommended that further research be conducted on the possible harnessing of the potentials of *Nicotiana tabacum* in pharmaceutical formulation of drugs.

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