Medical Properties of *Abutilon hirtum* (Lam.) Sweet (Malvaceae): A Review

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ABSTRACT

Herbal drugs have less side effects, compared with the chemical medicine. *Abutilon hirtum* L. (Malvaceae) is a medicinal plant used as a herbal medication for many illnesses. The perennial shrub or herb, commonly named Vadathuthi or Indian mallows, found in tropical areas. Different studies on medicinal plants has been carried out to understand their medicinal properties including their cytotoxic activities, antioxidant activities, hepatoprotective activities, anti-inflammatory activities, analgesic activities, antipyretic activities, anti-diabetic activities, acute toxicity, antimicrobial properties, antimalarial and antileishmanial properties. Moreover, *A. hirtum* is traditionally used in India for kidney gravel pain relief, treating diarrhea, toothaches and coughs, bladder inflammation, wound & ulcer demulcent, diuretic as well as mouth wash. Thus, to prove various studies performed on different classes of phytochemicals of total ethanolic extracts with various proportions of its leaf like flavonoids, alkaloid, tannins, saponin, cardial glycoside, terpenes, rutin, steroid, phenols, fatty acid and resins in order to detect the pharmaceutical and industrial properties of *A. hirtum* L. Natural compounds serve as raw materials for development of many popular drugs

Keywords: *Abutilon hirtum* L., Antileishmanial, Anti-diabetic activity, Acute toxicity, Antimicrobial

Introduction

Malvaceae is the flowering plant family that contains nearly 243 genera with 4225 species. The plants of this family include herbs, shrubs and trees. It is widely distributed throughout the world particularly in tropical regions, mainly in South America (Sikorska and Matlawska, 2008 ; Verma, 2011). *Abotilun* is an ancient Greek name for mulberry tree which was given to this genus owing to its resemblance in their leave shapes (Don, 1831). The genus *Abotilun* is composed of approximately 100-150 species present in tropics and subtropics regions (Arbat, 2012).

A.hirtum is often known as BelaBenda or Indian mallows or Florida key (Perumal, 2001), the action of natural drugs is effective without side effects. One of the best global medico-cultural diverse countries is India where the sector of medicinal plants is a part of time (Kotnis et al, 2004 ; Reyad-ul-ferdous1, 2015). From ancient times, various medicinal plants were used in India to treat several diseases. Traditionally, the *A. hirtum* leaves are utilized as demulcents, diuretics and for diarrhoea treatment, and their leaf decoction is applied as mouth washes and to cure cystitis (bladder infections) as well as ulcer and wound (Kapoor and Kapoor, 1980 ; Pullaiah, 2002 ; Thomson, 2007 ; Candana et al, 2008). In Thailand, the roots of *A. hirtum* are used as antipyretics and to treat toothaches and coughs. In Kenya, Their

fruits are consumed rawly, whereas the leaves consumed by camels & goats. In Malaysia, *A. hirtum* is applied as a dressing for relieving kidney gravel pains and usually added to glutinous rice to treat ulcer, and its seeds are used as expectorant and are useful for piles and as laxative in gonorrhea, chronic cystitis and gleet (Gomaa et al, 2016 ; Brink and Dako, 2012 ; Wcslcy et al, 2013).

Synonyms:

Abotilun graveolens and Sida hirta Lam. (Roxb. ex Hornem). Wight & Arn. ex Wight (1833).

Vernacular names

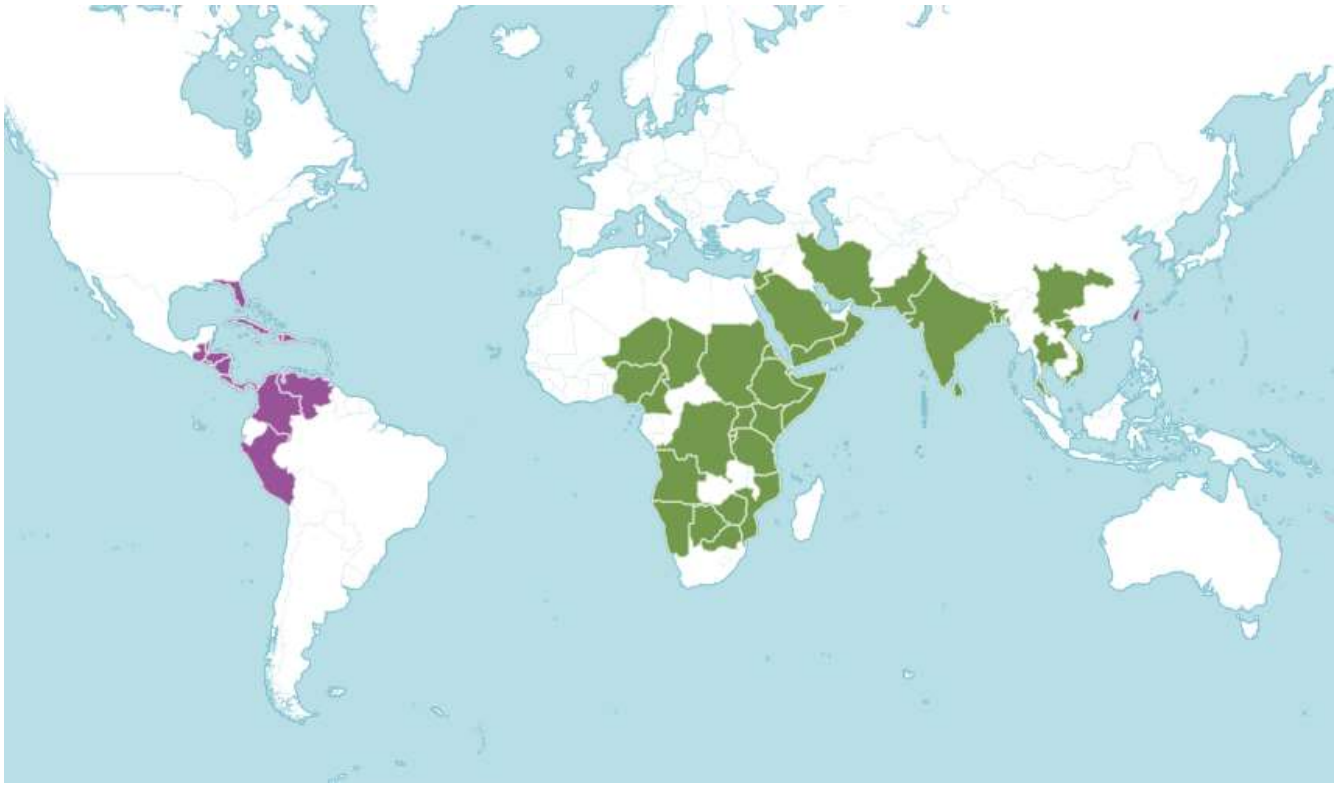
In Indonesia: it is known as kecemplok (Javanese), kembang sore besar (Balinese), bunga waktu kuning (Moluccas).

In Malaysia: it is known as angouri, bunga petag.

In Thailand: it is known as khrop chak krawaan (central), top tap (northern), khrop see (peninsular) (Fryxell, 1988)

Habitat

A.hirtum is reported to be present in woodlands, lowlands, grasslands, roadsides and scrubs, from sea levels to 1800 meter altitudes (Townsend et al., 1985). In China, it was observed in grassland at 300-1300 meter (Flora of China Editorial committees, 2015). The plant found in Bangladesh, Angola, Burundi, Botswana, Cameroon, Chad, Caprivi Strip, Djibouti, Ethiopia, Eritrea, Iran, India, Mozambique, Kenya, Namibia, Nigeria, Niger, Pakistan, Oman, Palestine, Rwanda, Saudi Arabia, Somalia, Sri Lanka, Sudan, Thailand, Tanzania, Uganda, Vietnam, Yemen, Zimbabwe and Zaïre (Fig. 1)



(Fig. 1): Map showing the areas of distribution of *A. hirtum.* (https://powo.science.kew.org/taxon/238-2).

Scientific classification

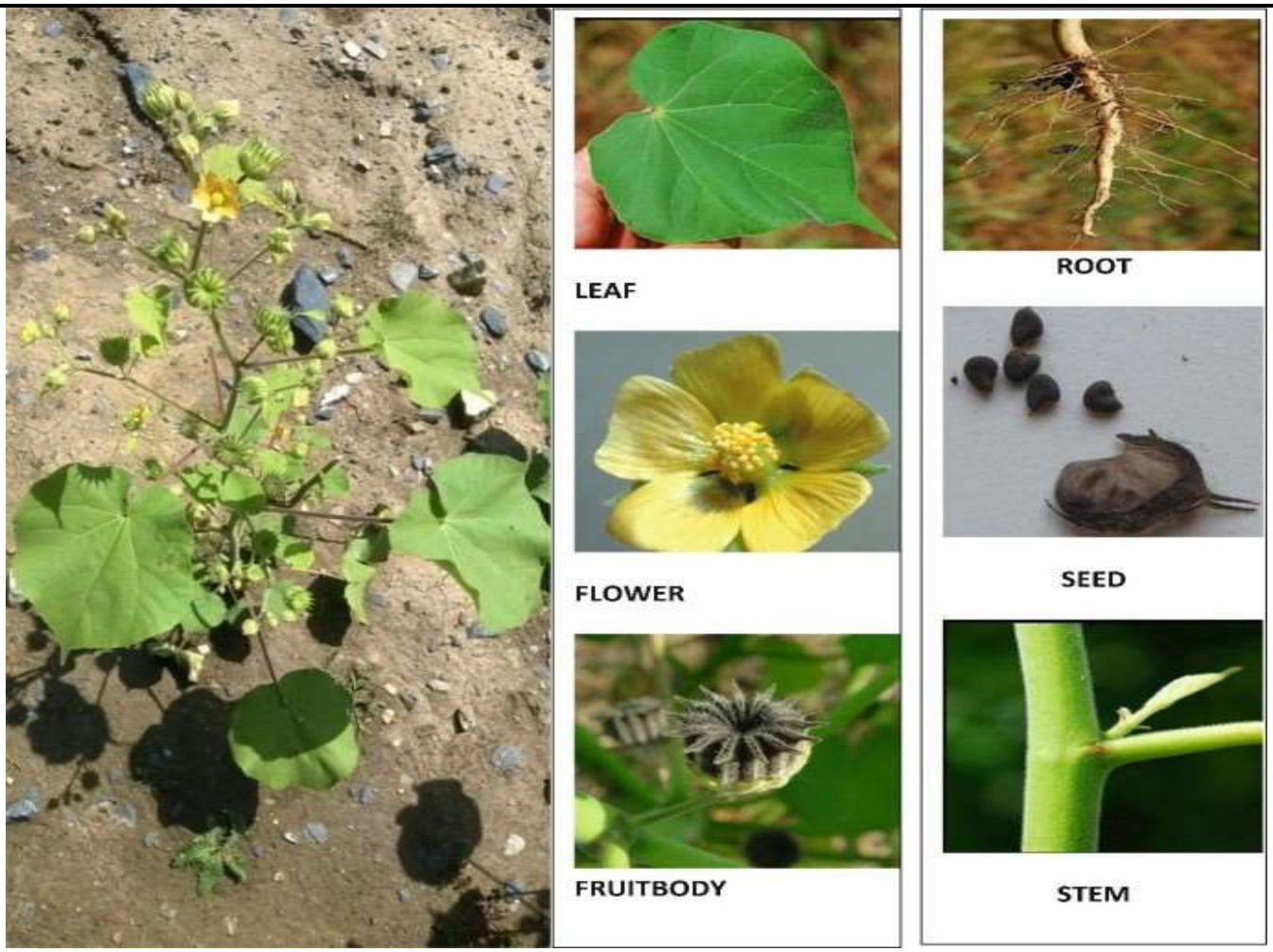
A.hirtum (Lam.) Sweet belongs to (Hinsley, 2006 ; Taia, 2009)

Kingdom: Plantae
Sub-kingdom: Virideplantae (green plant)
Infra-kingdom: Streptophyta (land plant)
Division: Tracheophyta (vascular plant)
Sub-division: Spermatophytina (seed plant)
Infra-division: Angiospermae (flowering plant)
Class: Magnoliopsida (Dicotyledon)
Sub-class: Dilleniidae
Superorder: Rosanae
Order: Malvales
Family: Malvaceae (mallows)

Sub-family: Malvoideae
Tribe: Abutilieae
Genus: Abutilon Mill (Indian mallow)
Species: *Abutilon hirtum* (Lam.) Sweet (Florida Keys Indian mallow).

Botanical description

A.hirtum is a perennial plant about 2.5 meters in height (Fig. 2). It has simple, alternate, petiolate, cordate leaves and acuminate apexes, fine serrate margins with symmetrical bases, green-colored and their upper surfaces are darker than lower ones, with hairy surfaces, coriaceous textures, faint odor and mucilaginous tastes showing palmately reticulate venations. On their lower surfaces, midribs are more apparent. The length of the leaf is 11-13 cm, while width is 8-10 cm. Their stems are cylindrical, erect, green in color and their monopodial branching have internodes with 0.5-7 cm long. The stem and lateral branches are covered by numerous hairs. The length of the stem is 0.5–1 m and the diameter is 0.2-1 cm. Its taste is mucilaginous and odor is faint with fibrous fractures when dry. Their flower is solitary, bisexual, axillary, regular and pedicellated. Their color is yellow, odorless, with mucilaginous taste and hairy pedicel. Their length is 1-2.2 cm and their diameter is 0.9-2 cm. The plant is actinomorphic, hypogenous, hermaphrodites, pentamerous and ebracteated. Their pedicels are green, cylindrical and hairy with their length is 0.4-0.8 cm and their diameter is 0.1-0.2 cm. Their calyxes are persistent composed of five united sepals. The shape of sepals is lanceolate with a green-colored acute apex, which shows valvate aestivations and hairy surfaces. The length of calyx is 1.1-1.7 cm while width is 0.8-1 cm. The polypetalous corola is composed of 5 contorted free petal. The yellow-colored petals have a cup shape. They have 0.9-1.8 cm length and 0.8-1cm width. The surface of corolla is smooth. The androecium consists of many epipetalous stamen with filaments fused to create staminal tubes which are 0.5 cm long. The yellow-colored filament is smooth, with its length is 0.2-0.23 cm, which carries small, yellow Reni form 2 lobed anther that is 1.4 mm long and 0.9 mm wide. The tap root carries many lateral rootlet, which is yellowish brown in color, with cylindrical shapes and odorless with mucilaginous tastes. Its length is 6-11cm and diameter is 0.5-1cm. It is woody and thick having a longitudinally-wrinkled surface and its fracture is fibrous. The fruit is a sub globose schizocarps of follicle like mericarp, 1-5cm × 1-2.5 cm, depressed, truncates; mericarp 16-30, oblong, 8-12 (-14) mm × 5-9 (-10) mm, truncates above and terminates into a minute tooth with (1-)3 seeded. Seeds are 2.5 mm × 2.5 mm, reticulate, black and papillous. (Townsend et al., 1985 ; Kumar, 2008 ; Gomaa, 2016 ; Kassem, 2007)



(Fig. 2): *A.hirtum*, general shape and the plant parts.

Major chemical constituents

A.hirtum plant contains Kaempferol, Quercetin, Rutin, Gallic acid, Caffeic acid, Fatty acids, 9-Hexadecenoic acid, 4-propyl, Benzaldehyde, Octane, 2,4,6-trimethyl, Heptadecane, 2,6-dimethyl, Diethyl Phthalate, 2,5-Octadecadinoic acid methyl esters, 1-Heptatriacotanol, Sulfuric acid, dodecyl 2-propyl esters, 3-Cyclopropyl Carbonyloxytridecane, Sulfurous acid, butyl dodecyl ester, 8-Octadecenal, Methoxyacetic acid, 3-tridecyl ester (Kassem, 2007 ; Pandey et al, 2011 ; Vivekraj et al, 2015 ; Gomaa, 2021).

Medicinal properties of *Abutilon hirtum*

A. hirtum belongs to Malvaceae and often called Vadathuthi. It is considered as the most essential drug in traditional medicine for treating different diseases (Vivekraj et al, 2015). The extract of *A.hirtum* demonstrated the existence of various secondary metabolite like alkaloids, flavonoides, saponins, tannins, steroids and trepens, cardial glycosides, phenols and resin. It was shown that 80% of isolate are sensitive to crude extracts at 200 mg/ml concentrations, however, susceptibility was low when the concentration was low. The range of MBC & MIC of plant fractions (AF9) against isolate was 150µg/ml–300µg/ml and 300µg/ml-600µg/ml respectively (De-Naan, 2020), that is responsible for their biological activity like antioxidant activity, cytotoxic activity, hepato-protective activity, anti inflammatory activities, analgesic activities, antipyretic activities, anti diabetic activities, acute toxicity, antimicrobial, antimalarial and anti-leishmanial activities (Gomaa, 2018).

Antioxidant activities

The aqueous extracts of *A. hirtum* leaf possessed important hepato-protective activities against CCl4 induced hepatotoxicity

among rats. It demonstrated important reductions in elevated serum enzyme levels (SGOT, SGPT, ALP and total bilirubin levels). In addition, the histopathological investigation of liver tissue proved the hepato-protective impact of extracts. These results confirmed the popular usage of these herbs as hepato-protective agents (Reddy, 2011). *In vitro,* free radical scavenging activities of different extracts (chloroform, petroleum ether, ethyl acetates, ethanol and aqueou of *A. hirtum* are estimated by the use of DPPH, FRAP as well as the reducing power assays. The aqueous extracts exhibited highest activities in DPPH assaying with IC50 values of 120 µg/ml, followed by ethyl acetate and ethanol extract (202 and 270 µg/ml, respectively).While, the ethyl acetate extract showed the highest FRAP value, followed by aqueous and ethanol's extracts. The reducing powers of ethanol and aqueous extract at 100 µg/ml was 0.454 and 0.428, respectively, that was slightly lower than the reducing power of ascorbic acid (0.532) at similar concentrations (Servin et al, 2013).

Cytotoxic activity

The petroleum ether, defatted alcohol, alcohol and aqueous extracts of *A.hirtum* leaves showed different cytotoxic activities against Ehrlich Ascites Carcinoma (EAC) at different concentrations (25, 50 and 100 µg/ml). The petroleum ether's extracts exhibited highest activities, particularly at doses 50 and 100 µg/ml, where it showed 100% viability inhibition of (EAC) cells while, the defatted alcohol and alcohol extracts showed only 40% and 20% viability inhibition of (EAC) cells, respectively at a dose of 100 µg/ml, with aqueous extracts were found to be inactive (Kassem, 2001). The cytotoxic activities of aqueous extract in *A. hirtum* plant was detected against human's breast cancer cell line (MCF-7). It revealed an increased rate of cell inhibition 43.71% at 300µg concentrations with IC50 values of 368.7 µg/ml on MCF-7 cells lines (Servin et al, 2013).

Hepato-protective activity

A study to investigate the hepato-protective activity was performed using aqueous leave extract of plants against experimentally-induced hepatotoxicity of rat. It was found that the LD_{50} values of extracts were greater than 4g/kg of the body weight when given orally to rats. Sylimarin was used as standard. The purpose of the study was to provide a scientific confirmation to the folklore claims on hepato-protective activities of leaves. The sera for all groups of animals have been investigated for estimation of biochemical parameters. It was found that when rats were treated with paracetamol and carbon tetrachloride, the serum level of glutamic oxaloacetic transaminases (SGOT), alkaline phosphatase (ALP), total bilirubin with direct bilirubin were increased, but levels of liver glutathione was decreased. The results suggested that leave extracts of *A. hirtum* possesses important hepato-protective activities (Srinivas et al, 2011).

Anti inflammatory activities

Total ethanolic extracts and the chloroform fraction of leaves of *A.hirtum* showed highest anti inflammatory activities and an inhibition rate of 50.8%, which is close to that of indomethacin (52.4%), and this result can be explained by their flavonoid and sterol contents (Gomaa et al, 2018 ; Owoyele et al, 2008). In addition, several mechanisms demonstrated anti inflammatory activities of flavonoides as a cyclooxygenase inhibitions as well as 5-lipoxygenase pathway, inhibitions of the biosynthesis of eicosanoide, in addition to their capability to degranulation of neutrophil's inhibition (Nijveldt et al, 2001).

Analgesic activities

The aqueous extracts of *A.hirtum* leaves revealed maximum analgesic activities (216.6%) with a fast onset and longer durations followed by petroleum ethers and chloroforms fractions with the total extracts were (189.8, 186.9 and 183.0% respectively), which often looks like that of the acetylsalicylic acid (186.4%) (Gomaa et al, 2018 ; Hosseinzadeh, 2000). This finding can be

related to the high contents of flavonoides and flavonoidal glycoside, as well as sterols that are reported to possess analgesic activities (Niazi et al, 2010).

Antipyretic activity

The total ethanolic extracts and various leaf fractions of *A. hirtum* showed that the total ethanol extracts and the majority of fraction demonstrated significant ($P<0.001$) antipyretics activities up to five hours. Total ethanolic extracts demonstrated higher activities in comparison with used standards acetylsalicylic acid with quick onsets (30 minutes) with longer durations showing max. activities. Following four hours of the experiment's beginning, the ethyl acetate, petroleum ether and aqueous fractions found similar impact to the acetylsalicylic acid fractions which also lasted up to five hours. The chloroform fraction showed the least activities as no significant effect was seen during the five hours of the experiment (Gomaa et al., 2018 ; Akapa et al., 2014).

Anti-diabetic activities

Fractions of crude polysaccharide revealed significant decrease in blood glucose level (81.08%). Total extracts of chloroform, petroleum ethers, ethyl acetates with aqueous fraction of the leaves of *A. hirtum* demonstrated significant anti-diabetic activities after five hours (47.49, 47.79, 50.04, 49.80, and 46.36% respectively) in comparison with the metformin extracts (55.45%). Total ethanolic extracts and various fractions showed potent anti diabetic effects and crude polysaccharide were shown to be with greatest anti diabetic activities from the 1st hr. until the 3rd hr. followed by severe hypoglycaemia following four hours. The hypoglyacemic effects can be related to a low blood glucose levels or to glucose absorption inhibition (Krisanapun et al, 2011), an elevated level of insulin secretion, a decrease in metabolism of insulin, throughout remediation of pancreatic islet destruction and pancreatic β-cell damage (Chen et al., 2011 ; Li et al., 2006).

Acute toxicities

No signs of toxicities or mortalities up to 3 g/kg of total ethanol extracts of *A. hirtum* leaves were observed. The LD_{50} of the total ethanol extracts was 3 g/Kg, which indicates its broad safety margins. Thus, the selected experimental doses of the total extracts with various fraction was 300 mg/kg, that is 1/10 of lethal doses (3 g/kg) (Gomaa et al., 2018 ; Prasad, 2010).

Antimicrobial, antimalarial and antileishmanial activities.

Total ethanolic extracts, various fractions and crude polysaccharides from *A. hirtum* leaves have been assessed for antimicrobial and antiparasitic activities. The determination of antimicrobial activities was performed by the use of disc diffusion against *Staphylococcus aureus* (Gram (+ve) and facultative anaerobic bacteria), *K. pneumonia*, *E.coli P. aeruginosa* (Gram (-ve) and facultative anaerobic bacteria), *Candida albicans*, *C. krusei* (Diploid fungi) and *C. glabrata* (haploid fungus). The antimalarial activity was examined on chloroquine sensitive (D6, Sierra Leone) strains of *Plasmodium falciparum* protozoan, while anti-leishmanial activities were tested against *Leishmania donovani*. The findings in the current study revealed that total extracts exhibited the lowest MIC (11.8 µg/ml) against *P. aeruginosa*. whereas, the chloroform fraction showed low MIC (59.03, 181.72 and 364.03 µg/ml) against *S. aureus*, *K. pneumoniae* and *P. aeruginosa*, respectively. The petroleum ether fraction exhibited the lowest MIC value (3.00 µg/ml) against *C. albicans*, whereas the total extract revealed the lowest MIC (33.11 µg/ml) against *C. glabrata*. *A. hirtum* leave extracts and fractions showed a weak antimalarial activity. On the other hand, the chloroform fraction of *A. hirtum* leaves showed a potent antileishmanial activity with the highest percentage of inhibition (78%) against *Leishmania donovani* (Gomaa, 2021).

Conclusion

This review provides valuable information about the various medicinal properties of *A. hirtum* for the first time. Some biochemical

studies on the plant parts showed that the main chemical constituents of *A. hirtum* are flavonoids, alkaloids, tannin, saponin, terpene cardial glycosides, rutin, steroid, phenols and resin, which are responsible for its medicinal activities. Therefore, this review showed the effort devoted to collect the detailed notes about *A. hirtum* could be beneficial to the societies in the field of alternative medicine.

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