

A REVIEW ON *GAILLARDIA PULCHELLA*<sup>1</sup>\*Tushar Jadhav, <sup>2</sup>Dr. G. V. Bihani and <sup>3</sup>Dr. K. R. Biyani<sup>1</sup>(B.Pharm), <sup>2</sup>(B. Pharm, M Pharm, Phd), <sup>3</sup>(B. Pharm, M Pharm, Phd)  
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## ABSTRACT

Herbal drugs have shown many pharmacological activities, and they are in use and demand due to their safety and less side effects. *Gaillardia pulchella* pharmacological activities are been elaborated in this review. *Gaillardia pulchella* are flowering plants widely cultivated in Egypt for their ornamental value. Previous reports demonstrated that sesquiterpene derivatives represent the major compounds in both species. Moreover, only few flavones were identified from genus *Gaillardia* and few studies on the cytotoxicity of *G. pulchella* were found. These sesquiterpenes, glycosides and other plant constituents have shown various pharmacological activities as anti-inflammatory, antistress activities respectively. Studies have shown a high anti-stress activity of 70 % ethanol extract from *Gaillardia pulchella* Foug. inflorescences. Phenolic constituents of *G. grandiflora* and *G. pulchella* aerial parts of both species, have shown significant anti-inflammatory and hepatoprotective activities.

**KEYWORDS:** *Gaillardia pulchella*, pharmacological actions, anti-stress, anti inflammatory, anti-oxidant, glycoside, hepatoprotective, plant extracts.

## INTRODUCTION

*Gaillardia pulchella* Foug (Asteraceae) are commonly known as firewheel, Indian blanket, Indian blanket flower, or sundance. They are short-lived flowering plants native to the Central United States and are widely cultivated in Egypt for their ornamental value. Genus *Gaillardia* includes about 23 species, but only three of which are commonly known, these include *G. pulchella*, which is an annual plant, while *G. grandiflora* and *G. aristata* are perennial plants. Now its cultivation has been expanded throughout the world because of its similarity to chrysanthemum and possibility of year round cultivation". The sesquiterpene lactones are characteristic compounds among the numerous secondary metabolites found in the Asteraceae family and in the *Gaillardia* species and they can be considered chemotaxonomic markers, while some flavonoids are probably typical for them. It also has

Fig: *Gaillardia pulchella* flower.

Been reported that the extracts of the *Gaillardia* sp. possess antiparasitic, antitumoral and cytotoxic activities. The antihypoxic and anti-ischemic properties of some extracts obtained from the leaves of *Ribes nigrum* L., inflorescences of *Gaillardia pulchella* Foug found that

the use of these extracts reduced the level of ischemic damage to the brain and also reduced tissue hypoxia due to restoration of mitochondrial functions.

### Pharmacological actions of *Gaillardia pulchella*

#### 1. Anti-inflammatory activity

According to the study mentioned in Pharmacogn. Mag. In New Apigenin Glycoside, Polyphenolic Constituents, Anti-inflammatory and Hepatoprotective Activities of *Gaillardia grandiflora* and *Gaillardia pulchella* Aerial Parts, *Gaillardia grandiflora* Hort. ex Van Houte and *Gaillardia pulchella* Foug are flowering plants, Previous reports demonstrated that sesquiterpene derivatives represent the major compounds in both species.<sup>[1]</sup> Moreover, only few flavones were identified from genus *Gaillardia* and few studies on the cytotoxicity of *G. pulchella* were found. Investigation of the phenolic constituents of the aerial parts of both species and evaluation of their anti-inflammatory and hepatoprotective activities was done. The 80% aqueous methanol extracts were prepared for both plants and evaluated for their biological activities. Phytochemical investigation of both extracts resulted in isolation of twelve compounds, which have been identified on the basis of ultraviolet, 1D and 2D nuclear magnetic resonance spectroscopy and negative ESI-MS.<sup>[2]</sup> Phytochemical investigation of *Gaillardia grandiflora* and *Gaillardia pulchella* 80% aqueous methanol extracts of the aerial parts led to the isolation of twelve compounds. The new compound 8-hydroxyapigenin 6-*O*- $\beta$ -D-apiofuranosyl-(1'' $\rightarrow$ 6'')-*C*- $\beta$ -D-4C-glucopyranoside was isolated from *G. grandiflora* for the first time in nature. Vicenin-2, vitexin, luteolin, apigenin and 6-methoxyluteolin were isolated from *G. pulchella*. The extracts of the species were nontoxic to mice up to 5 g/kg body weight. The extracts exhibited significant anti-inflammatory and hepatoprotective activities in dose dependent manner.<sup>[3]</sup>

#### 2. Anti-stress activity

According to the study mentioned in Indonesian journal of pharmacy in antistress activity of some plant extracts, To date, stress is a common medical and socially significant disease that requires rational pharmacological therapeutic correction. A modern person is constantly exposed to unfavorable factors that could provoke a stress disorders.<sup>[4]</sup> Stress is a normal physiological reaction of the body aimed at mobilizing available resources and limiting the impact on the body of negative factors. However, stress that goes beyond the physiological norm causes a violation of neuroendocrine, behavioral, emotional reactions and homeostasis changes. Chronic stress is the cause of the development of much psychosomatic pathology, for example, depression, anxiety, coronary heart disease, dementia.<sup>[5]</sup> The main pathogenic mechanisms of stress are activation of the hypothalamic-pituitary-adrenal and sympathetic-adrenal systems, which is accompanied by an increase in the concentration of corticosteroids and adrenaline in the blood. Acute stress was modeled by

immobilization of rats for 2h. The test extracts were administered per os prophylactically in a dose of 1/20 of LD<sub>50</sub> (2000mg/kg).<sup>[6]</sup> The following parameters were evaluated: organs mass coefficient (adrenal glands, thymus, spleen), the number of stomach erosion; the biochemical changes in the blood serum (adrenaline, cortisol, total protein and glucose concentration); the mitochondrial function parameters in brain and myocardium (evaluation of mitochondrial pore transitional permeability opening and mitochondrial membrane potential). 70% ethanol extract from *Gaillardia pulchella* Foug. inflorescences has the highest anti-stress activity, the course application of which contributed to the normalization of the weight index of organs, a decrease in glucose concentration by 64.5% ( $p < 0.05$ ), and cortisol by 73.7% ( $p < 0.05$ ) and adrenaline - 78.9% ( $p < 0.05$ ) in the blood, an increase in total protein level by 62.5% ( $p < 0.05$ ) and stabilization of mitochondrial function. The study showed a high anti-stress activity of 70% ethanol extract from *Gaillardia pulchella* Foug. inflorescences.

#### 3. Antioxidant activity

According to the study mentioned in journal by oleo science in analysis of essential oil from *Gaillardia pulchella* Foug, and its antioxidant activity, Flowers of *G. pulchella* were collected, the sample was soaked in water for 12 hours and then subjected to hydrodistillation for 3 hours using a Clevenger type collector. The obtained pale yellow essential oil was dried over anhydrous sodium sulfate and stored at 4°C.<sup>[7]</sup> Twenty-eight compounds were characterized representing 92.63% of the essential oil with n-Hexadecanoic acid (26.90%), Phyto (7.58%) and Cyclopropaneoctanoic acid, 2-[2-(2-ethylcyclopropyl)methyl]cyclopropylmethyl, methyl ester (6.73%) as the main components. A comparison of the essential oil constituents of *G. pulchella*, *G. megapotamica*, *G. scabiosoides*, and *G. cabreranae* showed that pinenes, limonene, caryophyllene and caryophyllene oxide were common to all these *Gaillardia* species. As compared to other species, *G. pulchella* contained less monoterpenoids and sesquiterpenes than essential oils from other species, such as pinenes, limonene, and caryophyllene, but contained more unsaturated fatty acids, alcohols, esters and aromatics. For instance, only a trace amount of caryophyllene was found in the oil of *G. pulchella*, whereas it reached 11.7% and 3.6% in *G. megapotamica* var. *scabiosoides* and *G. cabreranae* respectively, while n-Hexadecanoic acid was 26.90% in *G. pulchella*.<sup>[8]</sup> In order to evaluate the antioxidant activity of the essential oil from *G. pulchella*, two different extracorporeal antioxidant methods DPPH scavenging activity and reducing power were used. For the validation of this method, ascorbic acid was run as a standard along with the samples. The DPPH free radical is a stable free radical, which has been widely used as a tool for testing the free radical scavenging activities of antioxidants. The essential oil of *G. pulchella* provided dose-dependent DPPH scavenging efficacy, and the scavenging value

reached 72.34% at the concentration of 200 mg/ml.<sup>[9]</sup> The EC<sub>50</sub> value of essential oil was 70.95 mg/ml. The reducing power method is based on electron transfer ability of the test sample to reduce Fe (III) to Fe (II). Therefore, the reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity.

## RESULT AND DISCUSSION

1. The new 8-hydroxyapigenin 6-O-β-D-apiofuranosyl-(1''→6'')-C-β-D-4C1-glucopyranoside was isolated from *G. grandiflora* for the first time in nature, along with schaftoside, luteolin 6-C-β-D-4C1-glucopyranoside 8-methyl ether, apigenin 6-C-β-D-4C1-glucopyranoside 8-methyl ether, isoorientin, isovitexin, 6-methoxyluteolin and hispidulin, as well as vicenin-2, vitexin, luteolin and apigenin, which were isolated from *G. pulchella* together with 6-methoxyluteolin. Furthermore, the AME of both species were found to be nontoxic to mice and exhibited significant anti-inflammatory and hepatoprotective activities in dose dependent manner.
2. The studies have shown that in a series of ethanol (40%, 70%, 95%) and aqueous extracts obtained from leaves of *R. nigrum*, inflorescences of *G. pulchella*, and stems of *L. punctata*, 70% ethanol extract from inflorescences *G. pulchella* has the most pronounced anti-stress activity. The course administration of this extract at a dose of 100 mg / kg (orally) contributed to the reduction of typical post-stress effects (characteristic biochemical changes in the form of an increase in the concentration of adrenaline, cortisol and glucose, as well as a decrease in the level of total protein in the blood, the presence of gastric mucosa ulceration, hypertrophy of adrenal glands, involution of the thymus). Also, the administration of 70% ethanol extract, obtained from *Gaillardia pulchella* Foug. inflorescences helped to restore mitochondrial function, as evidenced by an increase in the mitochondrial membrane potential and a decrease in the latent opening time of the mitochondrial transition permeability pore.
3. In order to evaluate the antioxidant activity of the essential oil from *G. pulchella*, two different extracorporeal antioxidant methods DPPH scavenging activity and reducing power were used. For the validation of this method, ascorbic acid was run as a standard along with the samples. The DPPH free radical is a stable free radical, which has been widely used as a tool for testing the free radical scavenging activities of antioxidants. The essential oil of *G. pulchella* provided dose-dependent DPPH scavenging efficacy, and the scavenging value reached 72.34% at the concentration of 200 mg/ml. The EC<sub>50</sub> value of essential oil was 70.95 mg/ml. The reducing power method is based on electron transfer ability of the test sample to reduce Fe (III) to Fe (II). Therefore, the reducing capacity of a

compound may serve as a significant indicator of its potential antioxidant activity.

## CONCLUSION

The current study sheds light for the first time on the phenolic constituents of *G. grandiflora* and *G. pulchella* aerial parts. In addition, the AME extracts of both species were found to be safe and exhibited significant anti-inflammatory and hepatoprotective activities. Both plant species may thus be promising candidates for natural anti-inflammatory and hepatoprotective drugs.

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The essential oil showed certain antioxidant activity in 1,1-diphenyl-2-picrylhydrazyl (DPPH).

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