

Tithonia tubaeformis forraje con propiedades medicinales, una alternativa para la alimentación animal

Tithonia tubaeformis forage with medicinal properties, an alternative for animal feed

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Abstract:

Use of plants and each of its parts, within traditional Mexican medicine has transcended for many years, the wide variety of genres used creates the need for deeper research that contributes knowledge to the empirical results that are available. One of the genera that has been studied is *Tithonia*, which has been shown to have important bioactive properties and of pharmacological and biological interest, which is why, in this context, the *tubaeformis* species, a plant that is widely distributed in Mexico, considered undesirable, can become used as livestock feed and considered a botanical source for obtaining compounds of biological interest for their properties.

Keywords:

Animal feed, Bioactive compounds, Plant use, Xhoto flower

Resumen:

El uso de plantas y cada una de sus partes, dentro de la medicina tradicional mexicana ha trascendido durante muchos años, la amplia variedad de géneros utilizado crea la necesidad de realizar investigaciones más profundas que aporten conocimientos a los resultados empíricos que se tienen. Uno de los géneros que se ha estudiado es *Tithonia*, la cual ha demostrado tener propiedades bioactivas importantes y de interés fármaco-biológico por lo cual, en este contexto la especie *tubaeformis*, planta que se encuentra ampliamente distribuida en México, considerada no deseable, puede llegar a ser usada como alimento para el ganado y considerada una fuente botánica para la obtención de compuestos de interés biológico por sus propiedades.

Palabras Clave:

Alimentación animal, Compuestos bioactivos, Uso de plantas, Flor de Xhoto

Introduction

Genus *Tithonia* belongs to the *Asteraceae* family (Table 1), which ranges from smaller grasses to trees that are over 30 m tall. Eleven species have been recognized, divided into two groups, which are widely distributed in Central America and Mexico, in addition to being present in tropical and subtropical areas in the rest of the world, thanks to their considerable adaptive properties 10,14.

Table 1. Taxonomy of *Tithonia tubaeformis* 14.

Kindom	Plantae
Subkindom	Traqueobionta
Divisio	Magnoliophyta
Class	Magnolipsia
Subclass	Asteridae
Order	Asteraceae

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Manily	Asteraceae
Genus	<i>Tithonia</i>

General characteristics of *Tithonia tubaeformis*

Tithonia tubaeformis, is a forage plant of herbaceous type, native to Mexico, very resistant, since what grows in areas that have been altered by man, because it needs few resources. It has been considered undesirable because it invades crops, such as corn (Figure 1). The uses that this plant has are quite wide, as it is used as food for production animals, due to its nutritional value, the whole plant has been included and by segments (leaves or stems). Its medicinal properties are thanks to products obtained from its secondary metabolism, which have been used to treat gastrointestinal problems, inflammation and even as an antiparasitic 6,8.



Figure 1. Xhoto flower (*Tithonia tubaeformis*), in a corn crop, San Juan Teotihuacán, State of Mexico, Mexico.

Tithonia tubaeformis, commonly called xhoto flower, palocote, or acahual flower, is an annual, generally robust herb that has a large number of disk-shaped flowers, linear filariae, and can be oblong and oval. Its colours range from red to yellow, to roasted coffee. It has stems that measure from 1 to 3 m in a cylindrical shape, and alternate leaves from 2 to 11 cm that go from ovate to triangular-ovate, usually the upper leaves are lanceolate, its peduncles measure 10 to 45 cm in length and 4 to 11 mm in diameter, it blooms between August and November; its commonly propagated by seeds, dispersed thanks to human activity, due to the use of agricultural machinery or being found as a contaminant in the sale of seeds for different crops 4.

Uses of *Tithonia tubaeformis*

Although this plant is considered an invader in the cultivation lands, when growing in corn or sorghum plantations, and areas modified by man, becoming a pest in some areas, it is also used as natural medicine by natives of the regions where it's found. *Tithonia*

tubaeformis has been used in the relief of gastrointestinal complaints, as well as a digestion promoter 8, 9. Hinojosa et al. 8, found in vitro experiments, that *Tithonia tubaeformis* has anti-inflammatory properties, since it contains bioactive components that act on elastase, an enzyme that triggers inflammation. On the other hand, Heinrich et al. 7, mentioned that it is feasible to use it for the treatment of fever, muscle pain and bruising. Furthermore, *Tithonia tubaeformis* has been shown to serve as an effective treatment for induced peripheral neuropathy, a side effect caused by chemotherapeutic agents that affects the quality of life of cancer patients, acting as an antinociceptive 13.

In addition to the therapeutic uses that can be given to *Tithonia tubaeformis*, it has also been used for soil recovery, due to its ability to improve nutrient recycling and Phyto-remediation 11; being a species capable of recovering efficiently after cutting, and which generates considerable biomass, on the other hand, it has been included in livestock feed, as it contains adequate levels of protein 3,14. Pérez-Martínez et al. 15, tested the use of *Tithonia tubaeformis* in the feeding of rabbits for meat, obtaining an improvement in the productive parameters by providing only the leaf of the plant, likewise an increase in the weight of the carcass when the animals consumed the entire plant, without cause any impact on the health of rabbits. Likewise, Zepeda-Bastida et al., 18, suggest that there is a positive correlation between the quality of the carcass and the meat of rabbits when including leaves of *Tithonia tubaeformis* in the diet, without affecting their quality, in addition to reducing costs of feeding.

Tithonia tubaeformis bioactive compounds

Bioactive compounds are produced by plants as secondary metabolites, useful to increase their survival, as well as to adapt to changes that may take place in their environment, which generate toxicological and pharmacological effects for both animals and humans, which give them healing properties. Bioactive compounds are divided mainly into terpenes-terpenoids, alkaloids and phenolic compounds 1. Plants of the *Asteraceae* family have been shown to produce significant concentrations of bioactive compounds with various functions 17, within which are found antimicrobial, antiviral, anti-fungal, anti-inflammatory and prevent genomic deterioration 2. The genus *Tithonia*, species *diversifolia* has been studied to determine the functions of the present bioactive compounds, such as sesquiterpenes, lactones, chlorogenic acid and flavonoids with various therapeutic uses 12. On the other hand, secondary metabolites not only have been exploited for therapeutic use, also as an alternative to improve animal production 5, they have been used as growth promoters, lactation promoters and dew ormers 16. Hinojosa-Dávalos et al. 8, determined the bioactive compounds of *Tithonia tubaeformis*, and

suggested their biological activity (Table 2), which could be used and studied for use in production animals.

Table 2. Bioactive compounds and biological activity of *Tithonia tubaeformis* 8.

Compound	Biological activity
Phenols	Antioxidant
Flavonoids	Antimicrobial and anti-inflammatory capacity
Alkaloids	Mental illness treatment and pain reliever
Steroids	Cancer prevention
Tannins	Anti-inflammatory
Coumarins	Anticoagulant, antibacterial, antibiotic action

Conclusion

Tithonia tubaeformis is a plant that is widely distributed in the world, and that has multiple benefits, in addition to having different uses within different human activities; however, the lack of information on this and the limited research in which it has been used, mean that little is known about its different properties. It is necessary to carry out investigations of *Tithonia tubaeformis*, with the aim of being able to introduce the plant, and exploit it within its possibilities, in highly developed sectors, such as livestock or pharmacology.

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