

## GENUS ARISAEMA: A COMPREHENSIVE REVIEW ON FLAVONOIDS AS PHYTOCONSTITUENTS

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Article Received on 25 Feb. 2026,  
Article Revised on 17 March 2026,  
Article Published on 01 April 2026,

<https://doi.org/10.5281/zenodo.19326833>

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**How to cite this Article:** Susmitha P. V.\* (2026). Genus *Arisaema*: A Comprehensive Review on Flavonoids As Phytoconstituents. *World Journal of Pharmaceutical Research*, 15(7), 404-410.  
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### ABSTRACT

The genus *Arisaema* belongs to the family Araceae and comprises a large number of herbaceous plants widely distributed in Asia, Africa, and North America. Many species of *Arisaema* have been traditionally used in folk medicine for the treatment of various ailments such as inflammation, respiratory disorders, infections, and digestive problems. The therapeutic potential of these plants is mainly attributed to the presence of diverse phytoconstituents, among which flavonoids play an important role. Flavonoids are polyphenolic compounds known for their wide range of biological activities including antioxidant, anti-inflammatory, antimicrobial, and anticancer properties. Various studies have reported the presence of flavonoids such as quercetin, kaempferol, luteolin, and their glycosides in different species of *Arisaema*. These compounds contribute significantly to the pharmacological potential of the

genus. Modern analytical techniques such as LC-MS, HPLC, and spectroscopic methods have been used to identify and characterize flavonoids present in *Arisaema* species. This review provides a comprehensive overview of the flavonoid phytoconstituents reported in the genus *Arisaema*, their identification methods, and their pharmacological significance. Understanding the flavonoid profile of *Arisaema* species may support further research on their therapeutic applications and the development of plant-based drugs. The chemical structures of the flavonoids you listed. All of them belong to the flavonoid family, sharing the same C<sub>6</sub>-C<sub>3</sub>-C<sub>6</sub> backbone (two benzene rings A & B + heterocyclic ring C), but they differ in hydroxyl groups, glycosides, or saturation.

**KEYWORDS:** Arisaema genus, Flavonoids, Phytochemical Screening, LC-MS Spectroscopy.

## INTRODUCTION

Medicinal plants have been used for thousands of years as natural remedies for the treatment and prevention of diseases. Plants synthesize a wide range of secondary metabolites, commonly known as phytoconstituents, which exhibit significant bioactive properties. These compounds are responsible for the therapeutic effects of many traditional and modern medicines. Medicinal plants are plants that contain bioactive compounds used for therapeutic purposes. These plants are widely used in traditional systems of medicine such as Ayurveda, Traditional Chinese Medicine, and Unani medicine.<sup>[1]</sup>

According to the World Health Organization, nearly 80% of the world's population relies on plant-based medicines for primary healthcare. Many modern drugs are also derived directly or indirectly from plant phytochemicals.

Phytoconstituents such as alkaloids, flavonoids, terpenoids, tannins, phenolics, glycosides, and saponins play an important role in pharmacological activities including antioxidant, antimicrobial, anti-inflammatory, anticancer, and antidiabetic effects. Phytoconstituents are chemical compounds naturally produced by plants that contribute to their biological activity. They are usually classified as primary metabolites and secondary metabolites.<sup>[2,3,4]</sup>

Phytoconstituents are bioactive chemical compounds naturally present in plants. They are responsible for many medicinal properties of plants. In pharmacognosy, these compounds are identified using specific qualitative chemical tests that produce characteristic colour changes or precipitates.<sup>[6,7]</sup>

Liquid Chromatography–Mass Spectrometry (LC–MS) is a powerful analytical technique widely used for the identification, separation, and characterization of chemical compounds present in complex mixtures. It combines two analytical methods: liquid chromatography (LC) and mass spectrometry (MS). Liquid chromatography separates the different components of a sample based on their chemical properties, while mass spectrometry detects and identifies these components by measuring their mass-to-charge ratio ( $m/z$ ).

LC–MS has become an important tool in the fields of pharmacognosy, phytochemistry, pharmaceuticals, environmental analysis, and biomedical research. It is especially useful in

the study of plant-derived compounds such as flavonoids, alkaloids, terpenoids, and glycosides, where accurate identification of phytoconstituents is required.<sup>[10,11,12]</sup>

## MATERIALS AND METHODS

### Major Species of *Arisaema*

**Table 1: Arisaema species and Habitat.**

<i>Species</i>	<b>Common Name</b>	<b>Distribution</b>
<i>Arisaema nilamburens</i>	Cobra Lily	Western Ghats of South India, Kerala, Tamil Nadu
<i>Arisaema tortuosum</i>	Whipcord cobra lily	Himalayas, India, Nepal
<i>Arisaema triphyllum</i>	Jack-in-the-pulpit	North America
<i>Arisaema jacquemontii</i>	Himalayan cobra lily	Western Himalayas
<i>Arisaema consanguineum</i>	Himalayan cobra lily	India, Nepal, China
<i>Arisaema erubescens</i>	Chinese cobra lily	China, Southeast Asia
<i>Arisaema flavum</i>	Yellow cobra lily	Himalayas, Central Asia
<i>Arisaema leschenaultii</i>	Southern Indian cobra lily	South India
<i>Arisaema speciosum</i>	Himalayan cobra lily	India, Nepal, Bhutan
<i>Arisaema ciliatum</i>	Himalayan species	China, Tibet
<i>Arisaema amurense</i>	Asian cobra lily	Russia, China, Korea

### Tests for Flavonoids

Flavonoids are plant secondary metabolites commonly identified in phytochemical screening using simple colour-based chemical tests. These tests detect the phenolic structure and conjugated systems present in flavonoids.

**Table 2: Phytochemical Screening of Flavonoids.**

SL.NO	EXPERIMENT	OBSERVATION	INFERENCE
1	<b>Shinoda Test (Magnesium–Hydrochloric Acid Test)-</b> Take a small amount of plant extract in a test tube. Add a few magnesium turnings. Add concentrated HCl dropwise.	Development of pink, red, or orange color.	Indicates presence of flavonoids (especially flavonols and flavones).
2	<b>Alkaline Reagent Tes-</b> Add 2–3 drops of sodium hydroxide (NaOH) to the plant extract	Yellow colour disappears.	Confirms presence of flavonoids
3	<b>Lead acetate Test-</b> Add few drops of lead acetate solution to the extract	Formation of yellow precipitate.	Indicates presence of flavonoids.
4	<b>Ferric Chloride Test-</b> Add few drops of 5% ferric chloride (FeCl <sub>3</sub> ) to the extract	Formation of green, blue, or black coloration.	Indicates phenolic compounds including flavonoids
5	<b>Pew’s Test (Zinc–Hydrochloric Acid Test)-</b> Take the plant extract in a test tube. Add a small amount of zinc dust. Add concentrated HCl dropwise.	Formation of red or pink color	The presence of flavones and flavonols

### FLAVONOIDS AND LC-MS PEAK

LC-MS (Liquid Chromatography–Mass Spectrometry) is widely used to identify flavonoids by detecting their molecular ion peaks ( $m/z$  values). Each flavonoid shows a characteristic mass-to-charge ratio ( $m/z$ ) corresponding to its molecular weight. These are some of the Flavonoids present in Arisaema Species.

**Table 3: Flavonoids with LC-MS Peak Value and Molecular Weight.**

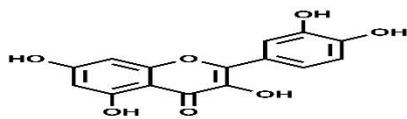
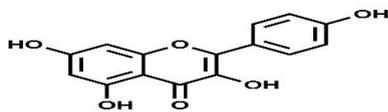
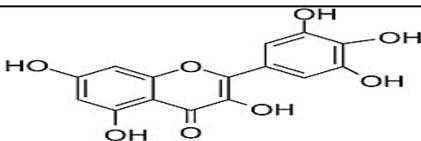
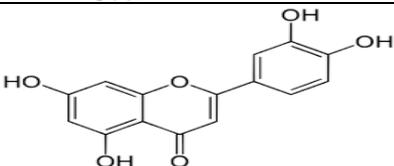
Flavonoid	Molecular Formula	Molecular Weight	LC-MS Peak ( $m/z$ )
Quercetin	$C_{15}H_{10}O_7$	302	301 $[M-H]^-$
Kaempferol	$C_{15}H_{10}O_6$	286	285 $[M-H]^-$
Myricetin	$C_{15}H_{10}O_8$	318	317 $[M-H]^-$
Luteolin	$C_{15}H_{10}O_6$	286	285 $[M-H]^-$
Apigenin	$C_{15}H_{10}O_5$	270	269 $[M-H]^-$
Rutin	$C_{27}H_{30}O_{16}$	610	609 $[M-H]^-$
Naringenin	$C_{15}H_{12}O_5$	272	271 $[M-H]^-$
Catechin	$C_{15}H_{14}O_6$	290	289 $[M-H]^-$

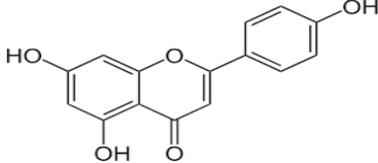
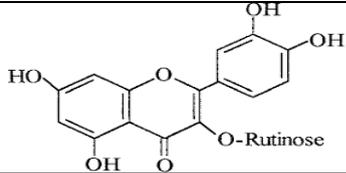
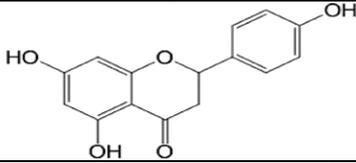
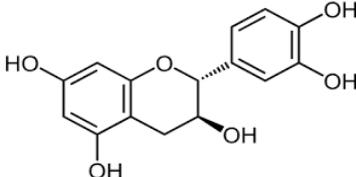
$[M-H]^-$  = molecular ion after losing one proton (negative ion mode).

In positive mode, peaks may appear as  $[M+H]^+$ .

Flavonoids are plant polyphenolic compounds with the basic C6–C3–C6 skeleton. Many flavonoids show important pharmacological activities such as antioxidant, anti-inflammatory, antiviral, anticancer, cardioprotective, and neuroprotective effects.

**Table 4: Flavonoids and Chemical Structures.**

Flavonoid	Molecular Formula	Molecular Weight	Chemical Structure
Quercetin	$C_{15}H_{10}O_7$	302	
Kaempferol	$C_{15}H_{10}O_6$	286	
Myricetin	$C_{15}H_{10}O_8$	318	
Luteolin	$C_{15}H_{10}O_6$	286	

Apigenin	$C_{15}H_{10}O_5$	270	
Rutin	$C_{27}H_{30}O_{16}$	610	
Naringenin	$C_{15}H_{12}O_5$	272	
Catechin	$C_{15}H_{14}O_6$	290	

### ACKNOWLEDGEMENT

I would like to express my sincere gratitude to all those who helped and supported me in the completion of this review. I am deeply thankful to my guide/mentor for their valuable guidance, encouragement, and continuous support throughout the preparation of this review. I would also like to extend my appreciation to my teachers and the institution for providing the necessary resources, academic environment, and encouragement that enabled me to carry out this work effectively. I am grateful to the authors and researchers whose published articles, books, and scientific papers served as important references and contributed greatly to the development of this review.

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