

Original Article

Ethnomedicinal Study and Thin Layer Chromatography Identification of Medicinal Plants to Treat Digestive Disorders in Medong Village, Pandeglang, Banten

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Abstract: Medicinal plants with anti-ulcer and anti-diarrheal properties are often used by the community to treat digestive disorders in Medong Village, Pandeglang, Banten, but have not been well recorded. The purpose of this study was to document the types of plants used as traditional medicine to treat ulcers and diarrhea, and to identify secondary metabolite compounds using thin-layer chromatography (TLC). Sampling was conducted using purposive and snowball sampling methods with 70 informants. Quantitative data analysis was carried out by calculating the use value (UV). The results of data collection from 70 informants identified 15 plant species used as anti-ulcer and antidiarrheal agents. Based on the highest UV value, guava (*Psidium guajava*) leaves and turmeric (*Curcuma longa*) rhizomes had the highest UV as antidiarrheal, and *Excoecaria cochinchinensis* leaves had the lowest. For treating ulcers, turmeric rhizomes and *Annona muricata* leaves have the highest UV, and *Polyscias scutellaria* leaves has the lowest. The parts of the plant that are often used as medicine are leaves, rhizomes, and herbs. Phytochemical screening showed that almost all samples contained secondary metabolite compounds that have antidiarrheal and antiulcer activity, namely flavonoids and tannins, and their presence was confirmed using TLC, with Rf values within the standard value range.

Keywords: anti-diarrheal; anti-ulcer; ethnomedicine; phytochemistry; tlc

1. INTRODUCTION

Along with Indonesia's high plant diversity, Indonesia is also a country with a high level of medicinal plant use as traditional medicine, comparable to China and India [1]. The use of medicinal plants has been passed down through generations, but the documentation remains incomplete. Research into medicinal properties is currently very advanced, although many medicinal plants are still unexplored.

Ethnomedicinal studies allow researchers to study a region's traditional knowledge system regarding the use of medicinal plants, while simultaneously conserving these plants and their habitats [2]. Exploring the community's traditional knowledge of medicinal plant use can be a first step in preserving the biodiversity of these medicinal plants, which can then be developed into more modern research areas such as biotechnology, pharmacy, and bioeconomic [3]. Thus, this research will not only provide data on the types of plants used by residents to treat digestive disorders but also provide insights into biodiversity and conservation measures that can be implemented by residents and, more broadly, the local government.

The benefits of medicinal plants are derived from the chemical compounds they contain. These compounds have been extensively studied for their potential as antimalarials, anticancer agents, antihypertensive agents, and others, even to aid family planning programs. From ethnomedicinal studies, these secondary metabolites can be confirmed using thin-layer chromatography (TLC). TLC allows us to visualize the profiles of the compounds found [4].

Similar to Cihanjuang Village, Pandeglang, Banten [5], Medong Village (Figure 1) also frequently reports digestive disorders among its residents. In addition to the high prevalence of

stomach ulcers and diarrhea in Indonesia, these two conditions are common, yet many people choose to self-medicate. This is especially true given that many villages in Banten are still far from primary healthcare facilities.

Medong residents use medicinal plants to treat diarrhea and ulcers, partly due to the distance from health facilities and traditional healing practices that have been passed down through generations. Ethnomedicinal knowledge in the Banten region is crucial for further research to prevent extinction and to serve as a basis for further research to develop new herbal medicines.



Figure 1. The people of Medong Village still use medicinal plants to treat digestive disorders

This research includes field studies, interviews with residents, identification of medicinal plant specimens, Use Value (UV) analysis, and phytochemical screening in the form of Thin Layer Chromatography (TLC) at the Phytochemistry Laboratory, Faculty of Pharmacy and Science, Universitas Muhammadiyah Prof. DR. HAMKA, Jakarta. Thus, comprehensive results and complete documentation can be obtained regarding the traditional use of medicinal plants in the region to treat digestive disorders.

2. MATERIALS AND METHODS

This research was conducted using a descriptive quantitative method, with informants determined using purposive-snowball sampling [6], a purposive sampling method to determine key informants and a snowball sampling method [2] to meet the target of general informants. Data collection used a semi-structured interview technique with a list of questions or questionnaires that had been validated by experts. Both key informants and general informants were native villagers, had knowledge and used medicinal plants for digestive disorders, were physically and mentally healthy, and were willing to be interviewed (proven by an informed consent). In addition, key informants were people trusted by residents as local traditional healers. Using the Isaac & Michael formula [7], a total of 70 informants were interviewed. This study was also submitted to an ethical review because it involved humans as research subjects (ethical clearance from Komisi Etik Penelitian Kesehatan Universitas Muhammadiyah Prof. DR. HAMKA No. 03/24.01/03030 and 03/24.01/03031) [8].

2.1. Specimen Identification

The plant identification process began with observations with informants in Medong Village. Observations were conducted to match interview data with the plant species in question. Morphology and habitat data were recorded, as well as plant documentation, which was then compared with identification books. Independent identification results were further confirmed by a botanist.

2.2. Use Value Analysis

The use value (UV) analysis is a quantitative method that is very helpful in determining plants that are frequently used in treating a disease. The higher the UV, the more potential the plant has for further research. UV is calculated using the following formula [9]:

$$UV = \frac{\sum U}{n}$$

where: UV = use value of plant species;
U = number of citations per plant species;
n = number of respondents

2.3. Abiotic Factor Measurements

During the medicinal plant data collection, soil pH, moisture, and light intensity were measured using a soil tester to determine the ecological conditions of the medicinal plants' growth in Medong Village. Meanwhile, ground elevation was measured using an altimeter, and temperature was measured using a GPS.

2.4. *Simplicia* Preparation

Fresh samples were collected directly from yards, fields, and forests around Medong Village. Fresh samples were sorted, washed, and then dried in Medong Village. Once dried, they were taken to the Integrated Laboratory of the Faculty of Pharmacy and Science, Universitas Muhammadiyah Prof. DR. HAMKA, to be made into powdered *simplicia* [10]. Documentation of the *simplicia* preparation can be seen in Figure 2.



Figure 2. Fresh sampling (left), rhizome washing (center), and measurement of abiotic factors (right) in Medong Village

2.5. Ultrasonic extraction

100 grams of the powdered *simplicia* was weighed, placed in a beaker, and 1 liter of 70% ethanol solvent was added. Ultrasonic extraction was carried out for 40 minutes at 40°C. Ultrasonic wave-assisted extraction was performed at a frequency of 40 kHz [11]. The extraction results were then filtered with filter paper to obtain the filtrate. The filtrate was concentrated using a vacuum rotary evaporator at 60°C and a water bath at 50°C until a thick extract was obtained.

2.6. Phytochemical screening and TLC

Before TLC, phytochemical screening was performed for alkaloids, flavonoids, phenolics, steroids, terpenoids, tannins, and saponins. Each test used 100 mg of powdered medicinal plants, with the working procedures summarized in Table 1. The TLC test uses a prepared test or reference solution, which is then spotted onto a plate (1-1.5 cm apart) and at a distance of 1.5-2 cm from the bottom edge of the plate. The plate is then placed in a vessel saturated with mobile phase, positioned vertically, with the bottom edge immersed in the mobile phase. Once the mobile phase has spread beyond the propagation distance, the plate is removed and air-dried. The resulting spots are observed under visible light, using ultraviolet light at wavelengths of 254 nm and 366 nm. The propagation distance for each spot is then measured and recorded.

Table 1. Phytochemical screening test procedures carried out

Secondary Metabolites	Reagents	Literatures
Alkaloid	aquadest, 2N HCL, Dragendorff, Mayer, Bouchardat, and Wagner reagents	[12]; [13]; [14]
Flavonoid	ethanol, magnesium powder, concentrated HCL	[13]
Tannin	distilled water, 1% gelatin solution, 10% NaCl	[14]
Phenolic	ethanol, FeCl ₃ 5%	[13]; [14]
Saponin	distilled water, 2N HCL	[15]; [14]
Steroid	chloroform, anhydrous acid, concentrated H ₂ SO ₄	[15]
Terpenoid	chloroform, concentrated H ₂ SO ₄	[13]

The plate is sprayed with the appropriate reagent, and the resulting color is observed and calculated using the Rf value. The Rf value is obtained by measuring the propagation distance of the compound from the starting point to the center of the spot, divided by the propagation distance of the phase to the front line. The Rf value (Retention Factor) can be calculated using the standard formula [14].

3. RESULTS AND DISCUSSION

3.1. Specimen Checklist

Table 2 shows that 15 species of medicinal plants are used in Medong Village, Pandeglang, Banten, for treating digestive disorders. These fifteen species belong to ten families, with the largest families being Zingiberaceae, Asteraceae, and Myrtaceae. Plants of the Zingiberaceae family are known to be the most widely used in traditional Javanese medicine [1]. Specifically, nine species of plants are used by residents to treat diarrhea, and ten species for anti-ulcer conditions. In comparison, four species of plants can be used for both digestive complaints: *Annona muricata*, *Blumea balsanifera*, turmeric (*Curcuma longa*), and temulawak (*Curcuma zanthorrhiza*). The eleven species used by residents are the leaves, three species for rhizomes, and a species for herbs. Documentation of plant samples can be seen in Figure 3.



Figure 3. Medicinal plants for treating digestive disorders in Medong Village include: A. Babadotan (*Ageratum conyzoides* L.), B. Cente (*Lantana camara* L.), C. Temulawak (*Curcuma zanthorrhiza* Roxb.), and D. Nangka walanda (*Annona muricata* L.).

Table 2. Family, type, local name, part used of medicinal plants used as antidiarrheal and/or antiulcer in Medong Village

No	Family	Species Name	Local Name	Parts Used	As an antidiarrhea	As an anti-ulcer
1	Acanthaceae	<i>Strobilanthes crispera</i> (L.) Blume	Pecah beling	Leaves	-	√
2	Annonaceae	<i>Annona muricata</i> L.	Nangka walanda	Leaves	√	√
3	Araliaceae	<i>Polyscias scutellaria</i> (Burm.f.) Fosberg.	Mamangkokan	Leaves	-	√
4	Asteraceae	<i>Ageratum conyzoides</i> L.	Babadotan	Herbs	-	√
5		<i>Blumea balsamifera</i> (L.) DC.	Sembung	Leaves	√	√
6	Euphorbiaceae	<i>Excoecaria cochinchinensis</i> Lour.	Daun merah	Leaves	√	-
7	Moringaceae	<i>Moringa oleifera</i> Lam.	Kelor	Leaves	-	√
8	Myrtaceae	<i>Psidium guajava</i> L.	Jambu biji	Leaves	√	-
9		<i>Syzygium polyanthum</i> (Wight) Walp.	Salam	Leaves	√	-
10	Rubiaceae	<i>Gardenia jasminoides</i> J. Ellis	Kaca piring	Leaves	-	√
11	Verbenaceae	<i>Lantana camara</i> L.	Cente	Leaves	-	√
12		<i>Alpinia malaccensis</i> (Burm.f.) Roscoe	Laja gowah	Rhizomes	√	-
13	Zingiberaceae	<i>Curcuma longa</i> L.	Kunyit	Rhizomes	√	√
14		<i>Curcuma zanthorrhiza</i> Roxb.	Temulawak	Rhizomes	√	√
15		<i>Zingiber zerumbet</i> (L.) Roscoe ex. Sm.	Lempuyang	Leaves	√	-

3.2. Use Value Analysis

Table 3 shows that guava leaves, turmeric, and temulawak rhizomes are the most commonly used plants by residents to treat diarrhea, while turmeric rhizomes, *Annona muricata* leaves, and temulawak rhizomes are the most frequently used part of plants to treat ulcers. Of the most commonly used species, those with the highest UV, turmeric and temulawak rhizomes are used by residents to treat both types of digestive disorders.

Based on research results, turmeric has been known to have a significant effect as an anti-ulcer agent [16]. Turmeric extract given to mice can reduce gastric acid excretion and protect the gastric mucosa from injury [17]. As an antidiarrheal, there has also been much research on turmeric's antibacterial effects, so it can be used as a diarrhea medication. Among these is the effect of turmeric rhizome extract in reducing defecation rates and other parameters [18]. Through this example of turmeric, the use of turmeric with the highest level of confidence is relevant to the studies or research that have been conducted.

For plant species rarely used for medicinal purposes, for example *Excoecaria cochinchinensis* as an antidiarrheal have the lowest UV values, and *Polyscias scutellaria* as an anti-ulcer has the lowest UV values. Low UV values may indicate low species availability and a lack of knowledge about the plant's uses [19]. Research on *Excoecaria cochinchinensis* as an antidiarrheal has not been conducted. However, research that has been conducted has examined the antibacterial effects of it [20]. Similarly, for *Polyscias scutellaria*, existing research still covers its antioxidant and anti-inflammatory effects [21]. Furthermore, the leaves have been known to have antimicrobial and antifungal effects [22].

Table 3. Use value of medicinal plants used as antidiarrheal and antiulcer in Medong Village

No	Names of Antidiarrheal Plants	UV	Names of Anti-Ulcer Plants	UV
1	Jambu Biji (<i>Psidium guajava</i>)	0.60	Kunyit (<i>Curcuma longa</i>)	0.68
2	Kunyit (<i>Curcuma longa</i>)	0.51	Nangka walanda (<i>Annona muricata</i>)	0.55
3	Temulawak (<i>Curcuma xanthorrhiza</i>)	0.39	Temulawak (<i>Curcuma xanthorrhiza</i>)	0.45
4	Sembung (<i>Blumea balsamifera</i>)	0.36	Cente (<i>Lantana camara</i>)	0.41
5	Nangka Walanda (<i>Annona muricata</i>)	0.31	Sembung (<i>Blumea balsamifera</i>)	0.38
6	Salam (<i>Syzygium polyanthum</i>)	0.29	Babadotan (<i>Ageratum conyzoides</i>)	0.35
7	Laja gowah (<i>Alpinia malaccensis</i>)	0.23	Kacaping (<i>Gardenia jasminoides</i>)	0.32
8	Lempuyang (<i>Zingiber zerumbet</i>)	0.19	Pecah beling (<i>Strobilanthes crispata</i>)	0.25
9	Daun merah (<i>Excoecaria cochinchinensis</i>)	0.13	Kelor (<i>Moringa oleifera</i>)	0.21
10			Mamangkokan (<i>Polyscias scutellaria</i>)	0.15

3.3. Abiotic Factor Measurements

Based on abiotic factor measurements, Medong Village is located in a lowland (105 m above sea level), with relatively hot weather (26.4°C), and soil with a pH that tends to be alkaline. This impacts the diversity of plants grown, as the medicinal plants obtained are also less diverse. Furthermore, differences in growing location can affect the chemical compounds that act as traditional medicinal properties, and even if the compounds are the same, the levels may vary [23].

For example, miana leaves (*Coleus scutellarioides*), that used as a medicinal plant in Bali, have different secondary metabolite content between those grown in the highlands and lowlands. Even though flavonoid compounds are found in both miana grown in the lowlands and highlands, the levels differ. Besides altitude, differences in temperature, humidity, light intensity, stress, free radical exposure, and soil fertility can also contribute to this [24]. In fact, in a study conducted by Mamonto et al. [25], TLC analysis using chloroform:ethyl acetate (9:1) as the eluent detected flavonoids in rambutan (*Nephelium lappaceum*) leaf extract from the highlands with a retention factor (Rf) of 0.82, whereas no flavonoids were detected in the extract from the lowlands.

3.4. Phytochemical screening

Table 4 shows the types of secondary metabolites contained in each specimen. The dominant compounds detected in the antidiarrheal and antiulcer medicinal plant samples in Medong Village were: phenols, flavonoids, alkaloids, tannins, and terpenoids. Regarding their mechanisms of action in treating digestive disorders, flavonoids and phenolic acids have been studied to have anti-shigellosis and antidiarrheal effects [26]. These compounds are more abundant in aboveground plant parts than in roots, and are related to their antibacterial activity. Meanwhile, for treating stomach ulcers and gastric ulcers, flavonoid compounds have been known to have gastroprotective effects due, in part, to their antioxidant activity [27]. Examples of flavonoids with these properties include chalcones, flavanones, catechins, anthocyanidins, flavones, and flavonols.

In addition to these compounds, alkaloids can also act as antidiarrheals due to their anti-inflammatory activity in intestinal disorders [28]. Meanwhile, tannins have an astringent effect, tightening and forming a protective layer on the intestinal mucosa, thereby reducing osmolarity [29]. According to a literature review, combinations of tannins with other compounds, such as ethacridine lactate, have been used to prevent and treat diarrhea [30]. As an anti-ulcer, condensed tannins have long been used to treat stomach problems. Tannins are known to chelate metals, possess antioxidant activity, and have the power to complex with other molecules [31].

Terpenoid compounds, which are components of essential oils in aromatic plants, can also act as antidiarrheals [32] and antiulcers. Their effects include antioxidants, inhibition of acid secretion, activity against *H. pylori* bacteria, and strengthening the gastric mucosal barrier [33].

Table 4. Phytochemical Screening Results of Antidiarrheal and Anti-Ulcer Medicinal Plants from Medong Village

No	Species	Alkaloid test	Phenolic test	Flavonoid test	Saponin test	Tannin test	Steroid test	Terpenoid test
1	<i>Strobilanthes crispa</i>	-	+	-	-	+	+	+
2	<i>Annona muricata</i>	+	+	+	+	+	+	+
3	<i>Polyscias scutellaria</i>	+	+	+	+	-	-	+
4	<i>Ageratum conyzoides</i>	-	-	-	+	-	+	+
5	<i>Blumea balsamifera</i>	+	+	+	-	+	-	+
6	<i>Excoecaria conchinchinensis</i>	+	+	+	+	+	+	+
7	<i>Moringa oleifera</i>	-	-	+	-	+	-	+
8	<i>Psidium guajava</i>	+	+	+	+	+	+	-
9	<i>Syzygium polyanthum</i>	+	+	+	+	+	+	-
10	<i>Gardenia jasminoides</i>	+	+	-	-	-	+	+
11	<i>Lantana camara</i>	+	+	+	+	+	+	-
12	<i>Alpinia malaccensis</i>	+	+	+	-	+	-	+
13	<i>Curcuma longa</i>	+	+	+	-	+	+	+
14	<i>Curcuma zanthorrhiza</i>	+	+	+	-	+	+	+
15	<i>Zingiber zerumbet</i>	-	+	+	-	+	-	+

Notes: (+) = identified secondary metabolite; (-) unidentified secondary metabolite

3.5. TLC of flavonoid and tannin

In this study, confirmation of the identity of secondary metabolite compounds was specifically focused on flavonoids and tannins, which are thought to play a significant role in overcoming digestive disorders. The mobile phase used for flavonoid compounds was n-hexane and ethyl acetate in a ratio of 7:3, and for tannin compounds, methanol and water in a ratio of 9:1. The flavonoid compound spray reagent used 10% $AlCl_3$; a positive reaction is indicated by the formation of a reddish stain [34]. A positive flavonoid reaction occurs if a blue stain appears under UV light of 366 nm [35]. Meanwhile, the spray reagent for tannin compounds with 5% $FeCl_3$, a positive reaction is indicated by the formation of a black stain [36].

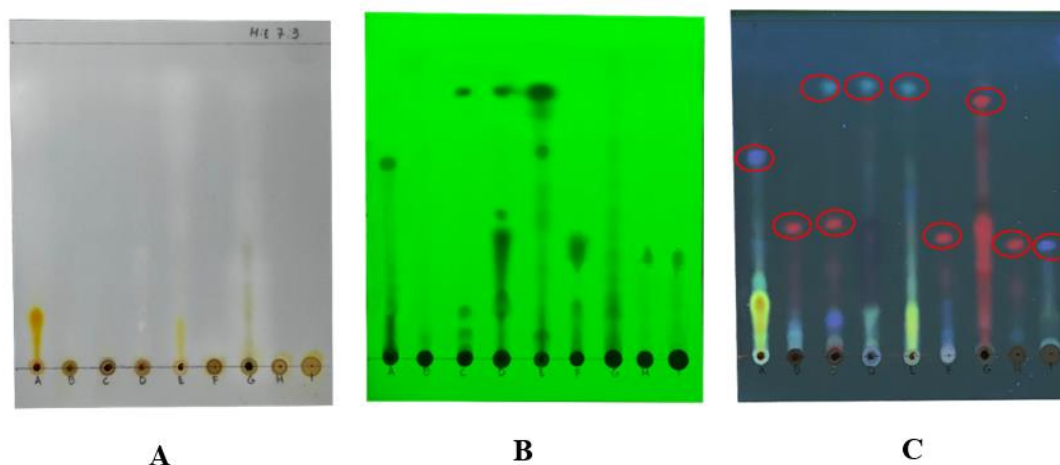


Figure 4. TLC results of flavonoid compounds. A. Visible light TLC plate after being sprayed with 10% $AlCl_3$, B. UV254 TLC plate after being sprayed with 10% $AlCl_3$, C. UV366 TLC plate after being sprayed with 10% $AlCl_3$. Spot descriptions from left to right: A = Temulawak rhizome, B = guava leaf, C = *E. conchinchinensis* leaf, D = *A. malaccensis* rhizome, E = turmeric rhizome, F = *Z. zerumbet* leaf, G = *B. balsamifera* leaf, H = bay leaf, and I = *A. muricata* leaf

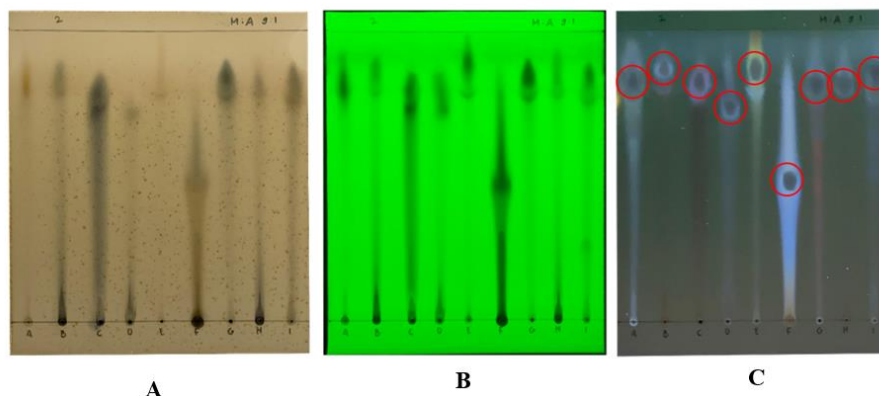


Figure 5. TLC results of tannin compounds. A. Visible light TLC plate after being sprayed with 5% FeCl₃, B. UV254 TLC plate before being sprayed with 5% FeCl₃, C. UV366 TLC plate after being sprayed with 5% FeCl₃. Spot descriptions from left to right: A = Temulawak rhizome, B = guava leaf, C = *E. conchinchinensis* leaf, D = *A. malaccensis* rhizome, E = turmeric rhizome, F = *Z. zerumbet* leaf, G = *B. balsamifera* leaf, H = bay leaf, and I = *A. muricata* leaf

The resulting Rf values can vary, influenced by, among other factors, the location where the plant is grown [25], the mobile phase used [37], and the type of flavonoids contained. Based on the Rf value standards, the plant samples in this study meet the TLC Rf value standards for flavonoid and tannin. The results obtained from the TLC flavonoid test were temulawak rhizomes (Rf 0.61), guava leaves (Rf 0.43), *E. conchinchinensis* leaves (Rf 0.44), *A. malaccensis* rhizomes (Rf 0.72), turmeric rhizomes (Rf 0.72), *Z. zerumbet* leaves (Rf 0.41), *B. balsamifera* leaves (Rf 0.71), bay leaves (Rf 0.4), and *A. muricata* leaves (Rf 0.4) (Fig 4). According to previous research on the genus *Alchemilla*, through TLC it was known that the rutin compound had an Rf of 0.44, isoquercetin with an Rf of 0.72, vitexin with an Rf of 0.77, and other flavonoid compounds [38].

A review of TLC results for flavonoid compounds, concluded that ethanol as the eluents tend to produce higher Rf values (above 0.9). This indicates greater validity in flavonoid identification. Because of this factor, the discussion of TLC results is limited only to confirming the presence of flavonoid compounds in plant samples used by Medong residents as antidiarrheals and antiulcers.

Meanwhile, the results obtained in the TLC tannin test, namely temulawak rhizomes (Rf 0.82), guava leaves (Rf 0.87), *E. conchinchinensis* leaves (Rf 0.82), *A. malaccensis* (Rf 0.72), turmeric (Rf 0.72), *Z. zerumbet* leaves (Rf 0.41), *B. balsamifera* leaves (Rf 0.78), bay leaves (Rf 0.78), and *A. muricata* leaves (Rf 0.84). There are several plants other than *Z. zerumbet* leaves that pass the standard Rf value range of tannins, but it can still be concluded that the stains and Rf values are tannin compounds (Fig 5).

This finding aligns with research conducted by Zaini & Shofia [39], Yuda *et al.* [40], and Fajriyah *et al.* [41], which indicates that the tannin Rf value obtained exceeds the standard value for several plant samples, with the largest Rf value being 0.88. Differences in spot shape and Rf distance can be caused by several factors, including the thickness and flatness of the plate, plate activity, number of spots, solvent, temperature, steam in the development vessel used, and the degree of saturation [42]. Thus, the plant samples were confirmed positive for containing flavonoids and tannins.

4. CONCLUSION

An ethnomedicinal study in Medong Village, Pandeglang, Banten, yielded data on 15 plant species used to treat diarrhea and ulcers, with the most common being the Zingiberaceae family. Based on use value calculations, the most commonly used medicinal plants for diarrhea treatment are guava leaves and turmeric rhizomes, while turmeric rhizomes and *Annona muricata* leaves are used to treat ulcers. The use of this plant is related to the many compounds identified in it, such as flavonoids and tannins, the presence of which was confirmed by TLC.

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