Chapter 84
Plantago asiatica L. 车前
(Cheqian, Asiatic Plantain)

Li Yang

84.1 Botanical Identity

Cheqian, a perennial herbal plant in the Plantago Family, is one of the most popular Chinese herbal medicines and is frequently used as an ingredient in dietary supplements. The medicinal part of the plant is the herb (Cheqiancao) or seed (Cheqianzi). Although there are 265 species of the genus Plantain in the world, only a few species with similar botanical characters are used as Cheqian. *Plantago asiatica* L. and *P. depressa* Willd. are the major and legal sources recorded in the Pharmacopoeia of the People's Republic of China and all historical records of Chinese herbal works [1, 2].

Cheqian is widely distributed in most areas of China, from north to south, such as Heilongjiang, Liaoning, Hebei, Jiangxi, Henan, Guangxi, Yunnan, Fujian, Qinghai, Jiangsu, Shanxi provinces, and so on. The fruit-spike is collected in the summer or autumn when the seed is ripe, and then dried in the sun. The seed is rubbed out and removed from foreign matter. When using the whole plant, the drug is collected in summer, removed from soil, and dried in the sun [3] (Fig. 84.1).

84.2 Chemical Constituents

Phenylethanoid glycosides, iridoid, flavonoids and its aglycones, polysaccharide, and triterpenoids are major kinds of active compounds found from *Plantago asiatica* L.

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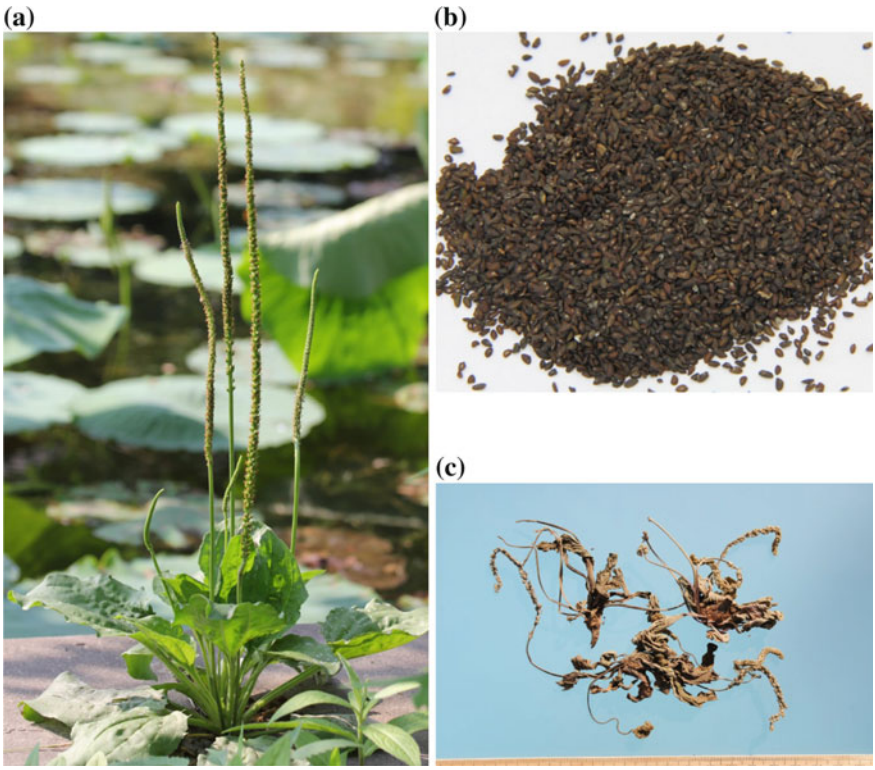

Fig. 84.1 The flowering plant (**a**) and crude drugs (**b** Cheqianzi, **c** Cheqiancao)

84.2.1 Phenylethanoid Glycosides

Acteoside (1), plantamajoside (2), isoacteoside (3), isoplantamajoside (4), desrhamnosylverbascoside, rehmannioside and many others are representative phenylethanoid glycosides isolated from Cheqian [4, 5]. Some of them are shown in Fig. 84.2a.

84.2.2 Iridoids

Geniposidic acid (4), aucubin (5), catalpol (6), 3,4-two hydroxyl aucubin and many others are representative iridoids isolated from Cheqian [6, 7]. Some of them are shown in Fig. 84.2b.

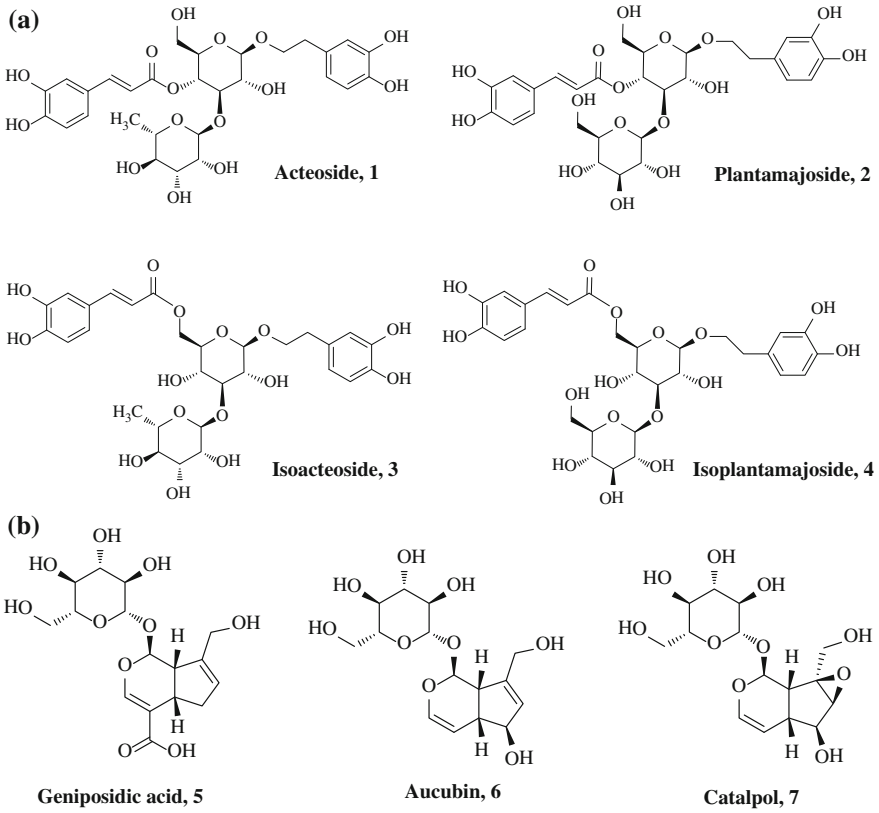

Fig. 84.2 Typical phenylethanoid glycosides (**a**) and iridoids (**b**) isolated from Cheqian

84.2.3 Flavonoid and Other Components

There are still flavonoids and its aglycones, polysaccharide, triterpenoids and other types of components found from Cheqian, such as homoplantagin, plantagoside, plantasan, and ursolic acid, etc. [8–10].

Among these compounds, acteoside and geniposidic acid are considered as the principal bioactive compounds in Cheqianzi, corresponding with traditional use of diuretics and antihypertention. However, plantamajoside is considered as the primary bioactive compound in Cheqiancao. Notably, there are the chemical markers which discriminate between Cheqianzi and Cheqiancao. Therefore, TLC identification and HPLC assay methods using acteoside and geniposidic acid as chemical markers were developed for the quality control of Cheqianzi, while TLC identification and HPLC assay methods using plantamajoside as a marker were established for the quality control of Cheqiancao [11, 12].

84.3 Pharmacological Studies

Cheqian is one of the most popular traditional medicines used by TCM. As recorded in Chinese Pharmacopoeia (2010 edition), the function of Cheqian could be expressed from many aspects as to clear heat, disinhibit urine and relieve stranguria, drain *Dampness* to check diarrhea, improve vision, and dispel phlegm. Modern pharmacological studies have proven that Cheqian can be used as a diuretic and antihypertensive, and a methanol extract of Cheqian was found to have dose-dependent glycation inhibitory activity and hepatoprotective effect. Cheqian essential oils have also shown hypocholesterolemic properties in mice through suppressing the expression of HMG-CoA reductase in vitro [13–16].

84.4 TCM Applications and Dietary Usage

84.4.1 TCM Applications

Cheqian is one of the most common herbal materials traditionally used as herbal medicines and diuretics, antipyretic and laxatives products. It exerts therapeutical and health-maintaining actions in the following aspects; as heat strangury with slow pain, edema distention and fullness, diarrhea caused by summerheat-dampness, swelling abscess, red painful swelling eyes, and phlegm-heat cough. Cheqian could be used by single form or combining forms with other herbs based on TCM theory.

Common Cheqian preparations are clinically used for: (1) diuretics or lithoexpulsium, like Bazheng mixture, Fenqing Wulin pill, Paishi granule, Qinglin granule and so on. They are usurally composed of 5–10 herbal components and Cheqian is mainly used for the treatment of edema distention and fullness, or swelling abscess. (2) Tonifying the kidney, like Wuzi Yanzong pill, Yishenling granule. Cheqian has been used clinically for nourishing the kidney and strengthening the essence. (3) Treatment of constipation and gastrointestinal functional disorder, Cheqian extract and preparations can be made from single Cheqian extract or active components, such as plantasan [17–19].

84.4.2 Dietary Usages

Because of the extensive documentation of Cheqian as one of the famous herbs and valuable dietary botanical materials, Cheqian can be used in many ways historically. Some of the ways to use Cheqian include making Cheqian tea or Cheqian soup. The following drinking or eating forms can be easily made at home.

84.4.2.1 Cheqian Tea

Composition: Cheqiancao (herb of *Plantago asiatica* L.) 50 g, honey 10 g.

Preparation: The whole plant of Cheqian is cleaned, dried in the sun and pounded into the juice, 100 ml should be obtained. Add honey. Drink the tea once or twice a month.

Function: Clearing phlegm, relieving coughs, and dispersing *Heat* and promoting eyesight. It is helpful for the treatment and prevention of ascites and edema distention.

84.4.2.2 Yeju Cheqian Tea

Composition: Yejuhua (capitulum of *Chrysanthemum indicum*) 15 g, Huangqin (root of *Scutellaria baicalennsis*) 9 g, Cheqianzi (seed of *Plantago asiatica* L.) 15 g.

Preparation: Put the slices or ground powder in a water pot or other glass container, add water and boil for 20 min. Remove the residue by filtration. Drink three times a day.

Function: It can be used in cases of red painful swelling eyes and helpful for the people suffering dizziness and hypertension.

84.4.2.3 Cheqian Drink

Composition: Cheqianzi (seed of *Plantago asiatica* L.).

Preparation: Pound proper amount of Cheqianzi into the juice and add honey. Boil the mixture a few minutes before drinking.

Function: It is used for the therapy for heat strangury and edema distention.

84.5 Clinical Evidences

There are thousands of clinical related reports or observational studies published on the effects of Cheqian and its related preparations for diseases of bacillary dysentery, chronic bronchitis, hypertension, and so on. Clinical reports showed that the preparation could effectively relieve hypertension in elderly patients in 50 cases. Cheqian is used with herbs such as Gualou (Fruit of *Trichosanthes kirilowii*), Zhebeimu (bulb of *Fritillaria thunbergii*), Pipaye (leaf of *Eriobotrya japonica*), etc. to treat a cough, and previous report showed 80 % of patients with a cough showed improvement after being treated with Cheqian decoction for a week. Cheqian is also used together with herbs that clear away heat and induce diuresis, such as Mutong (stem of *Akebia quinata*), Huashi (talcum), Bianxu (herb of *Polygonum aviculare*), etc., e.g. Bazheng powder to treat edema and strangury. After being treated with Cheqian tea, clinical symptoms of 80 % of the 30 pregnant women tested showed that their symptoms of gestational edema were eased or completely relieved [20, 21].

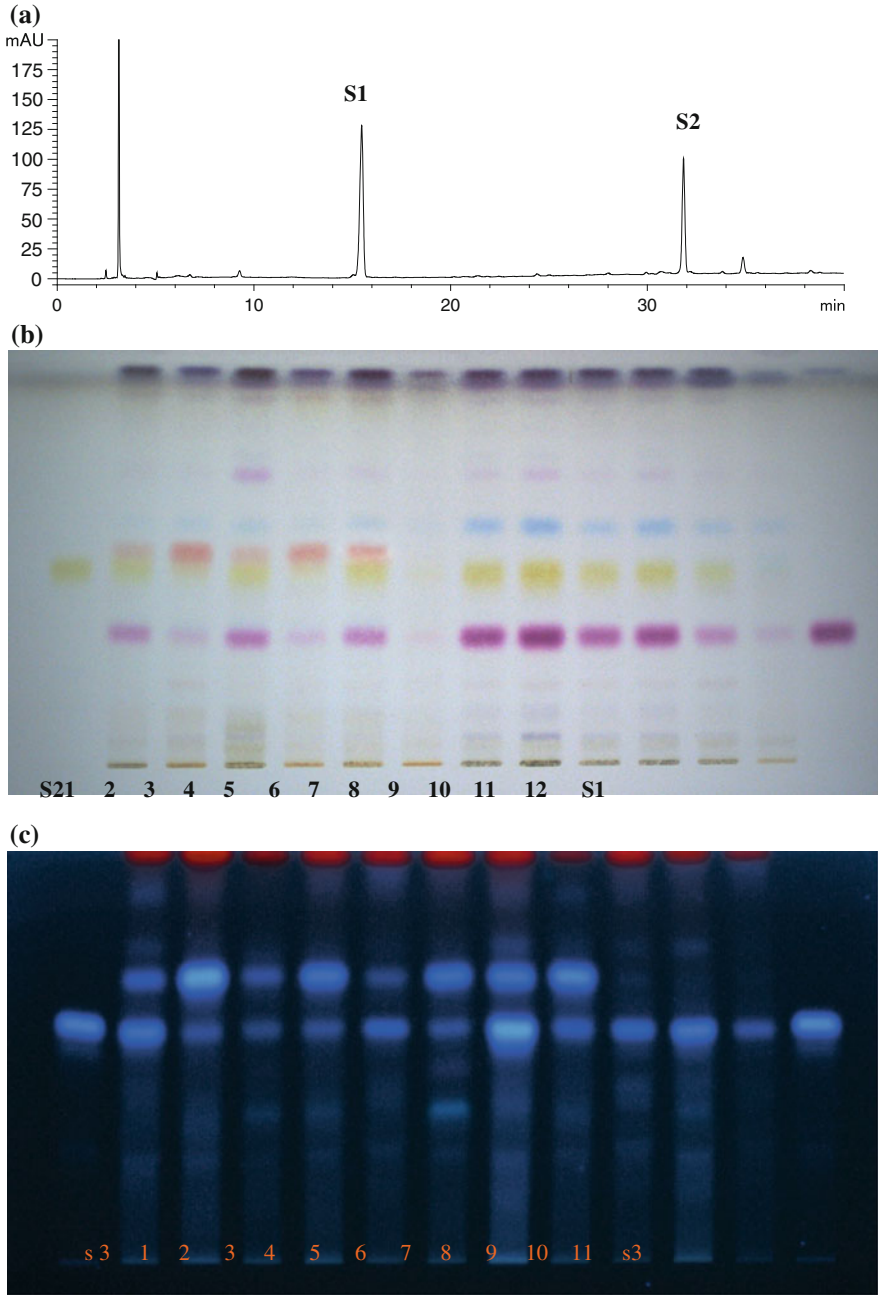

Fig. 84.3 Typical HPLC and TLC chromatograms of Cheqianzi (**a**, **b**) and Cheqiancao (**c**). *S1–S3* geniposidic acid, acteoside, and plantamajoside

84.6 Quality Evaluation and Assurance

Phenylethanoid glycosides and iridoids are two main types of active components of Cheqian. The typical HPLC and TLC chromatograms of crude Cheqian are shown in Fig. 84.3. From the figure we can see that acteoside, plantamajoside and geniposidic acid are the major components. Therefore, TLC identification and HPLC assay methods using acteoside and geniposidic acid as chemical markers were developed for quality control of Cheqianzi, while TLC identification and HPLC assay methods using plantamajoside as marker were established for quality control of Cheqiancao. Both the chemical markers and corresponding analytical methods have been adopted by the latest version of Chinese Pharmacopoeia (2010 edition) as quality criteria of Cheqianzi and Cheqiancao, respectively. As required in Chinese Pharmacopea 2010, it contains no less than 0.40 % of acteoside ($C_{29}H_{36}O_{15}$) and 0.50 % of geniposidic acid ($C_{16}H_{22}O_{10}$), with no less than 0.10 % of plantamajoside ($C_{29}H_{36}O_{16}$), calculated with the reference to the dried drugs Cheqianzi and Cheqiancao, respectively [1, 22].

84.7 Safety Evaluation and Toxicity Issue

There are few clinical reports on the toxicity and side effect directly related to Cheqian and related preparations. Additionally, animal tests have not shown clear toxicity for various organs through ip and oral administration. Cheqian is definitely a relatively safe herbal medicine often used as diuretics and antihypertention. However, when using the drug recreationally, without consulting a doctor, special care should be taken because it is obvious that Cheqian has strong biological activity and cannot be used as regular food. It's strongly suggested to ask your doctor if it's appropriate for you.

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