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Pharmacological Studies of Panacis Japonici Rhizoma. II

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Pharmacological properties attributed to Panacis Japonici Rhizoma (PJR) in Chinese medicine in Japan in terms of its usage as a drug for gastroenteric disorders, antipyretic, antitussive, expectorant and antiinflammatory drug, were studied. Chikusetsusaponin III was especially remarkable as it had antipyretic, antitussive, expectorative and antiedemic activities, increased intestinal motility, and prevented stress ulcers. Chikusetsusaponin IV showed expectorative action, protection against stress ulcers and acceleration of intestinal motility. Chikusetsusaponin V showed antiedemic activity. The substance giving protective effect against gastric secretion was found in the butanol layer but was not recognized in the saponins. Increased effect of intestinal motility was recognized in aqueous extract.

Keywords——*Panax pseudoginseng subsp. japonicus* HARA; chikusetsusaponin III; chikusetsusaponin IV; chikusetsusaponin V; antipyretic, antitussive and expectorative actions; antiinflammatory action; gastrointestinal system

The existence of many pharmacologically active substances was confirmed in Panacis Japonici Rhizoma (PJR; *Panax pseudogiseng subsp. japonicus*, HARA) by blind screening, that is, CNS-depressant, tranquilizing, cholinergic, anticholinergic, histamine-like, antihistamine-like, blood pressure elevating and lowering, antinicotinic and antiinflammatory substances. Especially chikusetsusaponin III (CS-III) whose aglycone is 20S-protopanaxadiol is remarkable as it has tranquilizing, anticholinergic, antihistamine-like, antinicotinic, blood pressure elevating and lowering activities.[2] In Chinese medicine modified in Japan, PJR is used as a drug for gastroenteric disorder, antitussive, expectorant, antipyretic and a drug for some types of inflammation.[3,4] Thus it is of interest to examine whether or not the components of PJR possess such effects in animal experiments. The present paper is an attempt to examine effects of 6 preparations from PJR as described previously[2] on various animal models of above diseases and the effect of standard drugs in order to compare the efficacy of the components.

Methods and Materials

The following methods were employed to determine antipyretic, antitussive, expectorative and antiinflammatory activities, and activity on gastric secretion, stress ulceration and intestinal motility in experimental animals.

Hypothermia Test——Male ddy mice (20—22 g) with 36.0 to 37.5° rectal temperature were used; each group consisted of 10 mice. The changes of rectal temperature were recorded every 30 or 60 min by a thermo-

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3) K. Ohtsuka, "Kanpo Diiten," Totoshobo, Tokyo, 1962, p. 467.
4) W.S. Kan, "Botany for Therapy," National Research Institute of Chinese Medicine, Taiwan, Republic of China, 1969, p. 409.

meter for 4 hours at room temperature (23°) and relative humidity of 65%. Test materials were given *p.o.* at either 400, 800 or 1000 mg/kg to mice in a volume of 0.1 ml per 10 g of body weight. As the control in this and the following tests, saline solution was given either *p.o.* or *i.p.*. Aminopyrine, 100 mg/kg, was given *p.o.* as a standard drug.

Antipyretic Test——Combined vaccine (Pertussis vaccine, Diphtheria and tetanus toxoid combined, Toshiba Kagaku Co. Ltd) was given *i.p.* to male ddy mice (20—22 g) with 36.0 to 37.5° rectal temperature in a dose of 0.1 ml per 10 g of body weight. Four and a half hour after vaccination, test materials were given *p.o.* at either 200, 400, 800 or 1000 mg/kg to those mice. Then, their rectal temperature was recorded at every 30- or 60-min intervals up to 210 min. Aminopyrine, 200 mg/kg, was given *p.o.* as a standard agent.

Antitussive Test——An antitussive test was carried out according to the original method of Takagi, *et al.*[5] Briefly, a guinea pig is anesthetized lightly by *i.p.* injection of 15 mg/kg of pentobarbital Na and fixed in a dorsal position. The trachea is exposed and a small hole punctured in it. A stimulating hair is introduced into the hole in 3 cm length to induce a cough. The stimuli were given 15, 30, 60, 90 and 120 min after *i.p.* injection of test materials at various dose levels and when no coughs occurred at all in response to stimuli, the material was considered to be effective. The AtD_{50} (median antitussive dose) of each material was calculated by the up and down method. Codeine phosphate was used as a standard agent.

Expectorative Test——As a model of expectorative test, an increased permeability of dye into the respiratory tract fluid was determined according to a modification of the method of Sakuno[6] and Takagi, *et al.*[7] Male guinea pigs (350—400 g) were anaesthetized with 20% urethane 4 ml/kg *i.p.* and then fixed in a dorsal position on a board. A T type cannula was inserted into a small hole which was made in the upper part of the trachea. Air saturated with vapor kept at 39° was passed through the one side of the cannula. A 5% pontamine sky blue 6BX (PSB) solution, 1 ml/kg, was injected into the femoral vein. Then the permeated fluid containing dye was collected from the tracheal duct for up to 4 hours by lowering the head of the guinea pigs at an angle of 30°. Immediately after sacrificing the animals, 0.5 ml of the collected fluid was re-injected into the trachea and recovered again in order to ensure the complete recovery of the dye which might have remained in the trachea. All the collected fluid was combined and the concentration of dye was analysed with Hitachi spectrophotometer at 605 mμ. Test materials were administered *p.o.* at either 200, 250 or 500 mg/kg at 0, 15, 30 and 45 min after the injection of dye. Ammonium chloride, 200 mg/kg, was used as a standard agent.

Capillary Permeability Test——Techniques employed were similar to those reported by Whittle.[8] A 5% solution of PSB (0.1 ml) was injected *i.v.* in mice. Five min later, a 0.7% acetic acid solution was injected *i.p.* in a volume of 0.2 ml per mouse and 20 min later the mice were killed by dislocation of the neck. The viscera was exposed and washed with distilled water. The combined washings were filtered through glass wool and made up to 10 ml in total in a graduated test tube. The amount of dye was determined by a spectrophotometer at 620 mμ and expressed as up per mouse. Test materials were given *p.o.* to mice at the dose of 400 mg/kg. Aminopyrine, 200 mg/kg, was given *p.o.* as a standard agent.

Carrageenin Paw Edema Test——According to the method of Winter,[9] male Wistar rats (150—170 g) in groups of 6 were used. A 1% carrageenin solution (0.1 ml) was injected into the tissues of the plantar surface of the hind paw of the animals as a phlogistic agent. The volume of the foot was determined immediately and at various periods (30, 60, 120, 180, 240 and 300 min) after carrageenin treatment. Phenylbutazone, 200 mg/kg, was used as a standard drug.

Gastric Secretion in the Shay Rat——Male Wistar rats, 160—170 g, were deprived of food overnight, and then the pylorus was ligated under anaesthesia. Test materials and atropine sulfate were administered intraduodenally (*i.d.*) immediately after the pylorus ligation in a volume of 0.5 ml per 100 g of body weight. Four hours later, the animals were sacrificed under ether anaesthesia and the stomach of each was removed. The gastric contents were collected and analysed for volume and acidity. The acidity was determined by titration of the gastric juice with 0.1N NaOH to pH 7.0. Total acid output was expressed as μEq/hr. The pepsin output was determined by the Anson's method,[10] and was expressed as mg tyrosine/hr.

Stress Erosion by Restraint and Water Immersion——Male ddy mice, 19—20 g, were deprived of food overnight, placed in a restraint cage and then immersed in a water bath (25°) for 6 hours.[11] After such stressing, these mice were immediately sacrificed by dislocation of the neck. The stomach of each was removed, inflated by injection of 1 ml of a 1% formalin solution and immersed in a 1% formalin solution for 10 min. The stomach was incised along the greater curvature and examined for lesions developed in the glandular protion. The length of each stress ulcer (mm) was measured individually under a dissecting

5) K. Takagi, H. Fukuda, and K. Yano, *Yakugaku Zasshi* **80**, 1498 (1960).
6) N. Sakuno, *Manshu Medical Journal* **33**, 779 (1940).
7) K. Takagi and E.B. Lee, *Yakugaku Zasshi*, **92**, 969 (1972).
8) B.A. Whittle, *Brit. J. Pharmacol.*, **22**, 246 (1964).
9) C.A. Winter, E.A. Risley, and G.W. Huss, *J. Pharmacol. Exp. Therap.*, **141**, 369 (1964).
10) M.L. Anson, *J. Gen. Physiol.*, **22**, 79 (1938).
11) S. Yano and M. Harada, *Japan. J. Pharmacol.*, **23**, 57 (1973).

microscope with a grid (10 X). Test drugs or chlorpromazine hydrochloride (CPZ) was given *i.p.* or *p.o.* 10 min before stress.

Gastrointestinal Propulsion Test——Male ddy mice, 21—23 g, were deprived of food overnight and then given 0.1 ml of 5% carbon black suspended in 10% acacia gum per animals.[12] Thirty min later, the animals were sacrificed and the intestinal tract was removed. The position to which the carbon black had travelled in the intestinal tract was measured. The ratio of the length with carbon black against the total length of the small intestine was calculated. The test drugs were given *p.o.* to the animals 30 min before carbon black treatment. Student's t-test was employed to determine statistical significance for all tests. Six preparations, namely MeOH ext., aqueous ext., BuOH ext., chikusetsusaponin III (CS-III), CS-IV and CS-V, were dissolved in physiological saline. Details of the preparations of these extracts and pure saponins were described in the previous report.[2]

Results

Effects of PJR and Aminopyrine on Normal Rectal Temperature

As shown in Fig. 1, BuOH ext and CS–III were found to reduce normal rectal temperature of mice significantly at doses of 1000, 400 and 800 mg/kg, respectively. The effect of these materials appeared within 30 min and persisted for about 1 hour after the administration. Other preparation such as MeOH ext., aqueous ext., CS–IV and CS–V had no effect on it. Aminopyline was confirmed to reduce rectal temperature at 100 and 200 mg/kg.

Effects of PJR and Aminopyrine on Vaccine-induced Hyperthermia

BuOH ext., 1000 mg/kg, and CS–III, 200 and 400 mg/kg, produced a significant lowering of vaccine-induced hyperthemia, as well as the normal rectal temperature (Fig. 2). The

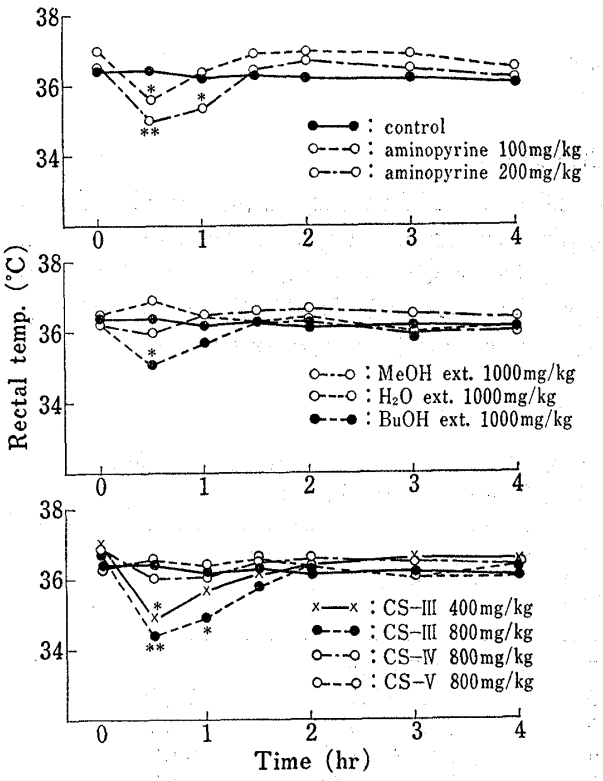

Fig. 1. Hypothermic Activity of Panacis Japonici Rhizoma and Aminopyrine in Mice

*: $p<0.05$, **: $p<0.01$

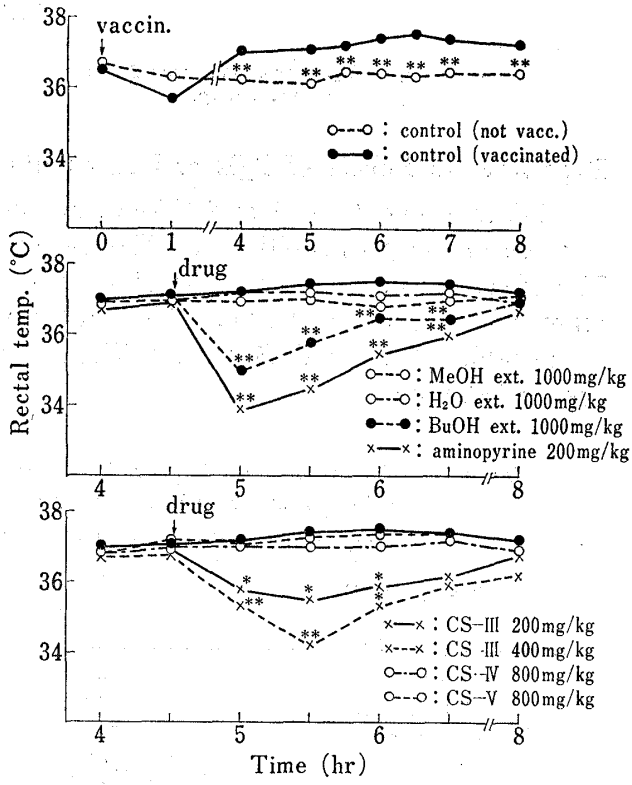

Fig. 2. Antipyretic Activity of Panacis Japonici Rhizoma and Aminopyrine in Mice

12) L.B. Witkin, C.F. Heubner, F. Galdi, E. O'Keefe, P. Spitaletta, and A.J. Plummer, *J. Pharmacol. Exp. Therap.*, 133, 400 (1961).

maximum effect appeared at 30 to 60 min after administration of these materials and the antipyretic effect persisted for about 2 hours. Aminopyrine, 200 mg/kg, was also effective.

Antitussive Effects of PJR and Codeine Phosphate

Methanol ext., BuOH ext. and CS–III inhibited the cough response induced by mechanical stimulation in quinea pigs. The AtD_{50} of these materials was shown in Table I. The AtD_{50} of codeine phosphate was 17.7 mg/kg. Thus, the effect of CS–III which showed the most potent antitussive effect of these 3 materials was found to be about 2.5 times less than that of codeine phosphate. Aqueous ext., CS–IV and CS–V, however, had no effect on the cough response.

Table I. Estimation of Median Antitussive Dose (AtD_{50}) of Panacis Japonici Rhizoma and Codeine Phosphate in Guinea Pigs by Mechanically Stimulating Method

Treatment[a]	Dose (mg/kg)	No. of animals	AtD_{50}[b] (mg/kg)
MeOH ext.	675.0	2	
	450.0	5	432.1
	300.0	3	
BuOH ext.	300.0	2	
	200.0	5	177.0
	133.3	3	
CS–III	75.0	2	
	50.0	5	44.3
	33.3	3	
Codeine phosphate	30.0	2	
	20.0	4	17.7
	13.3	4	

a) AtD_{50} was calculated with the up and down method.
b) Drugs were given *i.p.*

Expectorative Effects of PJR and Ammonium Chloride

Butanol ext, CS–III and CS–IV, at doses of 200 and 250 mg/kg caused a significant increase in the permeability of PSB into the respiratory tract in guinea pigs (Table II). The effect of these preparations of PJR were found to be almost equal to that of ammonium chloride, at 200 mg/kg. Methanol ext., aqueous ext. and CS–V did not exert any appreciable effect on PSB permeability, even though the first two fractions were given at a dose of 500 mg/kg.

Table II. Effects of Panacis Japonici Rhizoma and Ammonium Chloride on the Permeability of Pontamine Sky Blue into the Respitatory Tract Fluid of Guinea Pigs

Treatment[a]	Dose (mg/kg)	No. of Animals	Amount of PSB exuded[b] (ug/guinea pig) mean ± S.E.	Increment (%)
Control	—	5	31.7±2.5	
MeOH ext.	500	5	38.3±1.7	21.1
H_2O ext.	500	5	36.3±4.7	14.5
BuOH ext.	250	5	50.9±4.8**	60.6
CS–III	200	5	53.4±1.9**	68.5
CS–IV	200	5	59.6±9.5*	88.0
CS–V	200	5	28.6±3.8	−9.8
Ammonium chloride	200	5	52.0±4.0**	64.0

a) Drugs were given *p.o.* in four divided doses.
b) A 5% pontamine sky blue solution (PSB) was given *i.v.*(1 ml/kg).
* $p<0.05$, ** $p<0.01$

Effects of PJR and Aminopyrine on Capillary Permeability

CS–III and CS–V, at 400 mg/kg, revealed a significant inhibition of capillary permeability in response to acetic acid in mice (Table III), whereas CS–IV had no effect. Aminopyrine, at 200 mg/kg also significantly inhibited the permeability. The degree of inhibition observed with CS–V, 400 mg/kg, and aminopyrine, 200 mg/kg, was noted to be almost equal.

Table III. Effects of Panacis Japonici Rhizoma and Aminopyrine on Leakage of Pontamine Sky Blue into Peritoneal Cavity Induced by Acetic Acid in Mice

Treatment[a)]	Dose (mg/kg)	No. of Animals	Amount of PSB leaked (ug/mouse) mean ± S.E.	Inhibition (%)
Control	—	7	2010.0±199.6	
CS–III	400	6	1368.3± 52.9*	31.9
CS–IV	400	6	2023.3±192.2	−0.6
CS–V	400	6	918.3±110.4**	54.3
Aminopyrine	200	6	861.7± 57.1**	57.1

a) Drugs were given *p.o.*
* $p<0.05$, ** $p<0.01$

Effects of PJR and Phenylbutazone on Carrageenin Paw Edema

As shown in Fig. 3, CS–III, CS–IV, at 400 mg/kg significantly supressed the rat paw edema either 3 and 4 hours or 1 and 2 hours after the carrageenin application. phenylbutazone at a dose of 100 mg/kg induced a marked suppression of the development of edema during 1 to 5 hours after the injection.

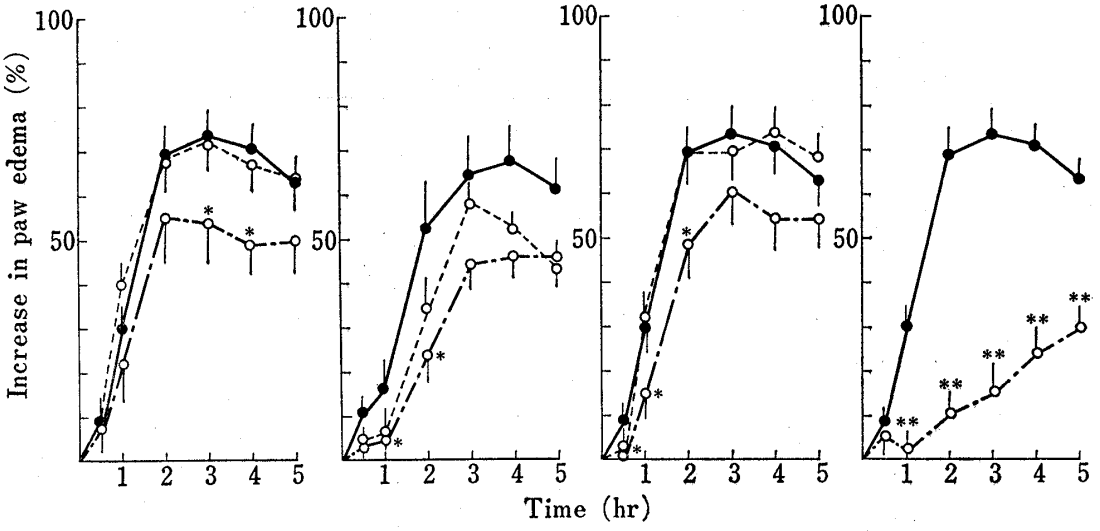

Fig. 3. Effects of Panacis Japonici Rhizoma and Phenylbutazone on Carrageenin Paw Edema

*: $p<0.05$, **: $p<0.01$
●—●: control, ○···○: CS-III 200 mg/kg, ○···○: CS-IV 200 mg/kg, ○···○: CS-V 200 mg/kg,
○-·-○: PB 100 mg/kg, ○-··-○: CS-III 400 mg/kg. ○-·-○: CS-IV 400 mg/kg, ○-·-○: CS-V 400 mg/kg

Effects of PJR and Atropine Sulfate on the Gastric Secretion in Pylorus-ligated Rats

As shown in Table IV, MeOH ext. at doses of 500 and 1000 mg/kg significantly inhibited the gastric secretion in either juice volume, acid or pepsin outputs or all of these parameters in pylorus ligated rats. Butanol ext., 200 and 400 mg/kg, also inhibited the gastric secretion in both juice volume and acid output significantly. Aqueous ext. and pure saponins had no effect on inhibition of gastric secretion. Atropine sulfate produced a marked inhibition of gastric secretion at a dose of 5 mg/kg.

TABLE IV. Effects of Panacis Japonici Rhizoma and Atropine Sulfate on the Gastric Secretion in Pylorus-ligated Rats (4hr)

Treatment	Dose (mg/kg)	No. of rats	Volume (ml)	Gastric contents Total acid output (μEq/hr)	Pepsin outputs (mg/hr)
Saline	—	8	6.3±0.4	157.1±12.1	31.0±3.9
MeOH ext.	250	7	6.7±0.9	169.1±29.8	34.7±5.0
	500	8	4.0±0.6**	94.5±15.8**	22.3±3.4
	1000	7	3.6±0.6**	91.9±17.3**	20.0±2.7*
H_2O ext.	250	5	4.3±1.1	96.1±32.2	22.0±5.4
	500	5	5.8±1.4	128.6±51.1	25.4±5.2
	1000	5	6.0±0.9	148.5±27.1	31.9±5.1
BuOH ext.	200	7	4.1±0.6*	83.2±11.2**	23.3±2.7
	400	7	3.8±0.4**	87.9±15.1**	23.5±2.6
CS–III	200	8	6.6±0.8	201.3±25.8	44.0±4.3
	400	9	6.2±0.8	167.5±24.0	35.1±4.6
CS–IV	200	5	5.6±1.0	134.3±27.7	32.2±5.4
	400	5	5.7±1.4	140.0±36.3	28.3±6.0
CS–V	400	7	6.8±0.7	182.1±18.6	40.2±5.1
Atropine sulfate	5	8	1.0±0.1**	32.2± 3.1**	6.8±0.8**

All values represent mean ± S.E. All materials were adm nistered intraduodenally immediately after the pylorus ligation in a volume of 0.5 ml per 100 g of body weight.
* $p<0.05$, ** $p<0.01$

TABLE V. Effects of Panacis Japonici Rhizoma and Chlorpromazine (CPZ) on Stress Ulcers Induced by Water-immersion (25°, 6 hr) in Mice

Treatment	Route	Dose (mg/kg) 0	50	100	200	400	800	1600	CPZ (mg/kg) *p.o.* 10 *i.p.* 5
MeOH ext.	*p.o.*	8.2±1.7					7.1±2.0 (13.4)	5.3±1.6 (35.3)	1.7±1.0** (79.2)
	i.p.	9.5±1.4		9.4±0.8 (1.0)	5.2±0.8* (45.3)	7.3±2.4 (23.1)			0** (100)
H_2O ext.	*p.o.*	8.2±1.1					9.2±3.0 (−12.1)	9.7±2.3 (−18.2)	0** (100)
	i.p.	11.0±2.2		12.8±4.5 (−16.3)	19.7±3.8 (−79.0)	15.0±2.8 (−36.3)			2.5±1.8* (77.2)
BuOH ext.	*p.o.*	8.6±1.6					7.8±2.2 (9.3)	4.8±1.2 (44.1)	3.7±1.5* (56.9)
	i.p.	14.8±2.7		11.8±3.8 (20.2)	7.2±0.5* (51.3)	4.0±1.4** (72.9)			1.2±0.5* (91.8)
CS–III	*p.o.*	8.3±1.3			8.7±2.1 (−4.8)	4.6±2.0 (44.5)	3.4±1.7* (59.0)		1.0±0.7* (87.9)
	i.p.	6.5±2.0	4.5±1.5 (44.4)	0.7±0.5* (89.2)					0.7±0.2* (89.2)
CS–IV	*p.o.*	9.7±1.5			8.4±1.9 (13.4)	7.9±2.0 (18.5)	4.0±1.8* (58.7)		3.2±1.6** (67.0)
	i.p.	12.3±1.6	7.7±2.8 (37.3)	7.4±2.6 (39.8)	4.8±1.0** (60.9)				2.0±1.4** (83.7)
CS–V	*p.o.*	9.2±2.0			6.7±0.6 (27.1)	6.6±0.7 (28.2)	7.8±2.4 (15.2)		1.8±0.8** (80.4)
	i.p.	13.5±1.2	13.0±2.5 (3.7)	4.5±1.8* (66.6)	5.8±1.5* (57.0)				2.0±1.3** (85.1)

Lesion indix is indicated as mean ± S.E.
* $p<0.05$, ** $p<0.01$
The number in the parenthesis means % inhibition.

Effects of PJR and CPZ on Stress Ulcers induced by Restraint and Water Immersion

Details of the results of PJR on stress ulcers in mice are given in Table V. It was noted that BuOH ext., CS–III, CS–IV and CS–V given by *i.p.* route significantly inhibited the stress ulcer at doses of 100 and 200 mg/kg. However, when these materials were given *p.o.*, CS–III and CS–IV inhibited the stress ulcers significantly at a dose of 800 mg/kg. CPZ markedly inhibited the stress ulcers by either *i.p.* or *p.o.* route at doses of 5 and 10 mg/kg.

Effects of PJR on Intestinal Propulsion

As shown in Table VI, it was found that MeOH ext., 1000 mg/kg, aqueous ext. and CS–III, 400 mg/kg, or CS–IV, 400 mg/kg, significantly enhanced the intestinal motility as evidenced by the movement of carbon black.

TABLE VI. Effect of Panacis Japonici Rhizoma on Intestinal Propulsion in Mice

Treatment	No. of Animals	Dose (mg/kg) *p.o.*						
		0	100	200	250	400	500	1000
MeOH ext.	6	62.6±3.9			62.9±2.7		64.8±3.4	79.1±3.7**
H_2O ext.	6	55.0±4.8			64.3±2.5		67.1±2.6*	61.1±4.0
BuOH ext.	6	62.8±4.3			68.3±4.1		66.9±5.9	73.7±5.1
CS–III	6	60.8±2.6	60.6±3.6	67.7±4.8		75.6±2.5**		
CS–IV	6	56.0±3.0	62.6±2.2	62.7±4.3		71.1±5.4*		
CS–V	6	60.9±3.4	57.6±2.8	60.1±3.1		65.4±3.1		

The value indicated the propulsion which was represented by percentage of total length of intestine.
All values represented mean ± S.E.
**: significant difference from control value ($p<0.01$), and *: ($p<0.05$)

Discussion

These studies show that some components of PJR have an antipyretic, antitussive, expectorative, or antiedemic effects, and effects on gastric secretion, stress ulceration and intestinal motility. In particular, both BuOH ext., and CS–III produced a hypothermia, which was more pronounced in the mice given pyrogenic vaccine than normal mice. Aminopyrine also showed almost the same effect as the components of PJR. It was suggested that CS–III, one of the main components of BuOH ext., had tranquillizing activity in the previous report,[2] but aminopyrine had no such activity. We have so far no idea how to explain these kinds of increased sensitivity of animals to drugs. It should be noted that BuOH ext. and CS–III also have a notable antitussive effect, even though their effects are slightly weaker than codeine phosphate. As expected from the clinical trial in oriental medicine, some components of PJR, such as BuOH ext., CS–III and CS–IV, revealed a notable increment of PSB solution into the tracheal fluid in quinea pigs. The effects of these materials were found to be almost equal to that of ammonium chloride, suggesting that these materials possess an expectorative effect. In addition, PJR in Chinese medicine is empirically known to be effective in curing inflammatory edema.[4] We have found an antiinflammatory activity of CS–V in blind screening, and have also confirmed the antiedemic effect of PJR, particularly, in its saponin fractions (CS–III and CS–V) in the experimental studies. As a matter of fact, CS–III and CS–V suppressed markedly the increased permeability induced by acetic acid *i.p.* in mice and to a lesser extent the carrageenin-induced edema in rat paw. The effects of MeOH ext., aqueous ext. and BuOH ext. were not determined in the present experiment because these fractions did not exert any preventive effect in the writhing test in mice in a previous report,[2] which suggested their little effect on the permeability. Methanol ext. and BuOH ext. inhibited gastric secretion in the pylorus ligated rat,

but saponins, especially CS–III which was estimated to have atropine-like, antihistamine-like, antinicotinic or papaverine-like activities, had no effect on gastric secretion. The fact that BuOH ext., CS–III, CS–IV and CS–V given *i.p.*, and CS–III and CS–IV given *p.o.*, inhibited stress ulcers, suggests the possibility that the protective effect is due to their CNS-depressant activity which was suggested by blind screening in the previous report.[2] Methanol ext., aqueous ext., CS–III and CS–IV enhanced the intestinal motility though CS–III had a tranquillizing activity. These findings provide useful supportive data for the application of PJR in Chinese medicine. Especially CS–III whose aglycone is 20S-protopanaxadiol is remarkable as it has antipyretic, antitussive, expectorative and antiedemic activities, increases intestinal motility, and prevents stress ulcers. CS–III may play an important role in the medical effect of PJR. CS–IV possessing oleanolic acid as the aglycone showed expectorative action, protection of the stress ulcers and acceleration of intestinal motility. CS–V showed antiedemic activity. The mechanism of pharmacological action of CS–III and other saponins has not been clarified as yet. The protective effect against gastric secretion was not recognized in the saponins and was found in BuOH layer. Increased intestinal motility was recognized in aqueous ext.