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Pharmacological Studies of Panacis Japonici Rhizoma. I

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Pharmacological properties of preparations from Panacis Japonici Rhizoma were studied by the screening methods consisting of 5 tests. CNS-depressant, tranquillizing, cholinergic, anticholinergic, histamine-like, antihistamine-like, antinicotinic, blood pressure elevating and lowering, and antiinflammatory activities were estimated. Chikusetsusaponin III whose aglycone is 20S-protopanaxadiol is especially remarkable as it has tranquillizing, anticholinergic, antihistamine-like, antinicotinic, and blood pressure elevating and lowering activities. Cholinergic, histamine-like and blood pressure elevating activities were found in the fraction which did not contain saponins. Antiinflammatory activity was estimated to chikesetsusaponin V.

Keywords——*Panax japonicum* C.A. Meyer; chikusetsusaponin III; chikusetsusaponin IV; chikusetsusaponin V; sedative action; Panax Ginseng root

Panacis Japonici Rhizoma (PJR), the rhizome of *Panax japonicum* C. A. Meyer, has been utilized for several hundred years in Japan as a substitute for Panax Ginseng root in Chinese medicine, especially as a drug for gastroenteric disorder, antitussives, expectorants and antipyretics. Kondo, *et al.*[2–5] have determined the chemical structure of several saponins contained in PJR, whereas no pharmacological studies have been reported on the extracts or the constituents of this drug. At the beginning, the following three approaches were adopted for our pharmacological studies on PJR. The first was how to find the pharmacological activities in PJR by bilnd screening in separating pharmacologically active principles. The second was determination of the pharmacological properties of PJR whether it can be used as a substitution of Panax Ginseng root. The third was determination of the pharmacological properties which can be attributed to PJR in Chinese medicine in Japan. The present study is an attempt to find pharmacological porpreties of PJR by blind screening and to differentiate pharmacologically active substances.

Methods and Materials

As pharmacological blind screening, five tests were employed in order to obtain a pharmacological spectrum of the activities of PJR extracts: 1) neuropharmacological observations in mice, 2) tests on cardiovascular system in rats, 3) tests on the isolated guinea pig ileum, 4) influence on hypnotic action of hexobarbital in mice, and 5) influence on writhing syndrome induced by 0.7% acetic acid. Acute toxicity in mice, local anaesthetic and local irritant activities in guinea pigs, and hemolytic activity[6] with rabbit blood, were also examined. Details of these tests are described in previous reports.[7,8] The pharmacological properties

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2) N. Kondo and J. Shoji, *Yakugaku Zasshi*, **88**, 325 (1968).
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which have been found in Ginseng, such as sedative activity and the effect on recovery from exhaustion, were also studied. To determine sedative activity of PJR, the following tests were employed: 1) climbing test in mice,[9] 2) rotating rod test in mice and rats, 3) motor activity test (hole cross test) in mice,[10] and 4) pole climbing test (avoidance of electroshock) in rats. Details of these methods have also been described in the literature.[11] To observe the effect on recovery from exhaustion, oscillation movement stress was applied to the mouse to produce a fatigued state. After a 4 hr-oscillation, drugs were given and the following 6 tests were used to measure fatigued states: 1) rectal temperature test, 2) rotating rod test, 3) inclined plane test, 4) spring balance test, 5) hole cross test, and 6) exploratory movement test. Details of these tests were described previously.[12,13]

The extracts and pure saponins of PJR were prepared as shown in Fig. 1. Six preparations, namely, MeOH extract (MeOH ext), aqueous fraction (H_2O ext), BuOH soluble fraction (BuOH ext), chikusetsusaponin III (CS-III), chikusetsusaponin IV (CS-IV) and chikusetsusaponin V (CS-V), were dissolved in physiological saline for testing.

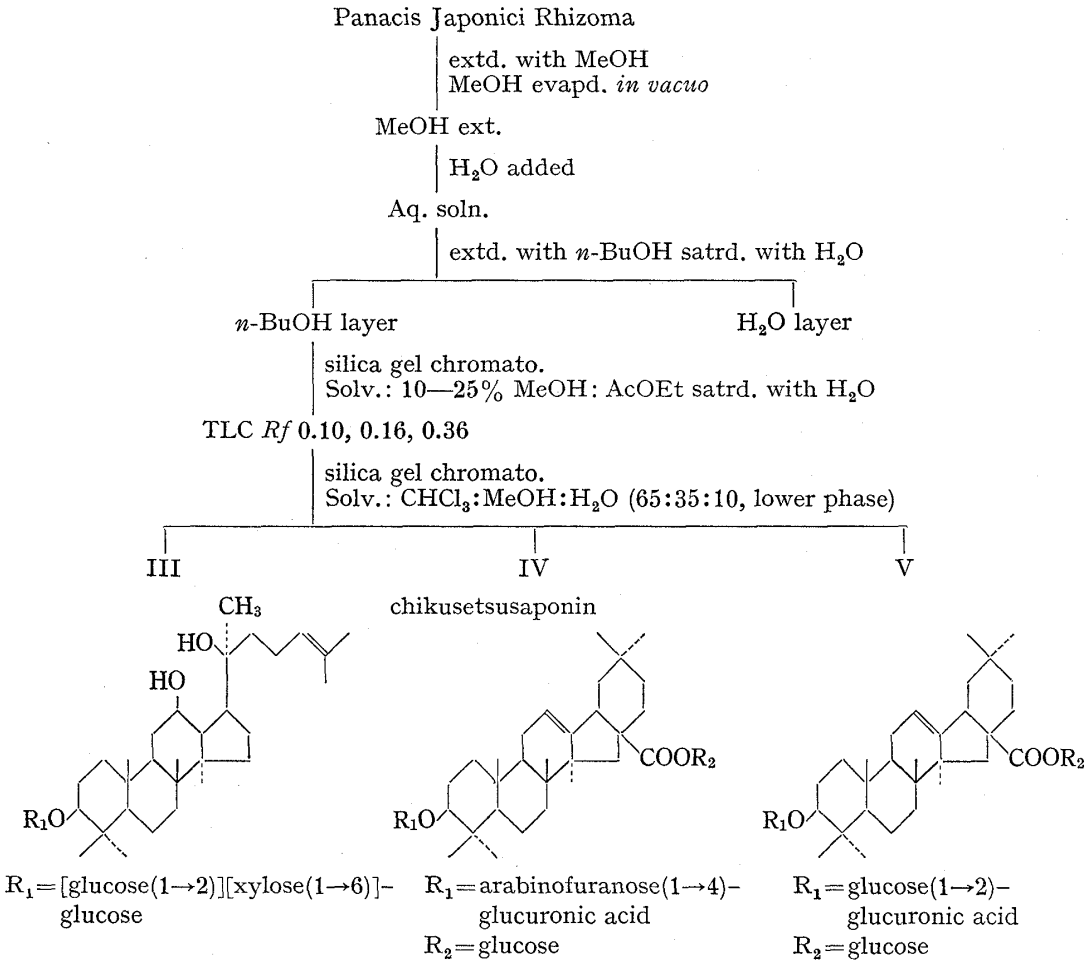

Fig. 1. Extraction and Isolation of the Chikusetsusaponins

Results

Fig. 2 shows the results of the neuropharmacological observations in mice. From the number of survival animals in each group, approximate *i.p.* LD_{50} values of the preparations were estimated to be more than 1 g/kg (H_2O ext), between 0.5 and 1 g/kg (MeOH ext, BuOH

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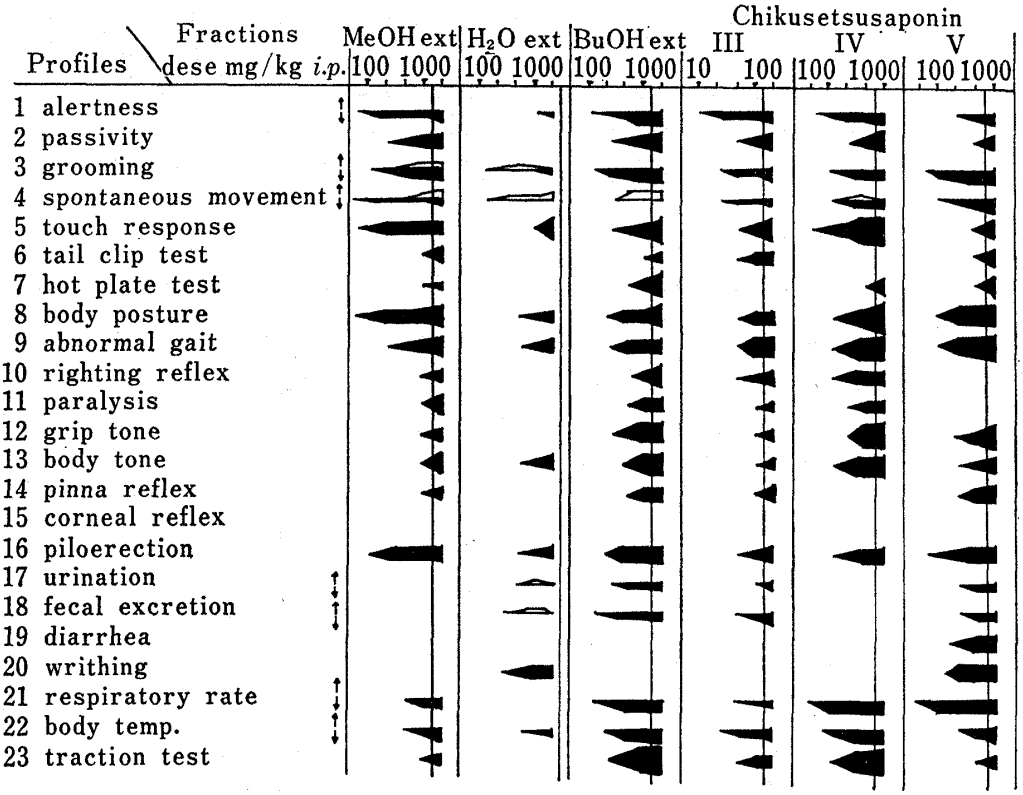


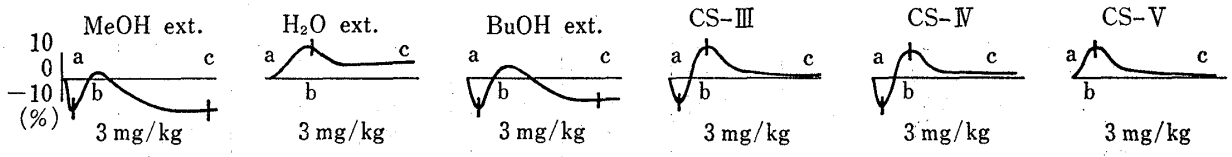
Fig. 2. Effect of Panacis Japonici Rhizoma on the Neuropharmacological Observations in Mice

The column shows the results obtained in the neuropharmacological screening procedure of Takagi, *et al.*[a] Length of column indicates from the dose which induced similar symptoms to those of control animal, to approximate lethal doses, and width of column indicates degrees of action. Ordinate lines in the column show approximate *i.p.* LD_{50} of the different extracts.
↑(↓): Symbols indicate increase (decrease) of contents.
a) K. Takagi, H. Saito, Y. Higuchi, and A. Yamaguchi, *Pharmacometrics*, **5**, 5 (1971).

ext, CS–IV and CS–V) and between 0.1 and 0.2 g/kg (CS–III). In doses of less than LD_{50}, MeOH ext produced the following symptoms: decrease of alertness and grooming, slight decrease in spontaneous movement, touch response, respiratory rate and rectal temperature, and slight increase in passivity and piloerection. Abnormal gait, and a slight increase in spontaneous movement and grooming were observed for a few min soon after the administration. Increase in grooming was also observed in the animals given H_2O ext, and increase in spontaneous movement was observed in the animals given H_2O and BuOH exts and CS–IV for a few min soon after the administration. Aqueous ext produced a slight increase of urination and fecal excretion. Butanol ext produced almost the same effects as those of MeOH ext, and a slight decrease of urination and fecal excretion. CS–III and CS–IV produced almost the same spectra as those of BuOH ext. Decrease of alertness, grooming, spontaneous movement and rectal temperature were observed particulary in the animals given CS–III. Symptoms indicating sedative activity were slightly observed in the animals given CS–V.

The effects of PJR preparations on arterial blood pressure in rats are summarized in Fig. 3. The arterial blood pressure of the rat showed a significant, but transient fall (phase a) by injection of 3 and 10 mg/kg of MeOH ext, returned to the normal levels and then showed a prolonged fall (phase c) within 3 min after the *i.v.* injection. In rats given 1 mg/kg of MeOH ext, a significant but prolonged fall was evident 3 min after the injection. With previous administration of atropine sulfate (Atr), the transient fall by MeOH ext decreased significantly. and the prolonged fall decreased significantly with previous administration of diphenhydramine hydrochloride (Diph). Tachyphylaxis was shown in the phase of c.

With doses of 1 and 3 mg/kg of H_2O ext, the blood pressure of rats showed a transient elevation. The pre-injection of phentolamine mesylate (Phent) or hexamethonium bromide (C_6) did not eliminate the hypertensive response. In rats given 10 mg/kg of H_2O ext, a significant but transient fall was shown before a transient elevation. The hypotensive response decreased significantly with Atr, but Diph and propranolol hydrochloride (Prop) did not



Fractions and drugs	Dose mg/kg	No. of animals	Max. Response a	Max. Response b	Max. Response c	Tachyphylaxis a	Tachyphylaxis b	Tachyphylaxis c	Atr a	Atr c	Diph a	Diph c	Atr+Diph a	Atr+Diph c
MeOH ext.	1	5	—	—	↓↓↓									
	3	7	↓↓↓	—	↓↓↓				*	—	—	*	***	***
	10	5	↓↓↓	—	↓↓↓	—	—	↓↓						
H_2O ext.	1	4	—	↑	—									
	3	5	—	↑	—									
	10	5	↓	↑↑↑	—	—	—	—	*	—	—	—	*	—
BuOH ext.	1	4	↓	—	—									
	3	6	↓↓↓	—	↓				*	—	—	***	***	***
	10	4	↓↓↓	—	↓	—	—	↓						
Chikusetsusaponin III	1	5	↓↓	↓	—									
	3	6	↓↓	↓↓	—	—	—	—	—	—	—	—	—	—
	10	8	↓↓↓	—	—	—	—	—						
Chikusetsusaponin IV	1	4	—	—	—									
	3	5	↓↓↓	↑↑↑	—	—	—	—	—	—	—	—	—	—
	10	8	↓↓↓	—	—									
Chikusetsusaponin V	1	4	—	—	—									
	3	5	—	↑↑↑	—									
	10	8	↓↓↓	↑	—				—	—	—	—	—	—

Effects of atropine sulfate (Atr: 2 mg/kg) and diphenhydramine hydrochloride (Diph: 3 mg/kg) on blood pressure were observed.
↑↑↑(↓↓↓): Symbols indicate the significant difference (increase or decrease) from control ($p<0.01$), ↑↑(↓↓): ($p<0.02$) and ↑(↓): ($p<0.05$).
***: Symbols indicate the significant antagonism from control ($p<0.01$), **: ($p<0.02$) and *: ($p<0.05$).

Fig. 3. Effect of Panacis Japoonici Rhizoma on Blood Pressure in Rats

Fractions and drugs	No. of organs	Histamine[a] Max. response 10^{-6}	Histamine[a] Max. response 10^{-5}	Histamine[a] Max. response 10^{-4}	Histamine[a] ED_{50} 10^{-6}	Histamine[a] ED_{50} 10^{-5}	Histamine[a] ED_{50} 10^{-4}	Concentration (g/ml) Acetylcholine[a] Max. response 10^{-6}	Acetylcholine[a] Max. response 10^{-5}	Acetylcholine[a] Max. response 10^{-4}	Acetylcholine[a] ED_{50} 10^{-6}	Acetylcholine[a] ED_{50} 10^{-5}	Acetylcholine[a] ED_{50} 10^{-4}	Nicotine[a] Max response 10^{-6}	Nicotine[a] Max response 10^{-5}	Nicotine[a] Max response 10^{-4}
MeOH ext.	8			↓↓	↑		↑						↑↑↑		↓	↓↓↓
H_2O ext.	8							↑↑↑			↓	↓↓↓				
BuOH ext.	8			↓		↑↑↑	↑↑↑			↓		↑↑↑	↑↑↑		↓↓↓	↓↓↓
Chikusetsusaponin Ⅲ	8			↓	↑↑	↑↑	↑↑↑			↓↓↓		↑↑↑	↑↑↑		↓↓↓	↓↓↓
Chikusetsusaponin Ⅳ	8					↑↑	↑↑↑									
Chikusetsusaponin Ⅴ	8															

a) The antagonism to the contraction induced by histamine dihydrochloride, acetylcholine cholide (cumulatively added) and nicotine tartrate (3×10^{-6} g/ml) was studied.
↑↑↑(↓↓↓): Symbols indicate the significant difference (increase or decrease) from control ($p<0.01$), ↑↑(↓↓): ($p<0.02$) and ↑(↓): ($p<0.05$).

Fig. 4. Effect of Panacis Japonici Rhizoma on the Guinea Pig Isolated Ileum

alter the hypotensive response caused by H_2O ext. A transient fall in a dose of 10 mg/kg became bigger after the repeated injections. Butanol ext produced almost the same effects as those of MeOH ext. CS–III, CS–IV and CS–V produced a transient fall and then a transient elevation. Atr, Diph, Prop, Phent and C_6 did not alter responses caused by these saponins. Tachyphylaxis was not detected upon repetitive injection. Effects of acetylcholine chloride (ACh), epinephrine hydrochloride (Epi) and histamine dihydrochloride(His) on cardiovascular response to all extracts were tested. They did not alter the three different characteristic blood pressure responses.

The effects of PJR preparations on the guinea pig isolated ileum are summarized in Fig. 4. They did not produce contraction of the ileum. Methanol ext, in concentrations of 10^{-6}, 10^{-5} and 10^{-4} g/ml, had no effect on maximal response of ACh contraction, but ED_{50} of ACh contraction was increased by a higher Concentration (10^{-4} g/ml). Methanol ext (10^{-4} g/ml) inhibited maximal response of His and nicotine tartrate (Nic, 3×10^{-6} g/ml) contractions. ED_{50} of His contraction was also increased in concentrations of 10^{-6} and 10^{-4} g/ml. Aqueous ext induced a significant potentiation of ACh contraction in concentrations of 10^{-6} and 10^{-5} g/ml, but had no effect on His and Nic contractions. Butanol ext and CS-III produced almost the same effects as those of MeOH ext. They (10^{-4} g/ml) inhibited maximal responses of ACh and His contractions, and ED_{50}s of ACh and His contractions were also increased by lower concentration (10^{-6} and 10^{-5} g/ml). They inhibited Nic contraction in concentrations of 10^{-5} and 10^{-4} g/ml. CS–IV produced an increase of ED_{50} of His but had no effect on ACh and Nic contractions. CS–V had no effect on the contractions. The effects of PJR preparations on hexobarbital anesthesia in mice are illustrated in Table I. Methanol ext in a dose of 100 mg/kg produced a significant prolongation of sleeping time

TABLE I. Effect of Panacis Japonici Rhizoma on Hexobarbital Anesthesia in Mice

Fractions and drugs	No. of animals	Dose (mg/kg) 0	100	300	1000	CPZ 2
MeOH ext.	10	21.6±3.5	35.8±2.0***	44.0± 4.1***	62.5±3.3***	57.1±4.2***
H_2O ext.	10	29.3±2.5	35.1±4.6	37.1± 3.3	40.4±3.2**	59.3±4.3***
BuOH ext.	10	31.3±2.4	47.0±3.6**	80.1±10.9***	*a)*	57.1±5.3***
Chikusetsusaponin III	10	32.3±3.3	65.6±9.1***	*a)*		57.9±3.5***
Chikusetsusaponin IV	10	32.3±3.3	36.6±4.2	61.3±4.7***		57.9±3.5***
Chikusetsusaponin V	10	31.3±2.4	37.7±3.1	59.4±2.7***		57.1±5.3***

Duration of loss of the righting reflex is indicated as mean time (min) ±S.E.
***: significantly different from control ($p<0.01$) and **: ($p<0.02$)
a) The mice died approximately 2.5 hr after the *i.p.* injection of hexobarbital.
CPZ: Chlorpromazine hydrochloride.

TABLE II. Effect of Panacis Japonici Rhizoma on Writhing Induced by 0.7% Acetic Acid in Mice

Fractions and drugs	No. of animals	Dose (mg/kg) 0	100	300	1000	Aminopyrine 200
MeOH ext.	5	24.6±2.6	25.4±2.0	18.8±5.1	24.6±2.2	0.2±0.2***
H_2O ext.	5	28.2±2.7	30.2±0.9	31.5±1.2	30.7±0.3	0***
BuOH ext.	8	19.5±3.1	23.4±1.4	22.5±1.5	14.0±3.2	1.7±1.0***
Chikusetsusaponin III	6	24.3±3.9	25.5±5.4	28.0±6.7		2.8±1.6***
Chikusetsusaponin IV	6	24.3±3·9	32.5±1.8	29.2±1.0		2.8±1.6***
Chikusetsusaponin V	8	29.3±4.9	22.2±5.4	13.4±5.6*		2.0±2.3***

The number of writhing per mouse is indicated as mean±S.E.
***: significantly different from control ($p<0.01$) and *: ($p<0.05$)

by hexobarbital (70 mg/kg, *i.p.*) administered 30 min after the *i.p.* injection of MeOH ext. Butanol ext and CS–III also produced a significant prolongation in a dose of 100 mg/kg and more. The effects of PJR preparations on writhing syndrome induced by acetic acid in mice are shown in Table II. CS–V in a dose of 300 mg/kg *p.o.* had a significant inhibiting effect on writhing. Butanol ext in a dose of 1 g/kg *p.o.* also had a slight inhibiting effect.

The effects of PJR preparations on mortality, hemolysis, local irritatoin and local anesthesia are shown in Table III. Oral LD_{50} values of all preparations were estimated to be more than 2 g/kg. All preparations were shown to have a weak hemolytic activity and local irritant activity in the vascular permeability test, but had no local anesthetic activity in the test utilizing the corneal reflex of the guinea pig.

Table III. Effect of Panacis Japonici Rhizoma on Mortality, Hemolysis, Local Irritation

Fractions and drugs	LD_{50} (mg/kg)[a]		Hemolytic[b] index	Local irritation ED_{50}[a](%)
	i.v.	*i.p.*		
MeOH ext.	629	733		0.101
H_2O ext.	3000<	4566		0.46
BuOH ext.	365	1400	1000	0.014
Chikusetsusaponin III	163	186	1000	0.014
Chikusetsusaponin IV	343	548	4000	0.014
Chikusetsusaponin V	278	656	1000	0.21
Pure Saponins (Merck)			50000	

a) LD_{50} and ED_{50} were calculated by up and down method.
b) Hemolytic index was calculated by the method of Fujita, *et al.*[6]

The effects of PJR preparations on motor activity in mice in the hole cross test are shown in Table IV. Methanol ext in a dose of 300 mg/kg *i.p.*, BuOH ext in doses of 100 and 300 mg/kg *i.p.*, and CS–III in doses of 30 and 100 mg/kg *i.p.* produced a significant decrease of motor activity of grouped mice. CS–IV and CS–V also produced a decrease in a dose of 300 mg/kg *i.p.* The effects of PJR preparations on exploratory movement in the climbing test are shown in Table V. Butanol ext in a dose of 100 mg/kg *i.p.* and CS–III in doses of 30 and 100 mg/kg *i.p.* produced a significant decrease of exploratory movement in mice. Methanol ext, H_2O ext, CS–IV and CS–V did not produce a decrease in a dose of 300 mg/kg *i.p.* The effects of saponins on motor coordination in the rotating rod test in rats, are shown in Table VI. CS–IV produced motor incoordintion in a dose of 100 mg/kg *i.p.*, and CS–V in a dose of 300 mg/kg *i.p.* The effects of saponins on conditioned avoidance response in rats are shown in Table VII. CS–III in doses of 30 and 100 mg/kg *i.p.* produced a specific blocking action of conditioned response. Maximal blocking effects on conditioned

Table IV. Effect of Panacis Japonici Rhizoma on Motor Activity in Mice

Fractions and drugs	Dose (mg/kg, *i.p.*)			
	0	30	100	300
MeOH ext.	104.8± 9.6		92.5± 7.5	68.5±12.6***
Water layer fraction	97.3±11.4			88.2± 9.8***
BuOH layer fraction	108.1±10.0		65.3± 8.3***	58.4± 6.6***
Chikusetsusaponin III	102.5± 8.6	72.1±6.4***	53.8± 5.9***	
Chikusetsusaponin IV	98.8±11.9		78.2± 9.4	
Chikusetsusaponin V	92.7± 6.9		98.6±11.5	72.8± 5.6***

Each value is the mean of values ±S.E. obtained from 6 groups of 5 mice each.
***: significantly different from control ($p<0.01$)

Table V. Effect of Panacis Japonici Rhizoma on Exploratory Movement in Mice

Fractions and drugs	Dose (mg/kg, *i.p.*)				CPZ 3
	0	30	100	300	
MeOH ext.	10		10	8	4***
Water layer fraction	10			8	5***
BuOH layer fraction	9	8	5*		4***
Chikusetsusaponin III	10	5***	3***		3***
Chikusetsusaponin IV	9			7	3***
Chikusetsusaponin V	10			8	5***

Numbers of mice which climbed the net for 10 min in a group of 10, are indicated.
***: significantly different from control ($p<0.01$) and *: ($p<0.05$)
CPZ: chlorpromazine hydrochloride

Table VI. Effects of Chikusetsusaponins on Motor coordination in Rats

Saponins	Dose mg/kg	No. of rats[a]		
		0.5[b]	1[b]	2[b]
Chikusetsusaponin III	0	0	0	0
	10	0	0	0
	30	0	0	0
	100	0	0	0
Chikusetsusaponin IV	0	0	0	0
	30	0	0	0
	100	2	2	0
	300	3	5	5
Chikusetsusaponin V	0	0	0	0
	30	0	0	0
	100	0	0	0
	300	2	2	0

a) Number of rats which failed to stay on the rotating rod for 3 min in a group of 5 rats.
b) time (hr)

Table VII. Effect of Chikusetsusaponins on Conditioned Avoidance Response in Rats

Saponins	Dose mg/kg	Inhibition of conditioned avoidance response (%)
Chikusetsusaponin III	0	2.2± 0.7
	10	2.2± 1.0
	30	7.8± 2.2*
	100	15.6± 2.8***
Chikusetsusaponin IV	0	2.2± 0.7
	30	3.3± 2.8
	100	25.6±15.0(12.3±12.3)
	300	65.0±10.3***(12.7±4.0**)
Chikusetsusaponin V	0	3.3± 1.0
	30	3.3± 1.3
	100	6.7± 1.7
	300	37.3± 8.3***(1.7±1.7)

***: significant difference from control value ($p<0.01$), **: ($p<0.02$) and *: ($p<0.05$)
Parentheses indicate the percent inhibition of conditioned escape response.
Groups of 6 rats were employed.

response occurred 20 min after the beginning of the test and were abolished approximate 40 min later. CS–IV and CS–V also produced a significant specific block of conditioned response in a dose of 300 mg/kg *i.p.*, but produced a block of unconditioned response at the same time. Antifatigue activity was not observed in every preparation used in a dose range of 10 to 300 mg/kg *i.p.*

Discussion

Pharmacological properties of 6 preparations of PJR were estimated from the results of 5 tests. Data on the neuropharmacological observations in mice were compared to a large mass of data of known drugs, but drugs showing similar neuropharmacological spectra could not be found. Interpretation of possible pharmacological properties of preparations was then attempted. Fig. 5 shows the pharmacological activities of PJR preparations obtained from the 5 tests. In the neuropharmacological observations in mice, CNS-depressant action was found in all the fractions used. In addition, traction test, lowering of body temperature and ptosis may indicate tranqillizing activity of CS–III. CNS-depressant activity of saponins was confirmed by the test on hexobarbital sleeping time and motor activity, and mild tranquillizing activity of CS–III at a dose of 30 mg/kg was confirmed by the specific blocking action of conditioned response in rats. It was also confirmed that 30 mg/kg of CS–III did not produce motor incoordination and a decrease of muscle tone, but decrease motor activity and exploratory movement. CS–IV and CS–V in a dose of 300 mg/kg also produced a block of both conditioned and unconditioned responses, motor incoordination and a decrease of motor activity. These results suggested that CS–IV and CS–V also exerted a weak CNS-depressant action. A weak CNS-depressant action may be found in the aqueous fraction.

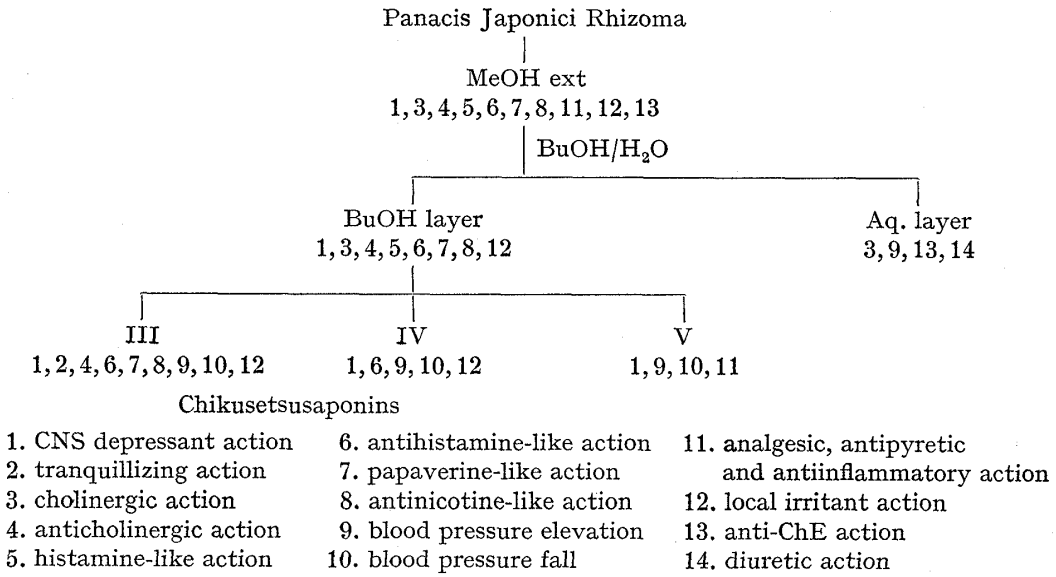


Fig. 5. Separation of Panacis Japonici Rhizoma

It was demonstrated that PJR had 4 different effects on the arterial blood pressure of the rat, that is, 2 transient hypotensive responses, a prolonged hypotensive and a transient hypertensive ones. Atr decreased one of the transient hypotensive responses to MeOH ext, H_2O ext and BuOH ext, but Diph and Prop did not eliminate it. Atr, Diph and Prop did not eliminate the other transient hypotensive response to saponins. Diph significantly decreased the prolonged hypotensive response to MeOH ext and BuOH ext, but Atr and Prop did not eliminate it. The previous administration of Phent and C_6 did not eliminate

the transient hypertensive response to H_2O ext and saponins. These results showed that PJR possesses cholinergic, histamine-like, and blood pressure elevating and lowering activities. The histamine-like action to MeOH ext and BuOH ext may be histamine releasing action because tachyphylaxis was shown in phase of c, and the prolonged hypotensive activity appeared 3 and 4 min after the injection.

All preparations did not induce the contraction of the ileum, but H_2O ext showed a potentiation of ACh contractions in concentrations of 10^{-6} and 10^{-5} g/ml. Anticholinergic, antihistamine-like and antinicotinic actions were found from MeOH ext, BuOH ext and CS–III. CS–III is thought to be the origin of these three activities, and to have a direct depressant action like papaverine as all three stimulants were inhibited by 10^{-4} g/ml of CS–III to about the same degree. CS–IV showed an inhibition of His contraction. CS–V had no effect on ACh, His and Nic contractions of the ileum.

CS–V had an inhibitory effect on writhing, therefore, it may have an antipyretic, analgesic and antiinflammatory activities based on the results of test 1 and 5. Antifatigue activity was not observed in every preparation of PJR. These saponins had a weak hemolytic effect and local irritant action, but no local anesthetic action.

The existence of many pharmacologically active substances was recognized in PJR, that is, CNS-depressant, tranquillizing, cholinergic, anticholinergic, histamine-like, antihistamine-like, blood pressure elevating and lowering, antinicotinic and antiinflammatory activities. Especially CS–III whose aglycone is 20S-protopanaxadiol is remarkable as it has tranquillizing, anticholinergic, antihistamine-like, antinicotinic and blood pressure elevating and lowering activities. Nevertheless it did not decrease the intestinal motility in mice (unpublished). Tranquillizing activity of CS–III is not stronger than that of ginsenoside Rb_1 of Panax Ginseng root whose aglycone is the same as CS–III. CS–IV and CS–V possessing oleanolic acid as the aglycone, and aqueous fraction of PJR which does not contain any saponins, showed a weak CNS-depressant action. A weak CNS-depressant action was found in both the H_2O ext of Panax ginseng root and ginsenoside Ro which is identical with CS–V.

The difference in pharmacological activities between Ginseng and PJR preparations has been demonstrated as follow: Ginseng has mild CNS-stimulant and antifatigue activities, but PJR has not. On the other hand, we did not find antihistamine-like action in Ginseng preparations. Methanol ext and H_2O ext of Ginseng root induced the contraction of the ileum which was decreased by Atr, but those of PJR did not.