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Evaluation of anti-diarrhoeal activity of *Quisqualis indica* L. leaves

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The aim of the present study is to evaluate the anti-diarrhoeal activity of the petroleum ether extract of leaves of *Quisqualis indica* L. against experimentally induced diarrhoea. Petroleum ether extract of the drug were evaluated for anti-diarrhoeal activity, using experimentally induced diarrhoea models: castor-oil induced diarrhoea, and charcoal induced gastrointestinal motility test in albino wistar rats of either sex. The earlier reported preliminary phytochemical screening of petroleum ether extracts revealed the presence of alkaloids, glycosides, flavonoids, tannins and phenolic compounds. petroleum ether extract of *Quisqualis indica* L. leaves at the doses (100, 200 mg/kg, p.o) were administered through the oral route. The plant extracts exhibited dose dependent anti-diarrhoeal effects in the all treated groups and the results were compared with that of standard drugs (Loperamide (3 mg/kg, p.o) and Atropine sulphate (0.1 mg/kg intraperitoneal), respectively as reference standard drugs. Statistically processed results support the conclusion, that the petroleum ether extracts of *Quisqualis indica* L. leaves (100 mg/kg and 200 mg/kg) possesses dose dependent, significant (P<0.05) antidiarrhoeal activity against experimentally induced diarrhoea.

Keywords: *Quisqualis indica*, Rangoon creeper, Anti-diarrhoeal, Atropine sulphate, Gastrointestinal motility.

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Introduction

Diarrhoea is characterized by increased frequency of bowel movement, wet stool and abdominal pain[1]. It is a major health problem especially for children under the age of 5 and up to 17% of children admitted in the pediatric ward die of diarrhoea. Worldwide distribution of diarrhoea accounts for more than 5-8 million deaths each year in infants and children below 5 years old especially in developing countries[2].

To combat the problem of diarrhoea in developing countries, the World Health Organization (WHO) has constituted a diarrhoea disease control program (DDC) which includes studies of traditional medicine practices together with the evaluation of health education and prevention approaches[3]. The synthetic anti-diarrhoeal drugs have various side effects like rashes, fever, joint pain, nausea, vomiting, headache[4], etc. Antibiotics used as anti-diarrhoeal drugs sometimes provoke adverse effects and microorganisms tend to develop resistance toward them[5]. Therefore, the search for safe and more effective agents has continued to be an important area of active research. Since ancient times, diarrhoea has been treated orally with several medicinal plants or their extracts based on folklore medicine.

Quisqualis indica L. (Family-Combretaceae) is a strong climber, ligneous vine that can reach from 2.5 m to up to 8 m. It is commonly known as Rangoon creeper.

It is indigenous in Africa, Indo Malaysian region and cultivated all over India. Flowers numerous, pendent, 7.5 cm long, 3.8 cm wide. At first they are white in color then they become deep red[6]. Pharmacognostic and phytochemical studies have reported the presence of alkaloids, glycosides, flavonoids, tannins and phenolic compounds in petroleum ether extracts of leaves[7].

The plant is also used as a cough cure. In Amboina the leaves are given in a compound decoction for flatulent distension of abdomen. In India also it is used for same purpose and seeds are given with honey as an electuary for the expulsion of entozoa in

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children. In Philippines the fruit and seeds are used as a vermifuge[7] whereas in China, Thailand and Indo-China region seed are used as vermifuge and for rickets in children. In Bangladesh seeds are used for diarrhoea, fever, boils, ulcers and helminthiasis[8]. Leaves contain rutin, trigonelline, L-proline, laspargine and quisqualic acid whereas flower gum contains pelargonidin-3-glucoside. Seed oil contains linoleic, oleic, palmitic, stearic and arachidic acids. Ellagitannins, quisqualin A & B is present in fruits of this plant[9] and flower contains linalool oxides (furanoid and pyranoid), 2,2,6-trimethyl-6-vinyl-3-oxo-tetrahydropyran, (E, E)-alphafarnesene, (Z)-3-hexenyl benzoate and benzyl benzoate[10]. Four diphhenyl propanoids were isolated from stem bark[11]. Antimicrobial, antibacterial, antifungal and anticoccidial activities of *Q. indica* have been already reported[12-14]. Methanolic extract of leaves also shown significant antipyretic property[15]. No report was found on anti-diarrhoeal property of the leaves of this species, therefore, authors selected this topic for study.

Material and Methods

Plant material

The mature green leaves of *Q. indica* L. were collected in the morning locally from Jaipur District, Rajasthan, India, in the month of August 2009. The plant was identified and authenticated by the Botanist from the Department of Botany, University of Rajasthan, Jaipur, India. A voucher specimen (RUBL20663) is deposited in the Department of Botany, University of Rajasthan. After authentication fresh leaves were collected in bulk, dried under shade and pulverized in a grinder. The coarse powder was used for further studies.

Preparation of extract

About 500 g of dry powder was taken in a closed bottle and it was extracted with petroleum ether by using cold maceration process for 7-8 days with occasional shaking. The petroleum ether extract was filtered, concentrated under reduced pressure to a semisolid mass and was made free from solvent[16,17]. For *in-vivo* studies, the concentrated petroleum ether extract of *Quisqualis indica* (PEQI) was administered orally after suspending in 0.5% Tween 80 in distilled water[18]. The freshly prepared solution of PEQI was used in each experiment. 100 mg/kg and 200 mg/kg b.w. test doses were selected for the oral acute toxicity study in mice.

Acute toxicity studies

In accordance with the OECD 423 guidelines the acute toxicity test was carried out in mice. All groups of test drug showed neither any toxic effect nor any lethal effect in the dose range up to 2000 mg/kg body weight. Two doses of 100 mg/kg and 200 mg/kg of body weight of petroleum ether extract were selected for further screenings[19].

Animals

Wistar albino rats of either sex, weighing 150-200 g were used for the study. The animals were kept in polypropylene cages in a room maintained under controlled atmospheric conditions and fed animals with standard diet (Hindustan Liver, Mumbai, India) with *ad libitum*. Pharmacological study was approved by Animal Ethical Committee of School of Pharmacy; Suresh Gyan Vihar University, with CPCSEA Reg no. 1234/a/.08/CPCSEA.

Drugs and chemicals

All chemicals and solvents used in the study were of analytical grade. Loperamide was purchased from Ranbaxy laboratory, Gurgaon, Castor oil from Central drug house, New Delhi and Atropine sulphate from Ives Drugs (India) Pvt Ltd, Indore. Chemicals used in the study were procured from Central drug house, Delhi.

Evaluation of anti-diarrhoeal activity

Castor oil induced diarrhoea

The animals were divided randomly into four groups containing six animals each group. All groups received castor oil at a dose of 1 mL/animal orally, 30 min after castor oil administration, Group I received vehicle (0.5% Tween 80 in distilled water). The second group received the reference drug Loperamide (3 mg/kg) orally whereas the third and fourth group received the extract dose PEQI 100 and PEQI 200 mg/kg p.o. After this administration, the animals were placed separately in metabolic cages with filter paper, which was changed every hour. The severity of diarrhoea was assessed each hour for 6 h. The total number of faeces and diarrhoea faeces excreted and the total weight of faeces were recorded within a period of 24 h and compared with the control group. The total number of diarrhoea faeces of the control group was considered 100%. The result was expressed as a percentage of inhibition of diarrhoea[20].

Gastro-intestinal motility test model

Albino rats of either sex weighing 150-200 g were used and they were divided into four groups of six animals each group. The first group (the control group) was orally administered the vehicle (0.5% Tween 80 in distilled water). The second group received the standard drug, atropine sulphate (0.1 mg/kg body weight intraperitoneal). The third and fourth groups received PEQI 100 mg/kg and PEQI 200 mg/kg body weight, respectively. 30 min after administration, each animal was given 1 mL of charcoal meal orally (10% activated charcoal in 5% gum acacia)[21]. Also, 30 min after this administration, each animal was sacrificed and the distance covered by the charcoal meal in the intestine, from the pylorus to the caecum was measured and expressed as a percentage of distance moved[22].

Statistical analysis

All the values were expressed as Mean ± SEM and analyzed for ANOVA followed by Dunnet's t-test. Differences between groups were considered significant at $P < 0.05$ levels. The statistical analysis was carried out using Graph Pad Prism 5 software.

Results and Discussion

Castor oil-induced diarrhoea

In the castor oil-induced diarrhoea experiment, the rats that did not receive the plant extract, showed typical diarrhoea signs such as watery and frequent defecation. The petroleum ether extract of *Q. indica* produced a marked anti-diarrhoeal effect in the rats. Both doses of PEQI significantly ($P < 0.05$) decreased the total number of wet faeces produced by administration of castor oil (15.32 at the dose of 100 mg/kg and 12.45 at the dose of 200 mg/kg) as compared to the castor oil-treated control group (21.16). The percentage of inhibition of castor oil induced diarrhoea in PEQI treated rats was 27.59% and 32.23%, respectively at 100 and 200 mg/kg dose (Table 1 and Fig. 1). The average weight of faeces in the control group was 13.62 g. Treatment with 100 mg and 200 mg of PEQI significantly reduced ($P < 0.05$) the weight of faeces to 10.16 and 9.37 from 13.62 (Table 1 and Fig. 2).

Charcoal-induced gut in transit changes

The administration of PEQI also slowed down the propulsion of charcoal meal through the gastro-intestinal tract when compared to the castor

Table 1—Effct of petroleum ether extract *of Quisqualis indica* L. leaves at the doses (100, 200 mg/kg. p.o) in castor oil-induced diarrhoea in albino rats

Groups	Total no. of faeces	Total no. of Diarrhoeal faeces	% Inhibition	Total weight of faeces	% Inhibition
Group I	25.16±1.472	21.16±1.941	-	13.62±1.062	-
Group II	8.83±0.894	5.50±1.049***	74.01	1.45±0.087***	89.35
Group III	20.12±1.032	15.32±1.359**	27.59	10.16±0.412**	25.40
Group IV	17.05±0.62	12.45±0.983***	32.23	9.37±0.356***	31.21

Values are expressed as mean ± S.E.M (n = 6) in each group. Statistical analysis ANOVA followed by Dunnett t-test.* P<0.05, **P<0.01, ***P<0.001 as compared with Group I (control group).

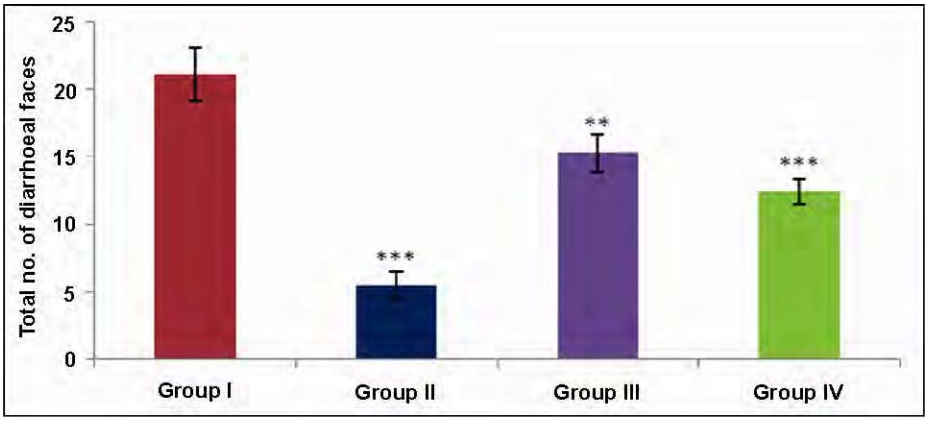

Fig. 1—Total number of diarrhoeal faeces in castor oil-induced diarrhoea in albino rats

oil-treated rats. The percentage of intestinal length travelled by charcoal meal in PEQI pre-treated (100 and 200 mg/kg) and castor oil treated rats was 68.12, 66.34 and 73.25%, respectively. Atropine on its part, produced a marked decrease in the propulsive movement and the intestinal length travelled by charcoal meal was 43.82 (Table 2 and Fig. 3).

Castor oil causes diarrhoea due to its active metabolite, ricinolic acid[23], which stimulates peristaltic activity in the small intestine, leading to changes in the electrolyte permeability of the intestinal mucosa. Its action also stimulates the release of endogenous prostaglandin[24].

In this study, the petroleum ether extract of *Q. indica* exhibited a significant anti-diarrhoeal

Table 2—Effect of petroleum ether extract of *Quisqualis indica* L. leaves at the doses (100, 200 mg/kg.p.o) in charcoal-induced gut in transit changes in albino rats

Groups	Mean length of small intestine	Percentage of distance travelled by charcoal meal	% Inhibition
Group I	101.65±0.98	73.25±1.12	-
Group II	101.60±1.36	43.82±1.13***	56.87
Group III	105.53±1.60	68.12±0.72**	35.44
Group IV	103.38±1.25	66.34±1.33***	35.82

Values are expressed as mean ± S.E.M (n =6) in each group. Statistical analysis ANOVA followed by Dunnett t-test. *P<0.05, **P<0.01, ***P<0.001 as compared with Group I (control group).

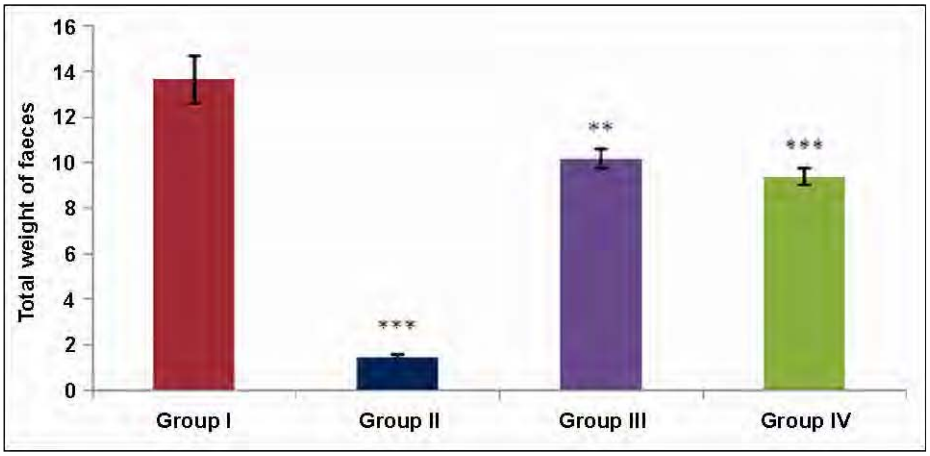

Fig. 2—Total weight of faeces in castor oil-induced diarrhoea in albino rats

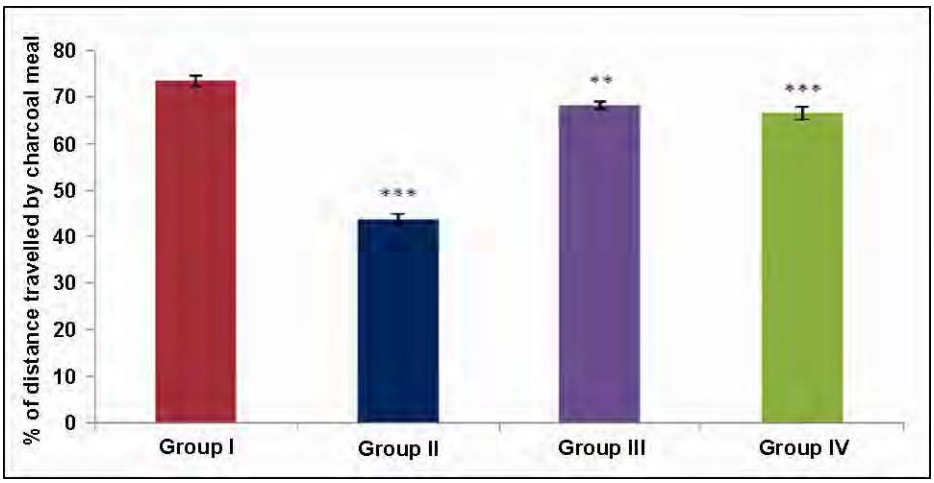

Fig. 3—Percentage of distance travelled by charcoal meal (cm) in albino rats

activity. Its effect depends on the dose. PEQI significantly reduced intestinal transit as observed by the decrease in intestinal motility of charcoal meal. The earlier reported preliminary phytochemical screening of petroleum ether extracts of leaves of *Q. indica* revealed the presence of alkaloids, glycosides, flavonoids, tannins and phenolic compounds[7]. Also earlier studies have reported that anti-dysenteric and anti-diarrhoeal properties of medicinal plants were due to tannins, alkaloids, saponins, flavonoids, sterol and/or triterpenes and reducing sugars[25, 26].

Hence, tannins, alkaloids and flavonoid present in this plant may be responsible for the mechanism anti-diarrhoeal activity. The antidiarrhoeal activities of flavonoids have been ascribed to their ability to inhibit intestinal motility and hydro electrolytic conditions[27]. Flavonoids present in the plant extracts are reported to inhibit release of autocoids and prostaglandins, there by may inhibit motility and secretion induced by castor oil[28]. Tannins and tannic acid present in antidiarrhoeal plants denature proteins in the intestinal mucosa by forming protein tannates which make the intestinal mucosa more resistant to chemical alteration and reduce secretion[29]. The presence of these constituents may mediate the anti-diarrhoeal property of the extract. Loperamide, apart from regulating the gastrointestinal tract is also reported to slow down transit in the small intestine, reduce colon flow rate and consequently any effect on colonic motility[30]. Atropine significantly reduced intestinal transit time. This is possible due to its anticholinergic effect[31]. Furthermore, a decrease in intestinal transit time with atropine could also be due to reduction in gastric emptying[32].

Conclusion

The results of this investigation revealed that PEQI contains pharmacologically active substances with anti-diarrhoeal properties. These properties confirm the use of *Q. indica* as an anti-diarrhoeal drug used by traditional healers.

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References

1 Ezekwesili CN, Obiora KA and Ugwu OP, Evaluation of Anti-diarrhoeal property of crude aqueous extract of *Ocimum gratissimum* L. (Labiatae) in Rats, *Biokemistr*, 2004, **16**(2), 122-131.

2 Fauci AS, Bravnwold E, Isselpacker K, Wilson JD, Kasper DL, Hauser SL and Longo DL, Harrison's Principles of Internal Medicine , edited by New York, McGraw Hill Company, 1993, Vol. **1**, 236 -242.

3 Syder JD and Mersom MH, The magnitude of the global problem of acute diarrhoea disease: A review of active surveillance data*, Bull World Health Organ*, 1982, **60**, 605-613.

4 Tripathi KD, Essentials of medical pharmacology, 5th edition, edited by Jaypee brothers-Medical publishers (P) Ltd, 2003, 168-170.

5 Soberon JR, Sgariglia MA, Sampietro DA, Quiroga EN and Vattuone MA, Antibacterial activities of plant extracts from North western Argentina, *J Appl Microbiol*, 2007, **102**, 450-61.

6 Kirtikar KR and Basu B, Indian Medicinal Plants, edited by Prashant Gahlot at Valley Offset Publishers,2006, **2**, 1037.

7 Singh Nitu, Kumari Parveen, Singh Nikhilesh and Damor Reena, Pharmacognostic and phytochemical study of leaves of *Quisqualis indica* Linn*., Intern J Res Pharm Sci*, 2011, **1**(1), 88-99.

8 Joshi SG, Medicinal plants, edited by Mohan Primlani for Oxford and IBH publishing Co.pvt. Ltd, 2002, 141.

9 Ta Chen Lin,Ying Tsun Ma, Jen Der Wu and Fen Ling, Tannin and related compounds from *Quisqualis indica*, J *Chinese Chem Soc*, 1997, **44**(2), 151-155.

10 Rout PK, Naik SN and Rao YR, Subcritical CO2 extraction of floral fragrance from *Quisqualis indica* L., *J Supercrit Fluids*, 2008, **45**(2), 200-205.

11 Jahan FN, Rahman MS, Rahman MM, Gibbons S, Masud MM, Sadhu SK, Hossain M, Hasan CM and Rashid MA, Diphenylpropanoids from *Quisqualis indica* and their anti-staphylococcal activity, *Latin Amer J Pharm*, 2009, **28**, 279-283.

12 Jhanan FN, Rahman,Mohammad S, Rashid and Mohammad A, Antimicrobial activity and toxicity of *Quisqualis indica*, *Intern J Orient Pharm Exp Med*, 2008, **l**(1), 53-58.

13 Kumar VP, Chouhan NS, Padh H and Rajni H, Search for antibacterial and antifungal agents from selected Indian medicinal plants, *J Ethanopharmacol*, 2006, **107**,182-188.

14 Dwivedi SC and Garg S, Larvicidal activity of plant extract *Corcyra cephalonica, Indian J Apllied Entomol*, 2001, **15**(2), 143-144**.**

15 Nitu Singh, Pankaj Khatri, KC Samantha and Reena Damor, Antipyretic activity of methanolic extract of leaves of *Quisqualis indica* Linn., *Intern J Pharm Res Development*, 2010, **2**(9), 123-126.

16 Jain NK and Sharma SN, A Textbook of Professional Pharmacy, 4th edition edited by Vallabh Prakashan, 2003, 111-120.

17 Agarwal SS and Paridhavi M, Herbal Drug Technology, edited by Universities press (India), Pvt. Ltd., 2007, 446-450.

18 Amresh, Reddy GD, Rao CV and Shirwaikar A, Ethnomedical value of *Cissampelos pareira* extract in

experimentally induced diarrhoea, *Acta Pharm*, 2004, **54**, 27-35.

19 OECD, Acute oral Toxicity – Acute oral toxic class method, Guideline 423, adopted 23.03.1996.

20 Zaval MA, Pera ZS, Perez P, Vargan R and Perz RM, Antidiarrhoeal activity of *Waltheria anorlana, Commelina coelestis* and *Alternanthera repens*, *J Ethnopharmacol*, 1988, **61**, 41-47.

21 Mandal SC, Mukharjee PK, Saha K, Pal M and Saha BP, Antidiarrhoeal evaluation of *Ficus racemosa* Linn. leaf extract, *J Nat Prod Sci*, 1997, **3**(2), 100-103.

22 Mujumdar AM, Antidiarrhoeal activity of *Azadirachta indica* leaf extract, *Indian Drugs*, 1998, **35**(7), 417- 420.

23 Ammon PJ, Thomas and Philips S, Effects of oleic and recinoleic acids net jejunal water and electrolyte movement, *J Clin Inves*, 1974, **53**, 374-379.

24 Galvez J, Zarzuelo A, Crespo ME, Lorente MD, Ocete MA and Jiménez J, Antidiarrhoeic activity of *Euphorbia hirta* extract and isolation of an active flavonoid constituent, *Planta Med*, 1993, **59**, 333- 336.

25 Galvez J, Zarzuelo A and Crespo ME, Antidiarrhoeic activity of *Scleroarya birrea* bark extract and its active tannin constituent in rats, *Phytother Res*, 1991, **5**, 276-278.

26 Longanga Otshudi A, Vercruysse A and Foriers A, Contribution to the ethnobotanical, phytochemical and pharmacological studies of traditionally used medicinal plant in the treatment of dysentery and diarrhoea in Lomela area, Democratic Republic of Congo (DRC), *J Ethnopharmacol*, 2000, **71**(3), 411-423.

27 Venkatesan N and Thiyagaranjan V, Anti-diarrhoeal potential of *Asparagus racemosus* Willd. root extracts in laboratory animals, *J Pharm Pharmac Sci*, 2005, **8**(1), 39-46.

28 Veiga VF, Zuninol, Calixto JB, Pititucci ML and Pinato AC, Phytochemical and antioedematogenic studies of commercial copaiba oils available in Brazil, *Phytother Res*, 2001, **15**(6), 476-480.

29 Havagiray RC, Ramesh G, Mehrd AD and Sadhana K., Studies on anti-diarrhoeal activity of *Calotropis gigantea* in experimental animals, *J Pharm Sci,* 2004, **7**(1), 70-73.

30 Theoderau V, Fioramont J, Hachet T and Bueno L, Absorptive and motor components of anti-diarrhoeal action of loperamide: an *in vivo* study in pigs, *Gut* 1991, **32,** 1355-1359.

31 Brown JH and Taylor P, Muscarinic receptor agonists and antagonist, *In*: Hardman JG, Limbird LE (Eds), Goodman and Gilman's the Pharmacological Basis of Therapeutics, 10th edn, edited by Macgrow Hill, New York, 1996, 115-158.

32 Izzo AA, Mascolo N, Capasso R, Germano MP, De Pasquale R and Capasso F, Inhibitory effect of cannabinoid agonists on gastric emptying in the rat, *Archieves Pharmacol,* 1999, **360**, 221-223.