Short Communication

Pharmacological studies of *Striga senegalensis* Benth (Scrophulariaceae) as an abortifacient

1. M. K. Choudhury*,
2. A. L. Phillips and
3. A. Mustapha

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Author Information

Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Nigeria

*Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Nigeria

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Striga senegalensis; Scrophulariaceae; methanol extract; isolated rat uterus; atropine inhibition of contract

Abstract

The methanol extract of *Striga senegalensis* Benth (Scrophulariaceae) was investigated on isolated rat uterus. Acetylcholine and the methanol extract of the plant produced dose related contractions of smooth muscle of the isolated rat uterus *in vitro*. Atropine in doses of 2×10^{-2} to 32×10^{-2} µg/mL antagonized dose dependently the contraction of the isolated rat uterus produced by both acetylcholine (1.6×10^{-1} µg/mL) and the methanol extract (160 µg/mL). © 1998 John Wiley & Sons, Ltd.

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   J. O. Adeboye, W. Asije and S. O. Awe

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SHORT COMMUNICATION

Pharmacological Studies of *Striga senegalensis* Benth (Scrophulariaceae) as an Abortifacient

M. K. Choudhury,* A. L. Phillips and A. Mustapha

Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Nigeria

The methanol extract of *Striga senegalensis* Benth (Scrophulariaceae) was investigated on isolated rat uterus. Acetylcholine and the methanol extract of the plant produced dose related contractions of smooth muscle of the isolated rat uterus *in vitro*. Atropine in doses of 2×10^{-2} to 32×10^{-2} µg/mL antagonized dose dependently the contraction of the isolated rat uterus produced by both acetylcholine (1.6×10^{-1} µg/mL) and the methanol extract (160 µg/mL). © **1998 John Wiley & Sons, Ltd.**

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Keywords: Striga senegalensis; Scrophulariaceae; methanol extract; isolated rat uterus; atropine inhibition of contractions

INTRODUCTION

The plant *Striga senegalensis* Benth (family Scrophulariaceae) is an erect annual, widespread in the tropics of Egypt, Gambia, Ghana, Mali, Nigeria, Niger Republic, Senegal, Sudan etc. It is a parasitic weed of food crop cereals such as rice, millet, maize and sorghum roots (Tarr, 1962; Hutchinson and Dalziel, 1963; Robson and Broad, 1988). The local names of the plant in Hausa are 'Kudiji', 'Makasar dawa' (killer of guinea corn), 'Dodon dawa' and 'Wuta wuta'. In some parts of Africa, the plant is used for the treatment of leprosy and leprous ulcers. In East Africa, a decoction or infusion of the roots is administered orally as an abortifacient and in the treatment of pneumonia (Kokwaro, 1976). In Northern Nigeria, a decoction of the plant is drunk and fresh leaves rubbed on to the skin for the treatment of fungal infections. Preliminary phytochemical studies revealed the presence of saponins and flavonoid compounds.

The methanol extract of *S. senegalensis* (whole plant) on isolated rat uterus was investigated and compared with the effects of drugs such as acetylcholine and atropine that are known to interact on the uterus in order to establish a scientific basis for the use of the plant as an abortifacient in traditional medicine.

MATERIALS AND METHODS

Plant material and extraction. The plant was collected from a farm along the Zaria-Kano road, Nigeria in the months of July to October 1993 and authenticated by the herbarium at the Department of Biological Sciences, Ahmadu Bello University, Zaria. A herbarium sample was made and a voucher deposited. The air-dried powdered plant (300 g) was extracted with light petrol (60°–80°, Soxhlet) for 48 h. The defatted marc was dried in air and then extracted with methanol (Soxhlet) for 48 h. Methanol was concentrated to yield a green solid (10 g), stored at 4°C and referred to as MST. The extract was dissolved in distilled water to obtain a stock solution which was further diluted with water for different concentrations.

Animal and isolated tissue preparation. Five adult female (non-pregnant) locally bred albino rats (average weight 130 g) were pretreated with 0.1 mg/kg diethylstilboestrol 24 h before killing to induce a state of 'oestrus'. The rats were killed by a blow on the head and exsanguinated. The abdomen was cut open to reveal the uterine horns. The uterine horns with attached fat and mesentery were removed from both right and left sides and then placed in a petri dish containing Dejalon's solution (Crossland, 1980). The residual fat and mesentery were detached from the uterus and the latter cut into left and right horns. Each uterine horn was mounted in an organ bath (25 mL) well supplied with oxygen and the temperature maintained at 37°C. The preparations were allowed to equilibrate for 30 min before studying the effects of various drugs on the tissue.

Apparatus. The samples of different concentrations were added separately to the organ bath and the responses recorded isometrically using a transducer connected to a recording microdynameter model no. 7050 (Ugo Basile, Italy) and the speed was set at 6 mm/min.

Chemicals. Acetylcholine, atropine and diethylstilboestrol were obtained from BDH Chemicals Ltd, UK and oxytocin was purchased from Ritcher International Generics Ltd.

The standard drugs and methanol extract were

* Correspondence to: M. K. Choudhury, Department of Pharmaceutical and Medicinal Chemistry, Faculty of Pharmaceutical Sciences, Ahmadu Bello University, Zaria, Nigeria.

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Table 1. Contraction produced by acetylcholine on isolated rat uterus

Volume of acetylcholine (mL)	Concentration of acetylcholine (μg/mL)	Mean response (mm ± SEM)	Increase in response (%)
0.05	2×10^{-2}	5 ± 0.35	5
0.1	4×10^{-2}	28 ± 0.61	28
0.2	8×10^{-2}	51 ± 0.57	52
0.4	16×10^{-2}	74 ± 0.71	75
0.8	32×10^{-2}	99 ± 0.82	100

Table 2. Contraction produced by methanol extract of *S. senegalensis* (MST) on isolated rat uterus.

Volume of MST (mL)	Concentration of MST (μg/mL)	Mean response (mm ± SEM)	Increase in response (%)
0.05	20	0 ± 0.59	0
0.1	40	24 ± 0.74	29
0.2	80	41 ± 0.87	49
0.4	160	61 ± 0.95	74
0.8	320	83 ± 1.23	100

Table 3. Contractions produced by acetylcholine (16×10^{-2} μg/mL) and MST (160 μg/mL) in the presence of atropine at increasing concentrations reversing those actions

		Acetylcholine		Methanol extract	
Volume of atropine (mL)	Concentration of atropine (μg/mL)	Mean response (mm ± SEM)	Response (%)	Mean response (mm ± SEM)	Response (%)
0	0	74 ± 0.78	75	61 ± 0.98	74
0.05	2×10^{-2}	68 ± 0.75	69	45 ± 0.88	55
0.1	4×10^{-2}	53 ± 0.68	54	32 ± 0.73	39
0.2	8×10^{-2}	37 ± 0.62	38	21 ± 0.65	26
0.4	16×10^{-2}	21 ± 0.56	21	10 ± 0.48	12
0.8	32×10^{-2}	5 ± 0.41	5	0 ± 0.00	0

dissolved in distilled water to obtain the following stock solutions. Acetylcholine (0.01 mg/mL), oxytocin (0.01 mg/mL), atropine (0.01 mg/mL), methanol extract (10 mg/mL). All the experiments were repeated four times ($n = 5$).

RESULTS AND DISCUSSION

Acetylcholine and the methanol extract of *S. senegalensis* produced a dose related increase in contractions of smooth muscle of the isolated rat uterus (Tables 1, 3). Atropine in doses of 2×10^{-2} to 32×10^{-2} μg/mL antagonized these maximal responses of acetylcholine (16×10^{-2} μg/mL) and the methanol extract (160 μg/mL) induced contractions (Table 3).

Acetylcholine is a well established neurotransmitter at all autonomic ganglia (both sympathetic and parasympathetic) and at neuro effector junctions (Elliot *et al.* 1977). Stimulant effects of acetylcholine on the ganglia, adrenal medulla and skeletal muscle are expressed on nicotinic receptors and are called its nicotinic effects or actions. Similarly, its stimulant effects on postganglionic parasympathetic nerve endings on cardiac muscle, smooth muscles and glands are mediated via muscarinic receptors and are called muscarinic effects. The uterus smooth muscle is innervated by both sympathetic and parasympathetic supply which runs to the wall of the tissue and whose stimulation results in relaxation and contraction of the smooth muscle, respectively.

Acetylcholine thus produced isometric contraction of isolated rat uterine smooth muscle by activating the muscarinic receptors on the muscle with consequent muscle contraction (Table 1). A maximal (100%) response was obtained when all the receptors were occupied. Atropine, the chief alkaloid of the plant *Atropa belladonna* is a competitive antagonist of acetylcholine at all muscarinic receptors and consequently decreases the height of contraction of the isolated rat uterus (Table 3). Similar observations were made (gradual reduction in height of contraction of the isolated uterus) when increasing doses of atropine were added to the methanol plant extract (MST, 160 μg/mL) on the rat uterus (Table 3).

The methanol extract of *S. senegalensis* thus produces a contractile effect on the isolated rat uterus by interacting with muscarinic receptors on the smooth muscle of the uterus in a manner similar to acetylcholine. The extract is, however, less potent than acetylcholine in producing this effect. These findings validate the traditional claim pertaining to the use of the plant for the purpose of procuring abortion (abortifacient).

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