

Assessment of Phytochemical and Anthelmintic Activity of Some Selected Ethnomedicinal Plants from Barak Valley Region of Assam

Abu Md Ashif Iqbal, Amlanjyoti Rajkhowa, P. Chinglemba Singh, Paromita Dutta Choudhury, Ram Kumar Sahu*

Department of Pharmaceutical Science, Assam University (A Central University), Silchar-788011, India.

*Corresponding Author E-mail: ramsahu79@yahoo.co.in

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Since ancient times it has been observed that the ethnomedicinal knowledge is backbone of rural healthcare. The traditional healers of Barak Valley region of Assam used traditional medicine for the treatment of various diseases including helminths infection. Hence the current study was planned to explore the traditional medicines namely *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* used as anthelmintic activity by the local people of Barak Valley region of Assam. The decoction of leaves of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* were prepared for the phytochemical studies and anthelmintic activity. The phytochemical study demonstrated the presence of flavonoids, tannins, phenolic compounds, alkaloids and glycosides in *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia*. The *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* showed significant anthelmintic activity by inducing mortality of earthworm *Pheritima posthuma*. The above findings confirmed the ethnobotanical uses of these plants as an anthelmintic by local people of Barak Valley area of Assam.

Keywords: Anthelmintic activity, Phytochemical, *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha*, *Momordica charantia*.

Helminthiasis are parasitic worm that cause infections to human. This parasitic infections mostly infected to children and also touching a large proportion of the world's population in developing countries. The malnutrition, pneumonia and anemia is the major cause of the worm infections. The Helminths infection became major challenges in developing countries due to their constant contamination of the environment

with their eggs and larvae. Further, the parasitic infection are mostly neglected by the health ministry of developing countries. There are numbers of allopathic Anthelmintic drugs are available in the market but these drugs associated with side effects and sometime caused problems in the liver and kidney¹⁻³. Hence it is necessary to develop certain alternative therapies against the parasitic infection. The natural products are found

to be effective against the Helminths infection with minimum side effects.

The nature has gifted more than 350,000 medicinal plants to the globe. The Indian traditional system of medicines inspired the researchers to explore scientific study on plants which are used as a source of medicines for the treatment of the various diseases⁴.

The Barak valley of Assam has rich flora and fauna. This particular area has numerous medicinal plants and used as drugs against many health complications namely diabetes, jaundice, inflammation, cancer, malaria, kidney failure, cardiovascular disease, respiratory tract infection etc. The herbs comprises of different types of phytochemical which are responsible for their pharmacological activity. The medicinal uses of plant by traditional healers of Barak Valley and and their scientific validation continue developing because of its numerous clinical significances and minimum side-effects. The data of ethnopharmacology study in this area demonstrate the limited number of plants have been scientifically explored for their phytochemical and anthelmintic studies^{5,6}. *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* are the most frequently used by the traditional healers of Barak Valley for the treatment of different diseases.

Justicia adhatoda is mostly used in the preparation of Ayurvedic and Unani formulations. The leaves of the *Justicia adhatoda* contained numerous phytochemical constituents such as phenols, tannins, alkaloids, anthraquinone, saponins, flavonoids, steroids, vasicinol, quinazoline alkaloid, hydroxypeganine, vasicine, betaine, vasicinone, adhatodine, adhasinone, anisotine, adhatonine etc. Consequently *Justicia adhatoda* has reported antitussive, abortifacient, antimicrobial, cardiovascular protection, anticholinesterase, antiinflammatory and other important activities⁷⁻⁹. Researchers reported antidiabetic, antimicrobial, antiplasmodial, anthelmintic, antioxidant and antianaemic activities of *Vernonia amygdalina*. The flavonoids, alkaloids, steroids, saponin, vernolide, Vernoniosides D, Vernoniosides E, vernodalol are found in *Vernonia amygdalina*^{10,11}. *Mikania micrantha* are scientifically documented for anti inflammatory, analgesic, antiviral, antiulcer, anticancer, antimicrobial and

central nervous system activities. The sterols, flavonoids, diterpenes, polyphenols, mikanolide, dihydromikanolide, sesquiterpene lactones etc are present in *Mikania micrantha*¹²⁻¹⁴. The different pharmacological activities of *Momordica charantia* has been scientifically documented namely antiviral, immunomodulation, antimutagenic, antihyperglycemic, antihyperglycemic, antiulcer, liver protective, antitumor, antifertility etc. Phytochemical studies established the existence of saponin, flavonoids, sterols, alkaloids, polypeptide, triterpenoids etc in *Momordica charantia*^{15,16}. Looking on significant medicinal properties, the current study was aimed to explore the phytochemical and anthelmintic activity of the leaves of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* collected from the Barak Valley Region of Assam.

MATERIAL AND METHODS

Collection of plant material

The leaves of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* were collected from the Barak Valley area of Assam. The plant parts were shade dried, reduced to coarse powder and stored in airtight container till further use.

Preparation of decoction

20 g of powdered crude drugs of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* were separately mixed with 150 ml of distilled water and macerated at ambient temperature for 24 h. After 24 h the drug macerate was boiled for 45 min and filtered through muslin cloth to get a decoction. The volume of the decoction was adjusted such that 20 g of mixture gave 50 ml of the decoction¹⁷.

Qualitative phytochemical study

The phytochemical study was conducted for the decoction of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia*, and determine the presence of alkaloids, glycosides, carbohydrates, tannins, phenolic compound, flavonoids, steroid, protein, fat and oil by following the methods of Mukherjee and Harbone^{18,19}.

Evaluation of anthelmintic activity

The adult Indian earthworm *Pheritima*

posthuma was used for the proposed anthelmintic study. The each group comprised six worms of each type. The two different concentration i.e. higher (without dilution) and lower concentration (dilution 1:1 with distilled water) of decoction of each plant were used for anthelmintic evaluation. The ten different groups were used to evaluate the anthelmintic activity and are mentioned below:

Group A were the control group worms placed in normal saline

Groups B were treated with 20 ml decoction (dilution 1:1 with distilled water) of *Justicia adhatoda*

Groups C were treated with 20 ml decoction (No dilution) of *Justicia adhatoda*

Groups D were treated with 20 ml decoction (dilution 1:1 with distilled water) of *Vernonia amygdalina*

Groups E were treated with 20 ml decoction (No dilution) of *Vernonia amygdalina*

Groups F were treated with 20 ml decoction (dilution 1:1 with distilled water) of *Mikania micrantha*

Groups G were treated with 20 ml decoction (No dilution) of *Mikania micrantha*

Groups H were treated with 20 ml decoction (dilution 1:1 with distilled water) of *Momordica charantia*

Groups I were treated with 20 ml decoction (No dilution) of *Momordica charantia*

Group J were treated with Albendazole (20 mg/ml) in normal saline

Observations were made for the time taken to set paralysis and death of the individual worms. Mean time for the paralysis in min was noted when no movement of any sort could be

observed, except when the worm was shaken vigorously; time of death in min was recorded after ascertaining the worms neither moved when shaken vigorously nor when dipped in warm water (50 °C). Further, the Albendazole (20 mg/ml) were included as standard compound²⁰⁻²².

Statistical analysis

All the values of findings are presented as mean \pm standard error mean (SEM).

RESULTS

Phytochemical screening

The qualitative phytochemical screening was performed on decoction to assess the phytochemical present in the *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia*. The findings of phytochemical screening expressed the presence of flavonoids, tannins, phenolic compounds, alkaloids and glycosides in *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* (Table 1).

Anthelmintic activity

Table 2 demonstrated the decoction of different concentration of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* showed significant anthelmintic activity. The lower concentration of decoction of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* induces paralysis of earthworm at 20.32 \pm 0.49, 17.48 \pm 0.08, 31.21 \pm 0.76 and 20.32 \pm 0.49 min, respectively, while higher concentration of decoction showed paralysis at 15.28 \pm 0.51, 12.15 \pm 0.41, 25.36 \pm 0.32 and

Table 1. Phytochemicals present in decoction of various plants

Phytoconstituent	<i>J. adhatoda</i>	<i>V. amygdalina</i>	<i>M. micrantha</i>	<i>M. charantia</i>
Alkaloids	+	+	+	+
Glycosides	+	+	+	+
Carbohydrates	-	-	-	-
Tannins and Phenolic compound	+	+	+	+
Flavonoids	+	+	+	+
Steroid test	-	-	-	-
Protein	-	-	-	-
Fat and oil test	-	-	-	-

+ = Present, - = Absent

Table 2. Anthelmintic activity of decoction of various plants

Group	Time taken for paralysis (min)	Time taken for death (min)
A (Control)	-	-
B	20.32±0.49	93.14±0.16
C	15.28±0.51	78.63±0.93
D	17.48±0.08	72.44±0.62
E	12.15±0.41	53.29±0.57
F	31.21±0.76	61.36±0.59
G	25.36±0.32	49.39±0.47
H	20.32±0.49	93.14±0.16
I	15.28±0.51	78.63±0.93
J (Standard drug)	10.23±0.74	46.18±0.38

Results are expressed as Mean ± SEM from six observations; Control worms were alive up to 24 hrs of observation.

15.28±0.51 min, respectively. Consequently, lower concentration of decoction of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* persuades mortality of earthworm at 93.14±0.16, 72.44±0.62, 61.36±0.59 and 93.14±0.16 min, respectively, while higher concentration of decoction displayed death at 78.63±0.93, 53.29±0.57, 49.39±0.47 and 78.63±0.93 min, respectively. The findings were comparable with the standard drugs Albendazole, at 20 mg/ml concentration. It was observed that the higher concentration of decoction of plants showed dose dependent anthelmintic activity.

DISCUSSIONS

The Helminths infection induce severe morbidity by affecting population in autochthonous region with chief economic and social consequences. The numerous studies documented the extracts of natural products exhibited anthelmintic activity^{23,24}. Hence for the present study earthworm *Pheritima posthuma* were selected as a model for the anthelmintic activity.

The biological activities of the medicinal plant are due to the presence of secondary metabolites. The production of novel therapeutic drugs from plants are based on the reconnoitered of the phytoconstituents. The secondary metabolites demonstrated various health benefits like antidiabetic, anticancer, anthelmintic,

antibacterial, CNS depressant, etc. The flavonoids and polyphenol have strong antioxidants, which scavenged the free radicals and inhibitors of lipid peroxidation. Hence flavonoids and polyphenol have chief role for the therapeutic efficacy of medicinal plants, and researchers are more focused to explore their biological activities²⁵. The findings of phytochemical studies demonstrate the presence of flavonoids, tannins and polyphenol compounds along with other chemical constituents. Swargiary *et al.* presented the similar studies on different medicinal plants exhibiting the presence of similar kind of phytoconstituents⁶. Zhou *et al* found higher quantity of flavonoid and polyphenol in *Cyclocarya paliurus* leaves and expressed its maximum antioxidant capacity. It suggested that the presence of large quantity of flavonoid and polyphenol might be interconnected with greater antioxidant property of the plant²⁶. The findings of antioxidant activity of *Cassia tora*, *Portulaca oleracea*, *Alternanthera sessilis*, *Ipomoea aquatica*, *Basella alba*, *Digera muricata*, *Leucas cephalotes* and *Solanum nigrum* indicates that with higher phenolic and flavonoid contents could be a significant source of natural antioxidants²⁷. The crude saponins of *Achillea wilhelmsii* and *Teucrium stocksianum* demonstrated significant anthelmintic activity by inducing mortality of earthworms²⁸. Further, it was reported a prominent anthelmintic activity against gastrointestinal nematodes from donkey²⁹ and goats³⁰ for *Medicago sativa* saponin mixtures. Pratap *et al.* reported that presence of alkaloids, phenols and tannins in methanol extract of *Mimosa pudica* responsible for significant anthelmintic activity³¹. The medicinal plant having secondary metabolites like alkaloids, polyphenol, flavonoids, tannins and saponins reported significant anthelmintic activity in previous studies^{32,33}. The outcomes of the phytochemical studies revealed the presence of alkaloids, polyphenol, flavonoids, tannins and saponins as a chief components in *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* which support that these plants might be produce anthelmintic activity.

The researchers are giving more attention toward the medicinal plant for the development of anthelmintic drug because it give new bioactive compounds with no or little side effects and easily accessible to the peoples of developing

countries. Moreover, the medicinal plants have the best compatibility with human physiology than allopathic medicines. The anthelmintic activity of decoction of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* were evaluated by perceiving the time required to paralysis and death of each worm. The standard drug Albendazole showed anthelmintic activity due to inhibitory action on microtubular function of earthworm³⁴. The decoction of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* displayed paralysis and death of the earthworm. The findings of studies suggest that the *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* retain prominent anthelmintic activity. The presence of alkaloids, polyphenol, flavonoids, tannins and saponins in plants may be responsible for the anthelmintic activity. The alkaloids induce paralysis in earthworm by its inhibitory action on the central nervous system. Consequently, tannins and polyphenol selectively bind to free proteins present in the gastrointestinal tract of host parasite or glycoprotein on the cuticle of the parasite and thereby cause deaths cause mortality³⁵⁻³⁷. In addition, these chemical constituents meddle with the energy generation by uncoupling the oxidative phosphorylation which meddle with the glycoprotein of cell surface prompts parasite demise³⁷.

The prepared herbal formulation has prominent anthelmintic activity, but for safety purpose of formulation, toxicological studies will conduct in future.

CONCLUSION

From the findings of present study, it was concluded that the traditional use of *Justicia adhatoda*, *Vernonia amygdalina*, *Mikania micrantha* and *Momordica charantia* as an anthelmintic by local people of Barak Valley area of Assam has been scientifically confirmed as they demonstrated anthelmintic activity against the earthworms. According to reported literature, the phytoconstituents like alkaloids, polyphenol, flavonoids, tannins and saponins present in these plants may be responsible for the anthelmintic activity. Further more research is required to found

the mechanism of action of anthelmintic activity for these plants, and their toxicity.

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Conflict of interest

None

REFERENCES

1. Idris OA, Wintola OA, Afolayan AJ. Helminthiasis; prevalence, transmission, host-parasite interactions, resistance to common synthetic drugs and treatment. *Heliyon.*; **5**(1): e01161 (2019).
2. Dkhil MA, Thagfan FA, Hassan AS, Al-Shaebi EM, Gaber RA, Al-Quraishya S. Anthelmintic, anticoccidial and antioxidant activity of *Salvadora persica* root extracts. *Saudi J Biol Sci.*; **26**(6): 1223–1226 (2019).
3. Shaheen SM, Harun-Or R, Haque A, Ferdous W. In vitro anthelmintic activity ethanolic leaves extract of *Gynura procumbens*, a prospective medicinal plant. *Pharmacologyonline.*; **1**: 191-197 (2019).
4. Swargiary A, Roy M. K, Daimari M. Survey and Documentation of Ethnobotanicals Used in the Traditional Medicines System of Tribal Communities of Chirang District of Assam Against Helminthiasis. *Biomed Pharmacol J*; **12**(4): 1923-1935 (2019).
5. Swargiary A, Daimari A, Daimari M, Basumatary N, Narzary E. Phytochemicals, antioxidant, and anthelmintic activity of selected traditional wild edible plants of lower Assam. *Indian J Pharmacol.*; **48**(4):418–423 (2016).
6. Swargiary A, Nath P, Basumatary B, Brahma D. Phytochemical, antioxidant, and trace element analysis of anthelmintic plants of North-East India. *Int J Pharm Pharm Sci*; **9**(9): 228-232 (2017).
7. Dhankhar S, Kaur R, Ruhil S, Balhara M, Dhankhar S, Chhillar AK. A review on *Justicia adhatoda*: A potential source of natural medicine. *African Journal of Plant Science.*; **5**(11): 620-627 (2011).
8. Correa GM, Alcantara AFDC. Chemical constituents and biological activities of species of

- Justicia - a review. *Rev. bras. farmacogn.*; **22**(1): 220-238 (2012).
9. Wasserman H, Kuo GH. The chemistry of vicinyl trycarbonyl, an efficient synthesis of -Vasicine. *Tetrahed. Lett.*, **32**: 7131-7132 (1991).
10. Danladi S, Hassan SA, Masaud IA, Ibrahim UI. Vernonia amygdalina Del: A Mini Review. *Research J. Pharm. and Tech*; **11**(9): 4187-4190 (2018).
11. Oyeyemi IT, Akinlabi AA, Adewumi A, Aleshinloye AO, Oyeyemi OT. Vernonia amygdalina: A folkloric herb with anthelmintic properties. Beni-Suef University Journal of Basic and Applied Sciences.; **7**(1): 43-49 (2018).
12. Li Y, Li J, Li Y, Wang X-x, Cao A-c (2013) Antimicrobial Constituents of the Leaves of Mikania micrantha H. B. K. *PLoS ONE*, **8**(10): e76725 (2018).
13. Silva ASB, Owiti AO, Barbosa WLR. Pharmacology of Mikania Genus: A Systematic Review. *Pharmacognosy Reviews.*; **12**(24): 230-237 (2018).
14. Banerjee AK, Dewanji A. Role of intraspecific trait plasticity in Mikania micrantha Kunth growth and impact of its abundance on community composition. *Journal of Asia-Pacific Biodiversity*; **10**(2): 237-249 (2017).
15. Jia S., Shen M., Zhang F., Xie J. Recent Advances in Momordica charantia: Functional Components and Biological Activities. *International Journal of Molecular Sciences.*; **18**(12): 2555 (2017).
16. Grover JK, Yadav SP. Pharmacological actions and potential uses of Momordica charantia: a review. *Journal of Ethnopharmacology.*; **93**(1): 123-132 (2004).
17. Chaudhuri A, Sharma S. Evaluation of Antidiabetic Activity of Polyherbal Formulation in Streptozotocin-Induced Diabetic Rats. *UK Journal of Pharmaceutical and Biosciences.*; **4**(5): 01-06 (2016).
18. Mukherjee PK. Quality Control Herbal Drugs- An approach to evaluation of botanicals. Business Horizons Pharmaceutical Publishers. New Delhi.; 131-196 (2005).
19. Harbone JB. Phytochemical Methods-a guide to modern techniques of plant analysis. 3rd ed. Springer, New Delhi.; 1-32 (2005).
20. T. Srinath Reddy, S. Arafath, Saba Shafeen, Hima Bindu. R, N. Adithya, S. Nagarjuna. In Vitro Evaluation of Anthelmintic Activity of Gymnema sylvestre Leaves Against Pheretima posthuma. *Int. J. Drug Dev. & Res.*; **5**(2): 382-386 (2013).
21. Vaishali M. Mute, Vaishali M. Sampat, Keta A. Patel, Kushalsanghavi, Dipin Mirchandani, Parth C. Babarial anthelmintic effect of Tamarind indicallinn leaves juice extract on Pheretima posthuma; *IJPRD.*; **7**(001): p:1-9 (2009).
22. Maicale A B, Attimarad.SL, Haradagatti DS, Karigar A, Anthelmintic activity of fruit pulp of Cordia dichotoma IJRAP, **1**(2):597-600 (2010).
23. Yadav AK. In vivo anthelmintic activity of Clerodendrum colebrookianum Walp., a traditionally used taenicidal plant in Northeast India. *Parasitol. Res.*; **111**: 1841-1846 (2012).
24. Klimpel S, Abdel-Ghaffar F, Al-Rasheid KAS, Aksu G, Fischer K, Strassen B, Mehlhorn H. The effects of different plant extracts on nematodes. *Parasitol. Res.*; **108**: 1047-1054 (2011).
25. Batool R, Khan MR, Sajid M, Ali S, Zahra Z. Estimation of phytochemical constituents and in vitro antioxidant potencies of Brachychiton populneus (Schott & Endl.) R.Br.. *BMC Chemistry*; **13**(32): 1-15 (2019).
26. Zhou M, Lin Y, Fang S, Liu Y, Shang X. Phytochemical content and antioxidant activity in aqueous extracts of Cyclocarya paliurus leaves collected from different populations. *Peer J.*; 1-18 (2019).
27. Aryal S, Baniya MK, Danekhu K, Kunwar P, Gurung R, Koirala N. Total phenolic content, flavonoid content and antioxidant potential of wild vegetables from western Nepal. *Plants.*; **8**: 96 (2019).
28. Ali N, Shah SW, Shah I, Ahmed G, Ghias M, Khan I. Cytotoxic and anthelmintic potential of crude saponins isolated from Achillea Wilhelmsii C. Koch and Teucrium Stocksianum boiss. *BMC Complement Altern Med.*; **11**: 106 (2011).
29. Maestrini M., Tava A., Mancini S., Tedesco D., Perrucci S. In vitro anthelmintic activity of saponins from Medicago spp. against sheep gastrointestinal nematodes. *Molecules.*; **25**: 242 (2020).
30. Maestrini M., Tava A., Mancini S., Salari F., Perrucci S. In vitro anthelmintic activity of saponins derived from Medicago spp. plants against donkey gastrointestinal nematodes. *Vet. Sci.*; **6**: 35 (2019).
31. Pratap CR, Deepak V, Krishna S, Fathima S, Thaha A, Raj J. Analysis of Phytochemical Constituents and Anthelmintic Activity of Leaf Extracts of Mimosa pudica L. *Asian J Biomed Pharmaceut Sci*; **8**(65): 1-5 (2018).
32. Jamkhande PG, Barde SR. Evaluation of anthelmintic activity and in silico PASS assisted prediction of Cordia dichotoma (Forst.) root extract. *Anc Sci Life.*; **34**: 39-43 (2014).
33. Maisale AB, Attimarad SL, Haradagatti DS, Karigar A. Anthelmintic activity of fruit pulp of Cordia dichotoma. *Int J Res Ayurveda Pharm International Journal of Research in Ayurveda and Pharmacy.*; **1**: 597-600 (2010).

34. Al-Ostoot FH, Mohammed YHE, Zabiulla, DS SK, Khanum SA. Therapeutic potential and in vitro anthelmintic activity of Ridge gourd fruit. *Asian J Pharm Clin Res.*; **12**(5): 309-312 (2019).
35. Paul A, Adnan M, Majumder M, Kar N, Meem M, Rahman MS, Rauniyar AK, Rahman N, Chy MNU, Kabir MSH. Anthelmintic activity of *Piper sylvaticum* Roxb. (family: Piperaceae): in vitro and in silico studies. *Clin Phytosci.*; **4**(1):17 (2018).
36. Sreejith M, Kannappan N, Santhiagu A, Mathew AP. Phytochemical, anti-oxidant and anthelmintic activities of various leaf extracts of *Flacourtia sepiaria* Roxb. *Asian Pac J Trop Biomed.*; **3**: 947–53 (2013).
37. Das SS, Dey M, Ghosh AK. Determination of Anthelmintic Activity of the Leaf and Bark Extract of *Tamarindus Indica* Linn. *Indian J Pharm Sci.*; **73**(1): 104–107 (2011).