**INTRODUCTION**

Over the years, plants have generally proven to be veritable sources of drugs used in orthodox medicine. This has in recent times encouraged the search for newer more efficacious and better tolerated drugs from plants. A criterion that has been used over the years for the selection of plants for pharmacological investigations is reported use in traditional medicine. Pyrexia or fever is caused as a secondary impact of infection, malignancy or other diseased states. It is the body’s natural function to create an environment where infectious agents or damaged tissues cannot survive. Normally, the infected or damaged tissue initiates the enhanced formation of proinflammatory mediators (cytokines, such as interleukin 1β, α, β, and TNF-α), which increase the synthesis of prostaglandin E2 (PgE2) near hypothalamic area and thereby trigger the hypothalamus to elevate the body temperature. When body temperature becomes high, the temperature regulatory system, which is governed by a nervous feedback mechanism, dilates the blood vessels and increases sweating to reduce the temperature. When the body temperature becomes low, hypothalamus protects the internal temperature by vasoconstriction.

High fever often increases faster disease progression by increasing tissue catabolism, dehydration, and existing complaints, as found in HIV. Most of the antipyretic drugs inhibit COX-2 expression to reduce the elevated body temperature by inhibiting PGF2 biosynthesis. These synthetic agents irreversibly inhibit COX-2 with a high selectivity and are toxic to the hepatic cells, glomeruli, cortex of brain, and heart muscles.

**MATERIALS AND METHODS**

**Collection of plant materials**

The leaves, bark, root of *Abroma augusta* was collected from Siliguri, Raiganj, West Bengal, India. A herbarium sheet was prepared & it was sent to A.J.C.B INDIAN BOTANIC GARDEN, Shibpur, Howrah, West Bengal, India for authentication. The authentication no. of the study plant is "CNH/111/2011/Tech.II/627". The leaves, bark, root of *Abroma augusta* was collected and dried under shade. These dried materials were mechanically powdered, sheaved using 80 meshes and stored in an airtight container. These powdered materials were used for further physiochemical, phytochemical study (Figure 1).

**Preparation of extract**

The air dried crushed leaves, bark and roots (1000g) were soaked for 12 hr in Methanol (3L) at room temperature. The residue was extracted with hot Methanol under reflux 3 times (each 1500 ml) after vacuum filtration. All solvent was evaporated under vacuum and extract was then lyophilized, to yield approximately 12% w/w of the residue, which was stored at 20°C until use. The concentrate was suspended in 5% w/v Tween 80 and given at dose 1ml/100gm body weight.

**Treatment of animals**

Healthy male and female rats (Wistar albino) and Mice (Swiss Albino) (25-30g) of 4-8 weeks old were selected after physical and behavioral veterinary examination from Institutional Animal House of Gupta College of Technological Sciences. The weight range was fall within ± 20% of the mean body for each sex at the time of initiation.
of treatment. All experiments involving animals complies with the ethical standards of animal handling and approved by Institutional Animal ethics committee (955/A/06/CPCSEA).

Sixty young adult male Wistar rats (120–150 g) and Swiss Albino Mice (25–30g), were obtained from the Institutional Animal House of Gupta College of Technological Sciences. The rats and mice were housed in polyethylene cages in the Animal House. They were housed in polyethylene cages, allowed one week of acclimatization, and maintained on standard rat chow and standard laboratory conditions throughout the experiment.

In-vivo antipyretic study
Brewer’s yeast induced pyrexia

The subcutaneous injection of Brewer’s yeast suspension is known to produce fever in rats. A decrease in temperature can be achieved by administration of compounds with antipyretic activity. Male or female rats with a body weight between 120-180 g were used. The animals were starved overnight. The animals were fasted for 18 hours prior to the experiment. Animals were divided into five groups of six animals each and marked. By insertion of a thermometer to a depth of 2 cm into the rectum the initial rectal temperatures are recorded. 15% suspension of Brewer’s yeast in 0.9% saline was prepared. Groups of 6 male or female Wistar rats with a body weight of 150 g were used. The animals were fevered by injection of 10 ml/kg of Brewer’s yeast suspension subcutaneously in the back below the nape of the neck. The site of injection was massaged in order to spread the suspension beneath the skin. Immediately after yeast administration, food is withdrawn. 18 h post challenge, the rise in rectal temperature was recorded. Only animals with a body temperature of at least 38 ºC were taken into the test. The room temperature is kept at 22–24 ºC. The measurement was repeated after 30 min. drug. Group I received Tween-80 (1%, i.p.) and served as control. Group II received Paracetamol (100mg/kg) and served as standard. Group III, group IV, group V received the leave, bark, root (250mg/kg i.p.) respectively. Rectal temperatures were recorded again 30, 60, 120 and 180 min post dosing. The results were tabulated by % inhibition by using formula

\[ \text{Temperature reduced in control} \times 100 \]

\[ \text{Temperature reduced in test} / \text{Temperature reduced in control} \times 100 \]

In-vivo Analgesic Activity
A) Eddy’s hot plate method

In this method heat is used as source of pain. Animals are individually placed on a hot plate maintained at constant temperature (55 ºC) and the reaction of the animal such as paw licking or jump response is taken as end point. The method was first described by Eddy and Leimbach. Male or female Swiss albino with a body weight between 20-30 g were used. The animals were starved overnight. The animals were fevered by injection of 10 ml/kg of Brewer’s yeast suspension subcutaneously in the back below the nape of the neck. The site of injection was massaged in order to spread the suspension beneath the skin. Immediately after yeast administration, food is withdrawn. 18 h post challenge, the rise in rectal temperature was recorded. Only animals with a body temperature of at least 38 ºC were taken into the test. The room temperature is kept at 22–24 ºC. The measurement was repeated after 30 min. drug. Group I received Tween-80 (1%, i.p.) and served as control. Group II received Paracetamol (100mg/kg) and served as standard. Group III, group IV, group V received the leave, bark, root (250mg/kg i.p.) respectively. Rectal temperatures were recorded again 30, 60, 120 and 180 min post dosing. The results were tabulated by % inhibition by using formula

\[ \text{Temperature reduced in control} \times 100 \]

\[ \text{Temperature reduced in test} / \text{Temperature reduced in control} \times 100 \]

B) Acetic acid induced writhing reflex

Pain is induced by injection of irritants into the peritoneal cavity of mice. The animals react with a characteristic stretching behavior which is called writhing. The test is suitable to detect analgesic activity. An irritating agent such as phenyl quinone or acetic acid is injected intraperitoneally to mice and the stretching reaction is evaluated. Male or female Swiss albino mice with a body weight between 20-30 g were used. The animals were starved overnight. Animals were divided into five groups of six animals each and marked. Group I received Tramadol (1%, i.p.) and served as control. After 15 min, acetic acid solution1%/v/v (inject 1ml/100g of body weight of the animal) was inject to the Group I. Number of Writhes were noted during a period of 10min. Group II received Tramadol 5mg/kg and served as standard. Group III, group IV, group V received the leave, bark, root (250mg/kg i.p.) respectively. After 15 min, acetic acid solution1%/v/v (inject 1ml/100g of body weight of the animal) was inject to the Group I. Number of Writhes were noted during a period of 10min. The results are tabulated by % inhibition

Mean of control group= Mean of treated group / Mean of Control group ×100

C) Tail immersion test

The procedure is based on the observation of drugs are selectively capable of prolonging the reaction time of the typical tail-withdrawal reflex in rats induced by immersing the end of the tail in warm water of 55 ºC. Male or female Swiss albino with a body weight between 20-30 g were used. The animals were starved overnight. Animals were divided into five groups of six animals each and marked. They were placed into individual restraining cages leaving the tail hanging out freely. The lower 5 cm portion of the tail was marked. This part of the tail was immersed in a cup of freshly filled water of exactly 55 ºC. Within a few seconds the rat reacts by withdrawing the tail. The reaction time was recorded by a stopwatch. After each determination the tail was carefully dried. Group I received Tween-80 (1%, i.p.) and served as control. Group II received Tramadol 5mg/kg and served as standard. Group III, group IV, group V received the leave, bark, root (250mg/kg i.p.) respectively. After 15 min, tail withdrawal reaction was recorded. The results are tabulated graphically

Statistical analysis

Results are expressed as the mean value ± standard error of mean (S.E.M). Within group comparisons were performed by the analysis of variance using ANOVA test. Significant difference between control and experimental groups was assessed by student’s t-test. A probability level of less than 5 % (P < 0.05) was considered significant.

RESULTS

In-vivo antipyretic activity

Methanolic Extracts were evaluated for Antipyretic activity. In Brewer’s induced pyrexia, the intraperitoneally administration of leaves, bark and root induced a significant antipyretic activity in a dose-dependent manner in the rats. Bark extract has shown significant analgesic effect than root and leaves (Table 1) (Figure 2).

| TABLE 1: Effect of Methanolic extract of Abroma augusta on Brewer’s yeast induced pyrexia |
|-------------------|--------|----------|----------|---|----------|--------|----------|
| GROUP             | DOSE  | 30min    | 60min    | 120min   | 180min   |
|                   | Mg/kg | RT(ºC)   | T%       | RT(ºC)   | T%       | RT(ºC)   | T%       |
| Control           |       | 37.9±0.13| 37.9±0.08| 38.5±0.09| 38.5±0.09| 38.5±0.09| 38.5±0.09|
| Standard 100      |       | 37.2±0.14| 36.6±0.08| 36.6±0.08| 36.6±0.08| 36.6±0.08| 36.6±0.08|
| Bark 250          |       | 37±0.02  | 36.5±0.07| 36.5±0.07| 36.5±0.07| 36.5±0.07| 36.5±0.07|
| Root 250          |       | 36.7±0.02| 36.7±0.09| 36.7±0.09| 36.7±0.09| 36.7±0.09| 36.7±0.09|
| Leaves 250        |       | 37.0±0.02| 36.6±0.08| 36.6±0.08| 36.6±0.08| 36.6±0.08| 36.6±0.08|

The data are expressed as mean ± S.E.M. Significant differences in each group versus the control were as follows: * P < 0.05. ** P < 0.01.
**In-vitro analgesic activity**

Analgesic activity of *Abroma augusta* was evaluated using both models to detect central and peripheral analgesics respectively. Acetic acid induced writhing test is used for detecting both central and peripheral analgesics, where as Hot plate model and Tail immersion test is more sensitive to centrally active analgesics.

Methanolic Extracts were evaluated for analgesic activity. In Eddy's hot plate method Acetic acid induced writhing response and Tail immersion method; the intraperitoneally administration of leaves, bark, root induced a significant (*p*<0.01, *p*<0.001) analgesic activity in a dose-dependent manner respectively in the mice and rats. Root extract has shown significant analgesic effect than bark and leaves, but less compared to Diclofenac sodium as a standard drug. But in Tail immersion method bark extract has shown significant analgesic effect than root and leaves with compare of Tramadol HCl as a standard drug[^4^] (Table 2, 3 and 4) (Figure 3, 4 and 5).

**Table 2: Effect of Methanolic extract of *Abroma augusta* on Eddy's Hot Plate Apparatus**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Reaction time (mean ± s.e.m.) (sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 min</td>
<td>30 min</td>
</tr>
<tr>
<td>Control</td>
<td>9.39 ± 0.21</td>
</tr>
<tr>
<td>Standard</td>
<td>10.01 ± 0.28</td>
</tr>
<tr>
<td>Bark</td>
<td>9.85 ± 0.36</td>
</tr>
<tr>
<td>Root</td>
<td>9.87 ± 0.40</td>
</tr>
<tr>
<td>Leaves</td>
<td>9.60 ± 1.4</td>
</tr>
</tbody>
</table>

The data are expressed as mean ± S.E.M. Significant differences in each group versus the control were as follows: * *P* < 0.05, ** *P* < 0.01.

**Table 3: Effect of Methanolic extract of *Abroma augusta* on Writhing Reflex in mice**

<table>
<thead>
<tr>
<th>Group</th>
<th>Dose</th>
<th>Mean number of writhing(10)</th>
<th>% of inhibition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>--------</td>
<td>57.66 ± 2.92</td>
<td>--------</td>
</tr>
<tr>
<td>Standard</td>
<td>5</td>
<td>16 ± 0.33</td>
<td>72.25**</td>
</tr>
<tr>
<td>Bark</td>
<td>250</td>
<td>25.66 ± 0.45</td>
<td>55.49*</td>
</tr>
<tr>
<td>Root</td>
<td>250</td>
<td>22.33 ± 0.085</td>
<td>61.27**</td>
</tr>
<tr>
<td>Leaves</td>
<td>250</td>
<td>28 ± 0.54</td>
<td>51.24*</td>
</tr>
</tbody>
</table>

The data are expressed as mean ± S.E.M. Significant differences in each group versus the control were as follows: * *P* < 0.05, ** *P* < 0.01.
**DISCUSSION**

The data presented here suggests that the *Abroma augusta* possesses analgesic and antipyretic activities. The extract at the doses tested was shown to possess analgesic activity evident in all the nociceptive models, signifying it possesses both central and peripherally mediated activities. The abdominal constriction response induced by acetic acid is a sensitive procedure to evaluate peripherally acting analgesics. In general, acetic acid causes pain by liberating endogenous substances such as serotonin, histamine, prostaglandins (PGs), bradykinins and substance P, which stimulate nerve endings. Local peritoneal receptors are postulated to be involved in the abdominal contractions response. The method has also been associated with prostanoids in general, that is, increased levels of PGE2 and PGF2α in peritoneal fluids, as well as lipoxygenase products. The significant reduction in acetic acid-induced writhes by *Abroma augusta* suggests that the analgesic effect produced by the extract may be via central mechanisms involving these receptor systems or via peripheral mechanisms involved in the inhibition of prostaglandins, leucotrienes, and other endogenous substances that are key players in inflammation and pain. Antipyretic are the agents, which reduce the elevated body temperature. Regulation of body temperature requires a delicate balance between production and loss of heat, and the hypothalamus regulates the set point at which body temperature is maintained. In fever this set point elevates and a drug like paracetamol does not influence body temperature when it is elevated by the factors such as exercise or increase in ambient temperature. Yeast induced fever is called pathogenic fever. Its etiology includes production of prostaglandins, which set the thermoregulatory center at a lower temperature. The present results show that *Abroma augusta* possesses a significant antipyretic effect in yeast-provoked elevation of body temperature in rats, and its effect is comparable to that of paracetamol (standard drug). So inhibition of prostaglandin synthesis could be the possible mechanism of antipyretic action as that of paracetamol. Also, there are several mediators or multiprocesses underlining the pathogenesis of fever. Inhibition of any of these mediators may bring about antipyresis.
CONCLUSION
The results obtained in this study indicate that different parts of *Abroma augusta* possess potent analgesic and antipyretic properties, which are mediated via peripheral and central inhibitory mechanisms. This could provide a rationale for the use of this plant in fever, pain and inflammatory disorders in folk medicine.

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REFERENCE