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Exploration of phytochemical, antioxidant and anti-inflammatory efficacy of the ethnomedicinal uses of ten orchids of Bangladesh

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ABSTRACT

Ten Bangladeshi orchids were harvested and filed with 66 ethnomedicinal uses from Chittagong, Khagrachari, Bandarban, and Cox's Bazar, by the most frequent being rheumatism, paralysis, epilepsy, fever, and fracture. Phytochemical, antioxidant, and anti-inflammatory properties of plants were studied in greater depth. Plant alkaloids gave a positive response (+) in varying degrees (+ to 4+) when tested qualitatively with one or more types of reagents. Anthraquinone, coumarin, flavonoids, glycosides, saponins, steroids, tannins, terpenoids, phlobatannins, and quinine were among the ten other secondary metabolites tested. Coumarin, flavonoids, glycosides, quinine, saponins, steroids, tannins, and terpenoids were found in each species, while anthraquinone and phlobatannins were found in seven and five species, respectively. Phytochemical screening revealed that *Aerides odorata* had the best profile. The IC_{50} values of different orchids ranged from 132.24 to 227.24 µg/ml. in the free radical scavenging assay, which was used to test antioxidant activity. As compared to the standard (Ascorbic acid: 73.05 µg/ml), the IC_{50} values of *A. odorata* (132.24 µg/ml), *Bulbophyllum lilacinum* (136.70 µg/ml), and *Dendrobium tortile* (138.59 µg/ml) in this bioassay were convincing. The highest scavenging ability was found in *A. odorata.* The heat-induced albumin denaturation bioassay was used to assess anti-inflammatory activity. Acetylsalicylic acid was used as a standard in this assay, with an IC_{50} value of 84.11 µg/ml. IC_{50} values ranged from 100.68 to 213.24 µg/ml during this experiment. *Cymbidium aloifolium* (100.68 µg/ml), *Luisia zeylanica* (111.35 µg/ml), and *P. teres* (121.10 µg/ml) have the lowest IC50 values in this bioassay as compared to the standard. *C. aloifolium* outperformed the other nine species in this bioassay. The phytochemical, antioxidant, and anti-inflammatory profile of *A. odorata* defined in this study favoured its ethnomedicinal uses, instituting it as the most bioactive and therapeutic orchid.

Keywords: Anti-inflammatory, antioxidant, medicinal orchids, phytochemical.

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INTRODUCTION

The Orchidaceae family has immense therapeutic potential and has been used for that since ancient times (Arora et al*.,* 2017). Orchids were used as medicine in the Ayurvedic, Siddha, and Unani systems of medicine, according to Charaka, Sushruta, and Vagbhata (Hegde, 1984; Rao, 1998). The use of orchid extracts has been linked to a variety of health benefits, including diuretic, anti-rheumatic, anti-inflammatory, anti-carcinogenic, hypoglycemic, antimicrobial, anticonvulsive, relaxation, neuroprotective, and antivirus properties (Gutiérrez, 2010). Biological experiments also indicate that orchids contain phytochemicals that can be used to treat lethal diseases (Mazumder and Rahman, 2008).

About 419 orchid species from 105 genera have been discovered in Asia, which all have healing properties (Teoh, 2016). The evergreen and semi-evergreen forests of Sylhet and Chittagong Hill Tracts are orchid hotspots in Bangladesh. So far, 178 orchid taxa have been discovered in Bangladesh, 29 of which have therapeutic properties and are widely used as traditional and folklore medicines to treat 45 different diseases in ethnic groups (Huda et al., 2006; Hossain, 2009). The ethnic groups of

hill tracts of Bangladesh have a hidden treasure of medicinal orchid uses that have yet to be discovered. Therefore, the current study sought to investigate the ethnomedicinal uses of ten orchids from various tribal peoples in Chittagong, Khagrachari, Bandarban, and Cox's Bazar, as well as their phytochemical, antioxidant, and anti-inflammatory efficacy, in order to explain their ethnomedicinal uses.

MATERIALS AND METHODS

Ethnobotanical data on orchid medicinal uses were gathered and documented from different tribal people throughout the Chittagong, Khagrachari, Bandarban, and Cox's Bazar areas of Bangladesh utilizing standard interview methods. Leaf samples of *Acampe papillosa* Lindl., *Aerides odorata* Lour, *Arundina graminifolia* (D. Don) Hochr *Bulbophyllum lilacinum* Ridl, *Cymbidium aloifolium* (L.) Sw., *Dendrobium aphyllum* (Roxb.) C.E.C. Fisch., *Dendrobium tortile* Lindl, *Luisia zeylanica* Lindl., *Papilionanthe teres* Schltr,. and *Rhynchostylis retusa* (L.) Blume, were collected from Chittagong, Khagrachari, Bandarban and Cox's Bazar. Dr. Mohammed Kamrul Huda, Professor of Botany at the University of Chittagong, named the plant samples. The voucher specimens (accession no. Rahman-007 to Rahman-017) were held at Herbarium of Chittagong University (HCU). Natural plant leaves were washed, chopped, air-dried at room temperature, and then ground into a coarse powder and placed in an airtight container for further research. It was deliberately avoided that one element was mixed with another. To obtain the blackish extract, methanolic extracts were filtered through Whatman No.1 filter paper and evaporated to dryness under vacuum below 50°C. Alkaloids, phlobatannins, flavonoids, saponins, tannins, terpenoids, steroids, glycosides, anthraquinone, quinine, and coumarin were all assessed qualitatively using the standard methods of Harborne (1973), Trease and Evans (1989), and Sofowara (1993). Antioxidant activity was measured using 2,2-diphenyl-1-picrylhydrazyl (DPPH), as described by Brand-Williams et al. (1995). Anti-inflammatory activity on egg albumin was measured using the procedure of Shinde et al. (1999). Linear regression analysis was used to measure the IC_{50} value for antioxidant and anti-inflammatory activities. Each experiment was carried out three times in total.

RESULTS AND DISCUSSION

Ethnomedicinal uses

From January to December 2019, ethnobotanical uses of the following ten different orchid species were recorded through interviews with different ethnic and local communities in the Chittagong, Khagrachari, Bandarban, and Cox's Bazar regions (Table 1).

Tribal and local people have been recorded to use the roots, leaves, pseudobulbs, stems, and whole plants of various orchid species for medicinal purposes. The orchids studied in this study had 66 ethnomedicinal uses, including 14 for *A. papillosa*, 11 for *A. odorata*, 03 for *A. graminifolia*, 08 for *B. lilacinum*, 23 for *C. aloifolium*, 12 for *D. aphyllum*, 02 for *D. tortile*, 05 *for L. zeylanica*, 12 for *P. teres*, and 20 for *R. retusa*. The most common diseases treated by orchids were rheumatism, paralysis, epilepsy, fever, and fracture according to the current study. New ethnomedicinal uses for five orchids, viz. *B. lilacinum, C. aloifolium, D. aphyllum, P. teres* and *R. retusa* were also recorded in this study (as indicated by personally communicated). Akhter et al. (2017) had comparable findings.

Qualitative assessment

Table 2 shows that each test gave a positive response in varying degrees (+ to 4+) with 5 different reagents in the following proportions: D-27, H-18, M-18, T-28, and W-24. *D. tortile* (17), *B. lilacinum* (14) and *A. odorata* (14) showed the maximum responses; while *D. aphyllum* (13), *P. teres* (11), *R. retusa* (11) *and L. zeylanica* (10) showed a moderate response and *A. graminifolia* (9), *A. papillosa* (8) *C. aloifolium* (7) showed a mild response in alkaloid tests with five different reagents. Based on plant responses, Tannic acid (28), Dragendroff's (27), and Wagner's (24) reagents were discovered to be the best alkaloid detecting reagents.

The results accord well with Akter et al. (2018) on the presence of alkaloids. They previously reported a positive response of alkaloids in the following proportion: D-22, H-16, M-20, T-27 and W-24 for nine medicinal orchids of Bangladesh. Among them, they reported a maximum of 14 positive responses for *B. lilacinum* and *A. odorata*; while *A. papillosa* (13), *C. aloifolium* (13), *D. aphyllum* (13) and *R. retusa* (10) for moderate responses and *P. teres* (9) for mild response in alkaloid detecting tests.

In addition to alkaloids, qualitative screens for other therapeutically significant secondary metabolites (such as flavonoids, glycosides, saponins, tannins, coumarin, steroids, terpenoids, phlobatannins, anthraquinone, and quinine) were performed on the medicinal orchids mentioned in Table 3. These results are in agreement with previously reported data (Marjoka et al., 2016; Radhika and Murthy, 2013; Shubha and Chowdappa, 2016; Akter et al., 2018).

The detection of bioactive phytochemical constituents in this study endorsed their ethnomedicinal claims and indicated their wide spectrum of biological applications (Tanrisever et al., 1988; Tashiro et al., 2000; Mothana et al., 2010). Alkaloids have many pharmacological activities, including antimalarial (e.g., quinine), antiasthmatic (e.g., ephedrine), anticancer, analgesic, and antibacterial properties. Quinine is a bitter-tasting natural white crystalline alkaloid with antipyretic (fever-reducing), antimalarial, analgesic (pain-killing), and anti-inflammatory properties (Goodwin and Mercer, 1986). The presence of flavonoids suggests that the plant might have an anti-oxidant, antiallergic, anti-inflammatory, antimicrobial, anticancer activity (Kunle and Egharevba, 2009). Terpenoids and steroids have anti-carcinogenic properties and can help prevent cancer (Yun et al., 1996;

Table 1. Ethnomedicinal uses of ten orchids of Bangladesh.

S/N	Species name	Ethnomedicinal uses
1	*A. papillosa*	The leaf is used to relieve fevers, earaches, and injuries, as well as to treat male and female physical issues. It is also used to treat rheumatism, sciatica, neuralgia, syphilis, uterine infections, scorpion stings, snake bites, chest pain, stomach problems, and a tonic (Huda et al., 2006; Hossain, 2009).
2	*A. odorata*	The leaf may be used to treat epilepsy, influenza, dyspepsia, paralysis, inflammation, waist pain, and fractures. It is also used in the treatment of joint pain, swelling, tuberculosis, and wounds (Huda et al., 2006; Hossain, 2009).
3	*A. graminifolia*	The plant is used to heal cracks on the heels (Yonzone et al., 2012). Rhizome has antibacterial properties. Decoction of the root is used to treat body aches (Hossain, 2009).
4	*B. lilacinum*	Pseudobulb is used as an aphrodisiac as well as a chyavanprash. Pseudobulbs, leaves, and whole plants are used to treat rheumatism, eye disease, tuberculosis, cough, and asthma (Bengali; Khagrachari) (Personally communicated).
5	*C. aloifolium*	Earache, paralysis, (Marma; Khagrachari) inflammation, painful menstruation, child delivery, epilepsy (Chakma; Khagrachari), infertility, irregular menstruation, rheumatism, cough, dyspepsia, asthma and boil (Bengali; Khagrachari) are all treated with this plant (Personally communicated). According to the literature, the plant is used to treat paralysis, earache, boils, fever, fracture, burns and sores, eye fatigue, chronic disease, and as an emetic, purgative, and tonic (Huda et al., 2006; Hossain, 2009).
6	*D. aphyllum*	The plant is used to treat wounds, earache, epilepsy, paralysis (Chakma; Khagrachari), abdominal pain, depression, eye inflammation (Marma; Cox's Bazar) diabetes, heavy menstruation, rheumatism, and leucorrhoea (Bengali; Chittagong) (Personally communicated). It is used in children with deformed head structures (Huda et al., 2006).
7	*D. tortile*	The plant is used as an aphrodisiac and a tonic (Lipa, 2019).
8	*L. zeylanica*	The stem is used as an emollient for boils, abscesses and burns (Rao, 1998). In Sri Lanka, Ayurvedic practitioners use plant oil to treat fractures (Cooray, 1940). Juice of leaves is used to treat chronic wounds, boils, and burns (Subedi, 2011).
9	*P. teres*	Diabetes, fever, heavy menstruation, vertigo, body ache, carve-depression, eye inflammation, blear, abdominal pain, heavy menstruation, leucorrhoea, and hypertension are some of the conditions treated by this plant (Marma; Bandarban) (Personally communicated).
10	*R. retusa*	The plant is used to treat paralysis, rheumatism, piles, irregular menstruation, heavy menstruation, painful menstruation (Marma; Cox's Bazar), fracture, fever, allergy (due to pollution of blood), inflammation (Bengali; Cox's Bazar) (Personally communicated). It is used as an emollient and in the treatment of rheumatoid arthritis, blood dysentery, wounds, skin diseases, asthma, tuberculosis, epilepsy, kidney stones, and menstrual disorders (Huda et al., 2006; Hossain, 2009).

Raju et al., 2004). Since some balsams and resins have antiseptic properties, the presence of resins and balsams supports the ethnomedicinal uses of the plant as an emollient and demulcent, as well as for treatment of sore throat, rheumatism, wounds, and burns (Evans, 2002). According to recent research, tannins and phlobatannins have the potential to be cytotoxic and/or antineoplastic agents (Claustra et al., 2005). Some saponins have also been stated to have anti-cancer and immunomodulatory properties by some researchers (Evans, 2002; Kunle and Egharevba, 2009).

Saponins and glycosides are also essential groups of secondary metabolites since some of them are cardioactive and are used to treat heart disorders (Oloyode, 2005). Anthraquinone is a digestive aid that acts as a laxative. Coumarins are useful in the treatment of radiogenic sialadenitis and mucositis (Mahler et al., 1992). Terpenoids have antimicrobial, antifungal, antiviral, antihyperglycemic, anti-inflammatory, antioxidant properties, are antiparasitic, immunomodulatory, and improve skin permeation (Brahmkshatriya and Brahmkshatriya, 2013).

Table 2. Qualitative tests for alkaloids in the studied species.

S/N	Species name	Alkaloid					Total response
		D	H	M	T	W	
1	*A. papillosa*	+++	+	+	++	+	8
2	*A. odorata*	+++	+++	++	+++	+++	14
3	*A. graminifolia*	+	++	+	+++	++	9
4	*B. lilacinum*	+++	++	+++	+++	+++	14
5	*C. aloifolium*	++	+	+	++	+	7
6	*D. aphyllum*	+++	++	++	+++	+++	13
7	*D. tortile*	++++	+++	+++	++++	+++	17
8	*L. zeylanica*	++	+	++	++	+++	10
9	*P. teres*	++	++	+	+++	+++	11
10	*R. retusa*	+++	+	++	+++	++	11
Total response		27	18	18	28	24	

Notes: Name of the reagents, D-Dragendroff's reagent, H-Hager's reagent, M-Mayer's reagent, W-Wagner's reagent and T-Tannic acid reagent.

Table 3. Qualitative tests for ten other secondary metabolites in the studied species.

S/N	Species name	Name of metabolites										Total response
		Ant	Cou	Flv	Gly	Phl	Qui	Sap	Str	Tan	Ter	
1	*A. papillosa*	+	++	+++	++	-	++	++	+	+++	++	18
2	*A. odorata*	+	+++	+++	+++	-	+++	++	+++	+++	+++	24
3	*A. graminifolia*	+	++	++	+	+	+++	+	++	+++	++	19
4	*B. lilacinum*	+	+++	+++	+++	-	+++	+	++	++	+	19
5	*C. aloifolium*	+	+++	+++	++	-	+++	++	+	+++	+++	21
6	*D. aphyllum*	-	++	++	+++	-	+++	++	+	++	+++	18
7	*D. tortile*	-	+++	++	+	+	+++	+	+	+++	+++	18
8	*L. zeylanica*	+	+	++	+++	+	+	+++	+++	+++	++	21
9	*P. teres*	+	++	++	++	+	++	+++	+++	++	++	20
10	*R. retusa*	-	+	+++	+	+	+	++	+	++	+++	15

Notes: Ant= Anthraquinone, Cou= Coumarin, Flv= Flavonoids, Gly= Glycosides, Phl= Phlobatannins, Qui= Quinine, Sap= Saponins, Str= Steroids, Tan= Tannins, Ter= Terpenoids. Here, "+++" means maximum response, "++" means moderate response, "+" means mild response, "-" means negative response.

Antioxidant activity

According to reports, phenolic compounds are responsible for antioxidant properties (Ahmed et al., 2014). The existence of flavonoids and tannins in the mentioned extracts was verified by the current research, so these plant extracts were tested for free radical scavenging activity to confirm their antioxidant activity. (Figure 1 to 11)

One of the most commonly used methods for determining the antioxidant function of herbal extracts and phytochemicals is the free radical scavenging activity assay (Uddin et al., 2008). Free radicals are continuously generated in living systems as a result of various endogenous (such as natural cellular metabolism) or exogenous (such as irradiation) processes (Lobo et al., 2010). These radicals include 2,2-diphenyl-1-picrylhydrazyl, hydrogen peroxide, hydroxyl, superoxide anions, and nitric oxide, the excess of which can destroy the immune system and cause a variety of diseases such as neurodegenerative diseases, cardiovascular diseases, liver diseases, rheumatoid arthritis, atherosclerosis, angina pectoris, diabetes mellitus, renal failure, and cancer (Nigri et al., 2004; Schetter et al., 2009).

In the current study, the DPPH radical was used as a substrate to assess the free radical scavenging behavior of the same orchid leaves that were used in the phytochemical investigation. The results of the DPPH scavenging assay performed in this study showed that these plants have possible scavenging activities. Finally, the percentage of scavenging behaviour was subjected to regression and correlation to determine the IC_{50} value.

The results of DPPH free radical scavenging activity of ascorbic acid which used as standard and its scavenging

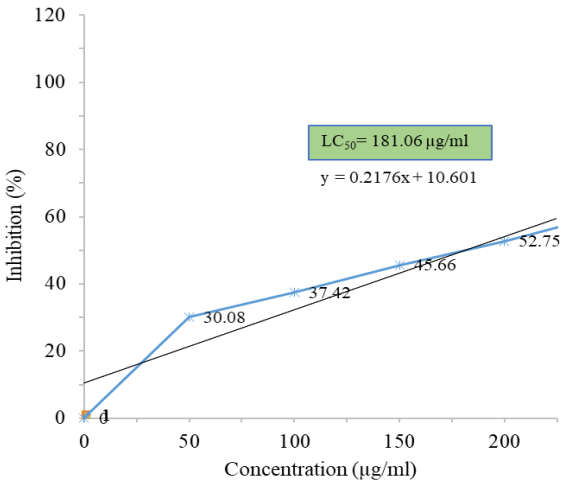

Figure 1. Antioxidant activity of *A. papillosa*.

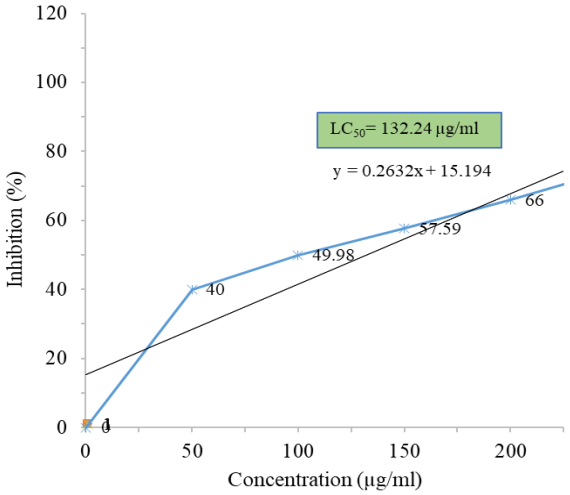

Figure 2. Antioxidant activity of *A. odorata.*

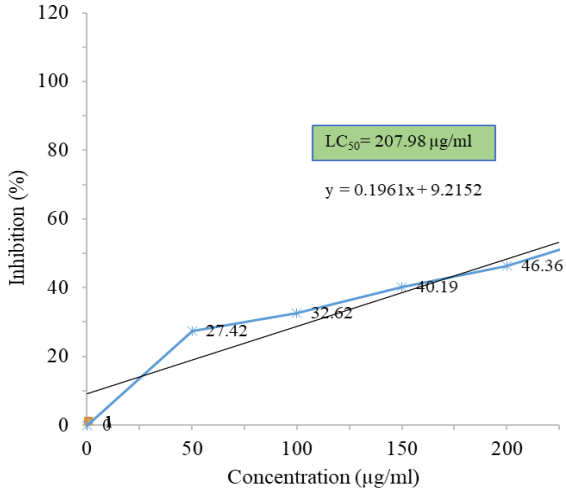

Figure 3. Antioxidant activity of *A. graminifolia.*

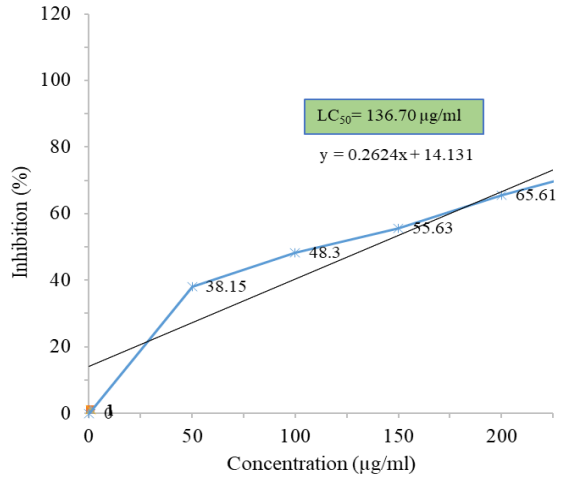

Figure 4. Antioxidant activity of *B. lilacinum.*

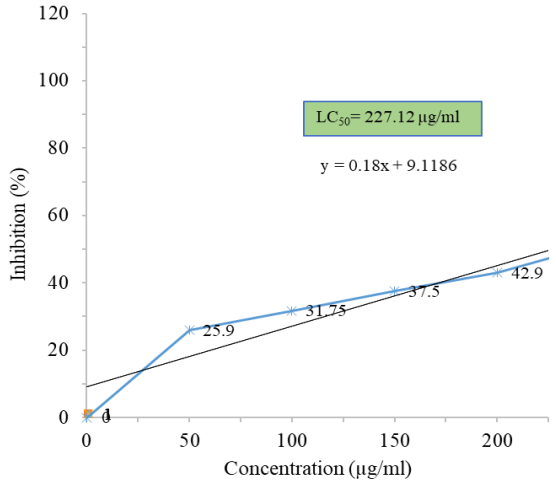

Figure 5. Antioxidant activity of *C. aloifolium.*

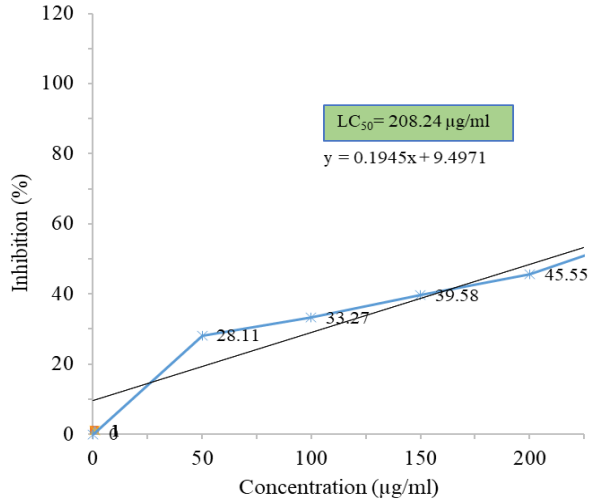

Figure 6. Antioxidant activity of *D. aphyllum.*

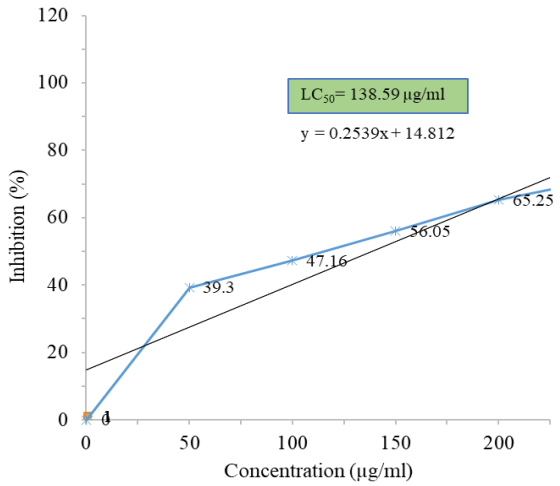

Figure 7. Antioxidant activity of *D. tortile.*

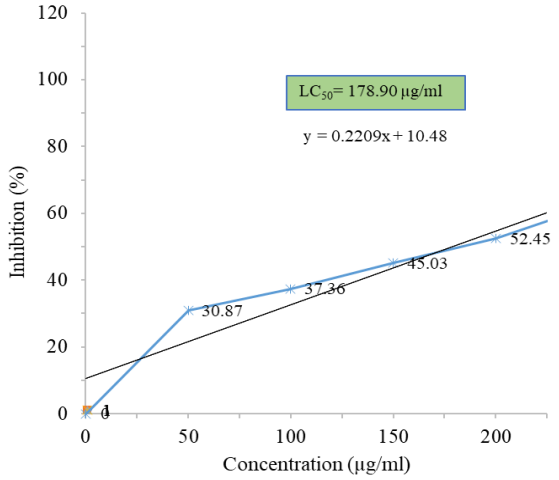

Figure 8. Antioxidant activity of *L. zeylanica.*

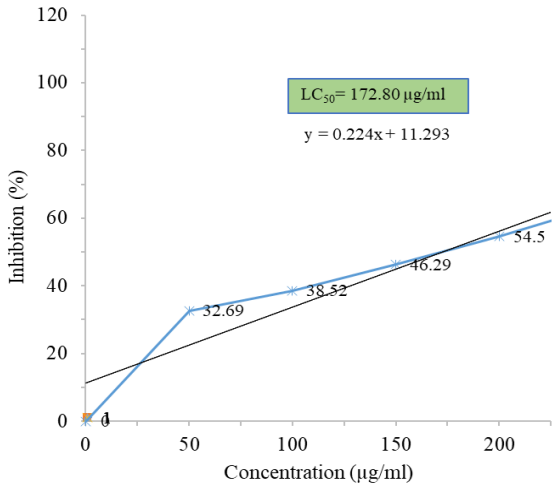

Figure 9. Antioxidant activity of *P. teres.*

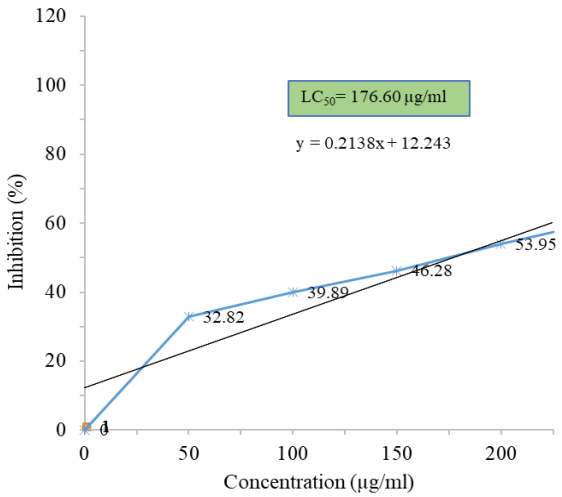

Figure 10. Antioxidant activity of *R. retusa.*

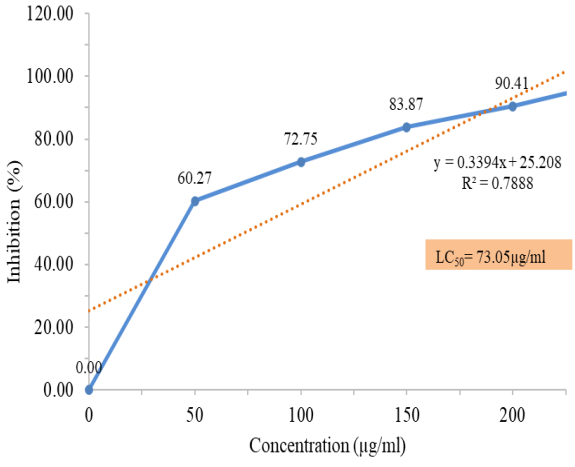

Figure 11. Antioxidant activity of ascorbic acid (standard).

activity (60.27, 72.75, 83.87, 90.41 and 98.48%) at the five concentrations (50, 100, 150, 200 and 250µg/ml) accordingly. The IC_{50} value of Ascorbic acid was 73.05 µg/ml. Scavenging activity was found to be 30.08%, 37.42%, 45.66%, 52.75%, 60.92% for *A. papillosa;* 40.00%, 49.98%, 57.59%, 66.00%, 75.00% for *A. odorata;* 27.42%, 32.62%, 40.19%, 46.36%, 55.74% for *A. graminifolia;* 38.15%, 48.30%, 55.63%, 65.61%, 73.90% for *B. lilacinum;* 25.90%, 31.75%, 37.50%, 42.90%, 51.64% for *C. aloifolium;* 28.11%, 33.27%, 39.58%, 45.55%, 56.35% for *D. aphyllum;* 39.30%, 47.16%, 56.05%, 65.25%, 71.50% for *D. tortile;* 30.87%, 37.36%, 45.03%, 52.45%, 62.82% for *L. zeylanica;* 32.69%, 38.52%, 46.29%, 54.50%, 63.76% for *P. teres;* 32.82%, 39.89%, 46.28%, 53.95%, 60.88% for *R. retusa* at five concentrations (50, 100, 150, 200 and 250 µg/ml) respectively.

After statistical analysis, the IC_{50} values for respective leaf extracts of *A. papillosa, A. odorata, A. graminifolia, B. lilacinum, C. aloifolium, D. aphyllum, D. tortile, L. zeylanica, P. teres* and *R. retusa* were 181.06, 132.24, 207.98, 136.70, 227.12, 138.59, 208.24, 178.90, 172.80 and 176.60 µg/ml, respectively. In this case, *A. odorata* had a high IC_{50} value (132.24 µg/ml), whereas *C. aloifolium* had a low IC_{50} value (227.12 µg/ml).

Antioxidant activity of Ascorbic acid (standard antioxidant) ranged from 60.27 to 98.48% with an IC_{50} value of 73.05 µg/ml, while antioxidant activity ranged from 25.90 to 75.00% with an IC_{50} value limit of 132.24 to 227.12 µg/ml for the ten orchid species studied in this study. According to Li et al. (2008), antioxidant activity is divided into five categories: highly active (<50 µg/ml), active (50 to 100 µg/ml), moderate (101 to 250 µg/ml), mild (250 to 500 µg/ml), and inactive (>500 µg/ml). As a result, each orchid investigated in this study appears to have moderate antioxidant activity. The results of this study are associated with those of Hossain et al. (2020), who investigated the antioxidant activity of three epiphytic orchids from Bangladesh and discovered that the leaf and stem extracts of *L. zeylanica* and *P. teres* had the highest free radical scavenging activity of 92.25% at 150 µg/ml and 82.23% at 100 µg/ml, respectively.

Since antioxidants can treat cancer, atherosclerosis, diabetes, inflammation, aging, malaria, rheumatoid arthritis, and neurodegenerative disorders (Vasconcelos et al., 2007), the plants associated with antioxidant activities in this study promote ethnomedicinal uses as anticancer, anti-inflammatory, and anti-rheumatic agents.

Anti-inflammatory activity

Plants' anti-inflammatory function is attributed to the presence of saponins, terpenoids, alkaloids, glycosides, and tannins (Tamrat et al., 2017). Many degenerative disorders, including rheumatoid arthritis, shoulder tendonitis, gouty arthritis, polymyalgia rheumatica, heart disease, asthma, cancer, and inflammatory bowel disease, are often linked to an inflammatory mechanism (Polya, 2003; Iwalewa et al., 2007). (Figures 12 to 21)

The results of egg albumin denaturation inhibition of acetylsalicylic acid, which was used as a control, and its anti-inflammatory activity were 55.26, 68.42, 76.32, 86.84 and 92.11% at five concentrations (50, 100, 150, 200, and 250 g/ml), respectively. The highest inhibition of acetylsalicylic acid was 92.11% at the concentration of 250µg/ml and the lowest inhibition was 55.26, at a concentration of 50 µg/ml. The IC_{50} value of acetylsalicylic acid was 84.11 µg/ml.

In anti-inflammatory bioassay (Figures 12-21), very strong inhibitory activity was exhibited by *C. aloifolium* (52.63 to 83.32%) and *L. zeylanica* (50.00 to 80.26%); strong inhibitory activity was exhibited by *P. teres* (47.95 to 75.10%) and *R. retusa* (46.30 to 73.80%); medium inhibitory activity was exhibited by *D. tortile* (40.28 to

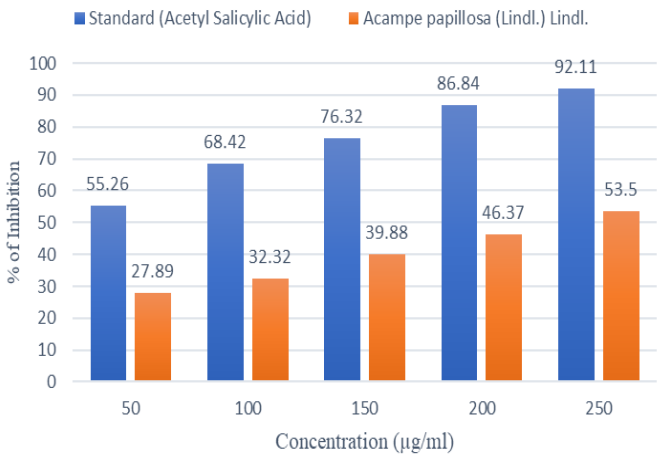

Figure 12. Anti-inflammatory activity of *A. papillosa* with the standard.

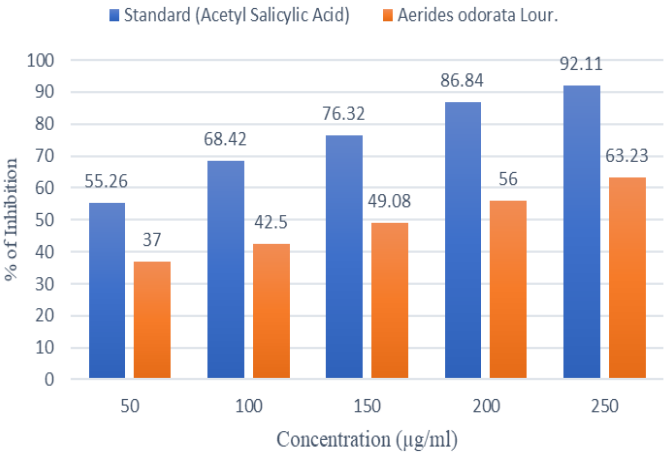

Figure 13. Anti-inflammatory activity of *A. odorata* with the standard.

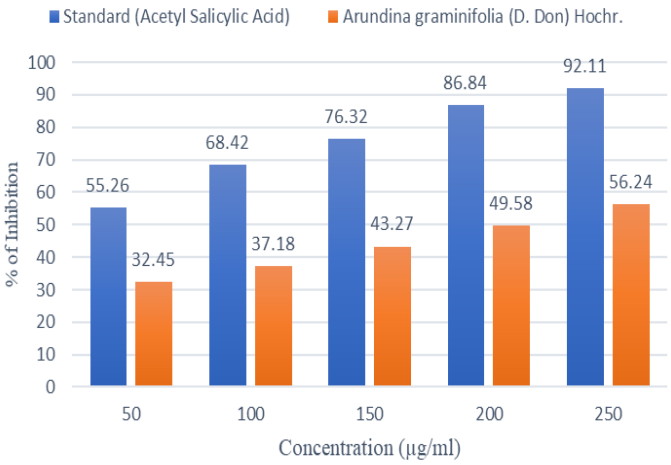

Figure 14. Anti-inflammatory activity of *A. graminifolia* with the standard.

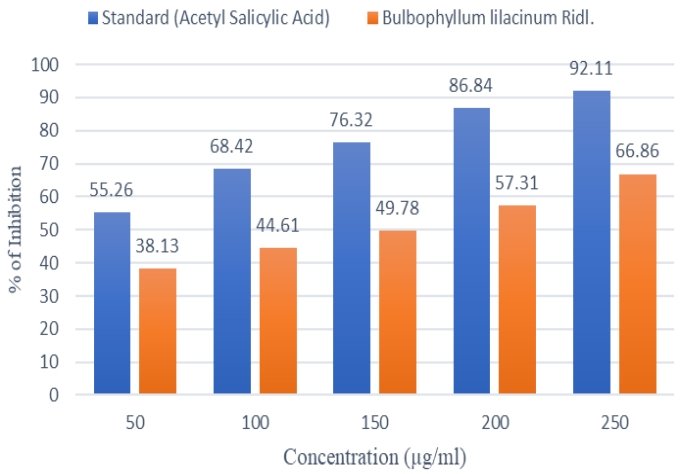

Figure 15. Anti-inflammatory activity of *B. lilacinum* with the standard.

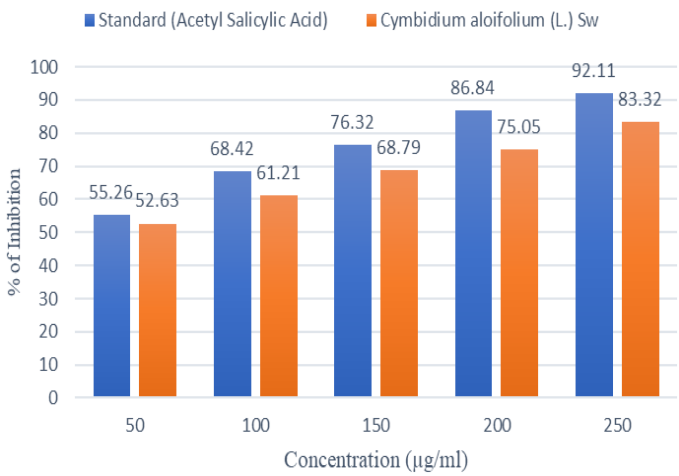

Figure 16. Anti-inflammatory activity of *C. aloifolium* with the standard.

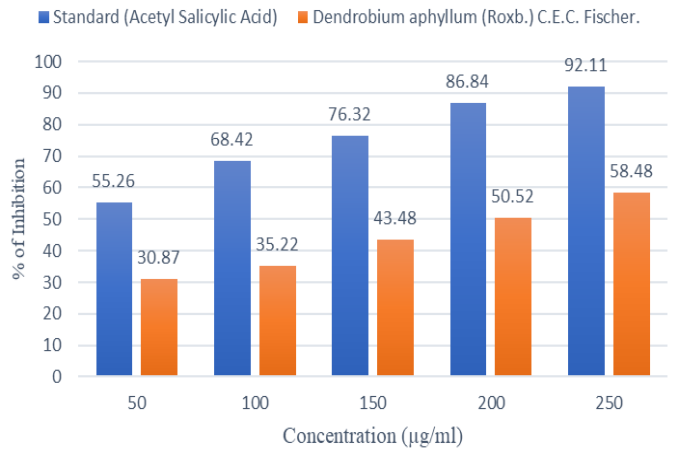

Figure 17. Anti-inflammatory activity of *D. aphyllum* with the standard.

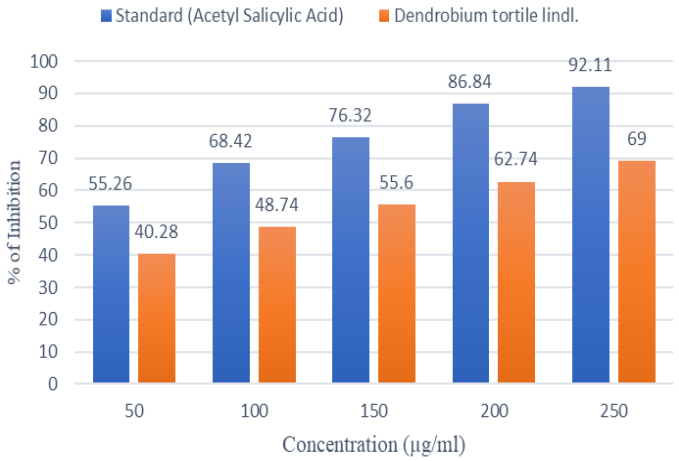

Figure 18. Anti-inflammatory activity of *D. tortile* with the standard.

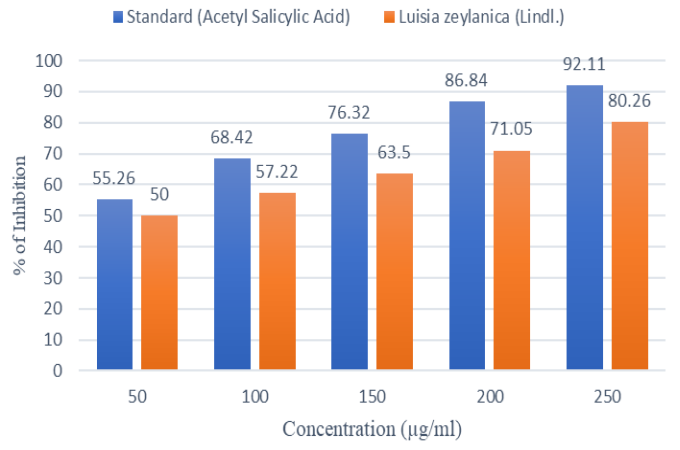

Figure 19. Anti-inflammatory activity of *L. zeylanica* with the standard.

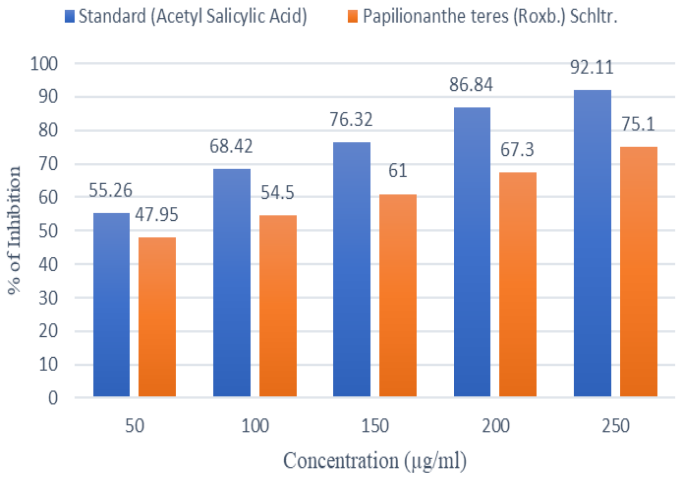

Figure 20. Anti-inflammatory activity of *P. teres* with the standard.

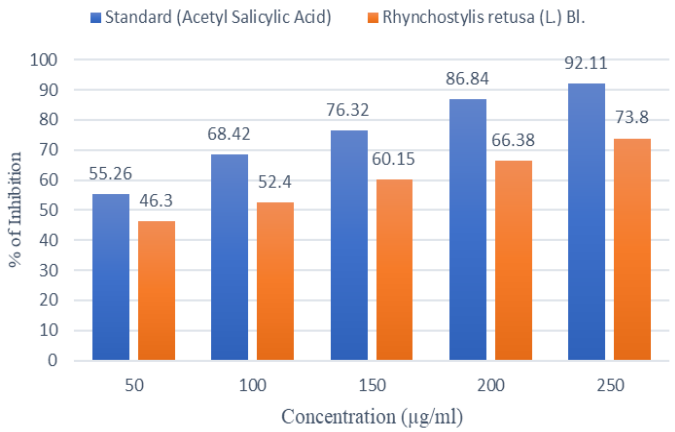

Figure 21. Anti-inflammatory activity of *R. retusa* with the standard.

69.00%), *B. lilacinum* (38.13-66.86%) and *A. odorata* (37.00 to 63.23%); while weak inhibitory activity was exhibited by *D. aphyllum* (30.87 to 58.48%), *A. graminifolia* (32.45 to 56.24%) and *A. papillosa* (27.89-53.50%) during the egg albumin denaturation process.

The IC_{50} value resulted after statistical analysis were 213.24, 165.08, 195.03, 156.79, 100.68, 191.04, 141.43, 111.35, 121.10 and 125.65 µg/ml for respective leaf extracts of *A. papillosa, A. odorata, A. graminifolia, B. lilacinum, C. aloifolium, D. tortile, D. aphyllum, L. zeylanica, P. teres* and *R. retusa.* Strong IC_{50} value determined for *C. aloifolium* (132.24 µg/ml) and the mild value for *A. papillosa* (213.24 µg/ml). The findings of Hossain et al. (2020) are consistent with the current study, which looked into the anti-inflammatory effect of three epiphytic orchids from Bangladesh. They reported the highest inhibition of egg albumin denaturation in *P. teres* (88.22 ± 0.205), followed by *L. zeylanica* (82.33 ± 0.144), and the lowest inhibition was found in the root of *R. retusa* (71.32 ± 0.151). Moderate anti-inflammatory activity was found in the leaf extract of *R. retusa*.

Because inflammation is at the basis of asthma, rheumatoid arthritis, inflammatory bowel disease, gout, atherosclerosis, and cancer (Kester et al., 2012), the anti-inflammatory activities of the plants obtained in this study support their ethnomedicinal use against asthma, rheumatism, inflammation, gout, and cancer.

CONCLUSION

The current study gathered the curative uses of ten orchids against a range of ailments from ethnic groups in Chittagong, Khagrachari, Bandarban, and Cox's Bazar, Bangladesh, of which five orchids viz. *B. lilacinum, C. aloifolium, D. aphyllum, P. teres* and *R.* retusa, had new ethnomedicinal uses. In phytochemical test, *A. odorata* demonstrated the strongest phytochemical profile, whereas *A papillosa* and *R. retusa* demonstrated a modest phytochemical profile against various screening tests. *C. aloifolium* had the lowest antioxidant activity on DPPH, while *A. odorata* had the highest. *C. aloifolium* had the highest anti-inflammatory activity on albumin, while *A. papillosa* had the lowest.

All of the plants studied in this research, however, appear to contain relevant phytochemical constituents with particular antioxidant and anti-inflammatory effects that are dose-dependent, substantiating their ethnomedicinal usage as anticancer, anti-inflammatory, and anti-rheumatic agents. More research is required to fractionate and purify the extract so that the bioactive compounds responsible for the antioxidant and anti-inflammatory properties can be identified.

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