Allelopathic Potential of *Eucalyptus rostrata* Leaf Residue on Some Metabolic Activities of *Zea mays* L.

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Abstract  A greenhouse pot experiment was conducted to investigate the possible allelopathic effect of Eucalyptus rostrata leaf residue on some metabolic activities associated with growth of 10, 20 and 30 – day – old corn plants. The lower level of *Eucalyptus* treatment (0.5 %, w/w) induced a stimulatory effect on the growth of shoot and root of corn plants. The positive effect was more obvious in shoot than in root growth. Inversely, high levels of incorporated *Eucalyptus* leaf residue (1 and 2 %, w/w) reduced all growth parameters of both shoot and root relative to the respective control, and this reduction was concentration dependent. The total phenolic aglycone content of mature *Eucalyptus* leaf was 16.89 mg g⁻¹ dry weight present as water-soluble leaf residue and decreased with root growth. Inversely, high levels of incorporated *Eucalyptus* leaf residue (1 and 2 %, w/w) reduced all growth parameters of both shoot and root relative to the respective control, which was correlated with increase in the total carbohydrate production. Similarly, the total nitrogen and total phosphorus, as well as nucleic acids were markedly higher than the control treatment. Negative pattern of changes in the contents of photosynthetic pigments, carbohydrate, nitrogen, phosphorus, phenolic compounds and nucleic acids, was observed in corn plant treated with high rates of *Eucalyptus* leaf residue (1 and 2%, w/w) as compared with their respective controls. These negative effects were concentration dependent.

1. Introduction

*Eucalyptus* (Family: Myrtaceae) includes about 150 species, seven of these species are cultivated in Egypt, most of them are trees of large size (Boulos and El-Hadidi, 1988). *Eucalyptus* trees are evergreen, and propagated only from seeds. The poor performance of crops beneath the tree area related to the allelopathic effect of *Eucalyptus* (Singh and Kohli, 1992; Anaya, 1999). Allelochemicals are naturally released from intact living or dead *Eucalyptus* tissues and accumulate in soil rhizosphere in concentrations high enough to produce allelopathic effects. Milled or chopped *Eucalyptus* parts release allelochemicals more rapidly than intact parts (May and Ash, 1990; Espinosa-Garcia, 1996). Leaf extracts, decaying leaves and soil collected under *Eucalyptus* canopies inhibited seed germination and seedling growth of associated species (Sivagurunathan et al., 1997). Leaf extracts, decaying leaves and soil collected under *Eucalyptus* canopies inhibited seed germination and seedling growth of associated species (Sivagurunathan et al., 1997). Leaf extracts, decaying leaves and soil collected under *Eucalyptus* canopies inhibited seed germination and seedling growth of associated species (Suresh and Vinaya Rai, 1987; Konar and Kushari, 1995). On the other hand, Kumar (1986) reported that a single row of *Eucalyptus* growing along field boundaries increased the yield of many crop plants. Lisanework and Michelsen (1993) demonstrated that aqueous leaf extracts of *Eucalyptus* trees significantly reduced both germination and radical growth of chickpea, maize and pea mostly at high concentrations. The inhibitory effects of leaf extract were higher than stem extracts (Phlomina and Srivasuki, 1996; Balasubramanian and Ravichandran, 1996; Sajjan et al., 1997).

A wide range of secondary metabolites have been identified in *Eucalyptus* species, including phenolic acids, flavonoids, tannins, coumarins, wax and terpenoids (Salama et al., 1990; Huang et al., 1994; Nishimura and Mizutani, 1995; Sivagurunathan et al., 1997).

Corn (*Zea mays* L.) is one of the most important cereal crops growing in the Arab Republic of Egypt. It is used as a food for human consumption and also as a feed grain for animals. In a field study, Igboanugo (1988) found that beans could be incompatible with *Eucalyptus*, while maize may be compatible with *Eucalyptus* for agrosilvicultural practices.

In the present investigation, *Eucalyptus rostrata* tree is used to study its allelopathic potential on some biochemical changes associated with the growth of corn (*Zea mays* L.).

**Keywords**  Phenolic Compounds, Growth, Pigments and Metabolic Activities
2. Materials and Methods

Fresh mature leaves of a 7-year-old *Eucalyptus rostrata* (Schlecht not Cav.) tree were collected from the campus of Cairo University, Beni-Suef Branch, Egypt. The leaves were air dried, ground to fine powder and sieved through 2mm-mesh screen. *Zea mays* L. grains were kindly obtained from the Agricultural Research Center, Ministry of Agriculture, Egypt.

The pot experiment was carried out under natural conditions in a plastic pot (25cm diameter x 15 cm length), containing 2 kg of a mixture of clay-sandy (2:1, w/w) soil. The soil was incorporated with 10, 20 or 40 g of powdered *Eucalyptus* leaf tissue at 2 cm depth that gave 0.5, 1 or 2% (w/w, residue/soil). The pots were divided into four groups including the control and the three different concentrations of *Eucalyptus* leaf residue. Each treatment was replicated twelve times in a completely randomized experimental design. Each pot was planted with ten grains of corn at 3cm depth. After emergence, the seedlings were thinned to 6

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The plant samples were harvested after 10, 20 and 30 days from sowing, separated into root and shoot, then washed thoroughly with distilled water. The lengths of shoot and root were measured and their fresh weights were recorded. The samples were dried in an oven at 60°C to constant weight. The water content of each organ was calculated on a dry weight basis. The shoot was ground to fine powder and kept in dry condition for the biochemical analyses.

Photosynthetic pigments of the fresh corn shoot tissues were extracted and determined according to the method described by Fadeel (1962). The contents of chlorophylls “a” and “b”, as well as and carotenoids were calculated according to equations adopted by Sestak et al. (1971).

The extraction of nucleic acids was carried out by the method cited by Mohamed and El-Sayed (1982). DNA and RNA content were measured by diphenylamine and orcinol reactions, respectively (Clark and Switzer, 1977) and calculated according to the equations outlined by Schneider (1945).

The dried powder shoot tissues were extracted with 80% ethanol by refluxing for one hour (Jindal and Singh, 1975) for estimating the phenolic content using Folin-Ciocalteau reagent (AOAC, 1990). The soluble reducing sugars were estimated in the ethanolic extract by Nelson’s reaction (Clark and Switzer, 1977). The non-reducing sugars were hydrolyzed in the ethanolic extract with 6N HCl (Gaines, 1973), whereas the insoluble carbohydrates in the remaining dry residue were hydrolyzed with 0.2N H2SO4 in boiling water bath for one hour (Streeter and Jeffers, 1979). The reducing values of the hydrolyzed samples were measured by Nelson’s reaction.

Total nitrogen and phosphorus were determined in the acid digested samples using Berthelot reaction (Chaney and Marbach, 1962) and modified Fiske-Subbarow method (Clark and Switzer, 1977), respectively. Soluble nitrogen and phosphorus were extracted from the dried shoot tissue with 10% TCA and the dried residue was acid digested to obtain the insoluble fractions. The amino-N was estimated in the TCA extract according to the method described by Russell (1944).

HPLC analysis of the allelochemicals in the *Eucalyptus rostrata* leaves was analyzed on a Hewlett-Packard HPLC system, fitted with a reverse-phase Ultrasphere C18 hypersil column (250 x 4.60 mm), 25 µm particle size. The mobile phase: acetonitril-acetic acid (30:70, v/v) was used over 48 min. All data were analyzed with two-way ANOVA program (Campbell, 1989).

3. Results and Discussion

Chemical analysis of mature *Eucalyptus rostrata* leaves contained 16.89 mg g⁻¹ dry weight Phenolic glycosides. Qualitative analysis of the phenolic content of *Eucalyptus* leaves by HPLC revealed the presence of several peaks (Figure 1), and only nine phenolic aglycones were identified (Table 1). Among the identified aglycones in *Eucalyptus* extract, p-coumaric acid constituted the major component. The two other aglycones catechol and chlorogenic acid were detected in a lesser amount. Salicylic acid, vanillin and coumarin were also identified, two relatively small fractions of caffeic acid and cinnamic acid, whereas ferulic acid was found in a trace amount.

In this respect, Srivastava et al. (1996) demonstrated that the most principal allelochemicals are phenolic glycosides in *Eucalyptus tereticornis*. Sivagurunathan et al. (1997) reported that litter of *Eucalyptus* species released more phenolic compounds than other plant parts and most of these compounds are phenolic acids, including caffeic, coumaric, gallic, gentisin, hydroxybenzoic, syringic and vanillic acids in addition to catechol. Recently, Gallet et al. (1999) showed that *Eucalyptus hermaphraditum* leaves and aqueous leaf extracts have high levels of phenolics, which are the most stable compounds.
Table 1. The quantitative and qualitative analysis of phenolic aglycones of *Eucalyptus rostrata* leaves using HPLC.

| Phenolic Compound        | Retention Time (min.) | Concentration µg⁻¹ dry weight |
|--------------------------|-----------------------|------------------------------|
|                          | Standard | Sample                  |                             |
| Pyrogallic acid          | 6.17     | --                      | --                          |
| Rescinnol                | 10.89    | --                      | --                          |
| Protocatechuic acid      | 11.46    | --                      | --                          |
| Catechol                 | 12.64    | 13.76                   | 1172 ± 0.31                 |
| *p*-hydroxybenzoic acid  | 15.98    | --                      | --                          |
| Chlorogenic acid         | 16.81    | 16.33                   | 956 ± 0.08                  |
| Caffeic acid             | 19.50    | 19.43                   | 58 ± 0.15                   |
| Syringic acid            | 20.28    | --                      | --                          |
| Vanillin                 | 22.88    | 21.96                   | 122 ± 0.09                  |
| *p*-Coumaric acid        | 24.65    | 24.15                   | 4750 ± 1.67                 |
| Ferulic acid             | 25.09    | 25.49                   | 1.53 ± 0.01                 |
| Coumarin                 | 29.47    | 29.25                   | 115 ± 0.03                  |
| Salicylic acid           | 30.92    | 31.27                   | 148 ± 0.07                  |
| Cinnamic acid            | 34.56    | 33.94                   | 29 ± 0.04                   |
| Kaempferol               | 39.29    | --                      | --                          |

Figure 1. HPLC chromatogram of *Eucalyptus rostrata* leaf phenolic aglycones.
The incorporation of *Eucalyptus* residue at lower rate of (0.5%) induced a stimulatory effect in all growth parameters of both root and shoot of *Zea mays*. The magnitude of promotion in all growth parameters was more pronounced in shoot than root as compared with their respective control at each growth stage (Table 2 & 3). However, increasing the level of incorporated *Eucalyptus* leaf residue up to 1% induced a pronounced reduction in all growth parameters of the root, but slightly stimulated the length, fresh and dry weights as well as water content of shoot of 20- and 30-day-old plants relative to the control (Table 3). The highest level of *Eucalyptus* leaf residue (2%) induced a marked reduction in the various growth parameters of both root and shoot, where the reduction was more obvious in root than in shoot.

This finding is in agreement with the results of Jayakumar *et al.* (1990) who showed that the irrigation of groundnut and maize with 5, 10, 15 and 20% water extract of abscised

### Table 2. Allelopathic effect of *Eucalyptus rostrata* leaf residue on the root growth criteria of *Zea mays* plant at different growth periods.

| Age/ (days) | Residue Rate (w/w) | Length (cm) | Plant Weight (g) | Water content (g H₂O g⁻¹ DW) |
| --- | --- | --- | --- | --- |
| | | | Fresh | Dry |
| 10 | Control | 9.2 ± 0.58 | 1.82 ± 0.11 | 0.19 ± 0.006 | 8.58 ± 0.25 |
| | 0.5 % | 10.5 ± 0.50 | 2.12 ± 0.11 | 0.22 ± 0.013 | 8.64 ± 0.89 |
| | 1.0 % | 7.8 ± 1.00 | 1.51 ± 0.02 | 0.17 ± 0.015 | 7.88 ± 0.89 |
| | 2.0 % | 6.0 ± 0.76 | 1.15 ± 0.02 | 0.14 ± 0.009 | 7.21 ± 0.77 |
| 20 | Control | 10.5 ± 0.50 | 2.48 ± 0.37 | 0.25 ± 0.040 | 8.92 ± 1.30 |
| | 0.5 % | 12.3 ± 0.29 | 2.52 ± 0.14 | 0.24 ± 0.010 | 9.50 ± 1.18 |
| | 1.0 % | 10.1 ± 0.29 | 1.92 ± 0.09 | 0.21 ± 0.003 | 8.14 ± 0.25 |
| | 2.0 % | 7.6 ± 0.58 | 1.53 ± 0.04 | 0.18 ± 0.010 | 7.50 ± 0.47 |
| 30 | Control | 16.0 ± 1.00 | 6.48 ± 0.50 | 0.62 ± 0.020 | 9.45 ± 0.74 |
| | 0.5 % | 18.6 ± 0.58 | 6.93 ± 0.19 | 0.63 ± 0.013 | 10.00 ± 0.08 |
| | 1.0 % | 14.3 ± 0.58 | 5.81 ± 0.06 | 0.59 ± 0.048 | 8.85 ± 0.64 |
| | 2.0 % | 11.6 ± 0.58 | 4.34 ± 0.03 | 0.48 ± 0.035 | 8.04 ± 0.86 |

### Table 3. Allelopathic effect of *Eucalyptus rostrata* leaf residue on the shoot growth criteria of *Zea mays* plant at different growth periods.

| Age/ (days) | Residue Rate (w/w) | Length (cm) | Plant Weight (g) | Water content (g H₂O g⁻¹ DW) |
| --- | --- | --- | --- | --- |
| | | | Fresh | Dry |
| 10 | Control | 10.6 ± 0.76 | 7.4 ± 0.37 | 0.64 ± 0.020 | 10.56 ± 0.72 |
| | 0.5 % | 12.5 ± 0.50 | 8.9 ± 0.34 | 0.73 ± 0.030 | 11.20 ± 0.05 |
| | 1.0 % | 9.3 ± 0.58 | 6.2 ± 0.12 | 0.55 ± 0.003 | 10.27 ± 0.16 |
| | 2.0 % | 6.8 ± 0.76 | 4.7 ± 0.58 | 0.47 ± 0.020 | 9.00 ± 1.49 |
| 20 | Control | 12.3 ± 0.58 | 12.1 ± 0.24 | 1.20 ± 0.030 | 9.10 ± 0.13 |
| | 0.5 % | 14.8 ± 0.29 | 14.0 ± 0.33 | 1.29 ± 0.030 | 9.85 ± 0.03 |
| | 1.0 % | 13.0 ± 0.00 | 12.9 ± 0.69 | 1.23 ± 0.060 | 9.50 ± 0.57 |
| | 2.0 % | 9.6 ± 0.58 | 8.3 ± 0.59 | 0.87 ± 0.060 | 8.54 ± 0.02 |
| 30 | Control | 15.01 ± 0.29 | 26.4 ± 0.15 | 3.09 ± 0.060 | 7.54 ± 0.74 |
| | 0.5 % | 19.3 ± 0.58 | 32.9 ± 1.48 | 3.62 ± 0.140 | 8.10 ± 0.08 |
| | 1.0 % | 16.3 ± 0.58 | 30.7 ± 0.46 | 3.44 ± 0.143 | 7.92 ± 0.64 |
| | 2.0 % | 11.3 ± 0.58 | 20.2 ± 0.12 | 2.62 ± 0.236 | 6.71 ± 0.86 |
*Eucalyptus globulus* leaf greatly reduced plant height and leaf area. Recently, Abu El-Soud (2001) demonstrated stimulation in pea growth parameters by increasing the rate of the incorporated *Acacia nilotica* leaf residue from 0.25 – 0.5% (w/w), but gradual suppression at 1.5 to 2% (w/w). In this respect, Rice (1984) related the reduction in plant growth to the inhibitory effect of allelopathic compounds on IAA biosynthesis and on gibberellic acid induction. Furthermore, Schon and E. Einhellig (1982) attributed the inhibition of sorghum growth by sunflower leaf residue to the decrease in leaf water potential (Ψw) that affected water utilization, which in turn affect cell turgidity and hence cell enlargement. Recently, Reigosa *et al.* (1999) assumed that allelopathic compounds are affecting many different physiological processes simultaneously and these effects are concentration dependent.

The phenolic contents of corn plant treated with different levels of *Eucalyptus* leaf residue showed variable changes (Fig. 2). The lowest level of *Eucalyptus* leaf residue (0.5%) induced an accumulation of the total phenolic compounds which was more pronounced in phenolic glycosides than phenolic aglycones throughout experimental periods of 10, 20 and 30 days. However, increasing *Eucalyptus* leaf residue level was accompanied by a marked increase in the phenolic aglycone contents, while contents of the phenolic glycoside was greatly reduced at the different stages of growth. The obvious reduction in total phenolics at the higher levels of *Eucalyptus* allelochemicals, could be due to their depressive effects on the enzyme systems involved in phenol biosynthesis. In this regard, Sato *et al.* (1982) early demonstrated that the activity of phenylalanine ammonia-lyase decreased markedly upon treatment with cinnamic acid derivatives. This enzyme catalyzes the first step reactions in phenolic pathway (Cosio and McClure, 1984). Usually, the sugar units bind to the free aglycones at the late stage of biosynthesis forming phenolic glycosides, which become non-toxic, more water-soluble and easily translocate to non-photosynthetic tissues (Hrazdina and Wagner, 1985). In this respect, Kleiner *et al.* (1999) demonstrated that the phenolic glycosides are mainly synthesized within the chloroplast and representing plant defense metabolites. The production of phenolic glycosides may be effective in protecting corn plant treated with lowest *Eucalyptus rostrata* (0.5 %) against the external stress conditions. This is true where high accumulation of phenolic glycosides, reduces the phytotoxic effects of *Eucalyptus* allelochemicals.

![Figure 2](image_url)

*Figure 2.* Allelopathic effect of *Eucalyptus rostrata* leaf residue on the phenolic content of *Zea mays* plant at different growth periods.
The incorporation of *Eucalyptus* leaf residue at lowest level 0.5% (w/w) caused a stimulatory effect on the accumulation of chlorophyll “a” and “b”, as well as carotenoids in the shoot of corn plants (Fig. 3). It obvious that such effect was more pronounced in carotenoids content. In contrast, the applications of *Eucalyptus* leaf residue above 0.5% induced reduction in contents of different pigment fractions, at each growth stage. This reduction was more obvious in chlorophyll “a” than in other pigments as compared with respective control. This could be possibly related to the degradation mechanisms of chlorophyll “a” and “b”, and / or to the reduction in the capacity to biosynthesis of new chlorophylls. These results agree with those obtained by Kohli *et al.* (1991) and Konar and Kushari (1995) using *Eucalyptus* extract on different crop plants. Prasad and Subhashini (1994) showed that the allelochemicals greatly inhibited porphyrin synthesis.

The application of *Eucalyptus* leaf residue at lower rate (0.5%), increased the total carbohydrate content in corn shoot at different plant ages (Fig. 4). This stimulatory effect was attributed to the accumulation in the insoluble sugar fraction and to the decline in the total soluble sugar fraction, as compared with their respective controls. Increasing concentration of *Eucalyptus* leaf residue above 0.5% induced a greater reduction in the level of different carbohydrate fractions. However, the highest concentration (2 %) induced the maximum inhibition in the contents of all sugar fractions, particularly the non-reducing sugar. These findings are in harmony with the result of Al-Wakeel and Soliman (1994) show that low concentration of lupin seed extract increased the level of the total carbohydrate content in the shoot of 60-day-old soybean, while the high concentration reduced these parameters. Similarly, Tripathi *et al.* (1998) showed that the total sugar content in soybean leaves increased as a result of treatment with 5% concentration of *Acacia* leaf extract, whereas, the 10 and 20% extracts reduced this accumulation. Recently, Abu El-Soud (2001) demonstrated that pea plant grown in soil incorporated with 0.25 and 0.5% (w/w) *Acacia* leaf residue for 45 days accumulated a large amount of carbohydrates than those grown in higher concentration of *Acacia* treatments. Under the present experimental condition, the reduction in chlorophyll “a” content consequently reduces the photosynthetic efficiency of the corn shoot and inturn reduces the accumulation of carbohydrate. This could account for the reduction in dry weight of corn plants treated with high levels of *Eucalyptus rostrata*. This explanation is consistent with the previous results obtained by other workers for adverse effects of allelochemicals application that could limit carbohydrate synthesis in many plant species (Mersie and Singh, 1993; Einhellig, 2001). Furthermore, it is well established that the phenolic compounds (sorgeolon and juglone) are powerful inhibitors of chloroplast CO₂-dependent oxygen evolution (Hejl *et al.*, 1993; Jose and Gillispie, 1998).
Figure 4. Allelopathic effect of *Eucalyptus rostrata* leaf residue on the carbohydrate contents of *Zea mays* plant at different growth periods.

Figure 5. Allelopathic effect of *Eucalyptus rostrata* leaf residue on the nitrogen contents of *Zea mays* plant at different growth periods.

Figure (5) shows that the incorporation of *Eucalyptus* leaf residue at 0.5% (w/w) level induced an obvious increase in the soluble, insoluble and total nitrogen contents. This indicates that the lowest *Eucalyptus* treatment may have a stimulatory effect on the nitrogen uptake and have the potential to enhance the enzyme system involved in the incorporation of amino acids into the insoluble form (e.g. protein synthesis). This result in support the data obtained by Tripathi *et al.* (1998), who showed an increase in protein content of soybean over the control by application of leaf extract of *Albizia procera* and *Acacia nilotica*. On contrast, the incorporation of *Eucalyptus* leaf residue with high concentrations (1 and 2%, w/w) reduced the contents of both soluble and insoluble nitrogen, and the reduction was concentration dependent. These results are in agreement with that reported in Costus species treated with *Eucalyptus globulus* leaches (Konar and Kushari, 1995). Also, Balasubramanian and Ravichandran (1996) showed that
allelochemicals of *Eucalyptus tereticornis* and other agroforestry trees inhibited the legume-rhizobium symbiosis and interfered with the subsequent nodulation and nitrogen fixation. Furthermore, the application of phenolic acids (caffeic, vanillic, *p*-coumaric, chlorogenic and ferulic acid) greatly reduced the nitrogen content of 3-week old tomato leaf (Mersie & Singh, 1988). The variable effects of *Eucalyptus* allelochemicals on corn nitrogen content could be explained on the basis of the interference of the allelopathic substances with nitrogen uptake and metabolism. Moreover, Cameron and Julian (1980) demonstrated the inhibition of protein content upon treatment with cinnamic and ferulic acids by depression of $^{14}$C-tyrosine incorporation into protein in *Lactuca sativa* L. seedlings. In accordance with this hypothesis, it was found that benzoic, cinnamic and ferulic acids inhibited the incorporation of $^{35}$S-methionine into protein in soybean seedlings, whereas *p*-hydroxybenzoic and *p*-coumaric acids increased its uptake (Baziramakenga *et al.*, 1997).

Application of *Eucalyptus* leaf residue at 0.5% caused a marked increase in both soluble and insoluble phosphorus as well as the total phosphorus contents in the corn shoot, as compared with their respective controls at each growth stage (Fig. 6). This result suggests that the low levels of *Eucalyptus* allelochemicals have stimulatory effect on the uptake and assimilation of phosphorus. These results are in accordance with Baziramakenga *et al.* (1994), who reported that low concentrations of phenolic acids (*p*-hydroxybenzoic and *p*-coumaric acids) slightly increase phosphorus absorption by roots of soybean plant. Inversely, the higher levels of *Eucalyptus* allelochemicals (1 and 2%) reduced the amount of all phosphorus fractions, possibly due to their interference with phosphorus uptake and assimilation. Similarly, the results agree with those of Mersie and Singh (1988) who demonstrated that *Parthenium hysterophorus* extract and residue greatly reduced phosphorus content of treated 3-week old tomato plant leaf. Other investigators showed that the allelochemicals, mainly phenolic acids, obviously reduced the phosphorus content in various plants by interference with the phosphate and anion uptake, as well as membrane permeability (Prasad and Rama Devi, 2001).

![Figure 6](image-url)

**Figure 6.** Allelopathic effect of *Eucalyptus rostrata* leaf residue on the phosphorus contents of *Zea mays* plant at different growth periods.
The application of Eucalyptus leaf residue at 0.5% (w/w) increased the contents of both DNA and RNA in corn shoot as compared with their respective controls throughout the experimental period (Fig. 7). The high accumulation of nucleic acids was consistent with the accumulation of nitrogen and phosphorus contents. This could be explained that is level of Eucalyptus treatment stimulate nitrogen and phosphorus uptake, as well as increase the incorporation of phosphorus into nucleotides and/or stimulate the enzyme system involved in the biosynthesis of new nucleic acids. Also, Baziramakenga et al. (1997) reported that low concentrations of benzoic, cinnamic, vanillic and ferulic acids stimulated the biosynthesis of nucleic acids by increasing the incorporation of $^{32}$P into DNA in soybean plant. On the other side, the higher rates (1 and 2%) of Eucalyptus leaf residue reduced the contents of nucleic acids. Early, Svensson (1972) demonstrated that coumarin interfere with RNA and DNA metabolism. Similarly, Van Sumere et al. (1975) suggested that the reduction of nucleic acid contents in soybean treated with phenolic acids was attributed to the enhancement of the hydrolysis of DNA and RNA. Recently, Seigler (1996) demonstrated that allelopathic compounds interact with nucleic acid metabolism causing modification of DNA and RNA.

The allelopathic potential of Eucalyptus leaf was correlated with the amount of phenolic compounds released from air dried mature leaf residue. The stimulation effect of these compounds at lowest level on corn plant result from the combined action of a number of allelochemicals on different cellular sites of action. Thus, the overall effect of one plant species on another may be the product of multiple and complex interaction of these compounds that may act simultaneously. In this regard, Reigosa et al. (2000) and Einhellig (2001) reviewed some information about the mechanism of action of allelochemicals on various physiological and biochemical process in the plants.

In conclusion, allelopathic interactions of Eucalyptus rostrata allelochemicals include both stimulatory and inhibitory effects on corn plant. The current study reveals that the high accumulation of Eucalyptus rostrata leaves on the soil surface may be responsible for retardation of growth of corn and consequently reduces the plant yield, while the low accumulation could improve the growth and productivity of corn.

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