16.3.2 Root Induction and Formation *In Vitro* Callus

The healthy developed calli were transferred to a MS medium containing dissimilar concentrations of NAA, IAA and IBA, and were kept under dark conditions. The greatest root formation was obtained on IBA (2 mg/L, 76.72%) and the number of roots also obtained per callus, per callus showed (27.43%), followed by IAA (2 mg/L, 67.22%) and the number of roots were also obtained per callus (22.62%). The least amount of root formation was observed (55.63%) on NAA (2 mg/L) and the number of roots were also obtained per callus (21.75%) (Table 16.2) (Figure 16.2).

This was further supported by Mehta et al. (2012), with the utmost root formation in MS medium with IBA observed on *Allium sativum*; the use of auxins individually or in combinations of cytokinins responsible for root formation, induction and elongation (Baksha et al. 2007; Hassan et al. 2008). In *Phyllanthus urinaria* the root formation (100%) was reported by Kalidass and Mohan (2009).

16.3.3 Antimicrobial Activity

The existing notice in the development of novel antimicrobial drugs can be partially attributed both to the rising emergence of bacterial and fungal resistance to antibiotic therapy and to newly emerging pathogens (Yaseen and Sudhakar 2010). The difference in the zone of inhibition is probably due to different solvents used for extraction and also the chemical components of the plants (Chew et al. 2012).

The antimicrobial activity by the zone of inhibition was observed and carried out for wild leaves, stems and *in vitro* calli in different solvents (hexane, ethyl acetate, chloroform, acetone and methanol) and extracts against the human pathogens *B. subtilis, S. aureus, E. coli, S. typhi, V. cholera* and *C. krusei*. In hexane extract (leaves and stems) the highest antimicrobial activity was observed on stems against *C. Krusei* (14 mm) followed by *in vitro* calli and leaf extracts showed against *E. coli*

TABLE 16.2
Root Formation *In Vitro* Callus of *L. aspera*

Types of Hormone	Hormone Conc. (mg/L) with MS	Root Formation (%)	No. of Roots Per Callus
IAA	0.5	43.14 ± 1.3^{d}	11.44 ± 0.13^{b}
	1.0	55.22 ± 1.8^{c}	16.14 ± 0.58^{b}
	2.0	67.22 ± 2.5^{b}	22.62 ± 1.99^{a}
NAA	0.5	34.51 ± 1.8^{e}	15.38 ± 0.51^{b}
	1.0	43.33 ± 2.1^{d}	16.32 ± 0.44^{b}
	2.0	55.63 ± 2.2^{c}	21.75 ± 0.82^{a}
IBA	0.5	56.67 ± 1.8^{c}	16.43 ± 0.98^{b}
	1.0	66.17 ± 1.3^{b}	21.13 ± 1.25^{a}
	2.0	76.72 ± 1.9^{a}	27.43 ± 2.34^{a}

Note: Number in parentheses shows standard deviation [SD]. Statistically significant at $p<0.05$ where $^{a}>^{b}>^{c}>^{d}$.