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Original article

Phytochemical analysis and fabrication of silver nanoparticles using *Acacia catechu*: An efficacious and ecofriendly control tool against selected polyphagous insect pests

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ABSTRACT

Globally, the farmers are struggling with polyphagous insect pest, and it is the number one enemy of agri-products, which made plenty of economic deterioration. *Spodoptera litura* and *Helicoverpa armigera* are the agronomically important polyphagous pests. Most of the farmers are predominately dependent on synthetic chemical insecticides (SCIs) for battle against polyphagous pets. As a result, the broad spectrum usage of SCIs led a lot of detrimental outcomes only inconsequently the researchers search the former-friendly phyto-pesticidal approach. In the present investigation, leaf ethanol extract (LEE) and silver nanoparticles (AgNPs) of *A. catechu* (*Ac*) were subjected to various spectral (TLC, CC, UV, FTIR, XRD and SEM) analyses. Larval and pupal toxicity of *A. catechu Ac*-LEE and *Ac*-AgNPs were tested against selected polyphagous insect pests. The significant larval and pupal toxicity were experimentally proven, and the highest toxicity noticed in AgNPs than *Ac*-LEE. The larval and pupal toxicity of *Ac*-AgNPs tested against *S. litura* and *H. armigera* LC_{50}/LC_{90} values were 71.04/ 74.78, 85.33/ 88.91 μg/mL and 92.57/ 96.21 and 124.43/ 129.95 μg/mL respectively. *Ac*-AgNPs could be potential phyto-pesticidal effectiveness against selected polyphagous insect pests. In globally, it is significantly sufficient ratification giving towards the prevention of many unauthorized SCPs.

1. Introduction

Most of the quality and quantity of the agricultural product is directly/ indirectly deteriorated by insect pests in many countries (Elumalai et al., 2010; Kamaraj et al., 2008; Krishnappa et al., 2010; Krishnappa and Elumalai, 2012; Misra, 2014). *Spodoptera litura* is a predominant polyphagous pest occupied a wide range of hosting around 200 floral species globally, in which 74 floral host species noticed from India (Elumalai et al., 2014; Paulraj et al., 2017). *S. litura* larvae consumed the different parts of host flora, including rhizome and causing severe damage, which gives above 60% of revenue loss in India (Elumalai et al., 2014; Krishnappa et al., 2010a, 2010b). India is a tropical country, polyphagous pest (*S. litura*) surviving and high abundance in that particular climate; therefore, recently, agriculture is facing severe economic losses (Paulraj et al., 2017). *Helicoverpa armigera* is a multivoltine, agronomically predominant polyphagous pest and it consumed a wide range of hosts estimated above 300 floras communities globally (Backiyaraj et al., 2014; Namin et al., 2014). The initial larval stage feeds only soft floral structures then turned to later stages feed on every part of flora (Gokulakrishnan et al., 2012).

Globally, most of the farmers are predominantly depending on synthetic chemical insecticides (SCIs) for battle against polyphagous insect fauna (Elumalai et al., 2010; Krishnappa and Elumalai, 2012). As the results of broad-spectrum usage of SCIs

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led a lot of detrimental outcomes: a drastic conflict between environment and living organisms, insect pest develops resistance against among the SCIs, the broad eradication of non-target fauna and flora, the direct/ indirect toxicity to formers, SCIs has lesser bio-degradable and drastic conventional effects on the natural ecosystem, unpredictable collapse in food chain/ food web, etc., (Govindarajan et al., 2005; Abinaya et al., 2018; Baranitharan et al., 2016, 2020; Benelli and Govindarajan, 2017; Govindarajan, 2011; Govindarajan et al., 2013, 2015, 2016a, 2016b, 2016c, 2016d, 2016e, 2016f, Govindarajan and Benelli, 2016a, 2016b, 2016c, 2016d, 2016e; Govindarajan and Karuppannan, 2011; Govindarajan and Sivakumar, 2012; Krishnappa et al., 2012, 2013; Krishnappa and Elumalai, 2013). Interestingly, the most of the scientist/researchers search for newer alternative SCIs approach usually it belong from naturally available phytoconstituents (PCs) (Govindarajan and Rajeswary, 2015; Govindarajan et al., 2016g,h; Baranitharan et al., 2019; Benelli, 2016; Elumalai et al., 2013, 2014; Govindarajan et al., 2016; Govindarajan and Benelli, 2017; Krishnappa and Elumalai, 2013, 2014). Because PCs have less/ zero toxic effects to the ecosystem and other related non-targets fauna and flora (Baranitharan et al., 2017; Benelli et al., 2017a, 2017b, 2017c; Divya et al., 2018; Karthika et al., 2017; Mathivanan et al., 2010; Muthukumaran et al., 2015; Veerakumar et al., 2014; Zahid et al., 2016). The PCs have multi-special derivatives it has been using in many countries (El-Wakeil, 2013; Sola et al., 2014). *Acacia catechu* (Leguminoseae) is a highly medicinal value flora, and it distributed in entire Asian and African continents. This plant has a lot of vital PCs; therefore, it has been used as different medicinal properties, and it could cure different human/animal infections. The floral parts like a leaf, branches, bark, fruits, seeds, and rhizomes were used as dental care mouthwash, buccal and alimentary canal infections, gastric ulcers, diarrhea, control of hypertension, dysentery, common cold, cough, asthma, leprosy, antimicrobial, antioxidant activities etc., (Patel et al., 2009; Negi and Dave, 2010; Stohs and Bagchi, 2015; Rahman et al., 2016). Since it is firsthand documentation, existing about the pesticidal activity of A. catechu leaf ethanol extract (*Ac*-LEE) and green-synthesized nanoparticles (*Ac*-AgNPs) against selected polyphagous insect pests *S. litura* and *H. armigera*. *Ac*-LEE and *Ac*-AgNPs of A. catechu were subjected to various spectral and microscopic analyses.

2. Material and methods

2.1. Floral collection and extract preparation

A fresh and cleaned *Acacia catechu* (Leguminoseae) leaf (Fig. 1A) was collected from parent flora at Namakkal District (11.2189° N, 78.1674° E), Tamilnadu, Southern India. The collected leaves were carefully washed with dechlorinated H_2O and immediately kept in the sunshine for 10–15 min. The partially dried and H_2O evaporated leaves were carried to the laboratory, which allowed to shade dried on Whatman filter paper (27 ± 2 °C). The dried floral parts were ground as a fine powder (Fig. 1B), which extracted by using the Soxhlet apparatus. Excess of solvent residue in that extract was evaporated naturally, which maintains room temperature on the Petri plate (Fig. 1C) and complete evaporated semi-dried extract weighed, stored in an aseptic glass vial at 0–4 °C in the refrigerator.

2.2. TLC, CC, and Phyto-chemical analysis

The *Ac*-LEE was subjected to find potential PCs accountable for different bioassay activities. The *Ac*-LEE was run on a pre-coated TLC sheet and CC packed with a silica gel column with a height 50 cm and capacity 50 ml. The *Ac*-LEE diluted with various solvent systems with the composition of ethanol and diethyl ether (Table 1). The phytochemical analysis using for the quality of various PCs found in the competent *Ac*-LEE described by Nweze et al. (2004) and Senthilkumar and Reetha (2009).

2.3. Silver nanoparticle (AgNP) synthesis

The *Ac*-$AgNO_3$ 90 ml Mm added with *Ac*-LEE 10 ml was prepared in 200 ml Erlenmeyer flasks for reduction into Ag + ions. $AgNO_3$ + *Ac*-LEE mixture was retained 1 h at 27 ± 3° C for complete bio-reduction. The preliminary finding of *Ac*-AgNPs found the colour change in the $AgNO_3$ + *Ac*-LEE mixture. The whole reactions allowed in darkness to avoid photoactivation. For the purification process, obtained *Ac*-AgNPs subjected to ultra-centrifugation above 5,000 rpm for 25 min. After the centrifugation, supernatant discarded and pellet carefully diluted with distilled H_2O (Satyavani et al., 2011), the blend was stored in a glass vial, labeled and stored for further analysis.

2.4. Characterization of AgNPs

The bio-reduction of Ag + ions solution was keenly monitored by using UV–vis spectroscopy (Rajesh et al., 2009). FTIR spectroscopy evaluated the bio-molecules present in purified *Ac*-AgNPs (Ashokkumar and Ramaswamy 2014). *Ac*-AgNPs were allowed to dry at 60° C, and the dried powder was subjected to XRD spectroscopy to identify their exact structure and material.

2.5. Polyphagous insect pests rearing

The polyphagous insect pests of *S. litura* and *H. armigera* its eggs/ egg masses (Fig. 2A and Fig. 3.A), larvae, pupae, and adults were collected from castor and legume field in Mayiladuthurai Dis-

Fig. 1. Floral collection and extract preparation. (A) *A. catechu* plant, (B) Dried leaf powder, (C) *A. catechu* condensed LEE in a Petri plate.

Table 1
Fractions obtained from *A. catechu* LEE by different ratios of elutants.

Sl. No.	Various solvent systems	Number of fractions obtained
1.	Ethanol:Diethyl ether – 7.5:2.5	2
2.	Ethanol:Diethyl ether – 8.0:2.0	3
3.	Ethanol:Diethyl ether – 8.5:1.5	4
4.	Ethanol:Diethyl ether – 9.0:1.0	5
5.	Ethanol:Diethyl ether – 9.5:0.5	3

trict (Latitude: 11° 06′ 12.74″ N; Longitude: 79° 39′ 18.00″ E), Tamilnadu. Before hatching, the collected eggs were sterilized with 0.02% NaClO and neonate larvae were separately kept in the rearing chamber, *S. litura* larvae allowed on fresh tender castor leaves and bendi fruits for *H. armigera.* Heat sterilized soil was provided for pupation at maintained 27 ± 2 °C with light 12 h : dark 12 h photoperiod and 70 ± 5% relative humidity in insectariums. Pupae were collected from soil and placed inside the oviposition chamber here cotton soaked with 10–20% (w/v) cane sugar with 1 (or) 2 drops of multivitamins and natural honey was provided for gravid moths to increase the fecundity.

2.6. Insect toxicity

Larval and pupal toxicity of *Ac*-LEE and *Ac*-AgNPs were evaluated by the method of Abbott, (1925), and mortality was calculated by probit analysis (Finney, 1971). Five batches of 0–6 h old, 25 number, well active, uniform size, hale and healthy 2nd instar larvae of *S. litura* and *H. armigera* were separately introduced in 100 x15 mm petri dish. Larval toxicity of *Ac*-LEE and *Ac*-AgNPs of different concentrations (20–150 μg/mL) sprayed on several host plant like castor leaf for *S. litura* and legume leaf for *H. armigera* which separately provided to polyphagous pests (Fig. 2B and 3B). Larval death were noted every 4 hrs interval, total % of mortality were calculated and it maintained four replicates.

$$\text{Mortality}(\%) = \frac{\%\text{LMT} - \%\text{LMC}}{100 - \%\text{LMC}} \times 100$$

where
%LMT = % larval mortality in the treatment
%LMC = % larval mortality in the control

The same methodology has been applied to pupal toxicity; the hale and healthy of even-sized fifth instars larvae of the selected polyphagous pests were allowed to feed with different concentrations (20–150 ppm) *Ac*-LEE and *Ac*-AgNPs sprayed on respective host leaves. All phytochemicals (LEE and AgNPs) treated and control larvae were separately allowed to pupate to evaluate the pupal toxicity in which 15 numbers of pupae for *S. litura* as well as 12 numbers of pupae for *H. armigera*. Single experiment setup of pupal toxicity maintained five batches in which a total of 75 and 60 pupae tested against *S. litura* and for *H. armigera,* respectively (Fig. 2C and 3C). The appropriate concentration of *Ac*-LEE/ *Ac*-AgNPs was mixed with dechlorinated H_2O applied on the respective host plant of selected pests. The larval and pupal toxicity were assessed on both narrow and broad range test.

$$\text{Mortality}(\%) = \frac{\%\text{PMT} - \%\text{PMC}}{100 - \%\text{PMC}} \times 100$$

where
%PMT = % pupal mortality in the treatment
%PMC = % pupal mortality in the control

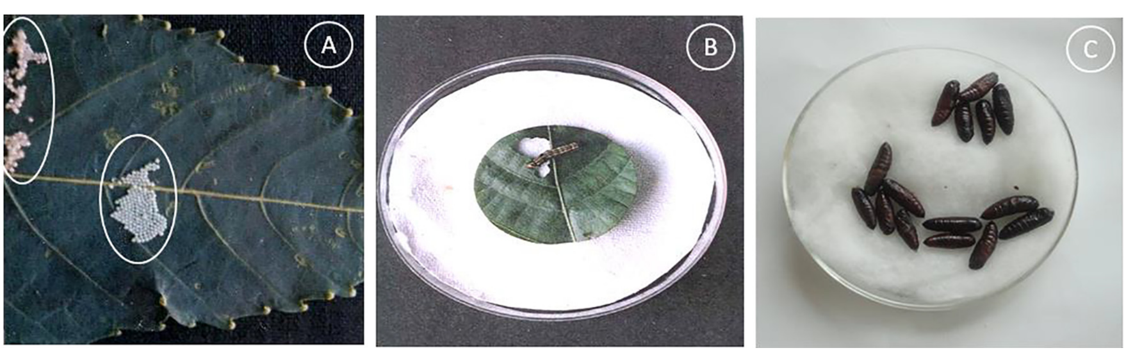

Fig. 2. Bioassay experimental setup of *A. catechu* LEE and AgNPs against *S. litura*. (A) *S. litura* eggs collected from castor plant leaf, (B) Larvicidal activity setup, (C) Pupicidal activity setup.

Fig. 3. Bioassay experimental setup of *A. catechu* LEE and AgNPs against *H. armigera*. (A) *H. armigera* eggs collected from legume plant leaf, (B) Larvicidal activity setup, (C) Pupicidal activity setup.

2.7. Statistical analysis

The % mortality data of polyphagous insect pests *S. litura* and *H. armigera* its larvae and pupae were subjected to different statistical tools, LC_{50}/LC_{90}, LCL, UCL, regression, chi-square, etc. All the values were calculated by (IBM) SPSS statistics new version 25.0 version.

3. Results

3.1. TLC, CC analysis and phytochemical screening

The *Ac*-LEE was subjected to the TLC plate to identify the bio-efficiency of PCs were examined. From TLC experiment provided 5 fractions which get in the solvent system ratio of ethanol 9: diethyl ether 1(Fig. 4A). The same principle was applied on CC; the *Ac*-LEE capable PCs were assessed by CC tightly packed with silica gel, which runs with the 50 ml solvent ratio of ethanol 9: diethyl ether 1, from the experiment totally we achieved 5 fractions (Fig. 4B). From the *A. catechu* extracts evaluated to phytochemical screening, the maximum phytochemicals (Alkaloids, flavonoids, saponins, tannins, triterpenes, coumarins, anthraquinones and phenolics) gathered from higher polarity solvent like *Ac*-LEE and it has been listed in Table 2.

3.2. Ac-AgNPs synthesis

The *Ac*-LEE of *Ac*-AgNPs ($AgNO_3$ + LEE) composite mixture was clearly indicated and confirming through the colour change (dark brown colour) by adding $AgNO_3$ with *Ac*-LEE. It is evidently examined in the Fig. 5.

3.3. UV, FTIR, and XRD analysis

Colour change is the basic observation of *Ac*-AgNPs synthesis which subjected into UV and FTIR spectral analysis of *Ac*-LEE of *Ac*-AgNPs are clearly explained in Fig. 6 and Fig. 7 and FTIR analysis supports our hypothesis that the bioreduction of Ag^{+} ions to Ag° carried out by *C A. catechu* leaf borne metabolite. Indeed, the FTIR spectrum showed major peaks at 3422.49, 2922.44, 2853.81, 1608.95, 1588.38, 1489.26, 1444.39, 1383.51, 1268.82, 1237.65, 1110.98, 1036.97, 888.44, 749.31, 724.33, 608.00, 539.81, 487.41, 429.37 $^{cm-1}$. Above the peak value is strong and broad, they corre-

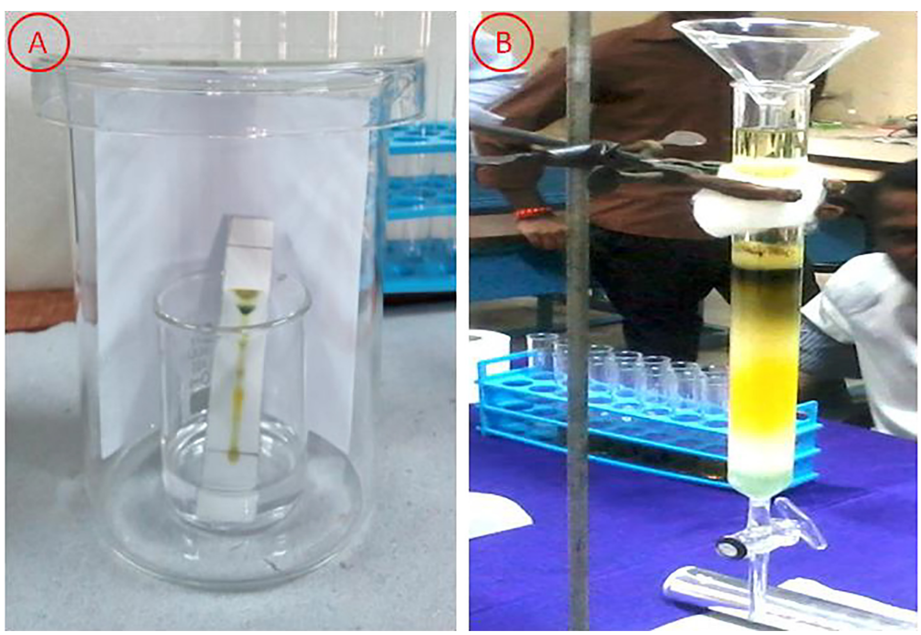

Fig. 4. Various fractionation units. (A) Air shield TLC unit, (B) CC unit.

Table 2
Phytochemical screening of different solvent extracts of *A. catechu*.

Sl. No.	Phytochemical screening	*A. catechu*, various leaf extracts				
		HNE	DER	DME	EAE	ETL
1.	Carbohydrates	–	+	–	–	–
2.	Alkaloids	–	–	–	–	+
3.	Flavonoids	+	+	–	+	+
4.	Saponins	–	+	–	–	+
5.	Tannins	+	+	+	–	+
6.	Triterpenes	+	+	+	–	+
7.	Resins	+	+	–	–	–
8.	Coumarins	+	+	+	–	+
9.	Anthraquinones	+	+	+	–	+
10.	Phenolics	+	–	+	–	+

HNE: Hexane; DER: Diethyl ether; DME: Dichloromethane; EAE: Ethyl acetate; ETL: Ethanol.
+ = noted for the presence of a phytochemical group.
– = noted for the absence of phytochemical group.

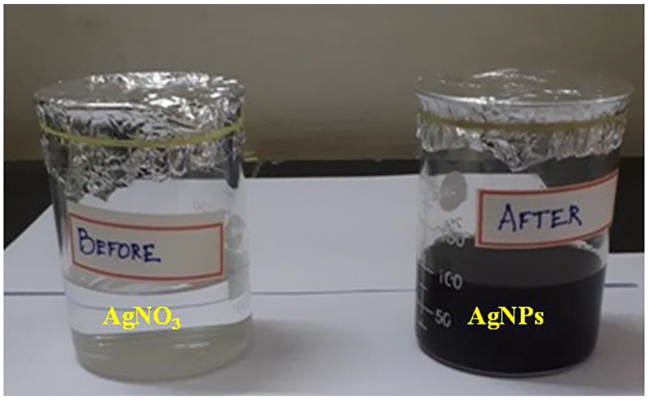

Fig. 5. Colour change observation in *A. catechu* LEE AgNPs.

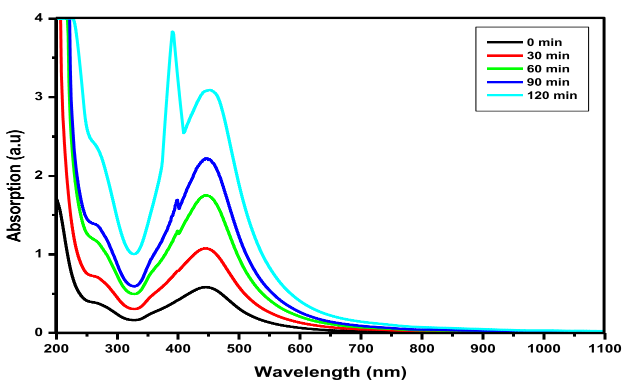

Fig. 6. Spectrum observation of *A. catechu* LEE of AgNPs through UV-Vis.

sponded to functional group like alcohols, phenols (O—H stretch, H-bonded, 3422.49 $^{cm-1}$). Alkanes (C-H stretch, 2922.44, 2853.81 $^{cm-1}$), 1* amines is medium (N—H bend, 1608.95 $^{cm-1}$), aromatics are medium (C—C stretch (in-ring), 1588.38, 1489.26, 1444.39 cm^{-1}), alcohols, carboxylic acids, esters, ethers are strong (C—O stretch, 1268.82, 1237.65, 1110.98, 1036.97 cm^{-1}), alkenes are strong (=C—H bend stretch, 888.44, 749.31, 724.33 $^{cm-1}$), alkynes is broad and strong (—C≡C—H: C—H bend stretch, 608.00 $^{cm-1}$),

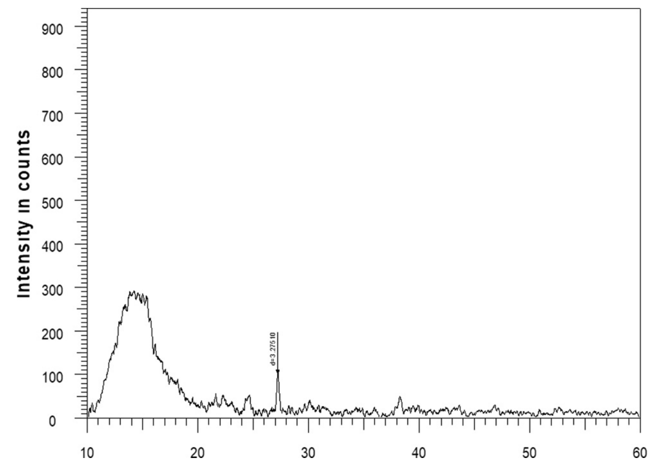

Fig.8. XRD spectrum of *A. catechu* LEE AgNPs.

and alkyl halides is medium (C—Br stretch, 539.81 $^{cm-1}$). The XRD analysis of *Ac*-LEE of *Ac*-AgNPs is obviously indicated in (Fig. 8), the appeared peaks were likely matched, and their data were confirming with NIST chemical library.

3.4. SEM analysis

Green synthesized *Ac*-LEE of *Ac*-AgNPs evaluated by SEM analysis and its image has been displayed in Fig. 9. From the image obviously declared, the *Ac*-AgNPs adhered with the *Ac*-LEE, and *Ac*-AgNPs confirmed the particle size range from 23.5 nm and 53.4 nm. SEM image has been magnified into different range, and *Ac*-AgNPs particles appeared like beads shaped it was indicated the category of NPs.

3.5. Insect toxicity

Polyphagous insect pests, *S. litura* and *H. armigera* larval and pupal toxicity values of *Ac*-LEE and *Ac*-AgNPs expressed in Tables 3 and 4. The predominant larval and pupal toxicity were experimentally demonstrated, and the highest toxicity was noticed in *Ac*-AgNPs than *Ac*-LEE. The larval toxicity of *Ac*-LEE and *Ac*-AgNPs tested against *S. litura* and *H. armigera* LC_{50}/LC_{90} values were

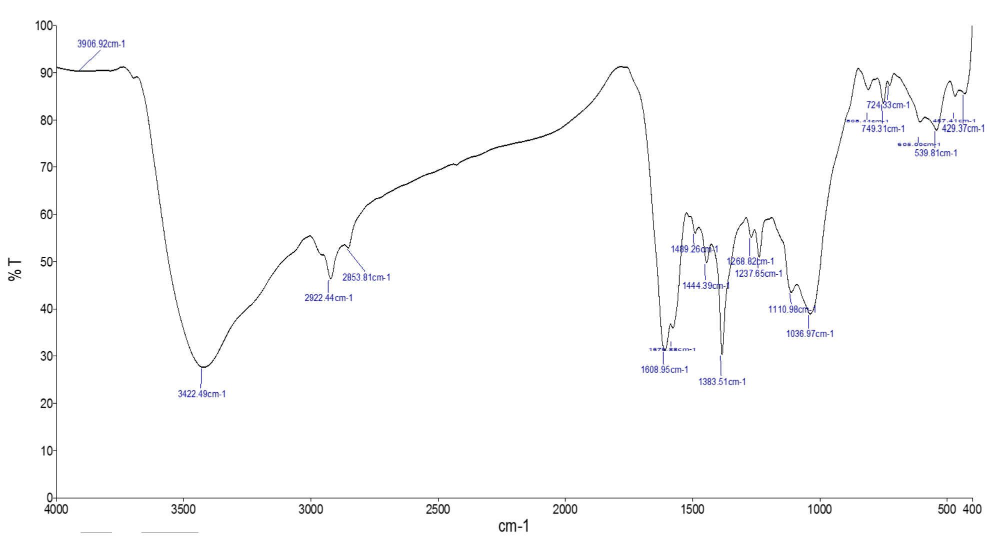

Fig. 7. FTIR spectrum of *A. catechu* LEE AgNPs.

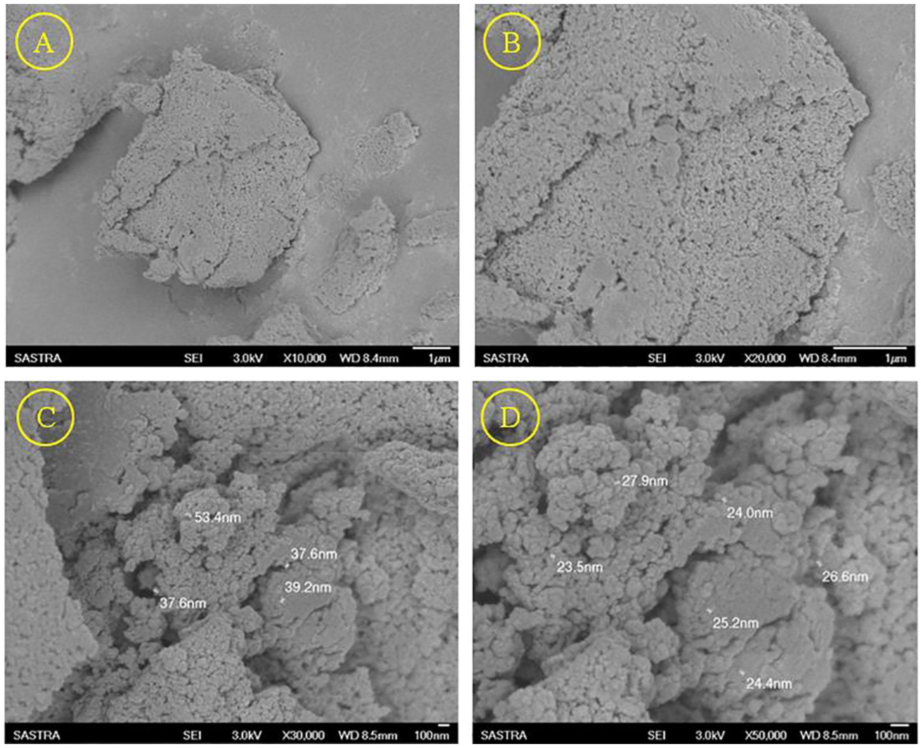

Fig. 9. SEM image of *A. catechu* LEE AgNPs. (Magnified at different range (A) 10000X, (B) 20000X, (C) 30000X, (D) 50000X).

Table 3
Larval toxicity induced by *A. catechu* LLE and AgNPs on the larvae of selected polyphagous insect pests.

Species tested	LC_{50} (μg/mL)	95% Fiducial limit (μg/mL)		LC_{90} (μg/mL)	95% Fiducial limit (μg/mL)		R-value	χ2
		LCL	UCL		LCL	UCL		
LEE of *A. catechu*								
S. litura	65.47	41.73	82.45	129.27	107.66	178.04	y = 15.03 + 1.65x	8.057
H. armigera	77.35	70.00	84.20	149.43	137.84	165.17	y = 4.88 + 1.67x	3.594
AgNPs								
S. litura	22.32	14.33	28.11	43.51	36.16	60.47	y = 4.24 + 0.54x	8.466
H. armigera	26.17	23.93	28.30	48.16	44.67	52.79	y = 0.50 + 0.52x	2.785

LC_{50} = Lethal Concentration brings out 50% mortality; LC_{90} = Lethal Concentration brings out 90% mortality; LCL = Lower Confidence Limit; UCL = Upper Confidence Limit; R-value = Regrasion value; χ^2 = Chi- square.

Table 4
Pupal toxicity induced by *A. catechu* LLE and AgNPs on the fresh pupae of selected polyphagous insect pests.

Species tested	LC_{50} (μg/mL)	95% Fiducial limit (μg/mL)		LC_{90} (μg/mL)	95% Fiducial limit (μg/mL)		R- value	χ2
		LCL	UCL		LCL	UCL		
LEE of *A. catechu*								
S. litura	91.28	59.247	115.01	173.15	143.62	243.33	y = 9.81 + 2.08x	9.257
H. armigera	107.84	98.03	117.16	206.63	190.27	229.05	y = 2.67 + 2.24x	4.857
AgNPs								
S. litura	35.90	21.07	46.67	68.24	55.22	105.15	y = 2.99 + 0.80x	11.921
H. armigera	41.14	37.78	44.38	74.85	69.38	82.18	y = 2.34 + 0.79x	3.368

LC_{50} = Lethal Concentration brings out 50% mortality; LC_{90} = Lethal Concentration brings out 90% mortality; LCL = Lower Confidence Limit; UCL = Upper Confidence Limit; R-value = Regrasion value; χ^2 = Chi- square.

112.48/ 114.20, 71.04/ 74.78 μg/mL and 176.53/ 185.60 and 92.57/ 96.21 μg/mL respectively. The pupal toxicity of *Ac*-LEE and *Ac*-AgNPs tested against *S. litura* and *H. armigera* LC_{50}/LC_{90} values were 122.31/ 127.25, 85.33/ 88.91 μg/mL and 208.49/ 212.48 and 124.43/ 129.95 μg/mL respectively. The other statistical values were apparently demonstrated in Tables 3 and 4.

4. Discussion

4.1. Preliminary phytochemical screening

A. catechu different leaf extracts were evaluated for identifying the qualitative abundance of phytochemical screening, and that results were verified in higher number of PCs groups were noticed in high polarity organic solvent like *Ac*-LEE. In previously, numerous PCs investigations have been reported in various floral sources, and it has efficiently controlled in various stages of insect pests. The PCs could be extracted from various parts of flora as well as species. It is incredibly efficient bio-recourse phyto-insecticidal agents, zero effectiveness on non-target fauna/ flora and PCs are best and supreme alternative recourse against SCPs. (Mkindi et al., 2019; Mungenge et al., 2014; Riaz et al., 2018; Ahmed et al., 2020).

4.2. Ag NPs synthesis

The several previous reports obviously synthesized *Ac*-AgNPs have murky brown/ reddish in colour. A similar propensity has been noticed in the present observation of selected flora *Ac*-LEE of *Ac*-AgNPs. Many reports strongly empathize with our present investigation (Pirtarighat et al., 2018; Morejón et al., 2018; Roy et al., 2019; Sutthanont et al., 2019).

4.3. Ag NPs characterization

UV–Vis spectral analysis: The confirmation of *Ac*-LEE green synthesized *Ac*-AgNPs have been proven by colour change from yellow to brown it can be experimentally observed by UV–vis spectral analysis. In earlier, many kinds of research have been supported to our present investigation. (Ndikau et al., 2017; Elamawi et al., 2018; Femi-Adepoju et al., 2019; Pilaquinga et al., 2019). **FTIR spectral analysis:** The floral community has several functional groups such as alkaloids, anthraquinones, flavonoids, triterpenes, polyphenols etc., and it could be confirmed and observing through FTIR spectral analysis (Asmathunisha et al., 2010). Therefore, *Ac*-LEE found various essential function groups and it confirmed their phyto-pesticidal effects while involving with *Ac*-AgNPs synthesis. Many similar types of works have been observed in previously published experiments (Devaraj et al., 2013; Ajitha et al., 2014; Jyoti et al., 2016; Suresh et al., 2016; Zia et al., 2016). **XRD analysis:** The periodic steps of lyophilization and acquisition *Ac*-LEE of *Ac*-AgNPs dried sample subjected to XRD spectral analysis. Results of XRD spectral investigation of *Ac*-AgNPs crystal structure strongly agreement with earlier reported values (Ramesh et al., 2016; Kumar et al., 2017; Vizuete et al., 2017; Oves et al., 2018; Shanmuganathan et al., 2018). **SEM analysis:** SEM reflected image has been magnified into various range it was produced the exact size and shape (morphology) of NPs. Similar propensity were recorded in many earlier outcome (Rautela et al., 2019; Pilaquinga et al., 2019; Erdogan et al., 2019).

4.4. Insect toxicity

Larval and pupal toxicity of *Ac*-LEE and *Ac*-AgNPs were tested against polyphagous insect pests *S. litura* and *H. armigera,* the predominant toxicity was noticed in *Ac*-AgNPs than *Ac*-LEE. The similar examinations were noticed in several previously reported insecticidal activities of different insect pests (agricultural/medical pests). The naturally available photoproducts like *F. religiosa* and *F. benghalensis* leaf AgNPs are significantly reduced gut protease activity of *H.armigera* (Kantrao et al., 2017). The environmental safety and predominant *C. cephalonica* larval toxicity was noticed on *O. sanctum* leaf AgNPs (Gogate et al., 2018). The green products *of E. hirta* leaf AgNPs against fourth instar larvae and pupae of *H. armigera,* the selected floral AgNPs provided statistically proven significant insecticidal activity (Durga Devi et al., 2014). The Ag NPs synthesized from different flora of *O.europaea, F. carica, E. japonica, C. limon, P. vera* and *M. nigra* prepared different concentrations against various life stages of *D. melanogaster* and their results were given predominant toxicity were recorded from Ag NPs (Araj et al., 2015). The original novel larvicidal agent prepared from *C. zedoaria* AgNPs, which tested against the larvae of *Cx. quinquefasciatus* and it produced a prime effect as well as a significant an eco-friendly approach (Sutthanont et al., 2019). *S. mammosum* AgNPs showed remarkable larval toxicity discovered against vector mosquitoes and it could be acted as a potential alternative tool against disease-spreading human vectors (Pilaquinga et al., 2019). The exploration of leaf extracts of *C. aromaticus* and *W. tinctoria* AgNPs against *Cx. quinquefasciatus* and it could be produced maximum toxicity to selected medical pest (Dass and Mariappan, 2018).

5. Conclusion

Ac-LEE green synthesized *Ac*-AgNPs could be potential phytopesticidal effectiveness against selected polyphagous insect pests. Around the world above 2000, the floral community has been used as medicinal/ pesticidal properties. In globally, it is significantly sufficient ratification giving towards the prevention of many unauthorized SCPs. Based, on the present research, *A. catechu* could be a potential multidirectional bioactive agent to combat the polyphagous insect pests.

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