Leaves and seeds of *A. hypochondriacus* and *A. caudatus* were evaluated for physicochemical properties. *A. hypochondriacus* leaves powder ash and protein content ranged from 19.2 to 21.7% and 23.3 to 33.8%, respectively. Among the *A. hypochondriacus* lines, PRA2007-2 showed the lowest ash content while PRA2008-1 showed the highest. The protein content was the lowest in PRA-2009-2 (23.3%) and the highest in Annapurna (33.8%). The ash and protein content in leaves ranged from 15.4 to 19.4% and 23.7 to 31.7%, respectively, from the *A. caudatus* lines. ICR1711 had a low ash and protein content than IC107197.

Hunter color L*-, a*- and the b*-values of amaranth leaves powder from different lines varied significantly. *A. hypochondriacus* leaves powder showed L*-, a*- and b*-values, ranged between 61.57 (PRA-3) to 83.82 (Durga), -2.02 (Durga) to -4.56 (PRA-2009-2) and 10.82 (IC42315-2) to 18.16 (PRA-2009-1), respectively. L*-, a*- and the b*-values of *A. caudatus* ranged between 52.21(IC1711) and 61.02 (IC107197), 0.8 (IC107197) and 9.93 (IC1711) and 3.97(IC1711) and 9.91(IC107197), respectively. IC1711 leaves powder showed the lowest L*- and b*-values (52.21 and 3.97, respectively). Antioxidant activity (AOA) of leaves powder ranged from 41.83 to 87.66% for *A. hypochondriacus* lines. Durga showed the highest antioxidant activity (87.6%) and PRA-2007-2 showed the lowest (41.8%). The antioxidant activity ranged from 73.76 to 75.66% for *A. caudatus* leaves. IC107197 showed the lowest antioxidant activity (73.7%) while IC1711 showed the highest 75.6%. *A. caudatus* leaves powder showed the AOA of 75.66%. Amaranthus leaves were extruded with corn grit.

*A. hypochondriacus* and *A. caudatus* grains from different lines were assessed for physical parameters like thousand kernel weight, bulk density etc. Proximate analysis was also done to determine ash, fat and protein content of amaranthus flour. Various physical parameters evaluated for different lines of *A. hypochondriacus* and *A. caudatus* were seed weight, bulk density and hunter colour. The grains from majority of amaranth
lines were small and lenticular in shape having thousand kernel weight ranging between 0.46 to 0.88g. *A. hypochondriacus* showed thousand kernel weight (TKW) in the range between 0.62 to 0.88 g, IC447680 showed the lowest seed weight while IC-35407 showed the highest. *A. caudatus* lines showed TKW in the range between 0.46 to 0.70 g, IC540869 showed the lowest and IC-38181 the highest seed weight, respectively. Bulk density ranged between 0.75 to 0.85 g/cm³. *A. hypochondriacus* showed bulk density in the range between 0.75 to 0.87 g/cm³, IC540874 showed the lowest bulk density while IC540862 showed the highest. *A. caudatus* lines showed bulk density in the range between 0.84 to 0.89 g/cm³, IC363742 and IC38181 showed the lowest and the highest bulk density, respectively. $L^*$, $a^*$ and $b^*$ values from *A. hypochondriacus* ranged between 61.38 to 68.29, 5.26 to 6.8 and 19.71 to 23.84, respectively. *A. hypochondriacus* showed higher $L^*$ and $b^*$ values compared to *A. caudatus*. Higher $L^*$ value indicate greater lightness among the lines. IC447682 showed the lowest $L^*$ value (61.38) and IC042264-16 showed the highest (68.29). RMA30 showed the lowest (5.41) and IC447682 showed the highest (6.7) $a^*$ value. Hunter $b^*$ values for *A. hypochondriacus* were observed being lowest in RMA30 (19.71) & highest in IC547395 (23.84). $L^*$, $a^*$ and $b^*$ values from *A. caudatus* ranged from 47.07 to 51.2, 11.82 to14.02 and 7.72 to 13.29, respectively with $a^*$ values being higher than that of *A. hypochondriacus*. IC540828 showed lowest $L^*$ and $b^*$ value (47.07 and 7.72, respectively) while IC467902 showed highest $a^*$ value of 14.02. The protein, ash and fat content of the flours ranged between 6.6% to 19.8%, 1.7% to 3.8% and 3.8% to 7.4%, respectively, for the *A. hypochondriacus* lines. Among the *A. hypochondriacus* lines, IC547370 showed the lowest protein, while IC540812 and IC547381 showed the highest. The ash content was the lowest in IC095284 (1.7%) and the highest in IC467901 (3.8%). The fat content was the lowest (3.8%) in IC540902, while VL344 had the highest (7.4%). The protein, ash and fat content varied in a narrow range, from 14.8% to 16.7%, 2.2% to 3.0%, and 5.4% to 8.2%, respectively, amongst the flours from the *A. caudatus* lines. IC423393 showed a lower protein content than IC540869. IC540869 had a low ash and fat content (2.2% and 5.4%), in contrast a higher ash content (3.0%) in IC423448, and a fat content (8.2%) in IC423393 were observed. *A. hypochondriacus* and *A. caudatus* lines showed that their crude fibre content ranged from 0.30% to 1.5%, and from 0.99% to 1.6%, respectively.
Among the *A. hypochondriacus* lines, IC42264-16 showed the lowest crude fibre content, while IC042265-2 showed the highest. *A. caudatus* IC38181 line showed the lowest, and IC363742 showed the highest crude fibre content. Pasting properties of flours from different amaranth lines showed a significant variation. Peak viscosity, breakdown viscosity, final viscosity, setback and pasting temperature ranged from 879 to 1613 cP, 167 to 628 cP, 769 to 1380 cP, 102 to 230 cP and 73.0 to 75.5 °C, respectively in the *A. hypochondriacus* lines, while these ranged from 1020 to 1906 cP, 352 to 855 cP, 832 to 1360 cP, 160 to 337 cP and 69.4 to 71.5 °C, respectively, in *A. caudatus*. *A. hypochondriacus* lines showed a lower peak viscosity, breakdown, final viscosity and setback, and a higher pasting temperature compared to *A. caudatus*. *A. hypochondriacus* IC467911 line showed the lowest peak viscosity and final viscosity; IC447682 showed the highest peak viscosity and final viscosity. *A. hypochondriacus* lines showed a wider range of setback values, with IC540835 having the lowest (102 cP), and IC447682 having the highest value (230 cP). The setback values of the amaranth flours varied significantly, indicating a variation in retrogradation tendency. Among the *A. caudatus* lines, IC423448 showed the lowest (160 cP), and IC540869 (337 cP) showed the highest setback. *A. hypochondriacus* lines showed higher pasting temperature (73.0 to 75.5°C) as compared to *A. caudatus* (69.4 to 71.5°C). The textural parameters of flour gels from different amaranth lines varied significantly. The *A. hypochondriacus* and *A. caudatus* flour gels showed a hardness between 1.20–3.5 g and 1.0–1.75 g, respectively, after 2 h of storage. *A. hypochondriacus* had a higher gel hardness *A. caudatus*. IC540874 and IC-447682, respectively, showed the lowest and the highest gel hardness among the *A. hypochondriacus* lines. The cohesiveness varied between 0.59 and 0.74, with IC467891 giving the lowest value, and IC540842 had the highest value. IC540874 showed the lowest gel gumminess (0.51), whereas IC447682 showed the highest (2.19). The *A. hypochondriacus* flour gels showed higher adhesiveness, ranging between 7.0 and 27.0 g sec, compared to 6.6 and 9.75 g sec, observed for *A. caudatus*.

The grains were milled into flour and defatted using hexane. The defatted and full fat flours were evaluated from physicochemical and pasting properties. The protein, ash and fat content of the full fat flours ranged from 10.5% to 18.3%, 1.9% to 3.8% and 4.9% to 7.4%, respectively for the *A. hypochondriacus* lines. The protein, ash and fat content
varied in a narrow range, from 14.8% to 16.7%, 2.2% to 3.0%, and 5.4% to 8.2%, respectively, amongst the flours from the *A. caudatus* lines. The protein and ash content of defatted amaranthus flour ranged from 9.2 to 19.1%, and 2.2 to 3.7%, respectively. Protein and ash content of *A. hypochondriacus* ranged between 9.2 and 15.7% and 2.2 and 3.5%. IC-95341 showed lower ash content than IC467910 and RMA22, respectively in *A. hypochondriacus*. Protein and ash content of flours from *A. caudatus* ranged from 13.7 to 19.1% and 2.5 to 3.7% with IC540869 showed the lowest ash and IC258399 the highest protein content.

\[ L^*, a^*, b^* \]

values of full fat flour from *A. hypochondriacus* lines, ranged from 76.79 to 83.40, 1.99 to 3.55 and 14.38 to 15.84, respectively, while these ranged from 63.06 to 73.42, 11.89 to 15.33 and 2.65 to 6.42, respectively, for *A. caudatus*. *A. hypochondriacus* lines showed the higher \( L^* \)- and \( b^* \)-values, and a lower \( a^* \)- value compared to the *A. caudatus* lines, indicating greater lightness and yellowness. *A. hypochondriacus* lines defatted flour, showed \( L^* \), \( a^* \)- and \( b^* \)-values ranged from 81.89 (RMA30) to 87.12 (IC042284-5), 1.64 (IC95341) to 2.59 (PRA-3) and 11.03 (IC-95341) to 14.96 (PRA3), respectively. Among from *A. caudatus* lines defatted flours, \( L^* \), \( a^* \)- and \( b^* \)- values ranged from 70.86 (IC38181) to 75.44 (IC540828), 10.20 (IC363742) to 13.98 (IC38181) and 4.11 (IC38181) to 5.67 (IC258399), respectively. Defatted flours from *A. hypochondriacus* lines showed higher \( L^* \)- values and lower \( a^* \)- and \( b^* \)- values as compared to their counterpart of full fat flours.

The pasting properties of full fat and defatted flours from different amaranth lines showed a significant variation. Peak viscosity, breakdown viscosity, final viscosity, setback and pasting temperature ranged from 747 to 1545 cP, 130 to 628 cP, 760 to 1234 cP, 87 to 721 cP and 72.6 to 75.5 °C, respectively, for full fat flours from the *A. hypochondriacus* lines, while these ranged from 1020 to 1906 cP, 352 to 855 cP, 832 to 1360 cP, 160 to 337 cP and 69.4 to 71.5 °C, respectively, for *A. caudatus* full fat flour. *A. hypochondriacus* defatted flours showed peak viscosity, breakdown viscosity, final viscosity, setback and pasting temperature ranged from 1122 to 1781 cP, 244 to 537 cP, 956 to 1451 cP, 120 to 163 cP and 71.75 to 73.50 °C, respectively, against between 1607
to 2123 cP, 635 to 1004 cP, 1217 to 1434 cP, 196 to 293 cP and 67.8 to 70.9 °C respectively, for *A. caudatus*.

Starch was isolated from *A. hypochondriacus* and *A. caudatus* lines and evaluated for relationship and diversity in granule size distribution, physico-chemical, thermal, pasting and rheological properties. *A. hypochondriacus* starches showed swelling power varied between 5.72 and 16.83 g/g whereas *A. caudatus* ranged between 16.82 and 22.31 g/g. VL0344 showed the lowest whereas IC38312 showed the highest swelling power, for *A. hypochondriacus*. Among *A. caudatus* starches, IC38181 showed the lowest whereas IC423393 showed the highest swelling power. Solubility of starches varied from 17.2 to 76% for *A. hypochondriacus* IC540839 showed the lowest whereas IC540862 showed the highest. Solubility of the starches ranged from 6.42 to 33.2%, from *A. caudatus* IC540869 showed the lowest whereas IC467902 showed the highest solubility. *A. hypochondriacus* cooked suspensions showed % transmittance between 0.85 to 2.84 %, which decreased between 0.83 to 2.73% after 24 hrs and 0.81 to 2.66 % after 48 hrs. *A. caudatus* starches showed % transmittance between 2.54 to 3.68 %, which decreased between 2.42 to 3.70 % after 24 hrs and 2.44 to 3.66 % after 48 hrs. Amaranth starch granules from *A. hypochondriacus* and *A. caudatus* were observed to be polygonal in shape with no fissures on the surface of the granules. The starches showed significant variation in the size distribution as well as in the percent weight of the granules. Starch granules ranged between 0 and 210 μm. The unimodal, bimodal and trimodal distribution profiles for the granules size of starches from different amaranthhus lines was observed, however, majority showed unimodal distribution. *A. hypochondriacus* showed unimodal and bimodal whereas *A. caudatus* showed unimodal, bimodal and trimodal distribution. Amaranth starches showed dual peaks at $2\theta = 17-18.18^\circ$ and single broad peak at $2\theta = 22.7-23.28^\circ$. Strong A-type pattern with higher peak intensities for *A. hypochondriacus* starches as compared to *A. caudatus* starches was observed. The presence of lower crystallinity in *A. caudatus* (19.09- 24.65%) starches as compared to *A. hypochondriacus* starches (20.55- 30.08%) was observed. Crystallinity between 24.5 to 27.9% has been reported for starch separated from amaranth. Peak viscosity, breakdown viscosity, final viscosity and pasting temperature of *A. hypochondriacus* starches ranged from 1582 (RMA-22) to 2331 (IC42265-2) cP, 628 (IC-467910) to 1121 (IC42265-2) cP, 1029

143
(RMA-22) to 1550 (RMA-30) cP and 70.40 (RMA-22) to 75.05 °C (IC-540862), respectively while these ranged from 3693 (IC-363742) to 5084 (IC-540869) cP, 2288 (IC-363742) to 3727 (IC-540869) cP, 1685 (IC-467902) to 2671 (IC-423393) cP 68.80 (IC-540869) to 71.20 °C (IC-423393) respectively, in. Thermal properties of Amaranth starches were measured using DSC showed wide variations. A. hypochondriacus starches T₀, Tp and Tc ranged between from 63.20 to 70.01 °C, 68.88 to 72.88 °C and 74.47 to 76.95 °C, respectively against from 60.46 to 63.28 °C, 65.05 to 67.05 °C and 70.93 to 74.40 °C, respectively, for A. caudatus starches. All the starches showed a smooth polymodal distribution with the peak maxima at DP11-12. DP 6-12, DP 13-18, and DP 19-24 ranged from 43.60 to 55.72%, 31.59 to 34.49% and 10.14 to 16.37%, respectively, for A. hypochondriacus and 50.67 to 57.53%, 29.30 to 32.02%, 10.04 to 13.09%, respectively for A. caudatus. DP 25-30 ranged between 2.56 and 5.53% for A. hypochondriacus and 2.75 and 4.2% for A. caudatus.

The storage modulus (\(G'\)) and loss modulus (\(G''\)) of aqueous starch suspensions (20%, w/w) were measured using a Haake Rheostress. The starch samples were heated from 50 to 90 °C at a rate of 0.5 °C/min and held at 90 °C for 10 min and then cooled to 50 °C at the same rate. \(G'_{\text{peak}}, G''_{\text{peak}}, G'_{\text{final}}, G''_{\text{final}}, G'_{\text{breakdown}}, G''_{\text{breakdown}}, G'_{\text{final}},\) and \(G''_{\text{final}}\) were measured. \(G'\) and \(G''\) of starches from all the lines increased during heating to a maximum value (\(G'_{\text{peak}}\) and \(G''_{\text{peak}}\)). A. hypochondriacus lines starch \(G'_{\text{peak}}\) and \(G''_{\text{peak}}\) ranged between 26.06 and 167.7 and 24.27 and 107.5 Pa, respectively. While \(G'_{\text{peak}}\) and \(G''_{\text{peak}}\) between 120.2 and 399.6 Pa and 201.2 and 472.8 Pa, respectively for A. caudatus lines were observed.

Protein isolates (PIs) were prepared from A. hypochondriacus and A. caudatus lines and evaluated for compositional, structural, rheological and functional properties. Protein isolates (PIs) from A. hypochondriacus lines showed protein content ranged from 79.23 to 85.20%. RMA22 showed the lowest protein content whereas PRA3 showed the highest. The protein content ranged from 79.34 to 84.32% for isolates from A. caudatus lines. \(L^*\), \(a^*\) and \(b^*\) values of PIs from different A. hypochondriacus lines ranged from 62.08 (VL0344) to 78.71 (Annapurna), 1.10 (PRA2) to 3.81 (VL0344) and 12.87 (Annapurna) to 17.06 (IC042284-5), respectively. A. hypochondriacus showed higher \(L^*\)-
and $b^*$-values compared to *A. caudatus*. Higher $L^*$ value indicate greater lightness among the lines. $L^*$-, $a^*$- and $b^*$-values of *A. caudatus* ranged from 60.16 to 75.97, 5.11 to 11.39 and 3.75 to 10.81, respectively with $a^*$ values being higher than that of *A. hypochondriacus*. Foaming capacity (FC) indicates the percentage increase in weight after whipping, while foaming stability (FS) reflects ability of protein to maintain the foam. The FC of PIs from different lines/cultivars varied significantly between 8% and 75%. *A. hypochondriacus* protein isolates, Annapurna showed the highest FC (75%), while PRA2 showed the lowest. *A. caudatus* showed FC in the ranged between 8% and 24%. IC363742, IC423448 and IC540869 showed the highest FC, while IC38165 and IC540828 showed the lowest. FS of PIs ranged between 68.57 (Annapurna) and 94.44% (PRA2) for *A. hypochondriacus* lines and 84.21 (IC363742) and 95% (IC540828), for *A. caudatus* lines. Oil binding capacity and water binding capacity are other important functional properties that affect the mouthfeel and flavor retention of the protein isolates. Oil binding capacity and water binding capacity of *A. hypochondriacus* protein isolates varied between 2.33 and 10.19 and 3.28 and 4.56 mg/mg, respectively while *A. caudatus* protein isolates showed range between 4.12 and 7.65 and 2.27 and 4.02 mg/mg, respectively. PI were evaluated for dynamic rheology using Haake Rheostress 6000S. During heating, both the moduli increased and $G'$ remained lesser than $G''$ until a certain temperature was reached, at which it rapidly increased and overtook $G''$. Holding the PIs at 93 °C caused some increase in the moduli, indicating formation of gel network. Holding the PIs at 93 °C caused some increase in the moduli, indicating formation of gel network. $G'$ and $G''$ of PI suspensions at 90 °C was between 15-560 Pa and 14-550 Pa, respectively, for *A. hypochondriacus* and 10-70 Pa and 6–56 Pa, respectively, for *A. caudatus* lines. PIs from Annapurna, PRA2, RMA22, IC38312 and IC095341 showed significantly higher accumulation of 52 kDa, 43 kDa and 42 kDa polypeptides, whereas, Annapurna, PRA2, RMA22, IC38312, IC042284-5, IC042311-7, IC467901 and IC540839 showed presence of 20 kDa polypeptide. Fourier-transform infrared (FTIR) spectra of PIs from different lines were recorded using FTIR spectrometer with a Attenuated Total Reflectance cell. The amide I region (1700–1600 cm$^{-1}$) in the spectra of proteins consists of many overlapping peaks that represent different structural elements. PIs exhibited amide I, amide II and amide III peaks at the wavenumber of 1639, 1540 and
1237 cm\(^{-1}\), respectively. The ratio of absorbance at wave numbers corresponding to β-sheets (1638 cm\(^{-1}\)) and α-helix (1656 cm\(^{-1}\)) was also calculated to describe their relative proportions in PIs from different lines. The ratio of absorbance between 1638 and 1656 cm\(^{-1}\) ranged between 0.85 and 1.06 for PIs from different lines/cultivars. IC467901 protein isolate showed the highest ratio (1.06), while PRA-2 showed the lowest (0.85) from A. hypochondriacus lines. A. caudatus lines protein isolate from IC540869 showed the lowest (0.87) while IC547512 showed the highest ratio (1.02). IC467901 proteins showed the greater proportion of β-sheets. The β-sheets have been reported to impart thermal stability. A. hypochondriacus lines. A. caudatus lines of protein isolate showed distinct difference in secondary structure. Among A. hypochondriacus lines, intermolecular β-sheets and antiparallel β-sheets, α-helix and β-turns and β-sheet structure ranged from 26.26 to 42.81%, 40.05 to 45.47% and 15.79 to 28.27%, respectively.

*Amaranthus* flour films were produced using glycerol as plastisizer. Thickness of the films ranged between 0.05 and 0.13mm. L\(^*\)-, a\(^*\)- & b\(^*\)- values ranged between 23.18 and 37.07, -0.02 and 2.20 and 2.05 and 7.17, respectively. Moisture content of films ranged between 8.72 and 23.55%. Solubility of films obtained from amaranth flour was in the range between 28.07 and 94.66%. Weight F values (3.20-68.88) for L\(^*\)-, a\(^*\)- and b\(^*\)- values were much higher than that of cultivars (27.05-33.82), indicating greater effect weight on the film properties. Cultivars F values showed significant effect on solubility of films (p ≤ 0.05). The cultivars, cultivars × glycerol and cultivars × weights effect on solubility was also significant.

Extrusion and product behaviour of corn grit blended with different levels of amaranth leaves was evaluated using a twin screw extruder. The torque, a safety indicator for extruder operation, varied between 33 and 62%. Corn grit and amaranth leaves powder blends had L\(^*\) from 46.01 to 64.38; a\(^*\) from -0.96 to 8.30 and b\(^*\) from 12.17 to 32.52. WAI increased with increase in feed moisture. WAI values of corn-amaranth extrudates ranged from 2.43 to 5.93 g/g and WSI of extrudates ranged between 8.68 to 54.07. Expansion of extrudates ranged between 8.01 and 16.14. Textural analysis of fried extrudates was performed. Fried extrudates containing (6%) amaranth leaves
powder extruded at 17% moisture resulted in greater hardness (143.06N) as compared to extrudates. Incorporation of amaranth leaves powder significantly increased the hardness of the extrudates. Sensory evaluation of extrudates showed that amaranth leaves powder could be successfully incorporated up to 2% level in corn to produce with acceptable sensory. The product containing 2% amaranth leaves were better as compared to extrudates incorporated with 6% amaranth leaves. Oil uptake of fried extrudates ranged between 13.70 and 54.50%. Addition of 6% amaranth leaves powder in corn grit extrudates showed the lowest value and the highest for 2% addition of amaranth leaves powder in corn grit extrudates.

Similarly, the effect of amaranth grain flour levels and barrel temperature on extrusion and product characteristics of corn grit was investigated. The ash, fat and protein content of extrudates from addition of amaranthus flour in corn grit blends ranged between 1.6 and 3.6%, 2.5 and 7% and 8.66 and 13.48%, respectively. Ash content found to be highest with the addition of 50% amaranth flour in corn grit extrudates at 150° C and lowest 0% addition of amaranth flour in corn grit at 125° C. The Bulk density of amaranth grain flour–corn grit extrudates varied between 0.10 and 0.19 g/cm³. Diameter of extrudates increased with increased in temperature ranged between 11.74 and 15.19.

Corn grit and amaranth grain flour blends with a level of 0, 10, 20, 30, 40 and 50 g/100 g amaranth extrudates had color values of the range: \( L^* \) from 52.75 to 61.97; \( a^* \) from 3.03 to 4.36 and \( b^* \) from 13.86 to 25.99. Water solubility Index (WSI) and Water absorption index (WAI) of extrudates ranged between 3.77 and 4.55 % and 14.8 and 35.72g/g. After frying, color values of extrudates ranged from: \( L^* \) from 51.65 to 59.26; \( a^* \) from 3.95 to 5.83 and \( b^* \) from 15.45 to 26.92. Diameter of fried extrudates ranged between 9.63 and 14.66. Hardness of extrudates with 50% amaranth grits represented by penetration force (55.43 N) is by 2.6 times higher than the penetration force for sample with 100% corn grits (28.63N), which is a major difference. Oil uptake of fried extrudates ranged between 17.7 and 44.2% with lowest value 40 % at 125 °C and highest for 50% at 175 °C was observed. Sensory evaluation showed that amaranth could be successfully incorporated up to 30% with the corn–amaranth blend to obtain acceptable snack products. The products containing 20% amaranth were better as compared to extrudates incorporated with 50% amaranth. The mean scores of sensory evaluation showed that all products with
corn and corn amaranth extrudates were within the acceptable range, while those containing 50% amaranth flour had harder and less overall acceptability compared to all other samples.

Popping behaviour of amaranthus grains was also evaluated and popped seed weight, bulk density and popping index and popping time were determined. Popped seed weight ranged between 175 to 220g. Bulk density ranged between 0.20 to 0.25 g/ml. Popping time for different amaranthus lines ranged from 2min 15 sec to 3min 45 sec. Hunter color values ($L^*$, $a^*$ and $b^*$) of the popped grains ranged between 69.07 (IC-540860) to 74.89 (IC-467901) and 3.06 (IC-540862) to 3.90 (IC-540839) and 11.96 (IC-540862) to 14.55 (IC-540839), respectively.

In conclusion, the present study demonstrated the diversity in amaranthus leaves characteristics as well as in the physicochemical, pasting and textural properties of flours from grains of different amaranth lines. *A. caudatus* lines had a higher protein content, fat content and tendency to retrogradation, and a lower $\alpha$-amylase activity, compared to the *A. hypochondriacus* lines. The study is useful in selecting lines with specific desired grain characteristics. *A. hypochondriacus* and *A. caudatus* starches also showed wide diversities in amylopectin structure, granules size distribution, thermal and rheological properties. Amaranth protein isolates from both the species showed variation in functional properties. Extruded corn based snacks with acceptable characteristics can be produced using 2% amaranthus leaves powder while amaranthus grains flour can be added upto the extent of 20%.