

EXPERIMENTAL RESULTS

Results

Before describing effects of different treatments on growth development and diosgenin synthesis, it will be worthwhile to be acquainted with normal behavioral growth and diosgenin formation pattern in control plants of Dioscorea prazeri and Dioscorea composita.

In D. prazeri, rate of extension growth as well as leaf formation was maximum during vegetative stage (Table 1). Panicle growth-rate as well as fruit formation was maximum (88% to 100%) during early-reproductive stage; whereas rate of diosgenin formation was maximum during vegetative stage.

In D. composita (Table 2) more or less an identical pattern of growth and development was noted; extension rate and leaf formation being maximum during early-vegetative and panicle and fruit formation rate during early-reproductive stage (75% and 63%). Rate of diosgenin formation was remarkably high during early-reproductive stage of this species.

Patterns of changes of different biochemical parameters of D. prazeri have been shown in table 3. Rate of chlorophyll synthesis was of high order during reproductive stage; whereas changes of SN and TN contents were maximum during vegetative stage. In case of D. composita, as in D. prazeri, chlorophyll synthesis, dry weight

accumulation SN and TN contents were maximum during early vegetative stage (Table 4).

Different phenoxy compounds, used in the present study, possess weak, medium and no auxin activity and it is interesting to record the effects of these auxin like compounds on growth, biochemical changes and diosgenin formation of D. prazeri and D. composita.

PAA had no appreciable effect on growth behaviour of D. prazeri and increased diosgenin synthesis during early stage of development in lower concentrations. Higher concentrations inhibited panicle and fruit formation (11% and 36%) during early-reproductive stage and augmented diosgenin formation (Table 5). 4-Cl (Table 6), in lower concentration, also had no appreciable effect; excepting inhibition of panicle formation by about 18% during early-reproductive stage. Diosgenin synthesis was augmented by this treatment during vegetative stage only (and to some extent during early reproductive stage). Higher concentration of 4-Cl remarkably inhibited panicle and fruit formation (38% and 66% respectively) during early-reproductive stage and increased diosgenin synthesis only during vegetative stage. Later developmental stages of this concentration showed steady decline. 2,5-D, in lower concentration also had no appreciable effect on growth and development of D. prazeri, excepting increasing of diosgenin synthesis in vegetative stage; but inhibited remarkably the rates of panicles and fruit formation (38% and 65% respectively). Slight augmentation in diosgenin synthesis was noted only during vegetative stage of higher concentration (Table 7).

2,4,6-T, both in lower and higher concentrations, had no effect on growth and development patterns as well as diosgenin synthesis of D. prazeri. Panicle and fruit formation was, however, inhibited (30% and 31% respectively) during early reproductive growth by higher concentration of 2,4,6-T (Table 8).

The effects of PAA, 4-Cl, 2,5-D and 2,4,6-T on pattern of changes of chlorophyll, dry weight, SN, and TN and diosgenin during different developmental stages of D. prazeri have been shown in Tables 9, 10, 11, 12. Only during vegetative stage, all the biochemical parameters including diosgenin synthesis increased. In nearly all the treatments, dry weight increase was concomitantly associated with the increase of diosgenin content. A diffused relationship with SN and diosgenin could be traced during later developmental stages of all treatments; higher increase of TN as compared to SN was noted during vegetative stage of all treatments. It is to be noted, however, that declining trends in almost all the biochemical parameters including diosgenin, during later stages of development became clear.

In case of D. composita, as in D. prazeri auxin analogues had no appreciable effects. In higher concentration of PAA (Table 13, panicle and fruit formation was inhibited (15% and 23% respectively) during early reproductive stage, diosgenin synthesis being maximum at early vegetative stage only. 4-Cl also had no appreciable effect on growth rate, excepting inhibition of panicle and fruit formation (25% and 13% respectively) in higher concentration and

less inhibition (2% and 13%) in lower concentration (Table 14).

Diosgenin content was of high order during early-vegetative stage and to some extent in late-vegetative stage of lower concentration; high diosgenin content being noticed during early-vegetative stage in higher concentrations also; which later declined steadily.

2,5-D augmented synthesis of diosgenin in D.composita during vegetative and later stages of development at lower concentrations but inhibited panicle and fruit formation (32% and 20% respectively).

d On the other hand, diosgenin content was remarkably decreased in higher concentration of 2,5-D (Table 15) during all the stages of development. Panicle and fruit formation was inhibited in both lower and higher concentrations. 2,4,6-T had no effects on growth rate in both lower and higher concentrations, excepting some increase in diosgenin content during early vegetative stage (Table 16).

In this context it could be mentioned that high concentration of auxin like compounds were inhibiting the rates of diosgenin synthesis of Dioscorea spp. as soon as the plants entered to produce their reproductive units. On the other hand, these compounds with low concentrations increased diosgenin synthesis with concomitant enhancement of extension growth. Non-auxins, however, in all cases, did not demonstrate such relationship.

Now, let us examine the effects of auxins and non-auxins on patterns of changes of biochemical parameters of D.composita. Results of different estimations have been entered in tables 17, 18,

19 and 20. All the parameters including diosgenin formation increased during early and late vegetative stages in lower concentrations and of also in higher concentrations in case on non-auxins. Auxin-like compounds inhibited dry weight, chlorophyll, TN and diosgenin formation in higher concentrations. With the advancement of developmental stages all the parameters revealed a minimum synthesis rate and even negative values were noticed in high concentration of auxins. Dry weight increased with concomitant increase of diosgenin. And in comparison to SN contents, TN increased during early reproductive stage. Increase of SN synthesis was noted only in higher concentrations of non-auxin and in lower concentrations of auxins.

Increasing durations of light and dark was extended to the plants and it was interesting to note that there were some convincing effects of light and dark treatments on growth, biochemical changes and diosgenin formation in two species of Dioscoreas under study. In D. prazeri, in almost all the treatments, additional light (60 and 120 hours) and dark (60 and 120 hours) had induced significant and reproducible effects in increasing the growth patterns during vegetative stage (Tables 21 and 22). Leaf formation was of high order in both the durations of dark treatments during vegetative stage and a declining trend was notice thereafter. In both the light treatments an increasing rate of panicle and fruit formation was noted; whereas in dark treatments, rate of panicle formation decreased (22% and 32%) respectively). Decrease in diosgenin synthesis became clear only after vegetative stage in dark treatments.

It is to be noted, however, that dark application to D. prazeri, increased diosgenin synthesis during the initial stage. In light treatments there occurred a steady increase in diosgenin synthesis but later developmental stages revealed lesser synthetic rates in comparison to vegetative stage of development. Tables 23 and 24 include the biochemical results of dark and light treatments on D. prazeri. All the biochemical parameters, including diosgenin, increased during vegetative stage. Dry matter increase was conspicuously associated with higher increase of diosgenin in all cases. In light treatments, SN content was comparatively higher than TN contents during the vegetative stage. SN and TN contents in dark treatments decreased after vegetative stage.

D. composita (Tables 25 and 26) highlighted the enhancement of vegetative growth, mainly, during vegetative stage in both the treatments. Increase in vegetative growth during early reproductive stage took place to a lesser extent, in comparison to late-vegetative stage. An identical pattern of leaf formation like vegetative growth in both the treatments was observed. Panicle and fruit formation was remarkably high during early-reproductive stage (95% and 146% respectively) in this species when plants were exposed to an additional light of 120 hours. Diosgenin formation was also increased during vegetative stage in both species; on the other had, a dark period exposure for 60 and 120 hours revealed no remarkable effects excepting 129% increase in fruit formation with additional 60 hours of darkness, whereas reproductive units in additional darkness of

120 hours were nil. Diosgenin was minimum in dark treatments in this species.

As regards biochemical parameters, chlorophyll content increased during early-reproductive stage and later again during early post-reproductive stage. Dry weight accumulations increased with concomitant increase in diosgenin. SN content also increased, accompanied by the increase of diosgenin in comparison to TN content during early-vegetative stage. TN content was noted to be decreasing after early-vegetative stage and continued upto the late-reproductive stage in both the treatments and later increased during senile stage. In dark treatments, all the biochemical parameters, including diosgenin, decreased except SN and TN contents, which showed a marginal increase during early-vegetative stage.

Results of agronomical trials also revealed some clear trends. The vegetative growth rate of both the species increased with increase of diosgenin contents in all the treatments. In D.prazeri, extension growth at initial stage, was much higher but diosgenin content increased in vegetative stage and later upto late-reproductive stages. And the patterns of diosgenin synthesis remained correlated with the increase of extension growth. Leaf formation was also high in early-vegetative stage with application of $N_{300}P_{300}K_{300}$ (Table 29i). In these experiments, flower and fruits were inhibited (about 25% and 33% during early-reproductive stages and the rates of such decrease became diluted with the progress

of developmental stages. In $N_{150}P_{150}K_{300}$ treatment (Table 29 ii) rates of extension growth, as well as, of diosgenin synthesis were less than that of $N_{300}P_{0}K_{300}$, $N_{150}P_{150}K_{150}$ and $N_{300}P_{150}K_{300}$ (Tables 30 i and ii) treatments showed no appreciable effects excepting increase of panicle formation of 12% and of fruit formation of 10% in $N_{150}P_{150}K_{150}$ treatments and a decrease of 30% in panicle formation in $N_{300}P_{150}K_{300}$ treatment. In these two treatments, leaf formation and vegetative growth were of high order; but prior to early-reproductive stage, a steady decrease was noticed. Diosgenin synthesis at post-reproductive stage also decreased. In $N_{150}P_{150}K_{300}$, an increase of 30% panicle formation was noticed.

In almost all the cases, chlorophyll synthesis in D.prazeri showed decreasing rates right from late-reproductive stage (Tables 31 i, ii & 32 i, ii). Dry weight accumulation rate increased with the increase in diosgenin synthesis. The rates of SN synthesis were higher during vegetative and other stages in comparison to those of TN.

The combination of NPK which had been studied in D.composita showed a remarkable improvement of synthesis of diosgenin vis-a-vis extension growth as well as leaf formation. The highest percentage of about 20% leaf formation was noticed in $N_{300}P_{0}K_{300}$ (Table 33 ii) where nearly 51% decrease of panicle formation was noted. But $N_{300}P_{150}K_{150}$ revealed highest rate of diosgenin synthesis (Table 33 i) where an increase of 14% panicle formation during early-

reproductive stage and nearly 15% leaf formation during early-vegetative stage was registered. Diosgenin synthesis was of high order in almost all stages upto late-reproductive stage. The other two doses also showed a high rate of leaf formation during early vegetative stage (Table 34 i and ii) and to some extent during late-vegetative stage. 18% decrease in panicle formation was noted during early-reproductive stage of $N_{300}P_{150}K_{300}$ treated plant; whereas 12% increase in fruit formation during late-reproductive stage was marked. In $N_{150}P_{150}K_{150}$ treatment, leaf formation was maximum during early-vegetative stage and increase in panicle formation was noted (9%) during late-reproductive stage only. Extension growth increased during early-vegetative stage and diosgenin synthesis was also enhanced during the same stage and to some extent upto late-reproductive stage.

As regards biochemical changes in different agronomical trials of D.composita (Tables 35 i, ii & 36 i, ii) dry weight accumulation was noted to increase with the increase of diosgenin formation. In most of the treatments chlorophyll contents increased during early-reproductive stage except in $N_{300}P_{150}K_{300}$ and then again declined. Soluble nitrogen (SN) content also increased more or less, with the increase of diosgenin and in all cases, SN was higher than TN. Dry matter accumulation was observed to be appreciably high during early-vegetative stage except in treatment of $N_{150}P_{150}K_{150}$ which also increased during late-vegetative and early-reproductive stages. But it could be noted that increase in dry matter accumulation was

concomitantly associated with increase of diosgenin content. An appreciable amount of increase of diosgenin was noted throughout the developmental stages, even upto senile stage. All the biochemical parameters gradually decreased with the advancement of developmental stages.

In experiments where systematic elimination of reproductive units were performed during different stages, patterns of growth behaviour and changes in different functional parameters in two species of Dioscorea appeared interesting.

The effects of removal of buds in D.prazeri on pattern of growth rate as well as on diosgenin contents were significant. Removal of flowers (panicle) had appreciable effects on growth-rate and diosgenin content. But removal of fruits produced much lesser effects on diosgenin contents and growth-rate (Tables 37, 39, 41). As regards changes of biochemical parameters in D.prazeri, chlorophyll, SN, TN and dry weight increased during the periods immediately after elimination of buds and flowers. During the developmental stages, all the biochemical parameters and diosgenin contents were less. Increase in dry matter accumulation remained associated with increase of diosgenin, like other treatments (Tables 38, 40, 42).

In case of D.composita, more or less, an identical pattern of growth, development and biochemical changes were noted; extension growth-rate and leaf formation being maximum during early-reproductive

stage. The rate of diosgenin-formation was remarkably high during early and late reproductive stages with elimination of buds and flowers (Tables 43, 45, 47). Fruit removal had no appreciable effect.

Chlorophyll synthesis, dry matter accumulation, SN and TN contents were maximum during early-reproductive stage of debudding and during late-reproductive stage of deflowering operation (Tables 44, 46, 48).