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Studies of different growth stages of wood apple (*Feronia limonia*) through extended BBCH-scale under rainfed semi-arid conditions of western India

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ABSTRACT

Twenty-eight genotypes of wood apple (*Feronia limonia* L.) were studies at CHES, ICAR (CIAH), Godhra, during 2017-2019. Eight principal growth stages of wood apple were found, starting from vegetative bud dormancy (stage 0) to maturity of fruit (stage 8). Three principal growth stages like stage 0, 1 and 3 are denoting to vegetative growth. Remaining stages (5, 6, 7 and 8) were reported to reproductive growth and development. The principle growth stages were divided in sub categorized called as secondary stages, which denoting the shorter developmental intervals. The first digit of code in BBCH scale denotes the principle growth stage (0-8) and second digit defined by the meso stages (1 to n). The third digit is numerical value between 0-9 that refer to percentage development of buds, leaves, shoots, flowering, fruit development, fruit maturity and senescence.

Key Words: Semi-arid, Development stages, Extended BBCH-scale.

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Wood apple grow well in rainfed semi-arid conditions (Singh *et al.*, 2020), (Hiwale, 2015). It can propagated by soft wood grafting and patch budding both in field as well as nursery conditions**.** The knowledge of timing of phenological events can help to get more stable yield with quality traits through improved management practices. Since there are no such specific information reported on its growth and development phases by which farmers can know what stage of plant is appropriate for proper cultural practice, the study was undertaken by using of BBCH-scale.

MATERIALS AND METHODS

A wood apple germplasm block was selected at Central Horticultural Experiment Station, ICAR-CIAH, Vejalpur, India, during 2017-19. The germplasm block was planted at 10m×10m spacing 13 years ago. The soil was clay loam. Average rainfall for three year study was about 620 mm and relative humidity 62%. The average annual temperature was 28.04^{0}C. The phenological stages were observed as per Gil-Albert (1989). The trees and branches were marked for study. One healthy trees of each germplasm was randomly selected, and three branches from each tree were studied. Three replicates of the experimental block were made.

For the collection of data and observation, frequency of visits ranged from 1 to 4 days in vegetative (bud break to shoot development) and fruiting stage (flowering to fruit set time) of trees and 7 days later stage of trees (fruit development to fruit ripening time), on the basis how quickly the wood apple trees showed their phenology. Fruit diameter (mm) was measured weekly with digital Varnier caliper. The duration of every phonological stage was observed in days starting at the beginning of bud development.

Three principal growth stages, 0, 1 and 3, denote to vegetative growth. Remaining stages (5, 6, 7 and 8) show reproductive growth and development. Rosette leaves (2), vegetative harvestable parts (4) and senescence (9) stages are not found in wood apple. The principle growth stages were sub categorized as secondary stages which denote the shorter developmental intervals. The first digit of code in BBCH scale denotes the principle growth stage (0-9) and second digit defined by the meso stage (1 to n).The third digit is numerical value between 0-9 that refer to percentage development of buds, leaves, shoots, flowering, fruit development, fruit maturity and senescence.

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Fig. 1: Flower morphology in wood apple

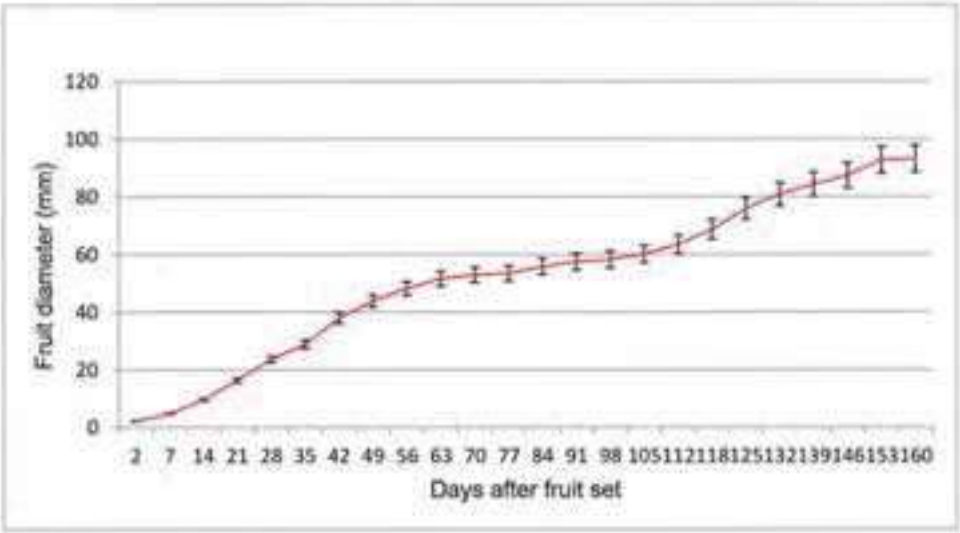


Fig. 2: Fruit growth in wood apple

RESULTS AND DISCUSSION

There were seven principle growth stages and 33 secondary growth stages. Fruit development start just after end of flowering and ovary also start to swelling (Fig. 1). The fruits showed the double sigmoid growth (Fig. 2), which starts from fruit set (711 stage) and end with full maturity (819 stage). The fruit growth is completed in 20-22 weeks with three distinct stages. The first stage was completed in 1-63 days with 51.56 mm fruit diameter. Fruit size increases in this stage mainly due to fruit cell division (Hopping, 1990). the maximum fruit growth was obtained in third stage (106-160days). It may be due accumulation of water and solutes within vacuoles and completion of this stage fruit attain maximum size (93.13mm).

The vegetative growth have three periodical events which start from growing of bud (010-019 stages), leaf (110-119 stages), and end with shoot (311-319 stages) development. During February-March, when temperature reach up to 25°c, auxiliary bud starts to growing (011stage) and after 7-9 weeks full shoot development is completed. The peak period of vegetative phase generally was occurred between Februarys and May. The vegetative stage normally completes in 18-22 weeks. Auxiliary bud break starts during spring month on first few nods of both new and old shoots. Different phonological events have been reported in bael (Singh *et al.*, 2015), wood apple (Singh *et al.*, 2016) and jamun (Singh *et al.*, 2022).

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The flowers are mainly produced on terminal of new shoots and laterals of old shoot (Vijayvargiya and Vijayvergia, 2014). The inflorescence bud growth (510-519) start in March. The flowering (610-619 stages) continues up to June, but peak flowering occurs during March-April and lasts about 2-5 weeks. The greenish-reddish flowers born in small loose panicle and anthesis of all flower in panicle completed in 1-2 weeks. For high quality fruit yield, fertilizers should be applied in identified phonological stage like bud swelling (011) and fruit development (712-715 stages).

CONCLUSION

Thus, phonological stages would be helpful to increase yield with quality fruit at farmers' fields under rainfed semi-arid ecosystem. Application of farm input with considering BBCH scale also minimise the cost of cultivation, improving net income..

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