
I. Varietal Differences in Sucker-producing Characteristics of Tobacco

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The sucker-producing characteristics and their genetic variations were studied by measuring the number and dry weight of leaf axil suckers, classified here as ground and upstalk suckers, of 130 flue-cured and Japanese domestic air-cured tobacco cultivars grown in randomized block design with two replications in 1979. Data obtained from this study showed the range from 0.3 to 8.5 ground suckers per plant, from 0.10 to 8.42g per plant for their dry weight, from 2.1 to 10.7 upstalk suckers per plant and 0.62 to 23.47g for their dry weight. Matsukawa, Perevi, MC and other 27 cultivars produced many ground suckers, and BY 103, Virginia 115, Shiroenshu and other 28 cultivars produced a few ones. Cash, Consolation 402, Perevi and other 3 cultivars produced many upstalk suckers, and Odaruma, Virginia 115, BY 101 and other 8 cultivars produced a few ones. Varietal correlations among four characters, that is, the number and dry weight of ground and the upstalk suckers were of appreciable value. Heritabilities calculated from the analysis of variance were 0.784 for the number of ground suckers, 0.873 for the dry weight of ground suckers, 0.782 for the number of upstalk suckers and 0.676 for the dry weight of upstalk suckers.

Introduction

Axillary buds, suckers, are inherent parts of the plant development of *Nicotiana tabacum* L., and potential for sucker development varies in the amount of growth per axil as well as the number of axils exhibiting growth (Gwynn 1979). Chemical and manual control of suckers has been done for many years in Japan, because a loss in yield, deterioration of leaf quality, and decrease in certain chemical constituents and smoking quality are incurred without sucker control. Undesirable residues can remain in the case of chemical sucker control.

Tobacco breeders have been encouraged for a long time to develop varieties with few or no suckers without lowering other characteristics, but little work for modifying sucker-producing characteristics has been done. The literatures suggest there exist varietal differences in sucker-producing characteristics of certain flue-cured tobacco cultivars (Gwynn 1979, USDA 1972 to 1979). The object of this work is to study the genetic aspects of sucker production and to determine if the breeding programs are warranted.

This paper is mainly concerned with varietal differences of sucker-producing characteristics in terms of the number and dry weight of suckers produced in 130 flue-cured and Japanese domestic air-cured tobacco cultivars in 1979.

Materials and Methods

The cultivars used in this study are listed in Table 1. They include 26 Japanese domestic air-cured cultivars and 104 flue-cured ones. Tobacco plants were grown in rand-

Received May 19, 1981
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(1) Suckers which were hand-suckerced from the 8th to 15th leaf position above cotyledons
(2) Suckers which were hand-suckerced from the 1st to 8th leaf position from the top of a stalk
-<sup>-</sup>  Significantly lower or higher value than the mean value of all entries at 1% level (1/2 LSD 0.01)
omized block design with two replications at the Utsunomiya Tobacco Experiment Station in 1979.

All entries were planted and grown according to the conventional domestic tobacco production practices until topping time. At the seventh week after transplanting the plants were hand-suckered. The numbers of suckers from 8th to 15th leaf position above cotyledons (ground sucker) were counted, and their dry weights were measured.

All plants in a plot were simultaneously topped when the older 5 blossoms of half plants were in bloom in average. Four days after topping the plants were hand-suckered and suckers from 1st to 8th leaf position from top (upstalk sucker) were counted and their dry weights were measured.

Data from a plot calculated and expressed an average number per plant and average dry weight per plant.

Results

Results are summarized in Table 1. None of the cultivars had no sucker. Varietal differences were found in four characteristics of sucker productivity, the number and dry weight of ground and upstalk suckers.

The number of ground suckers per plant varied from 0.3 (Shiroenshu) to 8.5 (Matsukawa (Kanto-Bunjo)). Thirty-eight cultivars including Cash No.2, Coker 254 and Consolation 402 produced many suckers (the values of the ground sucker number differed from the mean value of all entries over the value of a half of LSD<sub>0.0</sub>). Thirty-two cultivars including BY 103, BY (Kochitayoheni) and Coker 298 showed low ground sucker number. The dry weight of ground suckers per plant had a variation from 0.10 (Odaruma) to 8.42 g (Matsukawa (Kanto Bunjo)). Thirty-four cultivars including Cash No.2, Coker 187 Hicks and Coker 254 had high values of ground sucker weight but Bel 4-30, Bell 15, BY 102 and other 48 cultivars did not. The number of upstalk suckers per plant varied from 2.1 (BY 101) to 10.7 (Perevi). Twenty-six cultivars including Bright Consolation, BY 1 and Cash No.9 showed high upstalk sucker number but 31 cultivars including Bel 4-30, Bell 15 No.2 and BY 101 produced a few. Dry weight of upstalk suckers varied from 0.62 (Shiroenshu) to 23.47g (Perevi). Twenty-one cultivars including Bright Consolation BY 1 and Cash No.2 had high productivity of upstalk suckers but 21 cultivars including BY 101, Coker 111 and Coker 139 produced fewer.

The frequency distributions for the number of ground suckers, dry weight of ground suckers are presented in Fig. 1 and Fig. 2.

![Fig. 1. Frequency distributions for the number of ground suckers in 130 cultivars.](image1)

![Fig. 2. Frequency distributions for the dry weight of ground suckers in 130 cultivars.](image2)
suckers, the number of upstalk suckers and dry weight of upstalk suckers were shown in Fig.1 to Fig.4, respectively. The distributions for three characters, i.e., the number of ground suckers, the number and dry weight of upstalk suckers were nearly normal, and the mean values of them were 3.92, 5.20 and 6.65, respectively. The distribution for dry weight of ground suckers was partially skewed to small sucker weight, and the mean value was 2.86.

Positive correlation between the number of ground suckers and dry weight of ground suckers was significantly high, and the regresional line of dry weight on the number of ground suckers was monotonously increasing (Table 2, Fig.5). Correlation between the number and dry weight of upstalk suckers was significant at 1% level (r = 0.452). Cultivar belonging to flue-cured variety showed relatively higher weight of upstalk suckers than those belonging to Matsukawa variety in comparison with their number of upstalk suckers. Correlation coefficients between the number and dry weight of upstalk suckers within each variety group were 0.638 (in flue-cured cultivars) and 0.625 (in Matsukawa varieties), and both values were larger than that calculated pooling the two groups (Fig.6). Varietal correlations among the number of upstalk suckers and the number of ground suckers, and
Matsuda and Sato

Table 2. Varietal correlations among the number and dry weight of ground and upstalk suckers

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<td>0.673**</td>
<td>0.262**</td>
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<td>0.453**</td>
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**, *: Significant at 1% and 5% level, respectively

Table 3. Heritability ($h_g^2$) for four sucker characters

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<th>Number of upstalk suckers</th>
<th>Dry weight of upstalk suckers</th>
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<td>Number of ground suckers</td>
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<td>Dry weight of ground suckers</td>
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<td>0.676</td>
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$h_g^2 = s_g^2 / (s_g^2 + s_e^2)$ Average of 10 plants

dry weight of ground suckers were highly significant. The correlations between the dry weight of upstalk suckers and the number of ground suckers, and dry weight of ground suckers were significant, but the correlation coefficients were rather small (Table 2).

Heritability values ($h_g^2$) for four characters were calculated from the variance components. Four sucker-producing characteristics had high heritability, and the values were 0.784 for the number of ground suckers, 0.873 for dry weight of ground suckers, 0.732 for the number of upstalk suckers and 0.676 for dry weight of upstalk suckers (Table 3).

Discussion

The primary object of this study was to evaluate the genetic potential for productivity of tobacco cultivars. Significant differences in dry weight of ground and upstalk suckers were observed, and these show undoubtedly the combined results of genetic potential for sucker differentiation and sucker growth. The fact that significant difference in the number of suckers exists among cultivars indicates the presence of varietal differences in sucker differentiation.

Some cultivars showed the difference between ground sucker productivity and upstalk sucker productivity, and those differences are likely due to differences in growth and sucker productive habit of the cultivars, and also due to the fact that the measuring of upstalk suckers in some periods could possibly not include all the suckers that the plants would eventually produce.

None of 130 cultivars produced no sucker. Frequency distributions for four characters of sucker productivity showed continuous variation, and the variances as great as those for yield, alkaloids contents and other quantitative characteristics that had been reported by Matsuda and Kikuchi (1972).

Gwynn (1979) examined 15 cultivars and one breeding line referring to total sucker number and fresh weight. In his study, Virginia 115 was relatively low in sucker production, and Coker 319 was a highly productive cultivar. In this study the former resulted the same but the latter was different from his result with regard to ground and upstalk sucker productivity. Difference in sucker productivity reported by him and the authors is

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likely due to the difference in environmental factors and the methods of investigation because Gwynn's report mainly studied upstalk suckers. Speight G 28 showed the same results. The other cultivars showed almost the same results as reported by Gwynn (1979) and USDA (1972 to 1979).

Cultivars belonging to Matsukawa variety, a dominant variety of Japanese domestic air-cured tobacco, showed great sucker productivity, but Odaruma and Shiroenshu which are also Japanese domestic air-cured tobacco showed clearly low productivity of ground suckers. With regard to sucker productivity, Japanese domestic tobacco cultivars were found to have a wide range of variation, but the conclusion about the range of variation should be supported from further using many other cultivars.

The consistency of performance of the entries across ground and upstalk sucker production was found in the majority of cultivars tested, but occasionally was found discrepancy between two kinds of suckers. Accordingly in the case of comparison among the cultivars differing in sucker productive habit, it seems better to compare ground or upstalk sucker productivity respectively than the comparison of total sucker productivity.

Varietal variation in sucker production are so wide, and the heritability of sucker productivity is so high, that it is prospective to develop low sucker productive plants. Some of cultivars having low sucker productivity will be useful as parents in tobacco breeding programs.

Literature Cited


タバコにおける少わき芽品種の育成に関する研究

I. わき芽発生特性の品種間差異

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タバコの黄色品種および日本の在来品種合計130品種を用いて、わき芽発生特性の品種間差異を調査した。調査形質はground sucker（生育初期から中期までに下位節に発生するわき芽）の数と乾重、upstalk sucker（腰心後上位節に発生するわき芽）の数と乾重の4形質である。ground suckerの数は、個体あたり0.3から8.5本、乾重で0.10から8.42g、upstalk suckerの数は個体あたり2.1から10.7本、乾重で0.62から23.47gのそれぞればらつきがみられた。ground suckerの発生量の多いのは松川種内の各品種、Perevi、MCなど30品種、少ないのはBY 103、Virginia 115、白壁州他28品種であった。upstalk suckerの数および乾重とも多いのはCash, Consolation 402, Perevi他3品種、少ないのは大抵Virginia 115, BY 101他8品種であった。調査4形質間の品種間相関はいずれも有意であった。分散分析表から求めた遺伝率はground suckerの数で0.784、乾重で0.873、upstalk suckerの数で0.732、乾重で0.676であった。