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Improvement of local pepper cultivars for higher capsaicinoid content

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Abstract

The improvement of local pepper cultivars were selected by pure line selection in 2 populations during November 2006 to February 2009 at Lampang province. The first population was selected by the second and third fillials during 2006 to 2008. The second popopulation was selected by the first and second generations during 2008 to 2009.The designed was in RCB which blocks as generations. The first population showed the significantly on the generations except the ratio of the fresh and dry weight. The effects by the accessions/checks were not significant by all data except mite score. The third filial lines had shown the fresh yield more than or equally 0.5 ton/hectare such as Phrob Phra 3-14-1, Phrob Phra 2-1-1, Phrob Phra 3-9-1, Mae Sod 1-2-1, Phrob Phra 1-1-1, Phrob Phra 3-8-1 and Tha Song Yang 3-1-1. The high more than 79,000 SHU of the content of capsaicinoids were Phrob Phra 2-1-1, Phrob Phra 3-8-1 and Phrob Phra 3-14-1 which Phrob Phra 3-8-1 had the most capsaicinoid content, 169,600 SHU. The second population did not shown the effects by the accessions/checks by all data except mite score. Phrob Phra 1 (20) -1, Phrob Phra 2 (4) – 1, Phrob Phra 1 (18) – 1, Phrob Phra 1 (1) -1, Phrob Phra 3 (3) – 1 and Phrob Phra 2 (1) – 1 were fresh yielded more than or equally 1.0 ton/hectare**.** Phrob Phra 2 (4) – 1 line was the highest fresh and dry yield/hectare and capsaicinoid content which was 1.7 and 0.5 ton and 136,100 SHU

Keywords : pepper, improvement, local cultivars, high capsaicinoids

Introduction

Pepper is the economic vegetable in Thailand. The total planting area and the quantity of the product for pepper production in 2006/2007 were 75,955 hectare and 333,672 ton, 8.1 ton/hectare. The Customs Department reported the pepper exported products and seed were 61.7 and 5.2 million dollar. The dry peppers and seed were imported 21.8 and 0.2 million

dollar. (DOAE, 2007). The importance area of the pepper were the North – Eastern and the Northern region of Thailand. Peppers are mainly consumed as food additives in many regions of the globe, including Thailand because of their unique pungency, aroma, and color. The international usage of pepper for chemical product as feed additive, drug additive, health food, etc.

The pungent pigments were found in 1816 B.C. by Bucholz and thresh to capsaicin. (Govindarajan, 1987). Capsaicinoids were vanillyl amide of isodecyanic acid in the placenta of the pepper fruit. The pungent of pepper was depented on capsaicin and the others products such as nordihydrocapsaicin, dihydrocapsaicin, homocapsaicin and homodihydrocapsaicin. (Hoffman *et al*., 1983; Bernal *et al*., 1993) Capsaicin, a major alkaloid among capsaicinoids produced only in *Capsicum* fruits (Andrews, 1995 Walsh and Hoot, 2001), has wide applications in the food, medicine, and pharmaceutical industries (Andrews, 1995, Prasad, *et al*, 2005). As a medicine, capsaicin is known to kill some types of cancer cells and provide relief in arthritis and respiratory ailments. The pharmaceutical application of capsaicinoids is attributed to its antioxidant, anticancer, antiarthritic, and analgesic properties (Prasad, et al, 2005).

The hottest pepper varieties of the world was Habanero which had capsaicinoids 100,000 – 300,000 scoville units. Thai varieties was between 30,000 to 50,000 scoville units. The pungency of pepper varieties in the world had between 0 to 500,000 scoville units. The spicy group were arranged 5 groups from the less to the most of capsaicinoids equally 0 – 700, 700 – 3,000, 3,000 – 25,000, 25,000 – 70,000 and more than 70,000 scoville units (Bosland,1993)

The study on the production situation and environmental effected on fruit and capsaicin yield in pepper at Nakhonsawan, Sukhothai and Tak provinces was conducted between September 2005 and August 2006. The pepper planting area was 1 hectare/family. The experience of pepper planting was 7 years. Commercial pepper varieties were 58 % local and 42 % hybrid varieties. Pepper production in Tak province used Gnum Khuew, Prik Mun, Prik Karieng varieties. The T2, T6, T7, T3 and T1 lines of Tak province contained capsaicinoids 91,003, 87,521, 83,374, 79,185 and 39,384 Scoville heat unit (SHU).(Januluk *et al*, 2007).

The collection and study on local varieties of Tak province pepper was conducted between September 2006 to February 2008. The operational research accumulated the 192 local pepper varieties of Tak province between November to December 2006. The improvement programs were selected, bred, crossed between elited lines and collected data on yield, yield components and capsaicinoids at Lampang province during November 2006 to February 2008. The all population produced fresh and dry yield 2.2 and 0.7 ton per hectare. The capsaicinoids content averaged 79,469 SHU. Phrab Phra 3-29, Phrab Phra 3-33, Phrab Phra 3-9 (11/2 self), Phrab Phra 3-25 and Phrab Phra 3-9 (11/1 self) were high fresh and dry yield more than 6.3 and 1.3 ton/hectare. Mae Sod 1 – 8, Phrab Phra 3 – 9 (11/1 self) and Umphange 1 – 1 lines had high capsaicinoids between 103,800 to 121,500 SHU. (Januluk, 2008 a) The suitable harvesting period for yield and quality of local pepper varieties in Tak province only 119 days from 152 days. All the seventh of harvesting period were 89 % and 88 % of the total fresh and dry yield. The suitable harvesting period produced nordihydrocapsaicin, capsaicin, dihydrocapsaicincapsaicin and total capsaicinoids viz. 331,

5,023, 1,766, 7,121 g./hectare and 79,469 SHU. The Phrab Phra -3-29, 9, 33 and 9 pepper varieties were high total capsaicinoids yield more than 13,600 g/ hectare. (Januluk, 2008 b) The local pepper breeding program of for high capsaicinoids were selected the high yield and quality for fresh and dry market. All the purpose will increase yield and capsaicinoids content for fresh and industry market.

Methodology

The pure line selection was conducted to 2 populations during January 2008 to June 2009 at Lampang province. The 62 and 13 of S_2 and S_3 of B population were selected during March 2008 to June 2009. The 70 and 12 of S_1 and S_2 lines of C population were selected during January 2008 to June 2009. The advance population improvement was designed in RCB, 2 blocks as generations. The data recording were 1) the fresh and dry yield/hectare 2) the fresh/dry weight ratio 3) the harvesting date and period 4) the mite scored were 1 – 5 being less than 20 %, 40 %, 60 %, 80 % and 100 % of damaged leaf area. 5) the content of capsaicinoids

Results and Discussion

1. **B population**

The result showed the significantly on the generations except the ratio of the fresh and dry weight. The effects by the accessions/checks were not significant by all data except mite score. The fresh and dry yield of the first generation was higher than the second and third generations because the damage of mite were high in the last two generations. The third and second generations harvesting period were shorter than the first generations by the damage of mite. Phrob Phra 3-14-1, Phrob Phra 2-1-1, Phrob Phra 3-9-1, Mae Sod 1-2-1, Phrob Phra 1-1-1, Phrob Phra 3-8-1 and Tha Song Yang 3-1-1 were produced the fresh yield more than or equally 0.5 ton/hectare. The high dry yield/hectare were more than or equaaly 0.3 ton viz Phrob Phra 3-14-1, Phrob Phra 2-1-1 and Phrob Phra 3-9-1. The average of three generations the fresh yield/hectare was higher than checks such as 1.9 and 1.1 ton. The harvesting date of the first and second were less than the third generation, 130, 138 and 141 days after transplantation. The Phrob Phra 3-14-1, Phrob Phra 3-8-1, Tha Song Yang 2-1-1, and Tha Song Yang 1-2-1 were less than 140 days of harvesting date. The harvesting period of the first generation was more than the second and third generations by the damage of mite and thrip. The data were 141, 54 and 32 days. The average of mite and thrip score were high viz; 3.1 and 2.9. The only 2 accessions were mite score less than 3.0 such as Phrob Phra 3-14-1 and Phrob Phra 2-1-1. The accessions were scored thrip data less than 3.0 were Phrob Phra 1-1-1, Phrob Phra 3-14-1, Phrob Phra 2-1-1 and Phrob Phra 3-9-1. Mostly highly resistance to mite and thrip were high yield. The high more than 79,000 SHU of the content of capsaicinoid were Phrob Phra 2-1-1, Phrob Phra 3-8-1 and Phrob Phra 3-14-1. Phrob Phra 3-8-1 was the most capsaicinoid content which had 169,600 SHU. The average capsaicinoid content of lines were higher than checks which had 85,703 and 75,783.

2. C population

The effects by the accessions/checks were not significant by all data except mite score. The fresh and dry yield of the first generation was higher than the second generations because mite and thrip damaged the crop. Phrob Phra 1 (20) -1, Phrob Phra 2 (4) – 1, Phrob Phra 1 (18) – 1, Phrob Phra 1 (1) -1, Phrob Phra 3 (3) – 1 and Phrob Phra 2 (1) – 1 were fresh yielded more than or equally 1.0 ton/hectare. Phrob Phra 1 (20) -1 and Phrob Phra 2 (4) – 1

had more than 0.5 ton of dry yield/hectare. Phrob Phra 1 (20) -1 was the higer fresh yield than the highest of the checks which yielded of fresh and dry yield equally 3.0 and 0.8 ton/hectare. The harvesting date abd harvesting period of the first were less than the second generation, 137 and 142; 77 and 27 days after transplantation. Only 1 accessions was mite and thrip score less than 3.0, Phrob Phra 3 (3) – 1. The content of capsaicinoids of the selected line were more than 68,00 SHU which were Phrob Phra 1 (1) – 1, Phrob Phra 2 (4) – 1, Phrob Phra 1 (18) – 1, Phrob Phra 2 (1) – 1 and Phrob Phra 1 (20) – 1. Phrob Phra 2 (4) – 1 line was the highest fresh and dry yield/hectare and capsaicinoid content which was 1.7 and 0.5 ton and 136,100 SHU. The average of the two generations of lines was higher than the checks such as fresh and dry yield/hectare and capsaicinoids , 1.4 and 1.3 ton, 0.4 amd 0.4 ton, 90,380 and 75,633 SHU.

Conclusion

The improvement of local pepper bred by pure line selection. B and C populations were selected for the second and third, first and second fillials. The third lines of B population had shown the fresh yield more than or equally 0.5 ton/hectare such as Phrob Phra 3-14-1, Phrob Phra 2-1-1, Phrob Phra 3-9-1, Mae Sod 1-2-1, Phrob Phra 1-1-1, Phrob Phra 3-8-1 and Tha Song Yang 3-1-1. The high more than 79,000 SHU of the content of capsaicinoids were Phrob Phra 2-1-1, Phrob Phra 3-8-1 and Phrob Phra 3-14-1 which Phrob Phra 3-8-1 had the most capsaicinoid content, 169,600 SHU. The second lines of C population produced the fresh yielded more than or equally 1.0 ton/hectare such as Phrob Phra 1 (20) -1, Phrob Phra 2 (4) – 1, Phrob Phra 1 (18) – 1, Phrob Phra 1 (1) -1, Phrob Phra 3 (3) – 1 and Phrob Phra 2 (1) – 1. The content of capsaicinoids of the selected line were more than 68,00 SHU which were Phrob Phra 1 (1) – 1, Phrob Phra 2 (4) – 1, Phrob Phra 1 (18) – 1, Phrob Phra 2 (1) – 1 and Phrob Phra 1 (20) – 1. Phrob Phra 2 (4) – 1 line was the highest fresh and dry yield/hectare and capsaicinoid content which was 1.7 and 0.5 ton and 136,100 SHU.

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References

Andrews J. Peppers: 1995.The Domesticated Capsicums. Univ of Texas Press, Austin.

Bernal, M. A., M.A. Pedreño, A.A. Calderón, R. Muñoz, A. Ros Barceló, and F. Merino de Cáceres. 1993The subcellullar localization of isoperoxidase in *Capsicum annuum* leaves and their different expression in vegetative and flowered plants. Ann. Bot. 72:. pp. 415-421

Bosland, P.W. and Votava, E. J. 2000.Pepper Vegetable and Spice Capsicums. CABI Publishing. 204 p.

DOA. http://www.doae.go.th/IndexHome.asp. 2009. Govindarajan, V.S. 1987. CRC critical reviews in food science and nutrition. 24: pp. 245-355.

Hoffman, P.G., M.C. Lego and W.G. Galetto. 1983.Separation and quantitation of red pepper major heat principles by reverse – phase HPLC. J. Agr. Food Chem. 31: pp. 1326-1330.

J. Khanobdee, P. Lertsilpmongkol and P. Sirithunya. 2007.The Status of Environment and Production for Yield and Quality of Commercial Pepper Varieties in the Southern most of the Northern Region of Thailand. The International Workshop on Medicinal & Aromatic Plants. Thailand. 8 p.

J. Khanobdee. 2008.The Suitable Harvesting Period for Yield and Quality of Local Pepper Varieties in Tak Province of Thailand. The International Conference on Health and the Changing World. Thailand. 5 p.

Prasad, B C N; Shrivastava, Richa; Ravishankar, Gokare A. 2005.Capsaicin: A promising multifaceted drug from Capsicum spp. Evidence-Based Integrative Medicine. 2(3). pp. 147-166.

Walsh, B. M. and S. B. Hoot. 2001. Phylogenetic relationships of *Capsicum* (Solanaceae) using DNA sequences from two noncoding regions: The chloroplast *atpB- rbcL* spacer region and nuclear *waxy* introns. J Plant Sci. 162(6) : 1409–1418.