teins of veterinary importance, such as cytokines and vaccines, transgenic plants will become major suppliers of inexpensive biopharmaceuticals in the future.

The development of a tick vaccine using the tick-derived proteins of HL 34 and HL 35

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Tick feeding activities and the diseases they transmit constitute the largest source of disease-control-related monetary losses in the livestock industry. As the importance of tick is their role as vectors for animal pathogens, suppression of the tick vector population is the most effective way to control many tick-borne diseases, particularly protozoan diseases. At the present time, ticks can be effectively controlled by the use of acaricides which have many disadvantages, and hence it is necessary to develop alternative tick-control methods which are more friendly to natural environment. Immunological control of ticks is currently a major sustainable and practical alternative method. In an earlier study, a recombinant 29 kDa (p 29) protein associated with the tick salivary glands induced partial anti-tick immunity in rabbits. Thus, the objective of this study was to obtain additional antigen in order to enhance the recombinant p 29 (rp 29)-based vaccine.

Two cDNAs, here in named asHL 34 and HL 35, were cloned from a tick cDNA library, and expressed as recombinant proteins in *Escherichia coli*. Vaccination of rabbits with rHL 35 did not induce protective anti-tick immunity, while immunization with rHL 34 resulted in 14.7 and 29.1% mortality of nymph and adult ticks, respectively. Additionally, some of the dead ticks from HL 34-immunized rabbits were red in their body colors, suggesting that HL 34-induced immunity is effective from the early stage during tick feeding. By Western blot analysis, it was found that expressions of both HL 34 and HL 35 were not limited to the salivary glands, and that HL 34 was expressed in both immature and mature ticks. Northern blot analysis revealed that HL 35 was expressed only during feeding, 4 days post-infestation, while HL 34 appeared to be upregulated just before the completion of feeding. This may be the reason for the difference in the protection efficacy observed between HL 34 and HL 35. From these results, it was suggested that HL 34 is a potential candidate antigen for the tick vaccine. It will be of interest to examine the effectiveness of the cocktail vaccine of rHL 34 and rp 29 against ticks.