

Marcas – Patentes
Modelos – Diseños
Nombres Comerciales – Enseñas
Propiedad Intelectual
Registros en el Exterior
Registros Sanitarios INVIMA – ICA
Acciones Judiciales – Administrativas
Derecho Comercial – Industrial
Asesoría – Contratos – Otros
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Miembros ACPI – ASIPI – AIPPI

Mario Delgado Echeverry e Hijos Ltda.

Abogados Consultores – Marcas y Patentes

SEÑOR
SUPERINTENDENTE DE INDUSTRIA Y COMERCIO
SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
E. S. D.

SUPERINDUSTRIA Y COMERCIO
Radicacion : 84130178 00000004 Folios: 199
Fecha (AMD): 2005-08-18 15:09:20
Trabite : 811 PCT-PATENT 379 FASE MACI 412 REPOSIC -
Dependencia: 2020 DIVISION DE NUEVAS CREACIONES

REF: **Recurso de reposición ante el Señor Superintendente de Industria y Comercio contra la resolución No. 14575 del 24 de junio de 2005 que declaró retirada la solicitud de Patente de Invención PCT titulada: ANTÍGENOS PROTECTORES PARA EL CONTROL DE INFESTACIONES POR ESPECIE DE IXODES (Expediente PCT. 04130178).**

JAIME EDUARDO DELGADO VILLEGAS, Abogado, mayor y vecino de Bogotá, e identificado como aparece al pie de mi firma, se permite manifestarle:

En mi condición de apoderado de **THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY** con sede en a Rua 203 Whitehurst – Oklahoma State University, Stillwater – Oklahoma 74078, Estados Unidos de América, atentamente manifiesto que interpongo **RECURSO DE REPOSICIÓN** ante el Señor Superintendente de Industria y Comercio contra la resolución No. 14575 del 24 de junio de 2005 que declaró retirada la solicitud patente de invención PCT titulada: **ANTÍGENOS PROTECTORES PARA EL CONTROL DE INFESTACIONES POR ESPECIE DE IXODES (Expediente PCT. 04130178).**

MOTIVOS DE INCONFORMIDAD

Si bien es cierto que de acuerdo al Artículo 22 del Tratado de Cooperación en materia de patentes, el solicitante debe proporcionar a cada oficina designada una copia de la solicitud internacional y una traducción de la misma, antes del vencimiento del plazo de 31 meses para Colombia, y, de acuerdo a lo dispuesto en el Artículo 24 del mismo tratado:

"Los efectos de la solicitud internacional establecidos en el Artículo 11.3) cesarán en cualquier estado designado con las mismas consecuencias que la retirada de una solicitud nacional en ese estado ... iii) si el solicitante no realiza los actos mencionados en el Artículo 22 dentro del plazo aplicable", y además, tal como lo enuncia textualmente su Despacho en el numeral cuarto de su resolución:

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“Cuarto: que el punto 5.2.4 del Capítulo Quinto, del título X de la circular única de la Superintendencia de Industria, establece los requisitos mínimos para la entrada en la fase nacional en virtud de los Capítulos I y II del tratado, así: si la solicitud internacional fue depositada en idioma castellano para entrar en fase nacional en virtud del Artículo 22 o del Artículo 39.1 del tratado, el solicitante deberá presentar ante la Superintendencia, dentro del plazo de 31 meses contados desde la fecha de prioridad, una copia de la solicitud internacional tal como fue presentada, con el contenido prescrito para las traducciones (subrayado del Despacho)”; también lo es el hecho de que no se entró en fase nacional dentro del plazo prescrito por la ley (31 meses) y no se dio cumplimiento a todo lo dispuesto dentro de la normatividad enunciada, en el sentido de aportar dentro del plazo de 31 meses una copia de la solicitud internacional y una traducción de la misma, debido a circunstancias de fuerza mayor o caso fortuito que impidieron dentro del plazo legal establecido en la ley, no solo entrar en fase nacional, sino también dar cumplimiento al requisito establecido en la ley, circunstancias que ya fueron acreditadas dentro del presente expediente en marzo 14 de 2005, para lo cual se aportó la prueba pertinente, lo cual ocasionó que desafortunadamente nos fuera imposible cumplir lo establecido en la ley en lo referente al plazo de entrada en fase nacional, como el aportar el documento exigido por su Despacho, consistente en una copia de la solicitud internacional y una traducción de la misma.

Pese a lo anterior y como lo puede observar el Señor Superintendente de Industria y Comercio, dadas las circunstancias de fuerza mayor o caso fortuito acaecidas y que afectaron el trámite normal de la presente patente, empleamos toda nuestra diligencia para reconstruir la información perdida, lo cual nos permitió radicar la patente un mes y un día con posterioridad al término establecido en la ley.

Debido a lo expuesto, como para el 30 de diciembre de 2004, aún nos encontrábamos dentro del plazo establecido en el Artículo 49.6 del reglamento del Tratado de Cooperación en materia de patentes, que entró en vigor el primero (1) de enero de 2004, solicito el restablecimiento del derecho del solicitante **THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY** con sede en a Rua 203 Whitehurst – Oklahoma State University, Stillwater – Oklahoma 74078, Estados Unidos de América, en el sentido de revocar la decisión que declaró retirada la solicitud de patente de invención de la referencia y por lo tanto expedir otra que ordene la continuación de dicho trámite, ya que el citado Artículo 49.6 del reglamento del Tratado de Cooperación en materia de patentes, prevee circunstancias especiales de incumplimiento del citado reglamento, cuando a su tenor literal establece:

“Artículo 49.6 restablecimiento de los derechos en caso de incumplimiento de los actos mencionados en el Artículo 22:

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Abogados Consultores – Marcas y Patentes

49.6 Restablecimiento de los derechos en caso de incumplimiento de los actos mencionados en el artículo 22.

a) Cuando cesen los efectos de la solicitud internacional previstos en el artículo 11.3), debido a que, en el plazo aplicable, el solicitante no ha cumplido los actos mencionados en el artículo 22, la oficina designada, a petición del solicitante y a reserva de los párrafos b) a e) de la presente regla, restablecerá los derechos del solicitante en lo que respecta a esa solicitud internacional si comprueba que el retraso en la observancia de ese plazo no era intencional o, a elección de la oficina designada, que a tenido lugar la inobservancia del plazo a pesar de haber existido la diligencia requerida por las circunstancias.

b) La petición de restablecimiento de los derechos mencionados en el párrafo a) deberá presentarse en la oficina designada, y deberán realizarse los actos mencionados en el artículo 22, en el que venza primero de los dos plazo siguientes:

i) dos meses desde la fecha de supresión de la causa de la inobservancia del plazo aplicable en virtud del artículo 22;

o

ii) 12 meses desde la fecha de vencimiento del plazo aplicable en virtud del Artículo 22; a condición de que el solicitante pueda presentar la petición en cualquier momento posterior, si lo permite la legislación nacional aplicable por la oficina designada.

c) la petición mencionada en el párrafo a) deberá exponer las razones por las cuales no se a observado el plazo fijado en el artículo 22.

d) la legislación nacional aplicable por la oficina designada podrá exigir:

i) que se pague una tasa por la petición mencionada en el párrafo a);

ii) que se presente una declaración u otras pruebas en apoyo de las razones mencionadas en el párrafo c).

e) la oficina designada no deberá rechazar una petición formulada en virtud del párrafo a), sin dar al solicitante la posibilidad de presentar observaciones sobre el rechazo previsto, en un plazo razonable según el caso.

f) Si, el 1 de octubre de 2002, los párrafos a) a e) no fueran compatibles con la legislación nacional aplicada por la oficina designada, no se aplicaran a este mientras subsista la incompatibilidad con dicha legislación, a condición de que la oficina en

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cuestión informe de ello a la oficina internacional el 1 de enero de 2003 a mas tardar. La oficina internacional publicara lo antes posible esa información en la gaceta."

PETICIONES

Por lo expuesto anteriormente, solicito comedidamente al Señor Superintendente de Industria y Comercio, lo siguiente:

1. Se sirva **REVOCAR** la resolución No. 14575 del 24 de junio de 2005, que declaró retirada la solicitud Patente de Invención PCT titulada: **"ANTIGENOS PROTECTORES PARA EL CONTROL DE INFESTACIONES POR ESPECIE DE IXODES"** (Expediente PCT 04130178) y por lo tanto expedir otra resolución que ordene la continuación de dicho tramite de patente PCT.

ANEXOS

1. Poder que me faculta para actuar en el presente tramite y donde el Notario certifica sobre la existencia de **THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY** con sede en Rua 203 Whitehurst - Oklahoma State University, Stillwater - Oklahoma 74078, Estados Unidos de América, debidamente legalizado hasta por APOSTILLA. (7 folios)
2. Copia de la Solicitud PCT/US03/13229 del 29 de Abril de 2.003, tal como fue presentada en inglés, con lista de secuencia (110 folios). La traducción al español de la solicitud PCT fue radicada ante la SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO, el 30 de diciembre de 2.004
3. Carta de trasmisión recibida por la Oficina de los Estados Unidos, del 29 de abril de 2.003 (1 folio)
4. Invitación a pagar tasas adicionales del PCT y su respectiva traducción oficial al español (15 folios)
5. Notificación de recibo de copia de solicitud PCT del 28 de mayo de 2.003 (2 folios)
6. Notificación PCT de envío de documento de prioridad, del 4 de junio de 2.003 (1 folio)
7. Notificación PCT informando al solicitante comunicación Oficinas Internacionales de designación de países de Noviembre 5 de 2.003 (1 folio)

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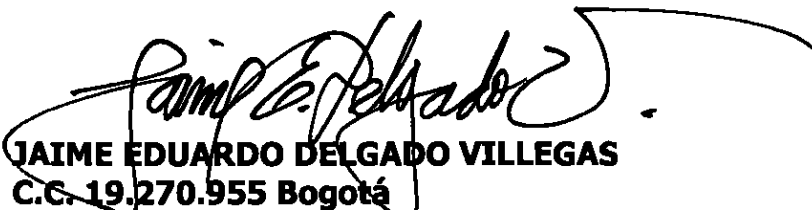
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Mario Delgado Echeverry e Hijos Ltda.

Abogados Consultores – Marcas y Patentes

8. Publicación de la solicitud PCT con No. WO 03/093416 A2 del 13 de noviembre de 2.003 (71 folios)
9. Notificación de envío de reporte de búsqueda internacional del 11 de febrero de 2.003 (1 folio)
10. Reporte de búsqueda internacional del 11 de febrero de 2.005 con opinión escrita (en inglés y su respectiva traducción oficial al español) (16 folios)

Atentamente,



JAIME EDUARDO DELGADO VILLEGAS
C.C. 19.270.955 Bogotá
T.P. 43.308 del C. S. de la J.



NOTARIA 18 DE BOGOTA

18 AGO 2005

Hoy compareció Famie
Edwido del Bordo Nolasco
con 19 770 955 de 1978 y dijo que reconoce
como suyo el anterior documento y la firma que en él
aparece, la que es de su puño y letra. Para constancia
se firma en Bogotá.

TP 43308C5J

Famie Edwido del Bordo Nolasco



OFFICE OF THE SECRETARY OF STATE

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APOSTILLE
(Convention de La Haye du 5 Octobre 1961)

1. Country: United States of America

This public document

2. Has been signed by

Cindy L. Malayer

3. Acting in the capacity of

Notary Public, State of Oklahoma

4. Bears the seal/stamp of

Cindy L. Malayer, Notary Public

CERTIFIED

5. At Oklahoma City, Oklahoma, U.S.A.

6. The 11th day of August, 2005

7. By Administrative Technician

8. No. C00020414



10. Signature:

Kathy Smith

Kathy Smith
Administrative Technician

Como Notario 18 de
constar que esta fotocopia
el original con que fue
1702-13-2005
GERMAN O. UBA COPABAN
Notario Deciocho-Encargado
Bogotá - Colombia

POWER OF ATTORNEY

The Undersigned Mr. Stephen W.S. McKeever, in the quality of - Vice-President of THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY, with address at: 203 Whitehurst - Oklahoma State University, Stillwater - Oklahoma 74078, United States, in this act grants ample and sufficient power of attorney to: JAIME EDUARDO DELGADO VILLEGAS and/or CLEMENCIA DELGADO VILLEGAS, attorneys, adults, residing in Bogotá (Colombia), so that on our behalf and representation, carry out before your office all types of errands an especial procedures for the registration and renewal of all kinds of Product and Service trademarks, deposits of name and commercial logotipe, industrial models and drawings, invention patents, utility models, Integrated circuits, name of domain, plant varieties, agricultural, veterinary and sanitary registries, capacity certificates, renewal, modification, transfer, assignment and expansions and to be responsible as general attorneys, for the supervision of all matters related to industrial property, being empowered to present and withdraw objections, to present appeals, to request testimonies, to receive documents, to pay legal fees, to approve exploitations, to agree on transactions on trademark agreements with third parties of legal entities, to abandon action, to substitute and to carry out all the necessary actions before any administrative authority of the aforementioned purposes' in the event that such procedures shall be transferred unto a judicial field, the legal representatives are authorized to act as plaintiff or defendant before the competent authorities, having an ample power to settle, to submit to arbitration, to waive, to present appeals and all other necessary special faculties. For that purpose, I kindly request to grant ample powers to our attorneys, who shall be able to exercise the functions independently or collectively. The present power of attorney revokes and cancels any other previous powers of attorney given by the Company in the territory of the Colombian Republic. Sincerely,

United States, August 2, 2005.



Stephen W. S. McKeever
Vice-President

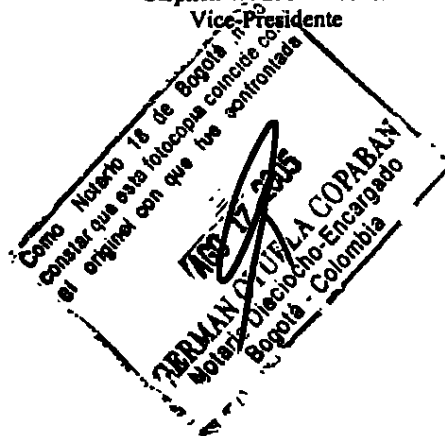
PODER

Atentamente se dirige a Usted Sr. Stephen W.S. McKeever, na cualidad de Vice-Presidente da THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY con sede à Rua 203 Whitehurst - Oklahoma State University, Stillwater - Oklahoma 74078, Estados Unidos, confiero poder general, amplio y suficiente a los Dres. JAIME EDUARDO DELGADO VILLEGAS, y/o CLEMENCIA DELGADO VILLEGAS, Abogados, mayores y vecinos de Bogotá, D.C. (Colombia), para que en nuestro nombre y representación adelanten ante Ustedes toda clase de diligencias y procedimientos especiales para el Registro y Renovación en su Despacho, de toda clase de Marcas de Producto y Servicio, Depósitos de Nombre y Enseña Comercial, Diseños Industriales y Patentes de Invención, Patentes modelo de Utilidad, Esquemas de Circuitos integrados, Nombres de dominio, Variedades vegetales, registros agrícolas, veterinarios y sanitarios, certificados de capacidad, renovación, modificación, traspaso y ampliación de los mismos y atiendan como Apoderados generales todo asunto referente a la Propiedad Industrial, quedando facultados para presentar y retirar Oposiciones, interponer recursos, solicitar testimonios, recibir documentos, cancelar costos legales, probar explotaciones, aceptar transacciones, llegar a acuerdos marcarios con terceras personas o entidades jurídicas, desistir, sustituir y hacer cuanto fuere necesario ante cualquier autoridad administrativa para los fines arriba indicados; y en caso de que el procedimiento debiera pasar a conocimiento judicial, quedan facultados para actuar como demandantes o demandados ante los Jueces que sean competentes, con poder amplio, pudiendo transar, someter a árbitros, desistir, interponer recursos y con todas las demás facultades especiales que fueren necesarias. Con éste objeto, ruego le confieran personería suficiente a nuestros Apoderados quienes podrán obrar en forma conjunta ou independiente. El presente poder revoca y cancela cuantos poderes se hubieren otorgado por la Compañía con anterioridad a esta fecha en el territorio de la República de Colombia. Atentamente,

Estados Unidos

, 2005.

Stephen W.-S. McKeever
Vice-Presidente



Please, submit to a public deed by public notary

Notarial Certificate:

The undersigned Notary Public certifies that the preceding signature reading Stephen W.S. McKeever

is authentic: that signer is Stephen W. S. McKeever of THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY and that he is empowered to grant this power, and that said Company exists and is duly organized in accordance with the laws of Oklahoma - United States.

All the foregoing facts are know to the Notary due to his having examined the respective documents to wich he, the Notary, attests.

Granted and signed, at Stillwater, Oklahoma, Payne County, U.S.A.

On: August 2, 2005

Notary Public. Cindy L. Malayer
Commission No. 00018223

Commission Expiration 12/9/2008

This Power of Attorney should be authenticated with the filed Notarial certificate and legalized by Apostille or by the Colombian Consulate.

Certificación Notarial:

El infrascrito Notario Público certifica que la firma que antecede y dice

es auténtica:

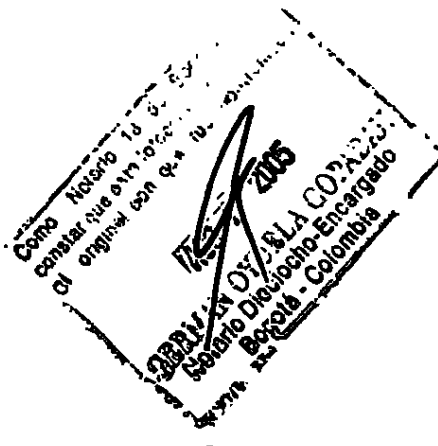
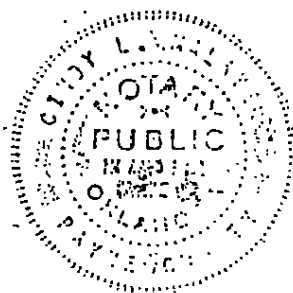
que el firmante es Senõr Stephen W. S. McKeever de THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY que tiene facultad para otorgar este poder y que dicha compañía existe y está debidamente organizada de conformidad con las Leyes de Oklahoma - Estados Unidos..

Todos los hechos anteriores le constan por haber examinado los documentos respectivos y de todo ello da fe.

Dado y firmado en

Notario Público.

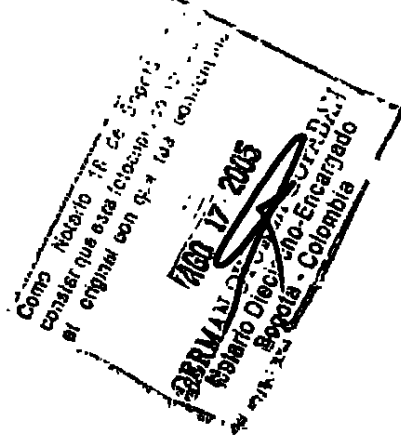
Autenticarlo ante Notario con el lleno de la Certificación Notarial y refrendarlo por Apostilla o Consulado.



Traducción Oficial código: DELGADO-PODOKL de un documento escrito en inglés, sellada por el suscrito Traductor Oficial, agosto 17 de dos mil cinco, Bogotá, D.C., República de Colombia.

PODER DE REPRESENTACIÓN

El suscrito Sr. **STEPHEN W.S. McKEEVER**, en calidad de Vicepresidente de **THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY**, con dirección en 203 Whitehurst, Oklahoma State University, Stillwater, Oklahoma 74078, United States, concede en este acto poder de representación amplio y suficiente a **JAIME EDUARDO DELGADO VILLEGAS y/o CLEMENCIA DELGADO VILLEGAS**, abogados, mayores y residentes en Bogotá (Colombia), para que en nuestro nombre y representación adelanten ante Ustedes toda clase de diligencias y procedimientos especiales para el registro y renovación de toda clase de Marcas Registradas de Productos y Servicios, depósitos de nombre e insignia comercial, modelos y dibujos industriales, patentes de invención, modelos de utilidad, circuitos integrados, nombre de dominio, variedades vegetales, registros agrícolas, veterinarios y sanitarios, certificados de personería jurídica, renovación, modificación, cesión, asignación y expansiones, y ser responsables como apoderados generales por la supervisión de todos los asuntos relacionados con la propiedad industrial, quedando facultados para presentar y retirar oposiciones,



Silvio A. PUERTAS F
 TRADUCTOR E INTERPRETE OFICIAL - INGL
 Resolución No. 0141 - 30/08/96 Minjustic

interponer apelaciones, solicitar testimonios, recibir documentos, cancelar costos legales, aprobar usufructos, aceptar transacciones sobre acuerdos de marcas registradas con terceras personas o entidades jurídicas, desistir, sustituir, y hacer cuanto fuere necesario ante cualquier autoridad administrativa para los fines antes mencionados. En caso de que dichos procedimientos deban pasar a conocimiento judicial, los representantes legales quedan facultados para actuar como demandantes o demandados antes las autoridades competentes, con poder amplio para transar, someter a arbitraje, desistir, interponer apelaciones y cualquier otra facultad especial necesaria.

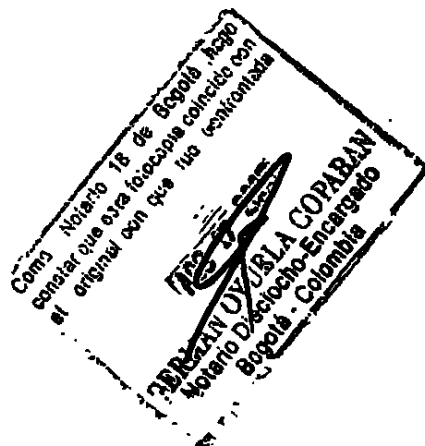
Para tal efecto, solicito amablemente conferir a nuestros representantes personería suficiente, y éstos podrán ejercer las funciones en forma conjunta o independiente.

El presente poder de representación revoca y cancela cualquier otro poder de representación anterior otorgado por la Compañía en el territorio de la República de Colombia.

Atentamente,

(Firmado) Stephen w.S. McKeever, Vicepresidente

Agosto 2 de 2005



Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLES
Resolución No. 0941 - 30/08/96 Minjusticia

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(Hoja anexa)

Por favor remitir a escritura pública ante notario público.

Certificado Notarial

El suscrito Notario Público certifica que la firma precedente que dice Stephen w.S. McKeever es auténtica; que el firmante es Stephen W.S. McKeever de THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY; y que tiene facultades para conferir este poder, y que dicha Compañía existe y está debidamente constituida según las leyes de Oklahoma, Estados Unidos.

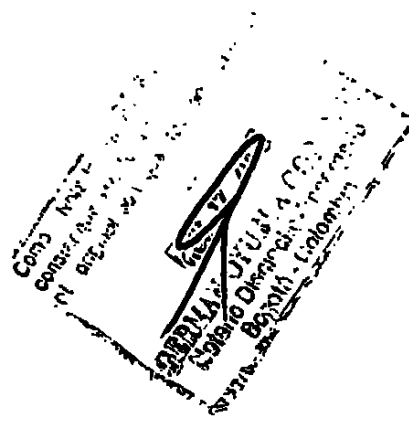
Todos los hechos anteriores son de conocimiento del Notario por cuanto ha examinado los documentos respectivos de los cuales el Notario da fe.

Dado y firmado en Stillwater, Oklahoma, Condado de Payne, EUA, el 2 de agosto de 2005.

(Firmado y sellado) Cindy L. Malayer, Notario Público, Nombramiento: 00018223, vencimiento del nombramiento: 9 de diciembre de 2008

Este Poder de Representación debe autenticarse con el certificado notarial diligenciado y legalizarse mediante Apostille o ante el Consulado Colombiano.

(Hoja anexa)



Silvio A. PUERTAS
TRADUCTOR E INTERPRETE OFICIAL - INGI
Resolución No. 0987 - 30/08/96 Minjust

72
75

OFICINA DEL SECRETARIO DE ESTADO, ESTADO DE OKLAHOMA

APOSTILLE (Convention de La Haye du 5 Octobre 1961) Apostille (Convención de La Haya del 5 de octubre de 1961).

1. País: Estados Unidos de América

Este documento público

2. Ha sido firmado por Cindy L. Malayer

3. Actuando en calidad de Notario Público, Estado de Oklahoma

4. Lleva el sello/estampilla de Cindy L. Malayer, Notario Público

Certificado

5. En la ciudad de Oklahoma, Oklahoma, EUA

6. El 11 de agosto de 2005

7. Por el Técnico Administrativo

8. Bajo el No. C00020414

9. Sello/estampilla del Estado de Oklahoma: (Sellado)

10. Firma: (Firmado) Kathy Smith, Técnico Administrativo

Traductor: SILVIO ALEJANDRO PUERTAS PINO

Resolución 0941 del 30 de agosto de 1996 del Ministerio de Justicia y del Derecho

MINISTERIO DE ECONOMÍA
FISCALÍA
SILVIO A. PUERTAS
Cuya firma aparece en el
documento desempeña
las funciones indicadas

NO SE ASUME
RESPONSABILIDAD DEL TEXTO
2005 AUG 17 A 11:00
JES
JEFE DE LEGALIZACIONES
SANTA FE DE BOGOTÁ D.C.

Silvio A. Puertas P.
TRADUCTOR E INTERPRETE OFICIAL - INGLES
Resolución No. 0941 30/08/96 Ministerio

3002 AL 1000

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

• For receiving Office use only

For receiving Office use only	
International Application No.	
International Filing Date	
Name of receiving Office and "PCT International Application"	
Applicant's or agent's file reference (if desired) (12 characters maximum) 03-368	

Box No. I TITLE OF INVENTION	
PROTECTIVE ANTIGENS FOR THE CONTROL OF IXODES SPECIES INFESTATIONS	
Box No. II APPLICANT ☐ This person is also inventor	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY 203 Whitehurst Oklahoma State University Stillwater, OK 74078 United States of America	
Telephone No.	
Facsimile No.	
Teleprinter No.	
Applicant's registration No. with the Office	
State (that is, country) of nationality: US	
State (that is, country) of residence: US	
This person is applicant for the purposes of: ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)	
DE LA FUENTE, Jose de Jesus 400 Squires Landing, Apt. M-5 Stillwater, OK 74074 United States of America	
This person is: ☐ applicant only ☐ applicant and inventor ☒ inventor only (If this check-box is marked, do not fill in below.)	
Applicant's registration No. with the Office	
State (that is, country) of nationality:	
State (that is, country) of residence:	
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.	
Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE	
The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as: ☐ agent ☐ common representative	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)	
WEEKS, R. Alan Fellers, Snider, Blankenship, Bailey & Tippens, P.C. 321 South Boston, Suite 800 Tulsa, OK 74103-3318 United States of America	
Telephone No. (918) 599-0621	
Facsimile No. (918) 583-9659	
Teleprinter No.	
Agent's registration No. with the Office 36.050	
☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.	

Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)	
If none of the following sub-boxes is used, this sheet should not be included in the request.	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) KOCAN, Katherine M. 3909 E. 92nd Street Perkins, OK 74059 United States of America	This person is: ☐ applicant only ☐ applicant and inventor ☒ inventor only (If this check-box is marked, do not fill in below.) Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) GARCIA-ALMAZAN, Consuelo 835 Connell Stillwater, OK 74075 United States of America	This person is: ☐ applicant only ☐ applicant and inventor ☒ inventor only (If this check-box is marked, do not fill in below.) Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) GARCIA-GARCIA, Jose Carlos 700 W. Scott Ave., Apt. 137 Stillwater, OK 74075 United States of America	This person is: ☐ applicant only ☐ applicant and inventor ☒ inventor only (If this check-box is marked, do not fill in below.) Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.) BLOUIN, Edmour F. 3909 E. 92nd Street Perkins, OK 74059 United States of America	This person is: ☐ applicant only ☐ applicant and inventor ☒ inventor only (If this check-box is marked, do not fill in below.) Applicant's registration No. with the Office
State (that is, country) of nationality:	State (that is, country) of residence:
This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box	
☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.	

Box No. V DESIGNATION OF STATES

Mark the applicable check-boxes below: at least one must be marked.

The following designations are hereby made under Rule 4.9(a):

Regional Patent

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZM Zambia, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT (if other kind of protection or treatment desired, specify on dotted line) and utility model
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP European Patent:** AT Austria, BE Belgium, BG Bulgaria, CH & LI Switzerland and Liechtenstein, CY Cyprus, CZ Czech Republic, DE Germany, DK Denmark, EE Estonia, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, SI Slovenia, SK Slovakia, TR Turkey, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GQ Equatorial Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | | |
|---|--|---|
| ☒ AE United Arab Emirates | ☒ GM Gambia | ☒ NZ New Zealand |
| ☒ AG Antigua and Barbuda | ☒ HR Croatia | ☒ OM Oman |
| ☒ AL Albania | ☒ HU Hungary | ☒ PH Philippines |
| ☒ AM Armenia | ☒ ID Indonesia | ☒ PL Poland |
| ☒ AT Austria and utility model | ☒ IL Israel | ☒ PT Portugal |
| ☒ AU Australia | ☒ IN India | ☒ RO Romania |
| ☒ AZ Azerbaijan | ☒ IS Iceland | ☒ RU Russian Federation |
| ☒ BA Bosnia and Herzegovina | ☒ JP Japan | |
| ☒ BB Barbados | ☒ KE Kenya | ☒ SC Seychelles |
| ☒ BG Bulgaria | ☒ KG Kyrgyzstan | ☒ SD Sudan |
| ☒ BR Brazil | ☒ KP Democratic People's Republic of Korea | ☒ SE Sweden |
| ☒ BY Belarus | ☒ KR Republic of Korea | ☒ SG Singapore |
| ☒ BZ Belize | ☒ KZ Kazakhstan | ☒ SK Slovakia and utility model |
| ☒ CA Canada | ☒ LC Saint Lucia | ☒ SL Sierra Leone |
| ☒ CH & LI Switzerland and Liechtenstein | ☒ LK Sri Lanka | ☒ TJ Tajikistan |
| ☒ CN China | ☒ LR Liberia | ☒ TM Turkmenistan |
| ☒ CO Colombia | ☒ LS Lesotho | ☒ TN Tunisia |
| ☒ CR Costa Rica | ☒ LT Lithuania | ☒ TR Turkey |
| ☒ CU Cuba | ☒ LU Luxembourg | ☒ TT Trinidad and Tobago |
| ☒ CZ Czech Republic and utility model | ☒ LV Latvia | |
| ☒ DE Germany and utility model | ☒ MA Morocco | ☒ TZ United Republic of Tanzania |
| ☒ DK Denmark and utility model | ☒ MD Republic of Moldova | ☒ UA Ukraine |
| ☒ DM Dominica | ☒ MG Madagascar | ☒ UG Uganda |
| ☒ DZ Algeria | ☒ MK The former Yugoslav Republic of Macedonia | ☐ US United States of America |
| ☒ EC Ecuador | ☒ MN Mongolia | |
| ☒ EE Estonia and utility model | ☒ MW Malawi | ☒ UZ Uzbekistan |
| ☒ ES Spain | ☒ MX Mexico | ☒ VC Saint Vincent and the Grenadines |
| ☒ FI Finland and utility model | ☒ MZ Mozambique | ☒ VN Viet Nam |
| ☒ GB United Kingdom | ☒ NO Norway | ☒ YU Yugoslavia |
| ☒ GD Grenada | | ☒ ZA South Africa |
| ☒ GE Georgia | | ☒ ZM Zambia |
| ☒ GH Ghana | | ☒ ZW Zimbabwe |

Check-boxes below reserved for designating States which have become party to the PCT after issuance of this sheet:

- ☒ NI Nicaragua (3 March 2003) ☐ SY Syrian Arab Republic (26 Jun 03) ☐
- ☐ PG Papua New Guinea (14 Jun 03) ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)

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Box No. VI PRIORITY CLAIM				
The priority of the following earlier application(s) is hereby claimed:				
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country or Member of WTO	regional application:* regional Office	international application: receiving Office
item (1) 29 April 2002 (29.04.02)	60/376,251	US		
item (2)				
item (3)				
item (4)				
item (5)				
☐ Further priority claims are indicated in the Supplemental Box.				
The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of this international application is the receiving Office) identified above as: ☒ all items ☐ item (1) ☐ item (2) ☐ item (3) ☐ item (4) ☐ item (5) ☐ other, see Supplemental Box				
* Where the earlier application is an ARIPO application, indicate at least one country party to the Paris Convention for the Protection of Industrial Property or one Member of the World Trade Organization for which that earlier application was filed (Rule 4.10(b)(ii)):				
Box No. VII INTERNATIONAL SEARCHING AUTHORITY				
Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used): ISA / EP				
Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority): Date (day/month/year) Number Country (or regional Office)				
Box No. VIII DECLARATIONS				
The following declarations are contained in Boxes Nos. VIII (i) to (v) (mark the applicable check-boxes below and indicate in the right column the number of each type of declaration):				Number of declarations
☐	Box No. VIII (i)	Declaration as to the identity of the inventor		:
☒	Box No. VIII (ii)	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent		1
☐	Box No. VIII (iii)	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application		:
☐	Box No. VIII (iv)	Declaration of inventorship (only for the purposes of the designation of the United States of America)		:
☐	Box No. VIII (v)	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty		:

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Box No. VIII (ii) DECLARATION: ENTITLEMENT TO APPLY FOR AND BE GRANTED A PATENT

The declaration must conform to the standardized wording provided for in Section 212: see Notes to Boxes Nos. VIII, VIII (i) to (iv) (in general) and the specific Notes to Box No. VIII (ii). If this Box is not used, this sheet should not be included in the request.

Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent (Rules 4.17(ii) and 51bis.1(a)(ii)), in a case where the declaration under Rule 4.17(iv) is not appropriate:

in relation to this international application,

THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY is entitled to apply for and be granted a patent by virtue of the following:

an assignment from

Jose de Jesus DE LA FUENTE (CB/US) of 400 Squires Landing, Apt. M-5, Stillwater, OK 74074 United States of America;

Katherine M. KOCAN (US/US) of 3909 E. 92nd Street, Perkins, OK 74059 United States of America;

Consuelo GARCIA-ÁLMAZAN (MX/US) of 835 Connell, Stillwater, OK 74075 United States of America;

Jose Carlos GARCIA-GARCIA (CB/US) 700 W. Scott Ave., Apt. 137, Stillwater, OK 74075 United States of America; and

Edmour F. BLOUIN (US/US) of 3909 E. 92nd Street, Perkins, OK 74059 United States of America;

to THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY, dated 29 May 2002 (29.05.02).

This declaration is made for the purposes of all designations.

☐ This declaration is continued on the following sheet, "Continuation of Box No. VIII (ii)".

Box No. IX CHECK LIST: LANGUAGE OF FILING

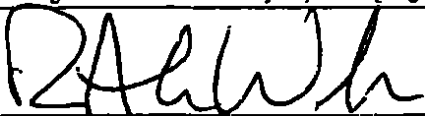
This international application contains:	This international application is accompanied by the following item(s) (mark the applicable check-boxes below and indicate in right column the number of each item):	Number of items
(a) in paper form, the following number of sheets:	1. ☒ fee calculation sheet	1
request (including declaration sheets) : 6	2. ☐ original separate power of attorney	
description (excluding sequence listings and/or tables related thereto) : 28	3. ☐ original general power of attorney	
claims : 9	4. ☒ copy of general power of attorney; reference number, if any:	1
abstract : 1	5. ☐ statement explaining lack of signature	
drawings : 4	6. ☐ priority document(s) identified in Box No. VI as item(s):	
Sub-total number of sheets : 48	7. ☐ translation of international application into (language):	
sequence listings : 29	8. ☐ separate indications concerning deposited microorganism or other biological material	
tables related thereto :	9. ☒ sequence listings in computer readable form (indicate type and number of carriers)	
(for both, actual number of sheets if filed in paper form, whether or not also filed in computer readable form; see (c) below)	(i) ☒ copy submitted for the purposes of international search under Rule 13ter only (and not as part of the international application):	1
Total number of sheets : 77	(ii) ☐ (only where check-box (b)(i) or (c)(i) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Rule 13ter	
(b) ☐ only in computer readable form (Section 801(a)(i))	(iii) ☐ together with relevant statement as to the identity of the copy or copies with the sequence listings mentioned in left column	
(i) ☐ sequence listings	10. ☐ tables in computer readable form related to sequence listings (indicate type and number of carriers)	
(ii) ☐ tables related thereto	(i) ☐ copy submitted for the purposes of international search under Section 802(b-quater) only (and not as part of the international application)	
(c) ☐ also in computer readable form (Section 801(a)(ii))	(ii) ☐ (only where check-box (b)(ii) or (c)(ii) is marked in left column) additional copies including, where applicable, the copy for the purposes of international search under Section 802(b-quater)	
(i) ☐ sequence listings	(iii) ☐ together with relevant statement as to the identity of the copy or copies with the tables mentioned in left column	
(ii) ☐ tables related thereto	11. ☒ other (specify): Filing Postcard	1
Type and number of carriers (diskette, CD-ROM, CD-R or other) on which are contained the		
☐ sequence listings:		
☐ tables related thereto:		
(additional copies to be indicated under items 9(ii) and/or 10(ii), in right column)		

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: ENGLISH

Box No. X SIGNATURE OF APPLICANT, AGENT OR COMMON REPRESENTATIVE

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).



R. Alan WEEKS
USPTO Reg. No. 36,050

For receiving Office use only

1. Date of actual receipt of the purported international application:	2. Drawings: ☐ received: ☐ not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:	
4. Date of timely receipt of the required corrections under PCT Article 11(2):	
5. International Searching Authority (if two or more are competent): ISA /	6. ☐ Transmittal of search copy delayed until search fee is paid

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

PCT

FEE CALCULATION SHEET
Annex to the Request

For receiving Office use only

International Application No.

Date stamp of the receiving Office

Applicant's or agent's
file reference

03-368

Applicant

THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE 240 T

2. SEARCH FEE 936 S

International search to be carried out by
(If two or more International Searching Authorities are competent to carry out the international search, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

Where items (b) and/or (c) of Box No. IX apply, enter Sub-total number of sheets } 77
Where items (b) and (c) of Box No. IX do not apply, enter Total number of sheets }

b1 first 30 sheets 476 b1

b2 47 x 12 = 564 b2
number of sheets in excess of 30 fee per sheet

b3 additional component (only if sequence listings and/or tables related thereto are filed in computer readable form under Section 801(a)(i), or both in that form and on paper, under Section 801(a)(ii)):

400 x = b3
fee per sheet

Add amounts entered at b1, b2 and b3 and enter total at B 1040 B

Designation Fees

The international application contains 119 designations.

5 x 104 = 520 D
number of designation fees payable (maximum 5) amount of designation fee

Add amounts entered at B and D and enter total at I 1560 I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable) 15 P

5. TOTAL FEES PAYABLE 2751

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☐ authorization to charge deposit account (see below) ☐ postal money order ☐ cash ☐ coupons
☒ cheque ☐ bank draft ☐ revenue stamps ☐ other (specify):

AUTHORIZATION TO CHARGE (OR CREDIT) DEPOSIT ACCOUNT
(This mode of payment may not be available at all receiving Offices)

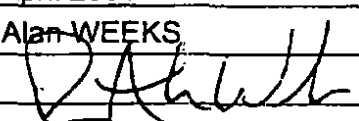
☐ Authorization to charge the total fees indicated above.
☒ (This check-box may be marked only if the conditions for deposit accounts of the receiving Office so permit) Authorization to charge any deficiency or credit any overpayment in the total fees indicated above
☐ Authorization to charge the fee for priority document.

Receiving Office: RO/ US

Deposit Account No.: 06-0540

Date: 29 April 2003

Name: R. Alan WEEKS

Signature: 

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PCT
GENERAL POWER OF ATTORNEY
(for several international applications filed under the Patent Cooperation Treaty)
(PCT Rule 90.5)

The undersigned person(s):

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)

THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY
203 Whitehurst
Oklahoma State University
Stillwater, OK 74078
United States of America

hereby appoints (appoint) the following person(s) as: ☒ agent(s)
☐ common representative

Name(s) and address

(Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country)

WEEKS, R. ALAN, Reg. No. 36,050 and/or
BROWN, DENNIS D., Reg. No. 33,559 and/or
HOLMES, FRED H., Reg. No. 43,677 and/or
WATT, TERRY L., Reg. No. 42,214 and/or
ZINGERMAN, SCOTT R., Reg. No. 35,420

Fellers, Snider, Blankenship, Bailey & Tippens, P.C.
321 South Boston Ave., Suite 800
Tulsa, OK 74104-3318
United States of America

to represent the undersigned before ☒ all the competent International Authorities
☐ the International Searching Authority only
☐ the International Preliminary Examining Authority only

in connection with any and all international applications filed by the undersigned with the following Office, Box PCT. RO/US, as receiving office and to make or receive payments on behalf of the undersigned.

Signatures of the applicant(s) (where there are several persons, each of them must sign; next to each signature, indicate the name of the person signing and the capacity in which the person signs, if such capacity is not obvious from reading this power):



THOMAS C. COLLINS, Vice President of Research
THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY

Date: 24 Mar 2000

PROTECTIVE ANTIGENS FOR THE CONTROL OF *IXODES* SPECIES INFESTATIONS

BACKGROUND OF THE INVENTION

Technical Field:

The present invention relates to the identification of protective antigens against infestations with *Ixodes* spp. ticks, gene sequences and encoded proteins for such antigens, related vaccines and methods useful to induce an immune response, which are protective to interfere with infestations by *Ixodes* spp. ticks.

Background:

Ticks parasitize wild, domesticated animals and humans and transmit pathogens including fungi, bacteria, viruses and protozoon. Currently, ticks are considered to be second in the world to mosquitoes as vectors of human diseases, but they are considered to be the most important vector of pathogens in North America (Parola and Raoult, 2001). *Ixodes* spp. are distributed worldwide and act as vectors of human diseases caused by *Borrelia burgdorferi* (Lyme disease), *Anaplasma phagocytophila* (human granulocytic ehrlichiosis), *Coxiella burnetti* (Q fever), *Francisella tularensis* (tularemia), *B. afzelii*, *B. lusitaniae*, *B. valaisiana* and *B. garinii*, *Rickettsia helvetica*, *R. japonica* and *R. australis*, *Babesia divergens* and tick-borne encephalitis (TBE) and Omsk Hemorrhagic fever viruses (Estrada-Peña and Jongejan, 1999; Parola and Raoult, 2001). Throughout eastern and southeastern United States and Canada, *I. scapularis* (the black legged tick) is the main vector of *B. burgdorferi* sensu stricto and *A. phagocytophila* (Estrada-Peña and Jongejan, 1999; Parola and Raoult, 2001).

Control of tick infestations is difficult and often impractical for multi-host ticks such as *Ixodes* spp. Presently, tick control is effected by integrated pest management in which different control methods are adapted to one area or against one tick species with due consideration to their environmental effects. Recently, development of vaccines against one-host *Boophilus* spp. has provided new possibilities for the identification of protective antigens for immunization against tick infestations (Willadsen, 1997; Willadsen and Jongejans, 1999; de la Fuente et al., 1999; 2000; de Vos et al., 2001). The recombinant *B. microplus* BM86 gut antigen included in commercial vaccine formulations TickGARD (Hoechst Animal Health, Australia) and Gavac (Heber Biotec S. A., Havana, Cuba) also confers partial protection against phylogenetically related *Hyalomma* and *Rhipicephalus* tick genera (de la Fuente et al., 2000; de Vos et al., 2001). However, immunization with BM86 failed to protect against the more phylogenetically distant *Amblyomma* spp. (de Vos et al., 2001). These results suggest that using Bm86 or a closely related gene for the production of vaccines against *Ixodes* spp. or other tick genera phylogenetically distant from *Boophilus* spp. (Black and Piesman, 1994) could be impractical. Therefore, the screening for novel protective antigens is necessary to identify vaccine candidates against infestations with these tick species of medical and veterinary importance. Control of ticks by vaccination would avoid environmental contamination and selection of drug resistant ticks that result from repeated acaricide application (de la Fuente et al., 1998; Garcia-Garcia et al., 1999). Anti-tick vaccines also allow for inclusion of multiple antigens in order to target a broad range of tick species and for incorporation of pathogen-blocking antigens.

Vaccination with DNA and cDNA molecules has been used to induce a protective immune response against *B. microplus* and several pathogens in laboratory

animals and livestock (De Rose et al., 1999; Drew et al., 1999; van Drunen Littel-van den Hurk et al., 2001; Kofta and Wedrychowicz, 2001). A new technique, expression library immunization (ELI) in combination with sequence analysis provides an alternative approach for identification of potential vaccine antigens based on rapid screening of the expressed genes without prior knowledge of the antigens encoded by cDNA clones. ELI was first reported for *Mycoplasma pulmonis* (Barry et al., 1995) and since then has been used for unicellular and multicellular pathogens and viruses (Manoutcharian et al., 1998; Alberti et al., 1998; Brayton et al., 1998; Melby et al., 2000; Smooker et al., 2000; Moore et al., 2002; Singh et al., 2002). However, the identification of individual protective clones has not been reported and it is predicted that identification of protective antigens will be more difficult as the complexity of the genome increases.

Although several reports in the literature have demonstrated by ELI that libraries can offer a degree of protection (Barry et al., 1995; Manoutcharian et al., 1998; Alberti et al., 1998; Brayton et al., 1998; Melby et al., 2000; Smooker et al., 2000; Moore et al., 2002; Singh et al., 2002), none have applied ELI to arthropods and particularly to ticks. Several vaccines have been developed to protect humans against *Ixodes*-transmitted pathogens including TBE virus and *B. burgdorferi*. However, it is not clear whether these vaccines will protect against all pathogen strains and genotypes. The inclusion of tick immunogens in pathogen-specific vaccines could enhance their protective effect and increase efficacy (Nuttall, 1999). This transmission-blocking approach is supported by evidence that host resistance to ticks provides some protection against tick-borne transmission of viruses and *B. burgdorferi* (Wikel et al., 1997). Furthermore, vaccination against *B. microplus* has

been demonstrated to contribute to the control of tick-borne diseases (de la Fuente et al., 1998; 1999).

SUMMARY OF THE INVENTION

The present invention is based upon our identification by ELI and sequence analysis of protective cDNA clones against experimental infestations with *I. scapularis*. This is the first example of the application of ELI to arthropods and particularly to ticks. The protective antigens are homologous to endopeptidases, nucleotidases, chorion proteins, vitellogenin receptors, peptidoglycan recognition proteins, glutamine-alanine rich proteins, ribosomal proteins, β -adaplin, Beta-amyloid precursor protein, Block of proliferation (Bop1), lectins, chloride channels, RNA polymerases, ATPases and heat-shock proteins. These antigens induce an immune response in vaccinated hosts that either interferes with tick development or results in a pro-feeding activity, which could be due to the expression of cDNAs encoding for tick immunosuppressants, anticoagulants and other proteins with low antigenicity and a pro-feeding activity or they could encode for proteins homologous to host proteins with anti-tick activity, which neutralization results in a tick pro-feeding activity. These protective antigens, although identified for *I. scapularis*, may be cross protective between *Ixodes* species considering the high degree of conservation of gene sequences and protein function between species of the same genus. A 5'-nucleotidase was identified and characterized in *B. microplus* by Liyou et al. (1999; 2000) but they did not assay its protection capacity. Although surprising at first glance, the protection capacity of ribosomal and heat shock protein preparations has been previously documented in other organisms (Elad and Segal, 1995; Silva, 1999; Melby et al., 2000; Cassataro et al., 2002) but never in ticks. The effect of cDNA vaccination on *I. scapularis*

experimental infestations of mice was evidenced by the reduction of the number of engorged larvae, the retardation of larval development, the inhibition of molting to nymphal stages and the appearance of visibly damaged larvae with red coloration. These effects were also recorded in vaccination experiments with recombinant BM86 and BM95 against infestations with *B. microplus*, including the red coloration in some ticks, attributed to blood leakage to the tick haemolymph (Garcia-Garcia et al., 2000).

Thus, in one embodiment of the present invention there is provided cDNA sequences, protein encoding fragments thereof, and derived protein sequences for protective *I. scapularis* antigens comprising antigens homologous to endopeptidases, nucleotidases, chorion proteins, vitellogenin receptors, peptidoglycan recognition proteins, glutamine-alanine rich proteins, ribosomal proteins, B-adaptin, Beta-amyloid precursor protein, Block of proliferation (Bop1), lectins, chloride channels, RNA polymerases, ATPases and heat-shock proteins.

In another embodiment of the present invention there is provided a vaccine composition comprising the *I. scapularis* protective recombinant proteins and/or modified cDNAs separately or which may optionally be combined with adjuvant to enhance the protection efficacy of vaccine preparations against *Ixodes* spp., wherein the vaccine composition further comprises a pharmaceutically acceptable carrier or diluent. The vaccine composition also may optionally be combined with tick-borne pathogen components to provide a means to control tick-borne infections, wherein the vaccine composition further comprises a pharmaceutically acceptable carrier or diluent and adjuvant.

In another embodiment of the present invention there is provided a method for inducing an immune response in a mammal to provide immune protection, which reduces or affects infestations by *Ixodes* spp. ticks and/or transmission of tick-borne

pathogens, the method comprising administering to at-risk human population and mammalian reservoir an effective amount of a vaccine composition comprising the *I. scapularis* protective recombinant proteins and/or modified cDNAs alone or in combination with an adjuvant or tick-borne pathogen components to provide a means to control tick infestations and to reduce transmission to humans of tick-borne infections, wherein the vaccine composition further comprises a pharmaceutically acceptable carrier or diluent.

A better understanding of the present invention and its objects and advantages will become apparent to those skilled in this art from the following detailed description, wherein there is described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated for carrying out the invention. As will be realized, the invention is capable of modifications in various obvious respects, all without departing from the scope and spirit of the invention. Accordingly, the description should be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a summary of the cDNA ELI approach used to identify protective antigens against *I. scapularis* infestations.

FIG. 2A is a graph depicting the results of a primary screen of cDNA pools (A-H 1-4, A5) by ELI. V, control mice injected with: 1 µg vector DNA alone. * $\alpha < 0.01$, ** $\alpha < 0.05$ (Tukey's *post-hoc* test for pair comparisons after ANOVA). Number in boxes represent values for inhibition of tick infestation with respect to the control group.

FIG. 2B is a graph depicting the results of a primary screen of cDNA pools (A6-A10, B-H 5-8) by ELI. V, control mice injected with 1 μ g vector DNA alone. * α <0.01, ** α <0.05 (Tukey's *post-hoc* test for pair comparisons after ANOVA). Number in boxes represent values for inhibition of tick infestation with respect to the control group.

FIG. 3 is a graph depicting the results of a tertiary screen by ELI of cDNA sub-pools formed according to the predicted function of encoded proteins. Only groups with $\geq 15\%$ are shown (white bars). The number of engorged larvae per mouse is expressed as mean $\pm$ SD (black bars). Control mice were injected with mitochondrial (MT) cDNAs. * $P \leq 0.05$ (Student's t-test).

DETAILED DESCRIPTION OF THE INVENTION

Before explaining the present invention in detail, it is important to understand that the invention is not limited in its application to the details of the construction illustrated and the steps described herein. The invention is capable of other embodiments and of being practiced or carried out in a variety of ways. It is to be understood that the phraseology and terminology employed herein is for the purpose of description and not of limitation.

The present invention derives from the sequences set forth on the Sequence Listing attached hereto and incorporated herein. In particular, there is provided 25 separate and distinct sequences comprising 14 cloned cDNA molecules and 11 deduced amino acid sequences of encoded polypeptides, said sequences having been isolated and identified as possessing the asserted utility in accordance with the following described experimental methodology.

Example 1: Construction of an I. scapularis cDNA library and screening for protective antigens by ELI

Tick cells

Monolayers of IDE8 (ATCC CRL 1973) cells, originally derived from embryonic *I. scapularis*, were maintained at 31°C in L-15B medium supplemented with 5% foetal bovine serum, tryptose phosphate broth and bovine lipoprotein concentrate after Munderloh et al. (1994). Cells were subcultured at 1:5 – 1:10 when monolayers reached a density of approximately 10^7 cells/T-25 flask. Medium was replaced weekly.

Library construction

A cDNA expression library was constructed in the vector pEXP1 containing the strong cytomegalovirus CMV_{IE} promoter (Clontech). Because we planned to target the early larval stages of *I. scapularis*, we chose to construct our library from cultured embryonic *I. scapularis* IDE8 cells-derived poly(A)⁺ RNA. The cDNA library contained 4.4×10^6 independent clones and a titer of approximately 10^{10} cfu/ml with more than 93% of the clones with cDNA inserts. The average cDNA size was 1.7 kb (0.5-4.0 kb).

Primary screen

The overall schema for identification of protective antigens through ELI, sequential fractionation and sequence analysis is shown in Fig. 1.

Ninety-six LBA (master) plates containing an average of 41 (30-61) cDNA clones per plate were prepared. Replicas were made and clones from each plate were pooled, inoculated in Luria-Bertani with 50 µg/ml ampicillin, grown for 2 hr in a 96 wells plate and plasmid DNA purified from each pool (Wizard SV 96 plasmid DNA purification system, Promega, Madison, WI, USA). BALB/c female mice, 5-6 weeks of age at the time of first vaccination, were used. Mice were cared for in accordance

with standards set in the Guide for Care and Use of Laboratory Animals. Mice were injected with a 1 ml tuberculin syringe and a 27 gauge needle at days 0 and 14. Three mice per group were each immunized IM in the thigh with 1 µg DNA/dose in 50 µl PBS. Two groups of 3 mice each were included as controls. One group was injected with 1 µg vector DNA alone and the second with saline only. Two weeks after the last immunization, mice were infested with 100 *I. scapularis* larvae per mouse. Ticks were artificially reared at the Oklahoma State University tick rearing facility by feeding larvae on mice, nymphs on rabbits and adults on sheep and using for infestation in our experiments the larvae obtained from the eggs oviposited by a single female. Twelve hours after tick infestation, larvae that did not attach were counted to calculate the number of attached larvae per mouse and mice were transferred to new cages. Replete larvae dropping from each mouse were collected daily and counted during 7 days. The inhibition of tick infestation (I) for each test group was calculated with respect to vector-immunized controls as $[1 - (\langle RL \rangle_n / \langle RL \rangle_c \times \langle RL \rangle_{ic} / \langle RL \rangle_{in})] \times 100$, where $\langle RL \rangle_n$ is the average number of replete larvae recovered per mouse for each test group, $\langle RL \rangle_c$ is the average number of replete larvae recovered per mouse for control group, $\langle RL \rangle_{ic}$ is the average number of larvae attached per mouse for control group, and $\langle RL \rangle_{in}$ is the average number of larvae attached per mouse for each test group.

Pools of 41 (30-61) *I. scapularis* cDNA clones were screened by ELI. Only 33 cDNA pools and controls were analyzed per experiment. The average tick infestation level was 50 ± 13 and 56 ± 15 and 56 ± 15 and 54 ± 18 larvae/mouse for cDNA immunized and control mice, respectively ($P > 0.05$) (Table 1). The average number of engorged larvae recovered per mouse was 9 ± 3 and 13 ± 4 in the cDNA-immunized mice and 16 ± 4 and 17 ± 3 in the control vector-immunized group ($P < 0.05$) (Table 1).

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No reduction was observed in the number of larvae collected from mice that received the vector DNA compared to saline-immunized controls. The maximum number of engorged larvae was collected 3 to 4 days after infestation. However, in mice immunized with cDNA pools B5, A8 and A10 (Fig. 2) a retardation of larval development in 1 to 2 days was recorded. The average inhibition of tick infestation (I) was $49 \pm 28\%$ and $30 \pm 22\%$ (Table 1). After two experiments covering the analysis of 66 pools (2705 clones), 9 protective pools (351 clones) were selected producing an inhibition of tick infestation $I \geq 60\%$ (Fig. 2A and 2B and Table 1). When we started these experiments, we planned to screen over 4000 cDNA clones considering the complexity of the tick genome. However, to our surprise 9 protective cDNA pools were identified after screening 66 pools containing 2705 cDNA clones. This result probably reflects the possibility of interfering with tick infestations at many different levels that involve a Pleiades of gene products. Results from vaccination experiments against ticks employing recombinant antigens support this view (reviewed by Mulenga et al., 2000). Because of the complexity of the screening procedure in mice vaccinated and challenged with tick larvae, it was difficult to work with more than 9 protective cDNA pools. Therefore we did not continue screening new cDNA pools and focused our attention on the 9 pools selected after the primary screen.

Secondary screen

The secondary screen was done to verify the protective capacity of the cDNA pools selected after the primary screen (Fig. 2A and 2B). After the primary screen of 66 cDNA pools (2705 clones), 9 pools with $I \geq 60\%$ were selected for the secondary screen (re-screening) employing 5 mice per group as described above. Engorged larvae were kept for molting in a 95% humidity atmosphere. Molting of engorged larvae was evaluated by visual examination of tick nymphs under a stereomicroscope

34 days after last larval collection. The inhibition of molting (M) for each test group was calculated with respect to vector-immunized controls as $[1 - (ML_n/ML_c \times RL_c/RL_n)] \times 100$, where ML_n is the number of nymphs for each test group, ML_c is the number of nymphs for the control group, RL_c is the number of larvae recovered for the control group, and RL_i is the number of larvae recovered for each test group. Control mice were immunized with the negative ($I=0\%$) F2 cDNA pool or saline only. A group was included immunized SC with two doses of 100 μ g of total IDE8 tick cell proteins per dose in Freund's incomplete adjuvant.

All 9 protective cDNA pools gave positive results in the secondary screen (data not shown). The tick infestation levels were higher in this experiment (average 85 ± 6 and 84 ± 3 larvae/mouse for cDNA-immunized and control mice, respectively; $P > 0.05$). Nevertheless, the average number of engorged larvae recovered per mouse was 39 ± 7 and 26 ± 6 for control and cDNA-immunized mice, respectively ($P < 0.05$). The group immunized with total IDE8 tick cell proteins was protected with $I=33\%$. Again, no reduction was observed in the number of larvae collected from mice that received the control cDNA (F2 negative pool after the primary screen; Fig. 2A) compared to saline-immunized controls.

In the secondary screen, molting of engorged larvae was evaluated after 34 days. Molting was affected in all but one test cDNA-immunized group. Inhibition of molting in test cDNA-immunized mice compared to the control cDNA-immunized group varied from 0% to 12% ($6 \pm 4\%$). The inhibition of molting was higher than 50% only in the larvae collected from mice immunized with cDNA pools B5 and A10, which showed a retardation of larval development in 1 to 2 days as in the primary screen. No differences were observed between control cDNA and saline-immunized mice. Among the larvae that did not molt to nymph, some were visibly damaged and

presented a strong red coloration. The percent of red larvae in cDNA-immunized mice varied between 3% to 18 % ($7\pm5\%$) while in the saline and control cDNA-immunized groups red larvae represented the 6% and 4%, respectively.

Tertiary screen

For the tertiary screen, 64 clones were grouped in 16 sub-pools each containing 1 to 17 plasmids according to the predicted function of encoded proteins (e.g., all the plasmids that encoded histone proteins were grouped together) and used with 4 sub-pools containing 182 clones of unknown function or with sequences without homology to sequence databases to immunize 4 mice per group. Mice were immunized with 0.3 μ g/plasmid/dose in 50 μ l PBS and evaluated as described above. Control mice were immunized with a pool of 20 plasmids containing mitochondrial cDNAs.

Tick infestation levels were similar in all test groups (72 ± 2 larvae/mouse) and in control mice (69 ± 2 larvae/mouse) ($P>0.05$). The number of engorged larvae recovered per mouse was also similar between test (16 ± 7) and control (14 ± 6) mice ($P>0.05$). However, the groups immunized with cDNA sub-pools containing clones with putative endopeptidase, nucleotidase, ribosomal proteins, heat shock proteins, glutamine-alanine-rich proteins and 3 of the sub-pools with unknown function or with sequences without homology to sequence databases had $\geq 15\%$ (Fig. 3). Furthermore, among them, the groups immunized with sub-pools containing clones with a putative endopeptidase, nucleotidase and two of the cDNA sub-pools with unknown function or with sequences without homology to sequence databases resulted in lower infestation levels compared to control mice ($P\leq 0.05$) and $\geq 40\%$ (Fig. 3). Clones homologous to chorion proteins, vitellogenin receptors, and peptidoglycan recognition

proteins were selected for their potential protection capacity in other stages of tick development.

Statistical analysis

The number of larvae attached per mouse and the number of engorged larvae recovered per mouse 7 days after infestation were compared by Analysis of Variance (ANOVA) followed by a series of Tukey's *post-hoc* tests for pair comparisons between cDNA-immunized and control vector DNA-immunized mice (primary screen), and by Student's t-test between mice immunized with positive cDNA pools and the control negative F2 cDNA pool (secondary screen) or between test cDNA sub-pools-immunized and control mice immunized with mitochondrial cDNAs (tertiary screen).

Example 2: Sequence analysis of protective clones

All the 351 cDNA clones in the 9 pools that resulted positive in the secondary screen were sequenced. DNA from individual clones in these pools was purified (Wizard SV 96 plasmid DNA purification system, Promega) from the master plate and partially sequenced. In most cases a sequence larger than 700 nucleotides was obtained. Nucleotide sequences were analyzed using the program AlignX (Vector NTI Suite V 5.5, InforMax, North Bethesda, MD, USA). BLAST (Altschul et al., 1990) was used to search the NCBI databases to identify previously cloned sequences that may have homology to those that we sequenced. Sequence analysis allowed grouping the clones according to sequence identity to DNA databases and predicted protein function. The protective clones selected after the tertiary screen were fully sequenced.

Comparison to sequence databases permitted to identify sequence identity to previously reported genes with known function in 152 (43%) of the clones (Table 2).

Fifty seven percent of the sequences were homologous to genes with unknown function or had no significant identity to previously reported sequences (Table 2). Of the clones with sequence identity to genes with known function, 85% were homologous to arthropod sequences. Ninety-three clones (61%) contained sequences homologous to *Drosophila melanogaster*, 5 (3%) to other insects and 32 (21%) to Ixodid tick species. Thirty percent of the clones were eliminated from further analysis based on their sequence identity, including those containing similar sequences (Table 2). The protective clones included antigens homologous to endopeptidases, nucleotidases, chorion proteins, vitellogenin receptors, peptidoglycan recognition proteins, glutamine-alanine rich proteins, ribosomal proteins, and heat-shock proteins.

Summary of results

The results obtained with the various protective clones identified in the Sequence Listing, along with certain selected expressed proteins, are summarized in Table 4.

SEQ ID NO:1 denotes the clone designated 4E6, wherein the relevant protein encoding fragment has been identified as comprising residues 1-117, which encodes the polypeptide shown in SEQ ID NO: 2.

SEQ ID NO:3 denotes the clone designated 4D8, wherein the relevant protein encoding fragment has been identified as comprising residues 80-575, which encodes the polypeptide shown in SEQ ID NO: 4.

SEQ ID NO:5 denotes the clone designated 4F8, wherein the relevant protein encoding fragment has been identified as comprising residues 1-951, which encodes the polypeptide shown in SEQ ID NO: 6.

SEQ ID NO:7 denotes the clone designated 4G11, wherein the relevant protein encoding fragment has been identified as comprising residues 1-697, which encodes the polypeptide shown in SEQ ID NO: 8.

SEQ ID NO:9 denotes the clone designated 4D6, wherein the relevant protein encoding fragment has been identified as comprising residues 198-1025, which encodes the polypeptide shown in SEQ ID NO: 10.

SEQ ID NO:11 denotes the clone designated 3E1, wherein the relevant protein encoding fragment has been identified as comprising residues 3-578, which encodes the polypeptide shown in SEQ ID NO: 12.

SEQ ID NO:13 denotes the clone designated 1C10, wherein the relevant protein encoding fragment has been identified as comprising residues 1-1119, which encodes the polypeptide shown in SEQ ID NO: 14.

SEQ ID NO:15 denotes the clone designated 3E10, wherein the relevant protein encoding fragment has been identified as comprising residues 51-1544, which encodes the polypeptide shown in SEQ ID NO: 16.

SEQ ID NO:17 denotes the clone designated 4F11, wherein the relevant protein encoding fragment has been identified as comprising residues 31-2295, which encodes the polypeptide shown in SEQ ID NO: 18.

SEQ ID NO:19 denotes the clone designated 3C12, wherein the relevant protein encoding fragment has been identified as comprising residues 6-332, which encodes the polypeptide shown in SEQ ID NO: 20.

SEQ ID NO:21 denotes the clone designated 2C12, wherein the relevant protein encoding fragment has been identified as comprising residues 3-137, which encodes the polypeptide shown in SEQ ID NO: 22.

SEQ ID NOS: 22, 23 AND 24, denote, respectively, clones 1A9, 1B2 and 4A4, each comprising a partial sequence with no associated polypeptide.

* * * * *

As noted above, the present invention relates to the sequences identified in the Sequence Listing. More generally, the invention concerns the given cDNA sequences and any nucleotide sequence coding for a protein which is capable of eliciting an antibody or other immune response (e.g., T-cell response of the immune system) which recognizes an epitope(s) of the amino acid sequences depicted in the Sequence Listing, including less than the full cDNA sequences and mutants thereof. Hence the nucleotide sequence may encode a protein which is the entire antigen encoded by the variously identified bases, or a fragment or derivative of the antigen or a fusion product of the antigen or fragment and another protein, provided that the protein which is produced from such sequence is capable of eliciting an antibody or other immune response which recognizes an epitope(s) of the given amino acid sequences.

As a result, the invention encompasses DNA sequences which encode for and/or express in appropriate transformed cells, proteins which may be the full length antigen, antigen fragment, antigen derivative or a fusion product of such antigen, antigen fragment or antigen derivative with another protein.

Proteins included within the present invention have an amino acid sequence depicted in the Sequence Listing. Other included proteins consist of a fragment of said sequence capable of eliciting an antibody or other immune response which recognizes an epitope(s) of the amino acid sequences depicted and a mutant of said sequence capable of eliciting an antibody or other immune response which recognizes an epitope(s) of such amino acid sequences.

The nucleotide sequences may be inserted into any of a wide variety of expression vectors by a variety of procedures. Such procedures and others are deemed to be known by those skilled in the art. Suitable vectors include chromosomal, nonchromosomal and synthetic DNA sequences; e.g., derivatives of SV40; bacterial plasmids; phage DNAs; yeast plasmids; vectors derived from combinations of plasmids and phage DNAs, viral DNA such as baculovirus, vaccinia, adenovirus, fowl pox virus, pseudorabies, etc. The appropriate DNA sequence must be operatively linked in the vector to an appropriate expression control sequence(s) (promoter) to direct mRNA synthesis. As representative examples of such promoters, there may be mentioned LTR or SV40 promoter, the *E. coli* lac or trp, the phage lambda PL promoter and other promoters known to control expression of genes in prokaryotic and eukaryotic cells or their viruses. The expression vector also includes a non-coding sequence for a ribosome binding site for translation initiation and a transcription terminator. The vector may also include appropriate sequences for amplifying expression.

The vector containing the appropriate cDNA sequence as hereinabove described, as well as an appropriate promoter or control sequence, may be employed to transform an appropriate host to permit the host to express the protein. Examples of host organisms and cells include bacterial strains (e.g., *E. coli*, *Pseudomonas*, *Bacillus*, *Salmonella*, etc.), fungi (e.g., yeasts and other fungi), animal or plant hosts (e.g., mouse, swine or animal and human tissue cells). The selection of the host is deemed to be within the scope of those skilled in the art.

It is also understood that the appropriate cDNA sequence present in the vector when introduced into a host may express part or only a portion of the protein which is encoded within the noted terminology, it being sufficient that the expressed protein be

capable of eliciting an antibody or other immune response which recognizes an epitope(s) of the listed amino acid sequences.

The isolated cDNAs and/or polypeptide expressed by the host transformed by the vector may be harvested by methods which will occur to those skilled in the art and used in a vaccine for protection of a mammal, such as a bovine, swine, human, etc., against infestations of *Ixodes* species. Such protective recombinant proteins and/or modified cDNAs are used in an amount effective to induce an immune response against *Ixodes* species ticks and their associated pathogens and may be used in combination with a suitable physiologically acceptable carrier. The term "inducing an immune response" when used with respect to the vaccine described herein means that the vaccine prevents disease associated with a particular tick species or reduces the severity of the disease.

The carrier employed in conjunction with vaccine may be any one of a wide variety of carriers. As representative examples of suitable carriers, there may be mentioned mineral oil, synthetic polymers, etc. Carriers for vaccines are well known in the art and the selection of a suitable carrier is deemed to be within the scope of those skilled in the art. The selection of a suitable carrier is also dependent upon the manner in which the vaccine is to be administered.

The present invention provides a method of immunizing a susceptible mammal, against infestations and disease caused by *Ixodes* species with the vaccine described above. For purposes of this invention, the vaccine is administered in an effective amount. The vaccine may be administered by any of the methods well known to those skilled in the art, for example, by intramuscular, subcutaneous, intraperitoneal or intravenous injection. Alternatively, the vaccine may be administered intranasally or orally. It is also to be understood that the vaccine may

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include active components, such as tick-borne pathogen components or adjuvants in addition to the antigen(s) or fragments hereinabove described.

The host expressing the antigen may itself be used to deliver antigen to non-human animals, by introducing killed or viable host cells that are capable of propagating in the animal. Direct incorporation of the cDNA sequences into host cells may also be used to introduce the sequences into animal cells for expression of antigen *in vivo*.

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Table 1. Primary screen of the *I. scapularis* cDNA library by ELI in mice.

Experimental group ^a	Number of pools screened (Number of clones)	Average±SD number of larvae attached per mouse ^b	Average±SD number of engorged larvae per mouse ^c	Average±SD inhibition of tick infestation (I) ^d	Number of pools selected for the secondary screen
Experiment 1	33 (1383)	50±13 (33-80)	9±3 (2-42)	39±55% (-183 - 87%)	6 (>75%)
Vector DNA-immunized controls for experiment 1	---	56±13 (45-67)	16±4 (5-27)	---	---
Experiment 2	33 (1322)	56±15 (29-79)	13±4 (1-27)	27±28% (-53 - 89%)	3 (>60%)
Vector DNA-immunized controls for experiment 2	---	54±18 (36-73)	17±3 (6-28)	---	---

^aNinety six LBA plates containing an average of 41 cDNA clones per plate were prepared. Replicas were made and clones from each plate were pooled, inoculated, grown for 2 hr in a 96 wells plate and plasmid DNA purified from each pool for ELI. Three mice per group were each immunized IM twice with 1 µg DNA/dose in 50 µl PBS two weeks apart. Two groups of 3 mice each were included as controls. One group was injected with vector DNA and the second with saline only.

^bFifteen days after the last immunization, mice were infested with 100 *I. scapularis* larvae per mouse. Twelve hrs later, larvae that did not attach were counted to calculate the number of attached larvae per mouse and mice were transferred to new cages.

^cEngorged larvae dropping from each mouse were collected daily and counted after 7 days.

^dThe inhibition of tick infestation (I) for each test group was calculated with respect to vector-immunized controls as $[1 - (RL_n/RL_c \times RL_i/RL_{in})] \times 100$, where RL_n is the average number of replete larvae recovered per mouse for each test group, RL_c is the average number of replete larvae recovered per mouse for control group, RL_i is the average number of larvae attached per mouse for control group, and RL_{in} is the average number of larvae attached per mouse for each test group.

Table 2. Classification of the clones in protective pools by putative protein function according to identity to sequence databases.

Putative protein Function	Number of clones
Biosynthetic ^a	2
Catabolism	4
Cell adhesion	2
Cell cycle ^a	2
Cytoskeletal ^a	8
Defense	2
DNA structure or replication ^a	3
Extracellular matrix	3
Endocytosis	2
Energy metabolism	10
Homeostasis	2
Morphogenetic	9
Mitochondrial ^a	34
Protein synthesis or processing ^{a,b}	34
RNA synthesis or processing ^a	7
Heat-shock proteins	4
Signal transduction	16
Transport	8
Unknown	199
Total	351

^aEliminated from further screening of protective antigens. Other clones were eliminated for containing similar sequences.

^bExcept for ribosomal proteins.

Table 3. Grouping of the clones according to the predicted function of encoded proteins in sub-pools for the tertiary screen.

Sub-pool (No. of clones)	Clone	Pool*
Ribosomal (17)	1A2, 1A10, 1C11	A5
	1F6	D1
	2B8	A10
	2F8, 2F10	E8
	3A10, 2C3, 3D2, 3D10	B4
	3G9, 3G10	E3
	4D11, 4D12, 4E7, 4F7	F1
Membrane protein (7)	1D8, 1D11, 1E10	D1
	2B12	A10
	2H5	E8
	3C9	B4
	3G11	E3
ATPase (6)	1A9, 1B2, 1C9	A5
	2C9	A10
	4A4	C3
	4G12	F1
Cell channel/Transporter (5)	1F4	D1
	2H11	E8
	4A12	C3
	4G10, 4G11	F1
Early development-specific (4)	1C8	A5
	3F4	E3
	4C7	C3
	4G9	F1
G protein-coupled receptor (4)	2B7, 2C12	A10
	2F12	E8
	4C9	C3
Growth factor receptor (3)	2E8	B5
	3B8, 3C8	B4
Lectin (3)	3E10	E3
	4B8, 4C8	C3
Vitellogenin (3)	1F12	D1
	4A6	C3
	4G2	F1
Heat shock (3)	1C10	A5
	1F10	D1
	3F6	E3
EGF-like (2)	2H4	E8
	4C10	C3
Secreted protein (2)	2F9	E8
	3C12	B4
Glutamine-Alanine rich (2)	4D6, 4E6	F1
Adaptin (1)	3E1	E3
Endopeptidase (1)	4D8	F1
Nucleotidase (1)	4F8	F1

*cDNA pools refer to positive pools after primary and secondary screens (Fig. 2A and 2B).

Table 4: Summary of results with *I. scapularis* cDNA clones.

cDNA clone	Predicted Protein	Inhibition of tick infestation I (%)	Inhibition of molting M (%)	Efficacy E (%)
4D8	Endopeptidase	40*/54**	7*/8**	44*/58**
4F8	Nucleotidase	50*/64**	17*/9**	58*/61**
1C10	HSP70	17*	ND	ND
4D6	Glu-Ala-rich	61*	11	66*
4E6	Glu-Ala-rich	20*/46**	16**	55**
3E1	β-adaptin (appendage region)	27*	5*	31*
2C12	Beta-amyloid precursor protein (APP)	-8***	ND	ND
4F11	Block of proliferation Bop1	-39***	ND	ND
3E10	Mannose binding lectin	-48*/-10***	ND	ND
4G11	Chloride channel	38***	30	57
3C12	RNA polymerase III	-104***	ND	ND
1A9, 1B2, 4A4	ATPase	-57***	ND	ND

Mice were immunized with cDNA-containing expression plasmid DNA as described above (*) or with 100 µg/dose of recombinant protein expressed in *E. coli* (**). I, M and E were calculated as described above. ND, not determined.

***Resulted in a pro-feeding activity. This effect could be due to the expression of cDNAs encoding for tick immunosuppressants, anticoagulants and other proteins with low antigenicity and a pro-feeding activity. Alternatively, they could encode for proteins homologous to host proteins with anti-tick activity, which neutralization results in a tick pro-feeding activity.

In view of the above, it will be seen that the several objectives of the invention are achieved and other advantageous results attained. As various changes could be made in the above DNA molecules, proteins, etc. without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. While the invention has been described with a certain degree of particularity, it is understood that the invention is not limited to the embodiment(s) set forth herein for purposes of exemplification, but is to be limited only by the scope of the attached claim or claims, including the full range of equivalency to which each element thereof is entitled.

WHAT IS CLAIMED IS:

1. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 1-117 of SEQ ID NO: 1.
2. An expression vector comprising the isolated cDNA molecule of claim 1.
3. An isolated cell transformed by the expression vector of claim 2.
4. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 1, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 1, and (iii) a combination of the isolated cDNA molecule of claim 1 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.
5. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 4.
6. The polypeptide encoded by the isolated cDNA molecule of claim 1.
7. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 80-575 of SEQ ID NO: 3.
8. An expression vector comprising the isolated cDNA molecule of claim 7.
9. An isolated cell transformed by the expression vector of claim 8.
10. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of

claim 7, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 7, and (iii) a combination of the isolated cDNA molecule of claim 7 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

11. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 10.

12. The polypeptide encoded by the isolated cDNA molecule of claim 7.

13. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 10-951 of SEQ ID NO: 5.

14. An expression vector comprising the isolated cDNA molecule of claim 13.

15. An isolated cell transformed by the expression vector of claim 14.

16. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 13, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 13, and (iii) a combination of the isolated cDNA molecule of claim 13 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

17. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 16.

18. The polypeptide encoded by the isolated cDNA molecule of claim 13.

19. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 1-697 of SEQ ID NO: 7.

20. An expression vector comprising the isolated cDNA molecule of claim 19.
21. An isolated cell transformed by the expression vector of claim 20.
22. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 19, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 19, and (iii) a combination of the isolated cDNA molecule of claim 19 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.
23. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 22.
24. The polypeptide encoded by the isolated cDNA molecule of claim 19.
25. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 198-1025 of SEQ ID NO: 9.
26. An expression vector comprising the isolated cDNA molecule of claim 25.
27. An isolated cell transformed by the expression vector of claim 26.
28. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 25, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 25, and (iii) a combination of the isolated cDNA molecule of claim 25 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

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29. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 28.

30. The polypeptide encoded by the isolated cDNA molecule of claim 25.

31. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 3-578 of SEQ ID NO: 11.

32. An expression vector comprising the isolated cDNA molecule of claim 31.

33. An isolated cell transformed by the expression vector of claim 32.

34. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 31, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 31, and (iii) a combination of the isolated cDNA molecule of claim 31 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

35. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 34.

36. The polypeptide encoded by the isolated cDNA molecule of claim 31.

37. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 1-1119 of SEQ ID NO: 13.

38. An expression vector comprising the isolated cDNA molecule of claim 37.

39. An isolated cell transformed by the expression vector of claim 38.

40. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 37, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 37, and (iii) a combination of the isolated cDNA molecule of claim 37 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

41. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 40.

42. The polypeptide encoded by the isolated cDNA molecule of claim 37.

43. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 51-1544 of SEQ ID NO: 15.

44. An expression vector comprising the isolated cDNA molecule of claim 43.

45. An isolated cell transformed by the expression vector of claim 44.

46. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 43, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 43, and (iii) a combination of the isolated cDNA molecule of claim 43 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

47. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 46.

48. The polypeptide encoded by the isolated cDNA molecule of claim 43.

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49. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 31-2295 of SEQ ID NO: 17.

50. An expression vector comprising the isolated cDNA molecule of claim 49.

51. An isolated cell transformed by the expression vector of claim 50.

52. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 49, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 49, and (iii) a combination of the isolated cDNA molecule of claim 49 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

53. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 52.

54. The polypeptide encoded by the isolated cDNA molecule of claim 49.

55. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 6-332 of SEQ ID NO: 19.

56. An expression vector comprising the isolated cDNA molecule of claim 55.

57. An isolated cell transformed by the expression vector of claim 56.

58. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 55, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 55,

and (iii) a combination of the isolated cDNA molecule of claim 55 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

59. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 58.

60. The polypeptide encoded by the isolated cDNA molecule of claim 55.

61. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 3-137 of SEQ ID NO: 21.

62. An expression vector comprising the isolated cDNA molecule of claim 61.

63. An isolated cell transformed by the expression vector of claim 62.

64. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 61, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 61, and (iii) a combination of the isolated cDNA molecule of claim 61 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

65. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 64.

66. The polypeptide encoded by the isolated cDNA molecule of claim 61.

67. An isolated cDNA molecule comprising a nucleotide sequence of that show in SEQ ID NO: 23.

68. An expression vector comprising the isolated cDNA molecule of claim 67.

69. An isolated cell transformed by the expression vector of claim 68.
70. A vaccine comprising an effective immunizing amount of the isolated cDNA molecule of claim 67 and a pharmaceutically acceptable carrier or diluent.
71. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 70.
72. An isolated cDNA molecule comprising a nucleotide sequence of that shown in SEQ ID NO: 24.
73. An expression vector comprising the isolated cDNA molecule of claim 72.
74. An isolated cell transformed by the expression vector of claim 73.
75. A vaccine comprising an effective immunizing amount of the isolated cDNA molecule of claim 72 and a pharmaceutically acceptable carrier or diluent.
76. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 75.
77. An isolated cDNA molecule comprising a nucleotide sequence of that shown in SEQ ID NO: 25.
78. An expression vector comprising the isolated cDNA molecule of claim 77.
79. An isolated cell transformed by the expression vector of claim 78.
80. A vaccine comprising an effective immunizing amount of the isolated cDNA molecule of claim 77 and a pharmaceutically acceptable carrier or diluent.

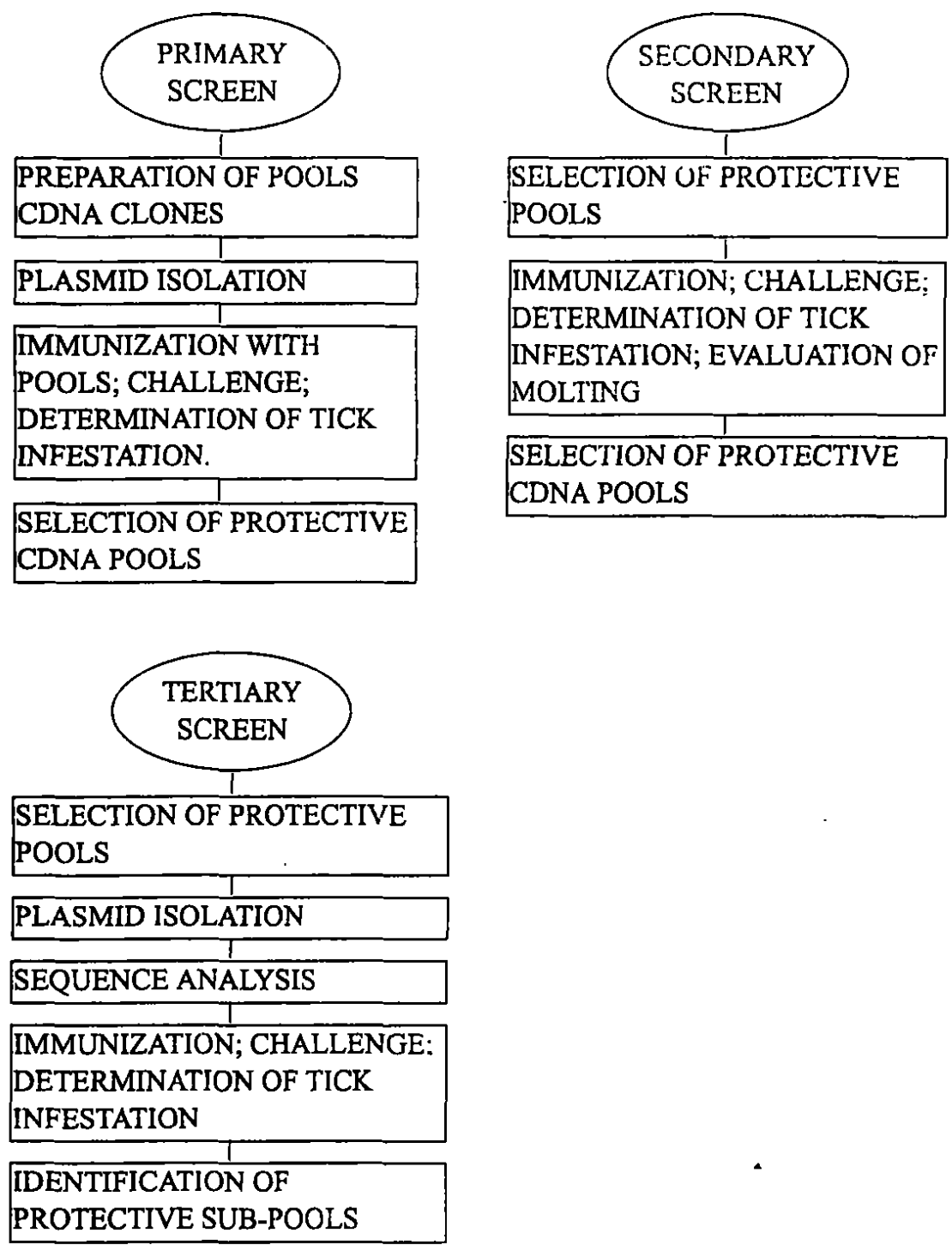
81. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 80.

ABSTRACT OF THE DISCLOSURE

Protective antigens against infestations with *Ixodes* spp. ticks, gene sequences and encoded proteins for such antigens, related vaccines and methods useful to induce an immune response, which are protective to interfere with infestations by *Ixodes* spp. ticks.

#202976.1

FIG. 1



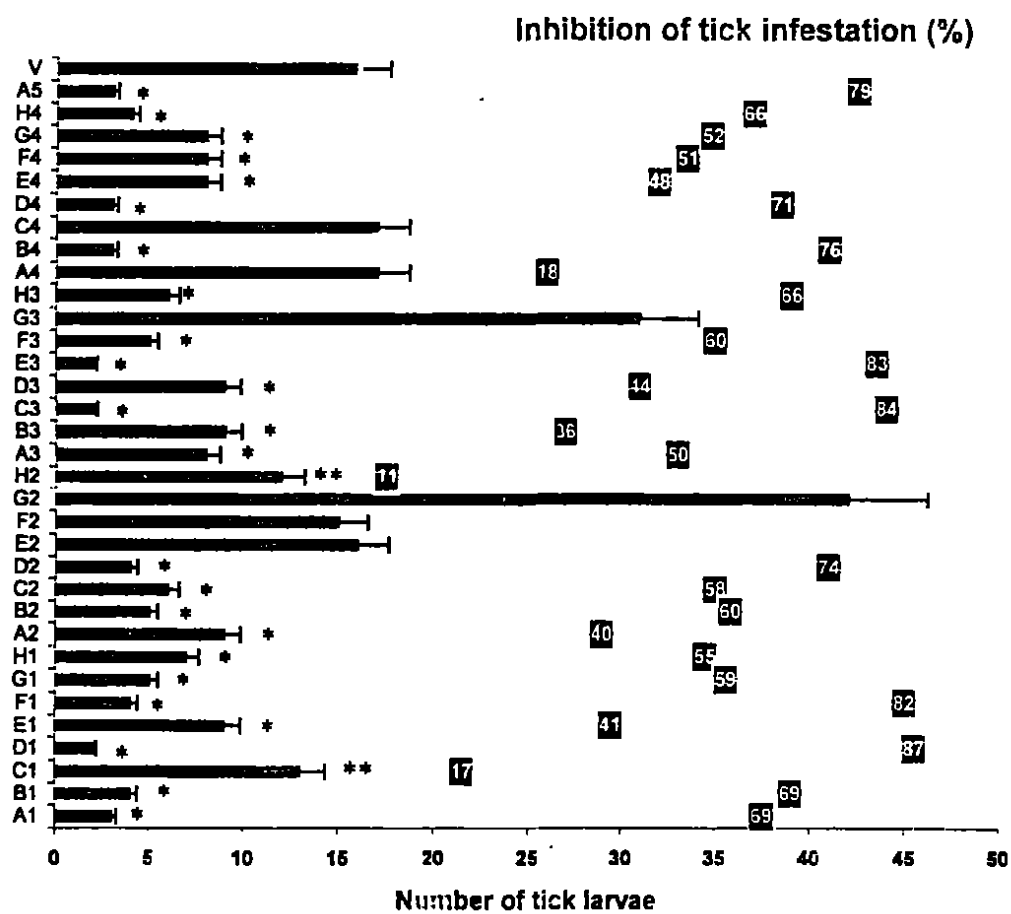


FIG. 2A

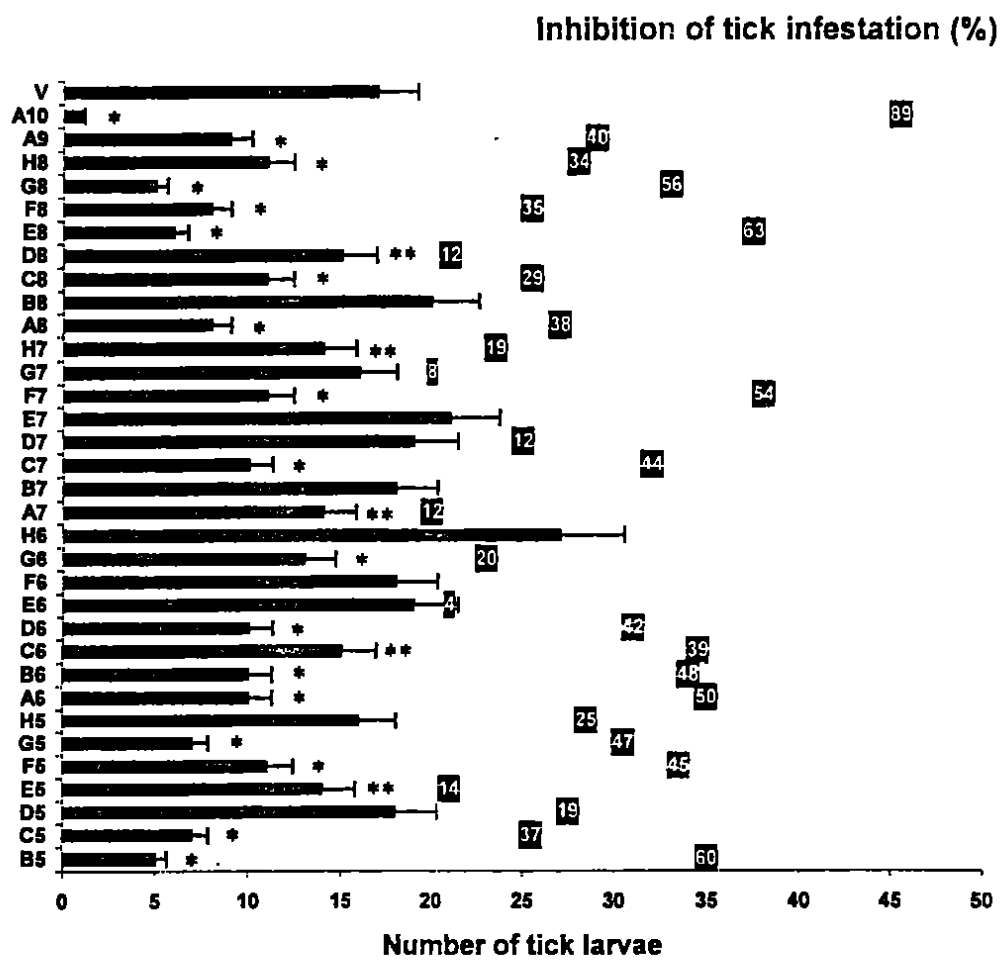


FIG. 2B

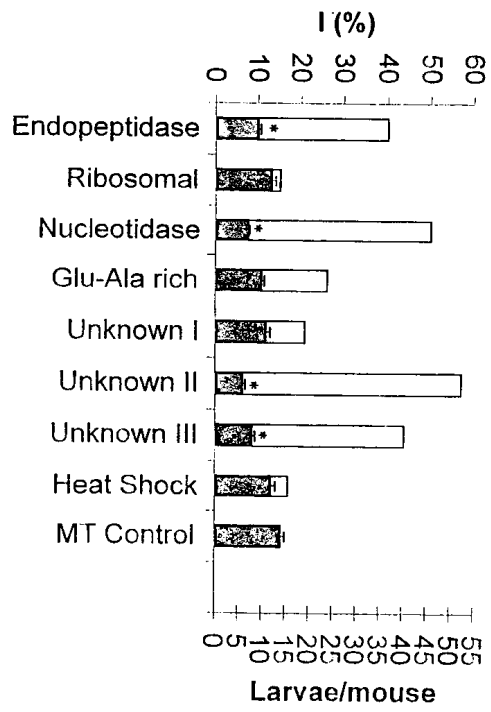


FIG. 3

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tttgaaacat accctgtcct taccaacctt caaacatttt tttttgngcc tgcttaaaaag 1500
catttacatt gcttgatcgt tgaattaatt ttttagctga tgtaaggac acttataata 1560
attaaggaaa tgagatcgat cttgagcttg tttngcctc tgtaanaatt gatgctcttt 1620
canacctaat gcttaatgca acaataatta tcaagtaatc cttactcagj tgtcagatat 1680
gcaagcagat gccaatgctt ctgttcattg agtggcaaaa ggcattgctc tttgtcacat 1740
tgcatgcatt tatgacagcc cnccttaata aactataatg cagctaant gaaaaaaaaa 1800
aaaaaaaaaa aaaaaaaaaa a 1821

<210> 6
<211> 316
<212> PRT
<213> Ixodes scapularis

<400> 6

Met Ala Ser Cys Gly Ala Ser Ala Thr Gly Pro Leu Val Leu Arg Val
1 5 10 15

Ile Ser Asn Thr Val Lys Ile Val Asn Ser Ala Gly Lys Ile Ile Lys
20 25 30

Asp Ile Met Asn Ser Gly Asn Leu Gly Ile Val Glu Lys Glu Gly Ile
35 40 45

Fuente2.ST25.txt

Asn Asp Leu Gln Thr Glu Ala Asp Arg Ser Val Gln Arg Cys Ile Val
50 55 60

Thr Ser Leu Ser Arg Gln Phe Pro Lys Leu Thr Ile Ile Gly Glu Glu
65 70 75 80

Thr Leu Glu Glu Lys Lys Ile Ser Asp Asp Trp Ile Ile Thr Glu His
85 90 95

Asp Lys Asp Val Leu Ala Thr Ser Leu Pro Asp Asn Leu Lys Asn Ile
100 105 110

Lys Glu Glu Asp Leu Val Val Trp Val Asp Pro Leu Asp Gly Thr Lys
115 120 125

Glu Tyr Thr Gln Gly Phe Leu Asp His Val Thr Ile Leu Val Gly Ile
130 135 140

Ala Val Asp Gly Lys Ala Val Gly Gly Val Ile His Gln Pro Tyr Tyr
145 150 155 160

Asn Tyr Gln Val Glu Lys Asp Val Tyr Lys Gln Gly Arg Thr Met Trp
165 170 175

Gly Ile Val Gly Val Gly Ala Phe Gly Ile Ser Arg Ile Ala Pro Pro
180 185 190

Glu Asn Lys Arg Ile Ile Thr Thr Thr Arg Ser His Ser Ser Pro Thr
195 200 205

Ile Asn Ser Cys Ile Glu Ala Met Asn Pro Asp Glu Val Leu Arg Val
210 215 220

Gly Gly Ala Gly His Lys Val Leu Leu Leu Ile Glu Gly Lys Ala His
225 230 235 240

Ala Tyr Val Phe Pro Ser Lys Gly Cys Lys Lys Trp Asp Thr Cys Ala
245 250 255

Pro Glu Ala Ile Leu His Ala Thr Gly Gly Leu Leu Thr Asp Val His
260 265 270

Gly Asn Arg Leu Glu Tyr His Lys Asp Val Glu His Val Asn Ala Gly
275 280 285

Gly Val Leu Ala Thr Cys Leu Lys Glu Gln His Glu Trp Phe Lys Asn
290 295 300

His Ile Pro Glu Asp Val Arg Lys Thr Leu Pro Leu
305 310 315

69
132

Fuente2.ST25.txt

<210> 7
<211> 697
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (573)..(573)
<223> n is a, c, g, or t

<400> 7
gacctcaagg aaggcatctg cccgcaggcc ttctggctca acaaggagca gtgttgctgg 60
gcctccaacg ataccttctt taagggggac gactgcaagc agtggatctg gtggcccgag 120
atgttcgaca gcggcatgga caaggacggg gcaggctttt acctgctctc ctacctgctg 180
tacgtcatgt ggagtgtgct cttcgccacc ctggccgtca tgctcgttcg caccttcgcg 240
ccctatgcct gtggatctgg aatcccggag atcaagacga ttctgagcgg cttcatcatc 300
cgcggtacc tgggcaagtg gacgctgacc atcaaatacag tgtgtctggt gctggccgtc 360
ggggcgggcc tcagcctggg caaagagggg cccctggtgc acgtggcctg ctgcatcggg 420
aacatcttct cctacctctt cccaagtac ggcaagaatg aggccaagaa gagggagatc 480
ctgtcggctg ccgccgccgc gggagtttct gtggcctttg gggctcccat cggcgggtgtt 540
ctcttcagcc tcgaagaggt gagctactac ttnccttga agacgctgtg gcgttccttc 600
ttctgcgcc cgggtggcagc ctggtgctg cgctccatca acccctttgg caacgaccac 660
ctggtgatgt tctacgtcga gtacgacttt ccctggc 697

<210> 8
<211> 232
<212> PRT
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (191)..(191)
<223> Xaa can be any naturally occurring amino acid

<400> 8

Asp Leu Lys Glu Gly Ile Cys Pro Gln Ala Phe Trp Leu Asn Lys Glu
1 5 10 15

Gln Cys Cys Trp Ala Ser Asn Asp Thr Phe Phe Lys Gly Asp Asp Cys
20 25 30

Lys Gln Trp Tyr Arg Trp Pro Glu Met Phe Asp Ser Gly Met Asp Lys
35 40 45

Asp Gly Ala Gly Phe Tyr Leu Leu Ser Tyr Leu Leu Tyr Val Met Trp
50 55 60

Ser Val Leu Phe Ala Thr Leu Ala Val Met Leu Val Arg Thr Phe Ala
65 70 75 80

Fuente2.ST25.txt

Pro Tyr Ala Cys Gly Ser Gly Ile Pro Glu Ile Lys Thr Ile Leu Ser
85 90 95

Gly Phe Ile Ile Arg Gly Tyr Leu Gly Lys Trp Thr Leu Thr Ile Lys
100 105 110

Ser Val Cys Leu Val Leu Ala Val Gly Ala Gly Leu Ser Leu Gly Lys
115 120 125

Glu Gly Pro Leu Val His Val Ala Cys Cys Ile Gly Asn Ile Phe Ser
130 135 140

Tyr Leu Phe Pro Lys Tyr Gly Lys Asn Glu Ala Lys Lys Arg Glu Ile
145 150 155 160

Leu Ser Ala Ala Ala Ala Ala Gly Val Ser Val Ala Phe Gly Ala Pro
165 170 175

Ile Gly Gly Val Leu Phe Ser Leu Glu Glu Val Ser Tyr Tyr Xaa Pro
180 185 190

Leu Lys Thr Leu Trp Arg Ser Phe Phe Cys Ala Leu Val Ala Ala Ser
195 200 205

Val Leu Arg Ser Ile Asn Pro Phe Gly Asn Asp His Leu Val Met Phe
210 215 220

Tyr Val Glu Tyr Asp Phe Pro Trp
225 230

<210> 9
<211> 1221
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (713)..(713)
<223> n is a, c, g, or t

<400> 9
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atatcaattt ttctgtaaat tagaaatgta accaatggcg tggctatctt ctagtcgaca 120
ctaacgtctc ggatctgctg ttcaaagtcc cgggcgatca agccgtatctt gttgtccagc 180
tgccaagtgc gtcgaatatg atgccgaaaa agaaagaatc agtcgcgagc tctaaagaag 240
acgcgccgat cgacgtgacg ggcttgcctt cccacaaacg acacaagaag cacaagcaca 300
aaaagtcacaa gcgcaagcga ggcacggacc aagacgaaga ccaatcgccc gccgagagcc 360
cgcagagcgg tggcgagggt agcagcagca agccccgcgt caagctcaag atcaagatcg 420

71
139

Fuente2.ST25.txt

gcggacagac ggtcgagaag aacgtgacca agctgaaaca gcagcggccg ccgccgccgy 480
accctagcga agccgatctc gccgaactcc tgatgaaacc caactcgggc gatacgagcg 540
cagacagcga tgacgaagag gaagcctggc tcgaagccct cgagtccggc aggctcgaag 600
aggctcgacga cgagctccgc aaaatgaagg acccgaccct gatgacggcc aggcagcggg 660
ccctgctcga gagcaagtcg cagaaggacg aggtccccgc gacggggatg gcnggcgtcc 720
gcggagcccc tcaaagagat gtccgaggag atgattcagc ggcggatgct gcggggccaaa 780
aagcgggaagc agcaggccga agagaagaaa gagaaggaga agaagcagac gatcgagcgt 840
ctgctcaaga agtccgactc gaggctgagg gccagcaaga agttggccaa gaagagcgat 900
actcccaagg tgtcgttggc caacacgcag gcaggcacgc tgctctcggt tcccgtcggc 960
gttgcgttcc cgctgtcggc agccgtggcc caggggtacc ccgagaagac gacgtgcggc 1020
attaaggggt gtcgtaaccc gaagaagtac tcgtgctcca agacaggcgt gcccctgtgc 1080
agcctcgagt gctacaagac gaacatgctg cagatgtgcg tctgagcggg cagctaggct 1140
tccgggctac agctgctcct tgtgtatatg tatataaagt cgagaatgct gaaaaaaaaa 1200
aaaaaaaaaa aaaaaaaaaa a 1221

<210> 10
<211> 275
<212> PRT
<213> Ixodes scapularis
<400> 10

Met Met Pro Lys Lys Lys Glu Ser Val Ala Ser Ser Lys Glu Asp Ala
1 5 10 15
Pro Ile Asp Val Ile Gly Leu Pro Ser His Lys Arg His Lys Lys His
20 25 30
Lys His Lys Lys His Lys Arg Lys Arg Gly Thr Asp Gln Asp Glu Asp
35 40 45
Gln Ser Pro Ala Ala Ser Pro Gln Ser Gly Gly Glu Gly Ser Ser Ser
50 55 60
Lys Pro Ala Leu Lys Leu Lys Ile Lys Ile Gly Gly Gln Thr Val Glu
65 70 75 80
Lys Asn Val Thr Lys Leu Lys Gln Gln Arg Pro Pro Pro Pro Asp Pro
85 90 95
Ser Glu Ala Asp Leu Ala Glu Leu Leu Met Lys Pro Asn Ser Gly Asp
100 105 110
Thr Ser Ala Asp Ser Asp Asp Glu Glu Glu Ala Trp Leu Glu Ala Leu
115 120 125

Fuente2.ST25.txt

Glu Ser Gly Arg Leu Glu Glu Val Asp Asp Glu Leu Arg Lys Met Lys
130 135 140

Asp Pro Thr Leu Met Thr Ala Arg Gln Arg Ala Leu Leu Glu Ser Lys
145 150 155 160

Ser Gln Lys Asp Glu Val Pro Ala Thr Gly Met Ala Gly Val Arg Gly
165 170 175

Ala Arg Gln Arg Asp Val Arg Gly Asp Asp Ser Ala Ala Asp Ala Ala
180 185 190

Gly Gln Lys Ala Glu Ala Ala Gly Arg Arg Glu Glu Arg Glu Gly Glu
195 200 205

Glu Ala Asp Asp Arg Ala Ser Ala Gln Glu Val Arg Leu Glu Ala Glu
210 215 220

Gly Gln Gln Glu Val Gly Gln Glu Glu Arg Tyr Ser Gln Gly Val Ala
225 230 235 240

Gly Gln His Ala Gly Arg His Ala Ala Leu Val Ser Arg Arg Arg Cys
245 250 255

Val Pro Ala Val Gly Ser Arg Gly Pro Gly Val Pro Arg Glu Asp Asp
260 265 270

Val Arg His
275

- <210> 11
- <211> 1942
- <212> DNA
- <213> Ixodes scapularis

<400> 11
cgatgcagggc gatgacgggc tttgcggtgc agttcaacaa aaacagtttc gggctgactc 60
cagctcagcc gctgcagttg cagattcccc tgcagcccaa cttcccagct gatgcgagct 120
tgcagctggg aaccaacggt cccgtgcaga agatggaccc ctcaccaac cttcaggtgg 180
ccatcaagaa caatgtggac gtgttctact tcagctgcct ggtgcccatg cacgtgctga 240
gcacggagga cggcctgatg gacaagcggg tgttcctggc cacctggaaa gacatccccg 300
cccaaaacga ggtccagtac accctcgaca acgtcaacct cactgcagac caagtttccc 360
agaagctgca gaacaacaac attttcacga tagccaagag gaacgtggac ggccaggaca 420
tgctgtacca gtccctgaag ctaccaacg gcatttggtt gttggcggag ctcaagatac 480
agccccggcaa tccaaggatc acgttgtctt tgaagacaag agcacctgaa gtggcagcag 540
gtgtacaaca aacttacgaa ctattctac acagctgagg ctgctgtgaa tyaaactctt 600
ctccacccc cttcttttga tggcagtc aa tgtctcgtt cattttcttg ttttcttttg 660

73
136

Fuente2.ST25.txt

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cggcgtgcta cggaacaagg tcctacattc ccaagttata tgggtgttgc gcgtaggggg 720
cagagtgccg ctgagcccg cagagccttg tttctgagga gagccgaacg caccacttcg 780
aaaaagaaaa agtgaaaacg gaaaaatgaa aaattttcca gttgtttcaa attaacattc 840
ctcgtagtca gtctgtggcc gttgagtttg gtgtaaagaa gaaaaagggtg tctcttttag 900
tgaaaatggg tgctttttat tgggtatccc tatcacaccg agcacgaaca taagaaatcc 960
tgacaaggat tctccttttag ttgtattatg gtggctggag cacacgaggc acctgttgcc 1020
aattcgaccc agcaaatgcc caattctcaa gatttgaggt cattgagggt gttttgctcc 1080
tcccccccca ccccccaact ttgtcgttggt attgtctaac agtgtaaatg ggcgacgact 1140
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caacttatgt gcataattga ttttcacagg ctgcyacgca gtctgtaaaa gaaggggaag 1260
tgaaactctg ctccgccgct gctagtgtca tcacgggacg accatcgcggt tttctctgac 1320
tatttaaaca aaactgcata gcttaggggg cagtctgtgc aaagtggaac aaccaaactg 1380
agccctgccc tttcgggtgtg tgtacaagca tctctgtgta acatyaacta ctttacatga 1440
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tgtcaacaga ttagaaccat tttttggaac ggctggaaag ataaccgctc attttgtttc 1560
tactaaaaga ctacgaaaag tggtgacttt ttgcatcggt ttggcaacgt ttgtttggca 1620
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tactgtagtg tccattaaag agcgagagtt tggttaaagg ttgttaattg aggtccgtgt 1740
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gccctccaaa acatgcacat tttaagtgtg aattgttgcg gcggcttgta caagtatgtg 1860
tgttatgtgt agaaaaagaa ctcttaatta aaatatttgt ggccaaaacg tcaaaaaaaaa 1920
aaaaaaaaaa aaaaaaaaaa aa 1942

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<210> 12
 <211> 191
 <212> PRT
 <213> Ixodes scapularis

<400> 12

Met Gln Ala Met Thr Gly Phe Ala Val Gln Phe Asn Lys Asn Ser Phe
 1 5 10 15

Gly Leu Thr Pro Ala Gln Pro Leu Gln Leu Gln Ile Pro Leu Gln Pro
 20 25 30

Asn Phe Pro Ala Asp Ala Ser Leu Gln Leu Gly Thr Asn Gly Pro Val
 35 40 45

Gln Lys Met Asp Pro Leu Thr Asn Leu Gln Val Ala Ile Lys Asn Asn
 50 55 60

24
137

Fuente2.ST25.txt

Val Asp Val Phe Tyr Phe Ser Cys Leu Val Pro Met His Val Leu Ser
65 70 75 80

Thr Glu Asp Gly Leu Met Asp Lys Arg Val Phe Leu Ala Thr Trp Lys
85 90 95

Asp Ile Pro Ala Gln Asn Glu Val Gln Tyr Thr Leu Asp Asn Val Asn
100 105 110

Leu Thr Ala Asp Gln Val Ser Gln Lys Leu Gln Asn Asn Asn Ile Phe
115 120 125

Thr Ile Ala Lys Arg Asn Val Asp Gly Gln Asp Met Leu Tyr Gln Ser
130 135 140

Leu Lys Leu Thr Asn Gly Ile Trp Val Leu Ala Glu Leu Lys Ile Gln
145 150 155 160

Pro Gly Asn Pro Arg Ile Thr Leu Ser Leu Lys Thr Arg Ala Pro Glu
165 170 175

Val Ala Ala Gly Val Gln Gln Thr Tyr Glu Leu Ile Leu His Ser
180 185 190

<210> 13
<211> 1428
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (701)..(701)
<223> n is a, c, g, or t

<400> 13
cgcgccgtgc agaagctgcg tcgggaggtt gagaaggcaa agaggaccct gtccactgct 60
caccaggcca ggatcgagat tgaatcgttc ttcgagggag aggacttcag tgagaccctg 120
actcgtgcta agtttgagga gctgaacatg gaccttttcc gttccaccat gaagcctggt 180
cagaagggtac tcgaggatgg tgacctcaag aagactgatg tggacgagat tgtgcttgtc 240
ggagggttcca ccaggatccc caaggttcaa cagctgggtca aggagtctt caatggcaag 300
gaaccacccc gtggcatcaa ccccgacgaa gcagtcgcct acggtgccgc cgtgcaggct 360
ggagtcctcg gcggagagga agacactggg gacctcgtgc tgttggacgt gaaccctctg 420
accctcggca tcgagacagt gggaggcgtc atgacgaaac tgatcccccg taacacagtc 480
atccccacga agaagtctca gatcttctcc acggcctcgg acgagcagag cactgtcacc 540
atccaggtct ttgaggggga gcgtcccctg acaaaggaca accaccagct gggcaagttc 600
gacctgactg gcatccccacc tgctcctcga ggtgtgcccc aaatcgaggt gaccttcgag 660
attgacgtca acggtatcct gcgggtcagt gcagaggaca ngggtacagg caacaagcag 720

Fuente2.ST25.txt

aagatcacca tcaacaatga ccagaacagg ctgacgcctg aggacatcga gaggatggta 780
aaggacgccg aaaagtttgc cgacgaggac aagaaggtca aggagaaggt ggaggcccg 840
aacgaactgg agtcttatgc ctactccctc aagaaccaga ttggagacaa ggagaagatg 900
ggaggcaagc tctccgacga ggacaagaag actattgagc aagctgtgga cgagaaaatc 960
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tttcgttgta gtaacttaag ttatacagat gtcttctact ggggtgggctt tctccatgag 1380
tgggaggggg ctgggtgtca aataaaagtg tttctattaa aaaaaaaa 1428

<210> 14
<211> 372
<212> PRT
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (234)..(234)
<223> Xaa can be any naturally occurring amino acid

<400> 14

Arg Ala Val Gln Lys Leu Arg Arg Glu Val Glu Lys Ala Lys Arg Thr
1 5 10 15
Leu Ser Thr Ala His Gln Ala Arg Ile Glu Ile Glu Ser Phe Phe Glu
20 25 30
Gly Glu Asp Phe Ser Glu Thr Leu Thr Arg Ala Lys Phe Glu Glu Leu
35 40 45
Asn Met Asp Leu Phe Arg Ser Thr Met Lys Pro Val Gln Lys Val Leu
50 55 60
Glu Asp Gly Asp Leu Lys Lys Thr Asp Val Asp Glu Ile Val Leu Val
65 70 75 80
Gly Gly Ser Thr Arg Ile Pro Lys Val Gln Gln Leu Val Lys Glu Phe
85 90 95
Phe Asn Gly Lys Glu Pro Thr Arg Gly Ile Asn Pro Asp Glu Ala Val
100 105 110
Ala Tyr Gly Ala Ala Val Gln Ala Gly Val Leu Gly Gly Glu Glu Asp
115 120 125

Fuente2.ST25.txt

Thr Gly Asp Leu Val Leu Leu Asp Val Asn Pro Leu Thr Leu Gly Ile
130 135 140

Glu Thr Val Gly Gly Val Met Thr Lys Leu Ile Pro Arg Asn Thr Val
145 150 155 160

Ile Pro Thr Lys Lys Ser Gln Ile Phe Ser Thr Ala Ser Asp Glu Gln
165 170 175

Ser Thr Val Thr Ile Gln Val Phe Glu Gly Glu Arg Pro Leu Thr Lys
180 185 190

Asp Asn His Gln Leu Gly Lys Phe Asp Leu Thr Gly Ile Pro Pro Ala
195 200 205

Pro Arg Gly Val Pro Gln Ile Glu Val Thr Phe Glu Ile Asp Val Asn
210 215 220

Gly Ile Leu Arg Val Ser Ala Glu Asp Xaa Gly Thr Gly Asn Lys Gln
225 230 235 240

Lys Ile Thr Ile Asn Asn Asp Gln Asn Arg Leu Thr Pro Glu Asp Ile
245 250 255

Glu Arg Met Val Lys Asp Ala Glu Lys Phe Ala Asp Glu Asp Lys Lys
260 265 270

Val Lys Glu Lys Val Glu Ala Arg Asn Glu Leu Glu Ser Tyr Ala Tyr
275 280 285

Ser Leu Lys Asn Gln Ile Gly Asp Lys Glu Lys Met Gly Gly Lys Leu
290 295 300

Ser Asp Glu Asp Lys Lys Thr Ile Glu Gln Ala Val Asp Glu Lys Ile
305 310 315 320

Lys Trp Leu Glu Gln His Ser Asp Ala Asp Ala Glu Glu Leu Lys Glu
325 330 335

Gln Lys Lys Gln Leu Ala Asp Thr Val Gln Pro Ile Val Ala Lys Leu
340 345 350

Tyr Pro Ala Gly Gly Thr Pro Pro Pro Thr Asp Lys Asp Asp Ser Thr
355 360 365

Lys Asp Glu Leu
370

<210> 15
<211> 1847

77
140

Fuente2.ST25.txt

<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (1814)..(1814)
<223> n is a, c, g, or t

<400> 15
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cggtgatgaa ctgcctacgg actgcgcttt taggcgctct cgtcgtccaa ctctacgcc 120
cgcagatagg tcaccggaaa ttcgagtaca agtacagttt caagggaccc tacctggcgc 180
agaaggatgg atcgggtgcct ttctgggagt acggcgggcaa ttgcatcgcc agtgaggaga 240
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catcgttccc ttggtgggag gtggagctgg tgttccgcac cacgggtacg ggcaggatag 360
gagctgacgg cctggccttc tggtagacag acaagaagca ggcggagggt cctgtctttg 420
gaagcagcga caagtggact ggcctggcca tcttcttga ttccttcgac aatgataaca 480
agcacaacaa cccatacatc atgggcatgg tgaacgatgg aacaaaagcc tacgatcatg 540
agagtgacgg tgccaaccaa cagctagcgg gatgccagcg ggacttccgc aacaagcctt 600
accctgtcag ggccaagata gaatacttca acaacattct cacggtgctg ttccacaacg 660
gcaacaccaa caacgacggg gactacgaga tgtgcttccg tgcggagaac gtgttcctgc 720
cgaccaacgg ccactttggg gtgtccgccg ccacgggggg cctggcagac gaccacgacg 780
ccctcaagtt cctgacgacg agcctgcatg cggagggcac gcagccggcc ctggcccagg 840
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tggaaaagca gaaggaggag taccggaaga cgcacccgga ggaggccgct aagcaggcca 960
tggagcacgg ccccgagcag gcctacgaca cgcagcagca gcgcgagctg cgccagatct 1020
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aggtgctcgg gcgccaggag cgcaccctgt cgctggtgtc ggctggcggc gccggcgctg 1140
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cagagtcctt gctgagcagc cagcgggagc tgctgcagac ggtggctcag gtcaagagct 1260
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agggcctcac ggccgagcag ctgcaagtgc tccaccaggt gcgggacagc gtggccagca 1380
tgcaccggga cgtctccaac aaccagccgc agaggactgg ctgcgcgaca tcctgtctca 1440
gcactacca cttcttgctg ttgcaacgt tgcagttggc tgtcacgctg ggctacttgg 1500
tgtacaggag cagcaaagag gcggcgggca agaagttcta ctgagtgcag atctcgagcc 1560
ttgccttgcc ctcccctccc atggagtgga ccttaacccc acagactgcc agaaaccagt 1620
gttgccagag gagccccct cccttcttat tgggtggggg gccacagcca tcacccattc 1680
ttcgagacaa ggccactgtt tggggggagg ggcaagagat tcatccgggg tgcgcaacaa 1740

Fuente2.ST25.txt

aacatggccg tacagagggga ggggtgctcc agaactgggt cccagccaca tcgttgcggtg 1800

ggagcgcctt tctncctcac tctaaaaaaaa aaaaaaaaaa aaaaaaa 1847

<210> 16
<211> 497
<212> PRT
<213> Ixodes scapularis

<400> 16

Met Ala Ala Ala Val Met Asn Cys Leu Arg Thr Ala Leu Leu Gly Ala
1 5 10 15

Leu Val Val Gln Leu Tyr Ala Thr Gln Ile Gly His Arg Lys Phe Glu
20 25 30

Tyr Lys Tyr Ser Phe Lys Gly Pro Tyr Leu Ala Gln Lys Asp Gly Ser
35 40 45

Val Pro Phe Trp Glu Tyr Gly Gly Asn Cys Ile Ala Ser Glu Glu Met
50 55 60

Val Arg Ile Thr Pro Ser Leu Lys Ser Lys Lys Gly Ser Ile Trp Ser
65 70 75 80

Lys Leu Pro Thr Ser Phe Pro Trp Trp Glu Val Glu Leu Val Phe Arg
85 90 95

Thr Thr Gly Thr Gly Arg Ile Gly Ala Asp Gly Leu Ala Phe Trp Tyr
100 105 110

Thr Asp Lys Lys Gln Ala Glu Gly Pro Val Phe Gly Ser Ser Asp Lys
115 120 125

Trp Thr Gly Leu Ala Ile Phe Phe Asp Ser Phe Asp Asn Asp Asn Lys
130 135 140

His Asn Asn Pro Tyr Ile Met Gly Met Val Asn Asp Gly Thr Lys Ala
145 150 155 160

Tyr Asp His Glu Ser Asp Gly Ala Asn Gln Gln Leu Ala Gly Cys Gln
165 170 175

Arg Asp Phe Arg Asn Lys Pro Tyr Pro Val Arg Ala Lys Ile Glu Tyr
180 185 190

Phe Asn Asn Ile Leu Thr Val Leu Phe His Asn Gly Asn Thr Asn Asn
195 200 205

Asp Gly Asp Tyr Glu Met Cys Phe Arg Ala Glu Asn Val Phe Leu Pro
210 215 220

Fuente2.ST25.txt

Thr Asn Gly His Phe Gly Val Ser Ala Ala Thr Gly Gly Leu Ala Asp
225 230 235 240

Asp His Asp Ala Leu Lys Phe Leu Thr Thr Ser Leu His Ala Glu Gly
245 250 255

Thr Gln Pro Ala Leu Ala Gln Gly Met Ala Asp Ser Glu Lys Glu Lys
260 265 270

Phe Ser Lys Glu Tyr Glu Val Tyr Lys Asp Lys Leu Glu Lys Gln Lys
275 280 285

Glu Glu Tyr Arg Lys Thr His Pro Glu Glu Ala Ala Lys Gln Ala Met
290 295 300

Glu His Gly Pro Glu Gln Ala Tyr Asp Thr Gln Gln Gln Arg Glu Leu
305 310 315 320

Arg Gln Ile Phe Glu Gly Gln Ser His Lys Leu Phe Glu Gly Leu Lys
325 330 335

Ala Leu His Arg Lys Leu Asp Glu Val Leu Gly Arg Gln Glu Arg Thr
340 345 350

Leu Ser Leu Val Ser Ala Gly Gly Ala Gly Val Ala Val Gly Gly Val
355 360 365

Pro Pro Pro Gln Met Gly Gly Val Pro Ser Leu Gln Arg His Glu Ala
370 375 380

Glu Ser Leu Leu Ser Ser Gln Arg Glu Leu Leu Gln Thr Val Ala Gln
385 390 395 400

Val Lys Ser Phe Val Ala Glu Val His Gln Arg Thr Ala Thr Leu Gln
405 410 415

His Gln Gly Ala Gly Gly Thr Gln Gly Leu Thr Ala Glu Gln Leu Gln
420 425 430

Val Leu His Gln Val Arg Asp Ser Val Ala Ser Met His Arg Asp Val
435 440 445

Ser Asn Asn Gln Pro Gln Arg Thr Gly Cys Ala Thr Ser Cys Leu Ser
450 455 460

Thr Thr His Phe Leu Leu Phe Ala Thr Leu Gln Leu Ala Val Thr Leu
465 470 475 480

Gly Tyr Leu Val Tyr Arg Ser Ser Lys Glu Ala Ala Ala Lys Lys Phe
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Tyr

<210> 17
<211> 2475
<212> DNA
<213> Ixodes scapularis

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<222> (1342)..(1342)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1388)..(1388)
<223> n is a, c, g, or t

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gaggacagcg atgacgaagg gtcaagcagc gcctactccg acttggagga ctccgaagga 180
gccgacagca gcgactcgaa cgatttgtcg gacacggagg cgtcggagga tgactacgat 240
gactcccaag acgaagaaaa cacgaagatt actttgactg ggggtggaggg gaaggacctt 300
gagttgaggg ggaaggacca ggaggcaccg gtggagtctg gcaaaagggtc ggcattygcac 360
cggcagcaag aggacgcaa ggaggacaga cgaacgcaag tgggtgaaga tgaatatgcc 420
tttgactctt ccgacgaaga ggacgttcgc aacacggttg gcaacattcc tctggagtgg 480
tacgagcact atccgcacat cggttatgat ctggaaggca agccaatcct gaagccgcct 540
cgggttagtg acctggacga cticctgagg aaaatggatg accccaacta ttggaggacg 600
gtgaaggaca agagcacggg acaggacgtt gtcctgaccg acgaagatgt ggacctgatt 660
cagaggctgc agaaaggaca gttccccagc tcgacgactg acccttacga gccatttgag 720
gacatctttt cgcacgagac catgatccac ccggtgacca ggcaccctcc ccagaaacgc 780
agcttcgtgc cttcaaggat agaaaaagca atggtgtcaa agatggtgca cgcaatcaag 840
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gacaaggatg actcgacagc gggcagcaat gagcgaatgc agcgccacat cccggcacc 960
aagatgaagc tgccgggtca tgaggagtct tacaacccgc cggccgaata cctcttcacc 1020
gaggaagagg aggccaagtg gagagagcag gagcccgaag aacggcgcac aaacttcctg 1080
cccgccaaat acccatgtct gcgcgcagtc ccagcctacg aacgcttcat tgaggagagg 1140
tttgagcgct gtctggatct ctacttgtgc ccgaggcagc ggaagatgag ggtgaatgtg 1200
gatgcagagg acctgattcc tcagctgccc aaaccaagg acctgcagcc tttcccaagc 1260
attcagtcta ttgtctatga gggtcatacg gactgtgtcc tctgcctgtc tttggagcct 1320
gcgggacagt tctttgcatc anggccgag gacggcaccg ttcgcatttg ggagctcttg 1380
acgggcangt gcctcaagaa gttccagttc gaggcgcccg tgaagagcgt ggcctggtgt 1440

81
144

Fuente2.ST25.txt

ccagttgtcg ttcccatgaa actctgcgtg gacaagactg ttcccatgct ggatgccgga 1500
gttacggaca aactgctgcc gttcaccacg ggacaccgag ttgtctgccc tccccgaaga 1560
gtcctcgggc caggcggcgg tagtggagtg ggagcagacg tcggcctcct ctccagagtt 1620
cctctcccgg ggggagcgtc tgcgggtcgt tcaccgccac ggtgtggtgc aggtgacgtg 1680
gcactcgagg ggagactact ttgccactgt cacggacgag ggacaggcca ccgtgcttgt 1740
ccatcagttg tccacgcggc ggttcgcagg ctccccctca gcaaggcgaa gggcggggtg 1800
tcccgggtgc tgttccaccc gctgcgcccc ttctgtctgg tggcgtgcca gcgcacagtg 1860
cgggtctacc acctgtcaa gcaggagctg gccaagaggc tcacatccaa ttgcaagtgg 1920
atctcgtgca tgggccgtcc acccccaggt gacaatctgc tgatcggcac gtacgagaag 1980
cggctgatgt ggttcgatct ggacctctcg accaaaccgt accagcagct gcgcatacac 2040
aatgccgcca tccgcagtgt ggcgttccat ccgcgctatc cactgtttgc gtccgccggc 2100
gacgatcgca gcgtgatcgt ttcgcacggt atggtgtaca atgatttact gcaaaaccca 2160
ctgatcgtgc cactgagacg gctgaagaac catgccatca gcaagggtat ggggtgtgtg 2220
gactgcgcct tccatcccca ccagccgtgg atagtcacgg ccggagcaga cagcacgctg 2280
cggctcttca cctaagccgg gacgtcgtct ggtgtacata gtgaatcgtc aagaccgtgc 2340
caataaaagg actccacacc taataaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 2400
aaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 2460
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<210> 18
<211> 754
<212> PRT
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (438)..(438)
<223> Xaa can be any naturally occurring amino acid

<220>
<221> misc_feature
<222> (453)..(453)
<223> Xaa can be any naturally occurring amino acid

<400> 18

Met Gly Pro Lys Thr Leu Ser Lys Gln Pro Ala Lys Ala Ser Ser Ser
1 5 10 15
Thr Ser Lys Arg Thr Ala Gly Pro Thr Ile Ser Lys Gln Thr Glu Asp
20 25 30
Ser Asp Asp Glu Gly Ser Ser Ser Ala Tyr Ser Asp Leu Glu Asp Ser
35 40 45

Fuente2.ST25.txt

Glu Gly Ala Asp Ser Ser Asp Ser Asn Asp Leu Ser Asp Thr Glu Ala
 50 55 60
 Ser Glu Asp Asp Tyr Asp Asp Ser Gln Asp Glu Glu Asn Thr Lys Ile
 65 70 75 80
 Thr Leu Thr Gly Val Glu Gly Lys Asp Leu Glu Leu Arg Gly Lys Asp
 85 90 95
 Gln Glu Ala Pro Val Glu Ser Gly Lys Arg Ser Ala Trp His Arg Gln
 100 105 110
 Gln Glu Asp Ala Lys Glu Asp Arg Arg Thr Gln Val Val Glu Asp Glu
 115 120 125
 Tyr Ala Phe Asp Ser Ser Asp Glu Glu Asp Val Arg Asn Thr Val Gly
 130 135 140
 Asn Ile Pro Leu Glu Trp Tyr Glu His Tyr Pro His Ile Gly Tyr Asp
 145 150 155 160
 Leu Glu Gly Lys Pro Ile Leu Lys Pro Pro Arg Val Ser Asp Leu Asp
 165 170 175
 Asp Phe Leu Arg Lys Met Asp Asp Pro Asn Tyr Trp Arg Thr Val Lys
 180 185 190
 Asp Lys Ser Thr Gly Gln Asp Val Val Leu Thr Asp Glu Asp Val Asp
 195 200 205
 Leu Ile Gln Arg Leu Gln Lys Gly Gln Phe Pro Ser Ser Thr Thr Asp
 210 215 220
 Pro Tyr Glu Pro Phe Glu Asp Ile Phe Ser His Glu Thr Met Ile His
 225 230 235 240
 Pro Val Thr Arg His Pro Pro Gln Lys Arg Ser Phe Val Pro Ser Arg
 245 250 255
 Ile Glu Lys Ala Met Val Ser Lys Met Val His Ala Ile Lys Met Gly
 260 265 270
 Trp Ile Lys Pro Arg Val Lys Lys His Asp Pro Glu Arg Phe Ser Leu
 275 280 285
 Leu Trp Asp Lys Asp Asp Ser Thr Ala Gly Ser Asn Glu Arg Met Gln
 290 295 300
 Arg His Ile Pro Ala Pro Lys Met Lys Leu Pro Gly His Glu Glu Ser
 305 310 315 320

Fuente2.ST25.txt

Tyr Asn Pro Pro Ala Glu Tyr Leu Phe Thr Glu Glu Glu Glu Ala Lys
325 330 335

Trp Arg Glu Gln Glu Pro Glu Glu Arg Arg Ile Asn Phe Leu Pro Ala
340 345 350

Lys Tyr Pro Cys Leu Arg Ala Val Pro Ala Tyr Glu Arg Phe Ile Glu
355 360 365

Glu Arg Phe Glu Arg Cys Leu Asp Leu Tyr Leu Cys Pro Arg Gln Arg
370 375 380

Lys Met Arg Val Asn Val Asp Ala Glu Asp Leu Ile Pro Gln Leu Pro
385 390 395 400

Lys Pro Lys Asp Leu Gln Pro Phe Pro Ser Ile Gln Ser Ile Val Tyr
405 410 415

Glu Gly His Thr Asp Cys Val Leu Cys Leu Ser Leu Glu Pro Ala Gly
420 425 430

Gln Phe Phe Ala Ser Xaa Ser Glu Asp Gly Thr Val Arg Ile Trp Glu
435 440 445

Leu Leu Thr Gly Xaa Cys Leu Lys Lys Phe Gln Phe Glu Ala Pro Val
450 455 460

Lys Ser Val Ala Trp Cys Pro Val Val Val Pro Met Lys Leu Cys Val
465 470 475 480

Asp Lys Thr Val Ser Met Leu Asp Ala Gly Val Thr Asp Lys Leu Leu
485 490 495

Pro Phe Thr Thr Gly His Arg Val Val Cys Pro Pro Arg Arg Val Leu
500 505 510

Gly Pro Gly Gly Gly Ser Gly Val Gly Ala Asp Val Gly Leu Leu Ser
515 520 525

Arg Val Pro Leu Pro Gly Gly Ala Ser Ala Gly Arg Ser Pro Pro Arg
530 535 540

Cys Gly Ala Gly Asp Val Ala Leu Glu Gly Arg Leu Leu Cys His Cys
545 550 555 560

His Gly Arg Gly Thr Gly His Arg Ala Cys Pro Ser Val Val His Ala
565 570 575

Ala Val Arg Arg Leu Pro Phe Ser Lys Ala Lys Gly Gly Val Ser Arg
580 585 590

Fuente2.ST25.txt
Val Leu Phe His Pro Leu Arg Pro Phe Leu Leu Val Ala Cys Gln Arg
595 600
Thr Val Arg Val Tyr His Leu Leu Lys Gln Glu Leu Ala Lys Arg Leu
610 615 620
Thr Ser Asn Cys Lys Trp Ile Ser Cys Met Gly Arg Pro Pro Pro Gly
625 630 635 640
Asp Asn Leu Leu Ile Gly Thr Tyr Glu Lys Arg Leu Met Trp Phe Asp
645 650 655
Leu Asp Leu Ser Thr Lys Pro Tyr Gln Gln Leu Arg Ile His Asn Ala
660 665 670
Ala Ile Arg Ser Val Ala Phe His Pro Arg Tyr Pro Leu Phe Ala Ser
675 680 685
Ala Gly Asp Asp Arg Ser Val Ile Val Ser His Gly Met Val Tyr Asn
690 695 700
Asp Leu Leu Gln Asn Pro Leu Ile Val Pro Leu Arg Arg Leu Lys Asn
705 710 715 720
His Ala Ile Ser Lys Gly Met Gly Val Leu Asp Cys Ala Phe His Pro
725 730 735
His Gln Pro Trp Ile Val Thr Ala Gly Ala Asp Ser Thr Leu Arg Leu
740 745 750

Phe Thr

<210> 19
<211> 447
<212> DNA
<213> Ixodes scapularis

<400> 19
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cgaatcggaa gtacccgcgg ctcaaggacg tggacgacgt gctcggcggt gcagccgcct 180
gggagaatgt tgactcgacc gaagagaagt gcccgaagtg tgyccatgay cgggcctatt 240
ttatgcagat ccagactagg tcggccgacg agcccatgac caccttctac aagtgtctgca 300
accagctctg tggccaccag tggagggact gacagatggc ggctttgacg aactcatgcc 360
cgtgcaaaat gcgtcggggg gagagagttt tggaataaaa catgcgcctt actttcataa 420
aaaaaaaaa aaaaaaaaaa aaaaaaa 447

<210> 20

85
148

Fuente2.ST25.txt

<211> 108
<212> PRT
<213> Ixodes scapularis

<400> 20

Met Leu Leu Phe Cys Pro Thr Cys Ala Asn Ile Leu Ile Val Glu Gln
1 5 10 15

Gly Leu Glu Cys Phe Arg Phe Ala Cys Asn Thr Cys Pro Tyr Val His
20 25 30

Asn Ile Lys Ala Lys Met Ser Asn Arg Lys Tyr Pro Arg Leu Lys Asp
35 40 45

Val Asp Asp Val Leu Gly Gly Ala Ala Ala Trp Glu Asn Val Asp Ser
50 55 60

Thr Glu Glu Lys Cys Pro Lys Cys Gly His Glu Arg Ala Tyr Phe Met
65 70 75 80

Gln Ile Gln Thr Arg Ser Ala Asp Glu Pro Met Thr Thr Phe Tyr Lys
85 90 95

Cys Cys Asn Gln Leu Cys Gly His Gln Trp Arg Asp
100 105

<210> 21
<211> 1567
<212> DNA
<213> Ixodes scapularis

<220>
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<222> (785)..(785)
<223> n is a, c, g, or t

<400> 21
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agcgccacct ggcaagcatg caggtcaatg gatatgagaa cccacctac aagtacttcg 120
aggccaacac caactgagcg gccacgcccc caggggaggg ggaaaagggg gcggacggac 180
gtattgtgcc tgctgcgggc tgcgggatta gctcgtcccg cgttgttccg ggagccagtt 240
ggtttgcctc gcgtcttagg agtaggcacg gcctcccttc tgcacccggt caaggaccat 300
ggttgttggg gacacgagcg gcgtggggcg cagccagcct gagctttggg tcccgggtacc 360
acggcaaacc gtttgttccc acccgcgga tgaataattt gtttgcctca gtttctttcg 420
aatcgagcgt cggcgccgcc tccgacagcc ccgagtgcac tctgtctgtt gcgaaagacc 480
aatggagtag ttgacactcg ggtcgcagct cgaacaagct cccgtaaaac gctacttaac 540
cggggccggc gaccgagcgt agagcttgct gtgcgtagtt gtggataaaa cttttttttt 600
ttgtgtgtgt gcttggtcac agacaatggg cagcttccga cgtagccac gcgccacacg 660

Fuente2.ST25.txt
ctcgcctttg ttttcttctt ctcgcggttg tcatacttag tttccattgg cgggttaaca 720
ttccagtccg ggcgggccc cccgttcagg cgcgtcctga tcaaaattga gcatttggtt 780
gtgcngtgca tttattggcc gcagcagggg gttcccgggt gcacctggtg tcgtgacacg 840
catgtcgtga ctttccccctc agacggttgt cttgtctcat ggctcgttca cacctctagt 900
gctggtagtc tctgttgctt aggtttgtag gagcacacta cagcagaggg tgtcacaaag 960
ttttctaagc tgtatataca tgaggaaaac attgcyttgc acacacgcga gtttcggcct 1020
gttttttagtt gggacagtga acgttttttg tacaggttat tatgtagtgc ctacatttgt 1080
atgtgccagc tgcattgtgt ttcctgcatg tggggaagcc tccgtgctgc cccgagctgt 1140
gtgcggcccc tcctgagttt ccatgtgccca tgggccagc ctagggtgaa ctgggggtgc 1200
agatgccctt gcgcacggtg tgccccggcg agcatttgtgt gtccgtaggc catcgacgct 1260
attcatgcga aattaatgtg gtcacagctg tcattgtctc agtgaacata tcatatgtcc 1320
aaatttgtct cccctgtcag tgtgtgcttc tcttggttct acacttgcct gcatttttgt 1380
tagtttgccg gactgtcctt ttcgggtcca ggtcgacagc aggctataac aacaattccg 1440
gtattttcca gtatcgggtc acaccaggtg taacctattg tgcattgtag gtaacttgag 1500
tggaagagct aaaataaaaa tttgcaagag tctcactaaa aaaaaaaaaa aaaaaaaaaa 1560
aaaaaaa 1567

<210> 22
<211> 44
<212> PRT
<213> Ixodes scapularis

<400> 22
Pro Gln Ala Gln Gly Phe Val Gln Val Asp Gln Gly Ala Leu Pro Ala
1 5 10 15
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20 25 30
Asn Pro Thr Tyr Lys Tyr Phe Glu Ala Asn Thr Asn
35 40

<210> 23
<211> 704
<212> DNA
<213> Ixodes scapularis

<220>
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<222> (534)..(534)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (598)..(598)
<223> n is a, c, g, or t

27
150

Fuente2.ST25.txt

<400> 23
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catgcagcag ttccattccg gcgtttttta tgcctacgtg aagctgaagg aacaagagtg 120
ccgcaacatt gtctggattg ccgaatgcgt tgctcagcgt catcgggtcca agatcgataa 180
ctacattcca atcttctagt cgctcgagga aaagaaatgg gccaatcgg tagtttgtcg 240
gtgtaatata tatatatata tatatctact tcgcaaaatt cttcagctag agtgtctatg 300
tctgggttagc tgcgattgtg cgagagggga aaaaaatgta gtcagtggca tgatcaagga 360
aggaaaaaaaa ttggccaata acttttacct tttgaagtta aagcaagggt taaaataatg 420
tctattttta cttcgcttta ccgtgtgctg gctattgctt tgcaaacgtt ttttaaaatt 480
tttgcagttc gtctttcttc ttttgagcac atatttattc cagagttcca atancctttt 540
atgtgtgaat gaatgactaa tccatgttgg ggttgggttaa tgggtgcattg ttgaaaanat 600
aaacccaac tccagctggc ctttggaana aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 660
aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaa 704

<210> 24
<211> 681
<212> DNA
<213> Ixodes scapularis

<220>
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<222> (432)..(432)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (467)..(467)
<223> n is a, c, g, or t

<220>
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<222> (472)..(472)
<223> n is a, c, g, or t

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<222> (481)..(481)
<223> n is a, c, g, or t

<220>
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<222> (493)..(493)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (495)..(495)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (499)..(499)
<223> n is a, c, g, or t

<220>

88
15)

<221> misc_feature
<222> (507)..(507)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (515)..(515)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (518)..(518)
<223> n is a, c, g, or t

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<222> (528)..(528)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (533)..(533)
<223> n is a, c, g, or t

<220>
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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<222> (586)..(586)
<223> n is a, c, g, or t

<220>
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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

Fuente2.ST25.txt

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

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<223> n is a, c, g, or t

<220>
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<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (651)..(651)
<223> n is a, c, g, or t

<220>
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<222> (658)..(658)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (666)..(666)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (673)..(674)
<223> n is a, c, g, or t

<400> 24
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acctttccgt ctcgctgtca gacgccttga accatgactg agttctggct catctcggct 120
ccgggcgaga aaacctgcc aacagacttat gacaagctgc tcagcgtcac aagcaacaag 180
cagaacaacc tctcgacctg ctacaagttc caccttccgg acttgaagggt gggtagctg 240
gatcagttgg ttggcctctc ggatgacttg ggaaagctcg acacctatgt cgaaagcatc 300
actcgaaaag tggccagcta tctgggggac gtgcttgacg accagaggga caaactagcc 360

Fuente2.ST25.txt

gacaaccttc cttgccaatg gcttggggct ggaggcctac ctgaccccgg ttttcagtgg	420
gacatggcca antaccccat caagcagttc gcctcaagag catcaentga antcatcagc	480
nagcaagtgt ctanattng accggtnгаа cctcnagnag caagttanct tgnttacaac	540
aaccttnaan aacttaagnt tcaantncat ncgaacccca aatccnccgg ggnaggccng	600
gcntttttcc ngttagccnt ggnctnacc ttattgcgcc aagggagcca ntttgtcntt	660
gggggntcgg ganntacctt a	681

<210> 25
 <211> 720
 <212> DNA
 <213> Ixodes scapularis

<220>
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 <222> (488)..(488)
 <223> n is a, c, g, or t

<220>
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 <222> (625)..(625)
 <223> n is a, c, g, or t

<220>
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 <223> n is a, c, g, or t

<220>
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<220>
 <221> misc_feature
 <222> (641)..(641)
 <223> n is a, c, g, or t

<220>
 <221> misc_feature
 <222> (680)..(680)
 <223> n is a, c, g, or t

<220>
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 <222> (692)..(692)
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 <223> n is a, c, g, or t

<220>
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 <222> (719)..(719)
 <223> n is a, c, g, or t

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Fuente2.ST25.txt

aagccaacga aaaggcagaa gaagtagacg ccaaggcagg aagaagagtt caacatcyag	120
aagggccgcc tggtcacgga gcaaaggctc aagatcatcg actactacac ccgtcgagag	180
aagcaagttg aactgcagcg caagatccaa agctccaaca tgctgaacca ggcccggctg	240
aaggtgctga aggcgggcca ggaccacatt gcgacggtgc tggaggagyc caagcgcgc	300
ctgggggaca tcaccaggga ccaggctcgc taccaagccc tcctgcagag catggttctg	360
caggcactgc ttcagctcct cgagcaggag gtggtcgtcc actgccgacc gcaagacgcc	420
gggctgctga acttggacac gctgagtgcc aagttcaagg aggccactgg ccgagaggtc	480
aagctcantg tggagcccag cctggcttcg agcagctgcg gcggagtcga gatgctctcc	540
aggcggggca agattcgcgt ctgcaacacg ctcgagtcgc ggctggacat gattgccctt	600
cagctttctg ccgcagatca agacngncct nttcggcagg ncccccaac cgcaagttca	660
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TRANSMITTAL LETTER TO THE
UNITED STATES RECEIVING OFFICE

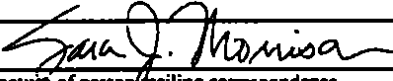
No tracking 92 155

Date	29 April 2003
International Application No.	
Attorney Docket No.	03-368

I. Certification under 37 CFR 1.10 (if applicable)

EV 232573473 US Express Mail mailing number	29 April 2003 Date of Deposit
--	----------------------------------

I hereby certify that the application/correspondence attached hereto is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Assistant Commissioner for Patents, Washington, D.C. 20231.

 Signature of person mailing correspondence	Sara J. Morrison Typed or printed name of person mailing correspondence
---	--

II. ☒ New International Application

TITLE	PROTECTIVE ANTIGENS FOR THE CONTROL OF IXODES SPECIES INFESTATIONS D	Earliest priority date (Day/Month/Year) 29 April 2002
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SCREENING DISCLOSURE INFORMATION: In order to assist in screening the accompanying international application for purposes of determining whether a license for foreign transmittal should and could be granted and for other purposes, the following information is supplied. (Note: check as many boxes as apply):

A. ☐ The invention disclosed was not made in the United States.

B. ☐ There is no prior U.S. application relating to this invention.

C. ☒ The following prior U.S. application(s) contain subject matter which is related to the invention disclosed in the attached international application. (NOTE: priority to these applications may or may not be claimed on form PCT/RO/101 (Request) and this listing does not constitute a claim for priority.)

application no.	60/376,251	filed on	29 April 2002
application no.		filed on	

D. ☒ The present international application contains additional subject matter not found in the prior U.S. application(s) identified in paragraph C. above. The additional subject matter is found on pages throughout application and ☒ DOES NOT ALTER ☐ MIGHT BE CONSIDERED TO ALTER the general nature of the invention in a manner which would require the U.S. application to have been made available for inspection by the appropriate defense agencies under 35 U.S.C. 181 and 37 CFR 5.1. See 37 CFR 5.15

III. ☐ A Response to an Invitation from the RO/US. The following document(s) is(are) enclosed:

A. ☐ A Request for An Extension of Time to File a Response

B. ☐ A Power of Attorney (General or Regular)

C. ☐ Replacement pages:

pages		of the request (PCT/RO/101)	pages		of the figures
pages		of the description	pages		of the abstract
pages		of the claims			

D. ☐ Submission of Priority Documents

Priority document		Priority document	
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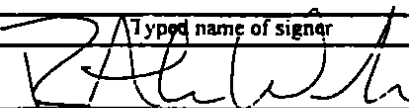
E. ☐ Fees as specified on attached Fee Calculation sheet form PCT/RO/101 annex

IV. ☐ A Request for Rectification under PCT 91 ☐ A Petition ☒ A Sequence Listing Diskette

V. ☒ Other (please specify):

(1) Filing Postcard; (2) PCT Request Form with Fee Calculation Sheet; (3) Check in the Amount of \$2,751.00; (4) Copy of PCT General Power of Attorney.

The person signing this form is the:

☐ Applicant	R. Alan WEEKS
☒ Attorney/Agent (Reg. No.) 36,050	 Typed name of signer
☐ Common Representative	 Signature

PATENT COOPERATION TREATY

No trademark 93
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From the INTERNATIONAL SEARCHING AUTHORITY

To:
R. ALAN WEEKS
FELLERS, SNIDER, BLANKENSHIP, BAILEY & TIPPENS,
P.C.
321 SOUTH BOSTON, SUITE 800
TULSA, OK 7413-3318

PCT

INVITATION TO PAY ADDITIONAL FEES

(PCT Article 17(3)(a) and Rule 40.1)

Date of Mailing (day/month/year)	PAYMENT DUE within 15 days from the above date of mailing
Applicant's or agent's file reference 03-368	International filing date (day/month/year) 29 April 2003 (29.04.2003)
International application No. PCT/US03/13229	
Applicant THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY	

1. This International Searching Authority

(i) considers that there are 36 (number of) inventions claimed in the international application covered by the claims indicated below/on an extra sheet:
Please See Continuation Sheet

and it considers that the international application does not comply with the requirements of unity of invention (Rules 13.1, 13.2 and 13.3) for the reasons indicated below/on an extra sheet:
Please See Continuation Sheet

(ii) ☐ has carried out a partial international search (see Annex) ☒ will establish the international search report on those parts of the international application which relate to the invention first mentioned in claims Nos.: 1-5

(iii) will establish the international search report on the other parts of the international application only if, and to the extent to which, additional fees are paid.

2. The applicant is hereby invited, within the time limit indicated above, to pay the amount indicated below:

<u>\$210.00</u>	X 35	= <u>\$7,350.00</u>
Fee additional per invention	number of additional inventions	total amount of additional fees

The applicant is informed that, according to Rule 40.2(c), the payment of any additional fee may be made under protest, i.e., a reasoned statement to the effect that the international application complies with the requirement of unity of invention or that the amount of the required additional fee is excessive.

3. ☐ Claim(s) Nos. _____ have been found to be unsearchable under Article 17(2)(b) because of defects under Article 17(2)(a) and therefore have not been included with any invention.

Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1430 Alexandria, Virginia 22313-1430 Facsimile No. (703)305-3230	Authorized officer Q. Janice Li Telephone No. 703-308-0196
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Form PCT/ISA/206 (July 1992)

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INVITATION TO PAY ADDITIONAL FEES

International application No.
PCT/US03/13229

This International Search Authority has found 36 inventions claimed in the International Application covered by the claims indicated below:

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees must be paid.

Group 1. Claims 1-5, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 1-117 of SEQ ID No: 1, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 2. Claims 1, 4, 5, 6, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 1-117 of SEQ ID No: 1, and a method of vaccination using the polypeptide.

Group 3. Claims 4, 5 drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 1-117 of SEQ ID No: 1 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 4. Claims 7-11, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 80-575 of SEQ ID No: 3, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 5. Claims 7, 10, 11, 12, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 80-575 of SEQ ID No: 3, and a method of vaccination using the polypeptide.

Group 6. Claims 10, 11, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 80-575 of SEQ ID No: 3, and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 7. Claims 13-17, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 10-951 of SEQ ID No: 5, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 8. Claims 13, 16, 17, 18, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 10-951 of SEQ ID No: 5, and a method of vaccination using the polypeptide.

Group 9. Claims 16, 17, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 10-951 of SEQ ID No: 5, and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 10. Claims 19-23, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 1-697 of SEQ ID No: 7, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 11. Claims 19, 22-24, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 1-697 of SEQ ID No: 7, and a method of vaccination using the polypeptide.

Group 12. Claims 22, 23, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 1-697 of SEQ ID No: 7 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 13. Claims 25-29, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 198-1025 of SEQ ID No: 9, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 14. Claims 25, 28-30, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 198-1025 of SEQ ID No: 9, and a method of vaccination using the polypeptide.

Group 15. Claims 28, 29 drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 198-1025 of SEQ ID No: 9 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 16. Claims 31-35, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 3-578 of SEQ ID No: 11, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 17. Claims 31, 34-36, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 3-578 of SEQ ID No: 11, and a method of vaccination using the polypeptide.

Group 18. Claims 34, 35 drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 3-578 of SEQ ID No: 11 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 19. Claims 37-41, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 1-1119 of SEQ ID No: 13, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 20. Claims 37, 40-42, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 1-1119 of SEQ ID No: 13, and a method of vaccination using the polypeptide.

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International application No.
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Group 21. Claims 40, 41, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 1-1119 of SEQ ID No: 13 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 22. Claims 43-47, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 51-1544 of SEQ ID No: 15, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 23. Claims 43, 46-48, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 51-1544 of SEQ ID No: 15, and a method of vaccination using the polypeptide.

Group 24. Claims 46, 47, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 51-1544 of SEQ ID No: 15 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 25. Claims 49-53, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 31-2295 of SEQ ID No: 17, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 26. Claims 49, 52-54, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 31-2295 of SEQ ID No: 17, and a method of vaccination using the polypeptide.

Group 27. Claims 52, 53, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 31-2295 of SEQ ID No: 17 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 28. Claims 55-59, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 6-332 of SEQ ID No: 19, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 29. Claims 55, 58-60, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 6-332 of SEQ ID No: 19, and a method of vaccination using the polypeptide.

Group 30. Claims 58, 59, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 6-332 of SEQ ID No: 19 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 31. Claims 61-65, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising at least residues 3-137 of SEQ ID No: 21, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 32. Claims 61, 64-66, drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 3-137 of SEQ ID No: 21, and a method of vaccination using the polypeptide.

Group 33. Claims 64, 65, drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 3-137 of SEQ ID No: 21 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 34. Claims 67-71, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising SEQ ID No: 23, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 35. Claims 72-76, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising SEQ ID No: 24, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 36. Claims 77-80, drawn to a cDNA molecule which encodes an *Ixodes* associated antigen having a nucleotide sequence comprising SEQ ID No: 25, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

1. This International Searching Authority considers that the international application does not comply with the requirements of unity of invention (Rules 13.1, 13.2 and 13.3) for the reasons indicated below:

The inventions listed as Groups 1-36 do not relate to a single general inventive concept under PCT Rule 13.1 because, under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature linking groups 1-36 appears to be that they are drawn to a cDNA molecule which encodes an *Ixodes* associated antigen and method of using such. However, each of the Groups 1-36 is drawn to a different composition and a method of using such, wherein the composition comprises a different nucleotide, a different polypeptide, or a combination of a nucleotide and polypeptide, which polynucleotide and polypeptide appear to be appear to be unrelated sequences with distinct properties and wherein each of the nucleotide or polypeptide has a different nucleic acid or amino acid sequence structure and antigenicity, therefore, the technical feature linking the inventions of groups 1 and 2-36 does not constitute a special technical feature as defined by PCT Rule 13.2, as it does not define one contribution as a whole over the prior art. Accordingly, Groups 2-36 and 1 are not so linked by the same or a corresponding special technical feature as to form a single general inventive concept.

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Applicants are advised to see 37 CFR 1.475 (a)-(d) for details. 37 CFR 1.475 (a) recites "An international and a national stage application shall relate to one invention only or to a group of inventions so linked as to form a single general inventive concept ('requirement of unity of invention')." 37 CFR 1.475 (b) does not provide for more than one product as a combination of invention.

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Traducción Oficial código: PCT-13229 de un documento escrito en inglés, sellada por el suscrito Traductor Oficial, agosto 18 de dos mil cinco, Bogotá, D.C., República de Colombia.

Solicitud Internacional No. PCT/US03/13229

INVITACIÓN PARA PAGAR HONORARIOS ADICIONALES

Esta Autoridad de Búsqueda Internacional ha encontrado 36 inventos afirmados en la Solicitud Internacional cubierta por las afirmaciones indicadas a continuación:

Esta solicitud contiene las siguientes invenciones o grupos de invenciones que no están suficientemente ligados como para formar un concepto inventivo general simple bajo la Regla 13.1 PCT. Para examinar todos los inventos deben pagarse los honorarios apropiados de examen adicional.

Grupo 1. Afirmaciones 1-5, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 1-117 de Identificación de Secuencia No. 1, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 2. Afirmaciones 1, 4, 5, 6, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 1-117 de

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Resolución No. 0941 / 30/08/94 Ministerio

Identificación de Secuencia No. 1, y un método de vacunación usando el polipéptido.

Grupo 3. Afirmaciones 4, 5, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 1-117 de Identificación de Secuencia No. 1 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 4. Afirmaciones 7-11, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 80-575 de Identificación de Secuencia No. 3, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 5. Afirmaciones 7, 10, 11, 12, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 80-575 de Identificación de Secuencia No. 3, y un método de vacunación usando el polipéptido.

Grupo 6. Afirmaciones 10, 11, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 80-575 de Identificación de Secuencia No. 3 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.



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Resolución No. 0941 / 31/04/94 Ministerio

Grupo 7. Afirmaciones 13-17, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 10-951 de Identificación de Secuencia No. 5, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 8. Afirmaciones 13, 16, 17, 18, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 10-951 de Identificación de Secuencia No. 5, y un método de vacunación usando el polipéptido.

Grupo 9. Afirmaciones 16, 17, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 10-951 de Identificación de Secuencia No. 5 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 10. Afirmaciones 19-23, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 1-697 de Identificación de Secuencia No. 7, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 11. Afirmaciones 19, 22-24, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 1-697 de

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 TRADUCTOR E INTERPRETE OFICIAL - INGLES
 Resolución No. 0941 - 30/08/96 Minjusticia

Identificación de Secuencia No. 7, y un método de vacunación usando el polipéptido.

Grupo 12. Afirmaciones 22, 23, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 1-697 de Identificación de Secuencia No. 7 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 13. Afirmaciones 25-29, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 198-1025 de Identificación de Secuencia No. 9, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 14. Afirmaciones 25, 28-30, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 198-1025 de Identificación de Secuencia No. 9, y un método de vacunación usando el polipéptido.

Grupo 15. Afirmaciones 28, 29, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 198-1025 de Identificación de Secuencia No. 9 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

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 TRADUCTOR E INTERPRETE OFICIAL - INGLE-
 sesión No. 0941 30/08/96 Maricao

Grupo 16. Afirmaciones 31-35, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 3-578 de Identificación de Secuencia No. 11, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 17. Afirmaciones 31, 34-36, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 3-578 de Identificación de Secuencia No. 11, y un método de vacunación usando el polipéptido.

Grupo 18. Afirmaciones 34, 35, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 3-578 de Identificación de Secuencia No. 11 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 19. Afirmaciones 37-41, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 1-1119 de Identificación de Secuencia No. 13, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 20. Afirmaciones 37, 40-42, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 1-1119 de

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 30/03/96 Minjusticia

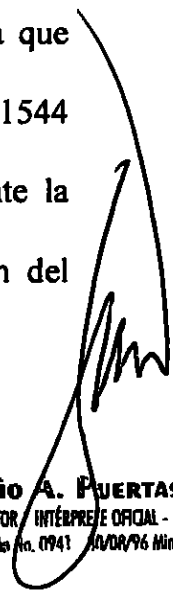
Identificación de Secuencia No. 13, y un método de vacunación usando el polipéptido.

Grupo 21. Afirmaciones 40, 41, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 1-1119 de Identificación de Secuencia No. 13 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 22. Afirmaciones 43-47, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 51-1544 de Identificación de Secuencia No. 15, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 23. Afirmaciones 43, 46-48, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 51-1544 de Identificación de Secuencia No. 15, y un método de vacunación usando el polipéptido.

Grupo 24. Afirmaciones 46, 47, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 51-1544 de Identificación de Secuencia No. 15 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.



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· RADUADOR / INTÉRPRETE OFICIAL - INGLÉS ·
· resolución No. 0941 / M/D/R/96 Ministerio ·

Grupo 25. Afirmaciones 49-53, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 31-2295 de Identificación de Secuencia No. 17, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 26. Afirmaciones 49, 52-54, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 31-2295 de Identificación de Secuencia No. 17, y un método de vacunación usando el polipéptido.

Grupo 27. Afirmaciones 52, 53, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 31-2295 de Identificación de Secuencia No. 17 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 28. Afirmaciones 55-59, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 6-332 de Identificación de Secuencia No. 19, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 29. Afirmaciones 55, 58-60, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 6-332 de

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TRADUCTOR E INTERPRETE OFICIAL - INGLESA
Asociación No. 0941 / 15/04/94 / 15/04/94

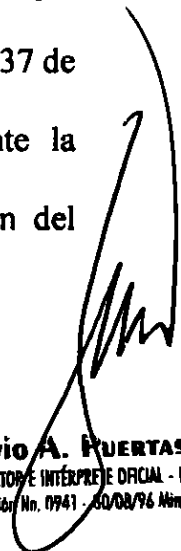
Identificación de Secuencia No. 19, y un método de vacunación usando el polipéptido.

Grupo 30. Afirmaciones 58, 59, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 6-332 de Identificación de Secuencia No. 19 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.

Grupo 31. Afirmaciones 61-65, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende al menos residuos 3-137 de Identificación de Secuencia No. 21, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 32. Afirmaciones 61, 64-66, extracción de un polipéptido codificado mediante una secuencia de nucleótidos que comprende al menos residuos 3-137 de Identificación de Secuencia No. 21, y un método de vacunación usando el polipéptido.

Grupo 33. Afirmaciones 64, 65, extracción de una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 3-137 de Identificación de Secuencia No. 21 y un polipéptido codificado mediante la molécula de cDNA, y un método de vacunación que usa una combinación del nucleótido y el polipéptido.



Silvio A. PUERTAS P.
TRADUCTOR E INTERPRETE OFICIAL - INGLES
Resolución No. 0941 - 80/08/96 Ministerio

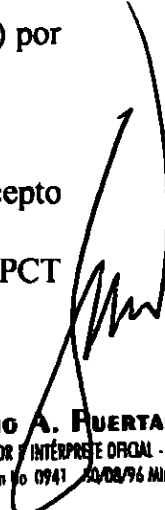
Grupo 34. Afirmaciones 67-71, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende Identificación de Secuencia No. 23, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 35. Afirmaciones 72-76, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende Identificación de Secuencia No. 24, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

Grupo 36. Afirmaciones 77-80, extracción de una molécula cDNA que codifica un antígeno asociado *Ixodes* que tiene una secuencia de nucleótidos que comprende Identificación de Secuencia No. 25, un vector que comprende al nucleótido, una célula aislada transformada por el vector y un método de vacunación usando la molécula cDNA.

1. Esta Autoridad de Búsqueda Internacional considera que la solicitud internacional no cumple con los requisitos de unidad de invención (Reglas 13.1, 13.2 y 13.3) por las razones indicadas a continuación:

Las invenciones enumeradas como Grupos 1-36 no se relacionan con un concepto inventivo general simple bajo la Regla 13.1 PCT porque bajo la Regla 13.2 PCT



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TRADUCTOR Y INTÉRPRETE OFICIAL - INGLÉS
matrícula No. 0941 30/08/96 Ministerio

carecen de la misma o de características técnicas especiales correspondientes por las siguientes razones:

La característica técnica especial que une los grupos 1-36 parece ser la extracción de una molécula de cDNA que codifica un antígeno asociado *Ixodes* y el método de usarla. Sin embargo, cada uno de los Grupos 1-36 extrae una composición diferente con un método de uso diferente, en donde la composición comprende un nucleótido diferente, un polipéptido diferente, o una combinación de nucleótido y polipéptido, donde el polinucleótido y el polipéptido parecen tener secuencias no relacionadas con propiedades distintas y en donde cada nucleótido o polipéptido tiene un ácido nucleico diferente o una estructura de secuencia de aminoácidos y antigenicidad diferentes, por lo tanto la característica técnica que une las invenciones de los grupos 1 y 2-36 no constituye una característica técnica especial según lo define la Regla 13.2 PCT, ya que no define una contribución como un todo sobre el estado del arte anterior. Del mismo modo, los Grupos 2-36 y 1 no están unidos por la misma o una característica técnica especial correspondiente como para formar un concepto inventivo general simple.

Se le aconseja a los solicitantes ver 37 CFR 1.475 (a)-(d) para ver detalles. La 37 CFR 1.475 (a) dice "Una solicitud de instancia internacional y nacional se relacionará con una invención solamente o con un grupo de invenciones unidas de

Silvio A. PUERTAS P.
 TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
 Resolución No. 1941 - 30/08/96 Ministerio

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tal forma que formen un concepto inventivo general simple ("requisito de unidad de invención"). La 37 CFR 1.475 (b) no supone más de un producto como combinación de invención.

Formulario PCT/ISA/206 (hoja de continuación) (julio 1992)

Traductor: SILVIO ALEJANDRO PUERTAS PINO

Resolución 0941 del 30 de agosto de 1996 del Ministerio de Justicia y del Derecho



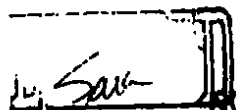
Silvio A. PUERTAS P.
TRADUCTOR e INTÉRPRETE OFICIAL - INGLÉS-
Resolución No. 0941 - 30/08/96 Ministerio

PATENT COOPERATION TREATY

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PCT

From the INTERNATIONAL BUREAU

NOTIFICATION OF RECEIPT OF
RECORD COPY

(PCT Rule 24.2(a))

To:

WEEKS, Alan, R.
Fellers, Snider, Blankenship,
Bailey & Tippens, P.
C.
321 South Boston
Suite 800
Tulsa, OK 74103-3318
United States of America

RECEIVED

JUN 10 2003

F.S.B.E.A.I.

Date of mailing (day/month/year) 28 May 2003 (28.05.03)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference 03-368	International application No. PCT/US03/13229

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY(all designated States)

International filing date : 29 April 2003 (29.04.03)

Priority date(s) claimed : 29 April 2002 (29.04.02)

Date of receipt of the record copy
by the International Bureau : 26 May 2003 (26.05.03)

List of designated Offices :

AP : GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

EP : AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

National : AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ,
EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,
LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN,
TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW

ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

☒ time limits for entry into the national phase - see updated important information (as of April 2002)

☒ confirmation of precautionary designations (if applicable)

☒ requirements regarding priority documents (if applicable)

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer: Norbert RIGHETTO
Facsimile No. (41-22) 338-7080	Telephone No. (41-22) 338 9889

INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated on the cover sheet of this Notification by paying national fees and furnishing translations, as prescribed by Articles 22 and 39 and the applicable national laws. In addition, the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure the necessary steps to enter the national phase are taken in a timely fashion. Most Offices do not issue reminders to applicants in connection with the entry into the national phase.

The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be **30 MONTHS** from the priority date, not only in respect of any elected Office where a demand for international preliminary examination is filed before the expiration of 18 months from the priority date (see Article 39(1)), but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see PCT Gazette No. 44/2001 of 1 November 2001, pages 18928, 18932 and 18934, as well as the PCT Newsletter, October and November 2001 and February 2002 issues.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Office by Office, refer to the PCT Gazette ("Section IV" part published on a weekly basis), to the PCT Newsletter (on a monthly basis) and to the relevant National Chapters in Volume II of the PCT Applicant's Guide (the paper version of which is updated usually twice a year and the Internet version of which is updated usually on a weekly basis). Finally, a cumulative table of all applicable time limits for entering the national phase is available from WIPO's Internet site, via links from various pages the site including those of the Gazette, Newsletter and Guide, at <http://www.wipo.int/pct/en/index.html>.

Information about the requirements for filing a demand for international preliminary examination is set out in the PCT Applicant's Guide, Volume IA, Chapter IX. Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 18 months from the priority date (this time limit may not be extended). If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. The Notice of confirmation and payment must reach the receiving Office within the 18-month time limit.

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

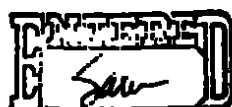
For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 18 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 18-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 18-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within the time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 18-month time limit is the filing date of the earliest application whose priority is claimed.



PCT

From the INTERNATIONAL BUREAU

**NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT**

(PCT Administrative Instructions, Section 411)

To:

WEEKS, Alan, R.
Fellers, Snider, Blankenship,
Bailey & Tipples, P.
C.
321 South Boston
Suite 800
Tulsa, OK 74103-3318
United States of America

RECEIVED

JUN 2003

F.S.B.B.&T.

Date of mailing (day/month/year) 04 June 2003 (04.06.03)	
Applicant's or agent's file reference 03-368	IMPORTANT NOTIFICATION
International application No. PCT/US03/13229	International filing date (day/month/year) 29 April 2003 (29.04.03)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 29 April 2002 (29.04.02)
Applicant THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY	

1. The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
2. This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
3. An asterisk (*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
4. The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
29 April 2002 (29.04.02)	60/376,251	US	27 May 2003 (27.05.03)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. (41-22) 338-7080

Authorized officer

Norbert RIGHETTO

Telephone No. (41-22) 338 9889

From the INTERNATIONAL BUREAU

No trademark

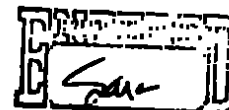
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PCT

NOTICE INFORMING THE APPLICANT OF THE
COMMUNICATION OF THE INTERNATIONAL
APPLICATION TO THE DESIGNATED OFFICES

(PCT Rule 47.1(c), first sentence)

To:

WEEKS, Alan, R.
Fellers, Snider, Blankenship, Bailey & Tippens, P.
C
321 South Boston
Suite 800
Tulsa, OK 74103-3318
ETATS-UNIS D'AMERIQUE

Date of mailing (day/month/year)

05 November 2003 (05.11.03)

Applicant's or agent's file reference

03-368

IMPORTANT NOTICE

International application No.

PCT/US03/13229

International filing date (day/month/year)

29 April 2003 (29.04.03)

Priority date (day/month/year)

29 April 2002 (29.04.02)

Applicant

THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY

1. Notice is hereby given that the International Bureau has communicated, as provided in Article 20, the international application to the following designated Offices on the date indicated above as the date of mailing of this notice:

AU, AZ, BY, CH, CN, CO, DE, DZ, HU, JP, KG, KP, KR, MD, MK, MZ, RU, TM

In accordance with Rule 47.1(c), third sentence, those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

2. The following designated Offices have waived the requirement for such a communication at this time:

AE, AG, AL, AM, AP, AT, BA, BB, BG, BR, BZ, CA, CR, CU, CZ, DK, DM, EA, EC, EE, EP, ES, FI, GB, GD, GE, GH,
GM, HR, ID, IL, IN, IS, KE, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PH, PL, PT,
RO, SC, SD, SE, SG, SK, SL, TJ, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW

The communication will be made to those Offices only upon their request. Furthermore, those Offices do not require the applicant to furnish a copy of the international application (Rule 49.1(a-iii)).

Enclosed with this notice is a copy of the international application as published by the International Bureau on 13 November 2003 (13.11.03) under No. 03/093416

4. **TIME LIMITS** for filing a demand for international preliminary examination and for entry into the national phase

The applicable time limit for entering the national phase will, subject to what is said in the following paragraph, be 30 MONTHS from the priority date, not only in respect of any elected Office if a demand for international preliminary examination is filed before the expiration of 19 months from the priority date, but also in respect of any designated Office, in the absence of filing of such demand, where Article 22(1) as modified with effect from 1 April 2002 applies in respect of that designated Office. For further details, see *PCT Gazette* No. 44/2001 of 1 November 2001, pages 19926, 19932 and 19934, as well as the *PCT Newsletter*, October and November 2001 and February 2002 issues.

In practice, time limits other than the 30-month time limit will continue to apply, for various periods of time, in respect of certain designated or elected Offices. For regular updates on the applicable time limits (20, 21, 30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at <http://www.wipo.int/pct/en/index.html>.

For filing a demand for international preliminary examination, see the *PCT Applicant's Guide*, Volume IA, Chapter IX. Only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination (at present, all PCT Contracting States are bound by Chapter II).

It is the applicant's sole responsibility to monitor all these time limits.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Authorized officer

Judith Zahra

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Facsimile No. (41-22) 740.14.35

Telephone No. (41-22) 338.91.11

Form PCT/IB/308 (April 2002)

(19) World Intellectual Property Organization
International Bureau

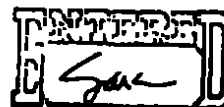
PCT

(43) International Publication Date
13 November 2003 (13.11.2003)

PCT

(10) International Publication Number
WO 03/093416 A2

- (51) International Patent Classification⁷: C12N
- (21) International Application Number: PCT/US03/13229
- (22) International Filing Date: 29 April 2003 (29.04.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
60/376,251 29 April 2002 (29.04.2002) US
- (71) Applicant: THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY [US/US]: 203 Whichurst, Oklahoma State University, Stillwater, OK 74078 (US).
- (72) Inventors: DE LA FUENTE, Jose de Jesus: 400 Squires Landing, Apt. M-5, Stillwater, OK 74074 (US); KOCAN, Katherine, M.: 3909 E. 92nd Street, Perkins, OK 74059 (US); GARCIA-ALMAZAN, Consuelo: 835 Connell, Stillwater, OK 74075 (US); GARCIA-GARCIA, Jose, Carlos: 700 W. Scott Ave., Apt. 137, Stillwater, OK 74075 (US); BLOUIN, Edmour, F.: 3909 E. 92nd Street, Perkins, OK 74059 (US).
- (74) Agent: WEEKS, Alan, R.; Sellers, Snider, Blankenship, Bailey & Tipples, P. C., 321 South Boston, Suite 800, Tulsa, OK 74103-3318 (US).
- (81) Designated States (*national*): AE, AG, AI, AM, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), DE (utility model), DK, DM, DZ, EC, EE (utility model), EG, ES, FI (utility model), FI, GB, GD, GE, GI, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PL, PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SI, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LI, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BJ, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Declaration under Rule 4.17:**
— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for all designations
- Published:**
— without international search report and to be republished upon receipt of that report
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*



(54) Title: PROTECTIVE ANTIGENS FOR THE CONTROL OF IXODES SPECIES INFESTATIONS

(57) Abstract: Protective antigens against infestations with *Ixodes* spp. ticks, gene sequences and encoded proteins for such antigens, related vaccines and methods useful to induce an immune response, which are protective to interfere with infestations by *Ixodes* spp. ticks.

WO 03/093416 A2

PROTECTIVE ANTIGENS FOR THE CONTROL OF *IXODES* SPECIES INFESTATIONS

BACKGROUND OF THE INVENTION

Technical Field:

The present invention relates to the identification of protective antigens against infestations with *Ixodes* spp. ticks, gene sequences and encoded proteins for such antigens, related vaccines and methods useful to induce an immune response, which are protective to interfere with infestations by *Ixodes* spp. ticks.

Background:

Ticks parasitize wild, domesticated animals and humans and transmit pathogens including fungi, bacteria, viruses and protozoan. Currently, ticks are considered to be second in the world to mosquitoes as vectors of human diseases, but they are considered to be the most important vector of pathogens in North America (Parola and Raoult, 2001). *Ixodes* spp. are distributed worldwide and act as vectors of human diseases caused by *Borrelia burgdorferi* (Lyme disease), *Anaplasma phagocytophila* (human granulocytic ehrlichiosis), *Coxiella burnetii* (Q fever), *Francisella tularensis* (tularemia), *B. afzelii*, *B. lusitanae*, *B. valaisiana* and *B. garinii*, *Rickettsia helvetica*, *R. japonica* and *R. australis*, *Babesia divergens* and tick-borne encephalitis (TBE) and Omsk Hemorrhagic fever viruses (Estrada-Peña and Jongejan, 1999; Parola and Raoult, 2001). Throughout eastern and southeastern United States and Canada, *I. scapularis* (the black legged tick) is the main vector of *B. burgdorferi* sensu stricto and *A. phagocytophila* (Estrada-Peña and Jongejan, 1999; Parola and Raoult, 2001).

Control of tick infestations is difficult and often impractical for multi-host ticks such as *Ixodes* spp. Presently, tick control is effected by integrated pest management in which different control methods are adapted to one area or against one tick species with due consideration to their environmental effects. Recently, development of vaccines against one-host *Boophilus* spp. has provided new possibilities for the identification of protective antigens for immunization against tick infestations (Willadsen, 1997; Willadsen and Jongejan, 1999; de la Fuente et al., 1999; 2000; de Vos et al., 2001). The recombinant *B. microplus* BM86 gut antigen included in commercial vaccine formulations TickGARD (Hoechst Animal Health, Australia) and Gavac (Heber Biotec S. A., Havana, Cuba) also confers partial protection against phylogenetically related *Hyalomma* and *Rhipicephalus* tick genera (de la Fuente et al., 2000; de Vos et al., 2001). However, immunization with BM86 failed to protect against the more phylogenetically distant *Amblyomma* spp. (de Vos et al., 2001). These results suggest that using Bm86 or a closely related gene for the production of vaccines against *Ixodes* spp. or other tick genera phylogenetically distant from *Boophilus* spp. (Black and Piesman, 1994) could be impractical. Therefore, the screening for novel protective antigens is necessary to identify vaccine candidates against infestations with these tick species of medical and veterinary importance. Control of ticks by vaccination would avoid environmental contamination and selection of drug resistant ticks that result from repeated acaricide application (de la Fuente et al., 1998; Garcia-Garcia et al., 1999). Anti-tick vaccines also allow for inclusion of multiple antigens in order to target a broad range of tick species and for incorporation of pathogen-blocking antigens.

Vaccination with DNA and cDNA molecules has been used to induce a protective immune response against *B. microplus* and several pathogens in laboratory

animals and livestock (De Rose et al., 1999; Drew et al., 1999; van Drunen Littell-van den Hurk et al., 2001; Kofa and Wedrychowicz, 2001). A new technique, expression library immunization (ELI) in combination with sequence analysis provides an alternative approach for identification of potential vaccine antigens based on rapid screening of the expressed genes without prior knowledge of the antigens encoded by cDNA clones. ELI was first reported for *Mycoplasma pulmonis* (Barry et al., 1995) and since then has been used for unicellular and multicellular pathogens and viruses (Manoutcharian et al., 1998; Alberti et al., 1998; Brayton et al., 1998; Melby et al., 2000; Smooker et al., 2000; Moore et al., 2002; Singh et al., 2002). However, the identification of individual protective clones has not been reported and it is predicted that identification of protective antigens will be more difficult as the complexity of the genome increases.

Although several reports in the literature have demonstrated by ELI that libraries can offer a degree of protection (Barry et al., 1995; Manoutcharian et al., 1998; Alberti et al., 1998; Brayton et al., 1998; Melby et al., 2000; Smooker et al., 2000; Moore et al., 2002; Singh et al., 2002), none have applied ELI to arthropods and particularly to ticks. Several vaccines have been developed to protect humans against *Ixodes*-transmitted pathogens including TBE virus and *B. burgdorferi*. However, it is not clear whether these vaccines will protect against all pathogen strains and genotypes. The inclusion of tick immunogens in pathogen-specific vaccines could enhance their protective effect and increase efficacy (Nuttall, 1999). This transmission-blocking approach is supported by evidence that host resistance to ticks provides some protection against tick-borne transmission of viruses and *B. burgdorferi* (Wikel et al., 1997). Furthermore, vaccination against *B. microplus* has

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been demonstrated to contribute to the control of tick-borne diseases (de la Fuente et al., 1998; 1999).

SUMMARY OF THE INVENTION

The present invention is based upon our identification by ELI and sequence analysis of protective cDNA clones against experimental infestations with *I. scapularis*. This is the first example of the application of ELI to arthropods and particularly to ticks. The protective antigens are homologous to endopeptidases, nucleotidases, chorion proteins, vitellogenin receptors, peptidoglycan recognition proteins, glutamine-alanine rich proteins, ribosomal proteins, β -adaplin, Beta-amyloid precursor protein, Block of proliferation (Bop1), lectins, chloride channels, RNA polymerases, ATPases and heat-shock proteins. These antigens induce an immune response in vaccinated hosts that either interferes with tick development or results in a pro-feeding activity, which could be due to the expression of cDNAs encoding for tick immunosuppressants, anticoagulants and other proteins with low antigenicity and a pro-feeding activity or they could encode for proteins homologous to host proteins with anti-tick activity, which neutralization results in a tick pro-feeding activity. These protective antigens, although identified for *I. scapularis*, may be cross protective between *Ixodes* species considering the high degree of conservation of gene sequences and protein function between species of the same genus. A 5'-nucleotidase was identified and characterized in *B. microplus* by Liyou et al. (1999; 2000) but they did not assay its protection capacity. Although surprising at first glance, the protection capacity of ribosomal and heat shock protein preparations has been previously documented in other organisms (Elad and Segal, 1995; Silva, 1999; Melby et al., 2000; Cassataro et al., 2002) but never in ticks. The effect of cDNA vaccination on *I. scapularis*

experimental infestations of mice was evidenced by the reduction of the number of engorged larvae, the retardation of larval development, the inhibition of molting to nymphal stages and the appearance of visibly damaged larvae with red coloration. These effects were also recorded in vaccination experiments with recombinant BM86 and BM95 against infestations with *B. microplus*, including the red coloration in some ticks, attributed to blood leakage to the tick haemolymph (Garcia-Garcia et al., 2000).

Thus, in one embodiment of the present invention there is provided cDNA sequences, protein encoding fragments thereof, and derived protein sequences for protective *I. scapularis* antigens comprising antigens homologous to endopeptidases, nucleotidases, chorion proteins, vitellogenin receptors, peptidoglycan recognition proteins, glutamine-alanine rich proteins, ribosomal proteins, β -adaptin, Beta-amyloid precursor protein, Block of proliferation (Bop1), lectins, chloride channels, RNA polymerases, ATPases and heat-shock proteins.

In another embodiment of the present invention there is provided a vaccine composition comprising the *I. scapularis* protective recombinant proteins and/or modified cDNAs separately or which may optionally be combined with adjuvant to enhance the protection efficacy of vaccine preparations against *Ixodes* spp., wherein the vaccine composition further comprises a pharmaceutically acceptable carrier or diluent. The vaccine composition also may optionally be combined with tick-borne pathogen components to provide a means to control tick-borne infections, wherein the vaccine composition further comprises a pharmaceutically acceptable carrier or diluent and adjuvant.

In another embodiment of the present invention there is provided a method for inducing an immune response in a mammal to provide immune protection, which reduces or affects infestations by *Ixodes* spp. ticks and/or transmission of tick-borne

pathogens, the method comprising administering to at-risk human population and mammalian reservoir an effective amount of a vaccine composition comprising the *I. scapularis* protective recombinant proteins and/or modified cDNAs alone or in combination with an adjuvant or tick-borne pathogen components to provide a means to control tick infestations and to reduce transmission to humans of tick-borne infections, wherein the vaccine composition further comprises a pharmaceutically acceptable carrier or diluent.

A better understanding of the present invention and its objects and advantages will become apparent to those skilled in this art from the following detailed description, wherein there is described only the preferred embodiment of the invention, simply by way of illustration of the best mode contemplated for carrying out the invention. As will be realized, the invention is capable of modifications in various obvious respects, all without departing from the scope and spirit of the invention. Accordingly, the description should be regarded as illustrative in nature and not as restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 is a summary of the cDNA ELI approach used to identify protective antigens against *I. scapularis* infestations.

FIG. 2A is a graph depicting the results of a primary screen of cDNA pools (A-H 1-4, A5) by ELI. V, control mice injected with 1 μ g vector DNA alone. * α <0.01, ** α <0.05 (Tukey's *post-hoc* test for pair comparisons after ANOVA). Number in boxes represent values for inhibition of tick infestation with respect to the control group.

FIG. 2B is a graph depicting the results of a primary screen of cDNA pools (A6-A10, B-H 5-8) by ELI. V, control mice injected with 1 μ g vector DNA alone. * α <0.01, ** α <0.05 (Tukey's *post-hoc* test for pair comparisons after ANOVA). Number in boxes represent values for inhibition of tick infestation with respect to the control group.

FIG. 3 is a graph depicting the results of a tertiary screen by ELI of cDNA sub-pools formed according to the predicted function of encoded proteins. Only groups with $\geq 15\%$ are shown (white bars). The number of engorged larvae per mouse is expressed as mean $\pm$ SD (black bars). Control mice were injected with mitochondrial (MT) cDNAs. * $P \leq 0.05$ (Student's t-test).

DETAILED DESCRIPTION OF THE INVENTION

Before explaining the present invention in detail, it is important to understand that the invention is not limited in its application to the details of the construction illustrated and the steps described herein. The invention is capable of other embodiments and of being practiced or carried out in a variety of ways. It is to be understood that the phraseology and terminology employed herein is for the purpose of description and not of limitation.

The present invention derives from the sequences set forth on the Sequence Listing attached hereto and incorporated herein. In particular, there is provided 25 separate and distinct sequences comprising 14 cloned cDNA molecules and 11 deduced amino acid sequences of encoded polypeptides, said sequences having been isolated and identified as possessing the asserted utility in accordance with the following described experimental methodology.

Example 1: Construction of an *I. scapularis* cDNA library and screening for protective antigens by ELI

Tick cells

Monolayers of IDE8 (ATCC CRL 1973) cells, originally derived from embryonic *I. scapularis*, were maintained at 31°C in L-15B medium supplemented with 5% foetal bovine serum, tryptose phosphate broth and bovine lipoprotein concentrate after Munderloh et al. (1994). Cells were subcultured at 1:5 – 1:10 when monolayers reached a density of approximately 10^7 cells/T-25 flask. Medium was replaced weekly.

Library construction

A cDNA expression library was constructed in the vector pEXP1 containing the strong cytomegalovirus CMV_{IE} promoter (Clontech). Because we planned to target the early larval stages of *I. scapularis*, we chose to construct our library from cultured embryonic *I. scapularis* IDE8 cells-derived poly(A)+ RNA. The cDNA library contained 4.4×10^6 independent clones and a titer of approximately 10^{10} cfu/ml with more than 93% of the clones with cDNA inserts. The average cDNA size was 1.7 kb (0.5-4.0 kb).

Primary screen

The overall schema for identification of protective antigens through ELI, sequential fractionation and sequence analysis is shown in Fig. 1.

Ninety-six LBA (master) plates containing an average of 41 (30-61) cDNA clones per plate were prepared. Replicas were made and clones from each plate were pooled, inoculated in Luria-Bertani with 50 µg/ml ampicillin, grown for 2 hr in a 96 wells plate and plasmid DNA purified from each pool (Wizard SV 96 plasmid DNA purification system, Promega, Madison, WI, USA). BALB/c female mice, 5-6 weeks of age at the time of first vaccination, were used. Mice were cared for in accordance

with standards set in the Guide for Care and Use of Laboratory Animals. Mice were injected with a 1 ml tuberculin syringe and a 27 gauge needle at days 0 and 14. Three mice per group were each immunized IM in the thigh with 1 µg DNA/dose in 50 µl PBS. Two groups of 3 mice each were included as controls. One group was injected with 1 µg vector DNA alone and the second with saline only. Two weeks after the last immunization, mice were infested with 100 *I. scapularis* larvae per mouse. Ticks were artificially reared at the Oklahoma State University tick rearing facility by feeding larvae on mice, nymphs on rabbits and adults on sheep and using for infestation in our experiments the larvae obtained from the eggs oviposited by a single female. Twelve hours after tick infestation, larvae that did not attach were counted to calculate the number of attached larvae per mouse and mice were transferred to new cages. Replete larvae dropping from each mouse were collected daily and counted during 7 days. The inhibition of tick infestation (I) for each test group was calculated with respect to vector-immunized controls as $[1 - (\langle RL \rangle_n / \langle RL \rangle_c \times \langle RL \rangle_{ic} / \langle RL \rangle_{in})] \times 100$, where $\langle RL \rangle_n$ is the average number of replete larvae recovered per mouse for each test group, $\langle RL \rangle_c$ is the average number of replete larvae recovered per mouse for control group, $\langle RL \rangle_{ic}$ is the average number of larvae attached per mouse for control group, and $\langle RL \rangle_{in}$ is the average number of larvae attached per mouse for each test group.

Pools of 41 (30-61) *I. scapularis* cDNA clones were screened by ELI. Only 33 cDNA pools and controls were analyzed per experiment. The average tick infestation level was 50 ± 13 and 56 ± 15 and 56 ± 15 and 54 ± 18 larvae/mouse for cDNA immunized and control mice, respectively ($P > 0.05$) (Table 1). The average number of engorged larvae recovered per mouse was 9 ± 3 and 13 ± 4 in the cDNA-immunized mice and 16 ± 4 and 17 ± 3 in the control vector-immunized group ($P < 0.05$) (Table 1).

No reduction was observed in the number of larvae collected from mice that received the vector DNA compared to saline-immunized controls. The maximum number of engorged larvae was collected 3 to 4 days after infestation. However, in mice immunized with cDNA pools B5, A8 and A10 (Fig. 2) a retardation of larval development in 1 to 2 days was recorded. The average inhibition of tick infestation (I) was $49 \pm 28\%$ and $30 \pm 22\%$ (Table 1). After two experiments covering the analysis of 66 pools (2705 clones), 9 protective pools (351 clones) were selected producing an inhibition of tick infestation $\geq 60\%$ (Fig. 2A and 2B and Table 1). When we started these experiments, we planned to screen over 4000 cDNA clones considering the complexity of the tick genome. However, to our surprise 9 protective cDNA pools were identified after screening 66 pools containing 2705 cDNA clones. This result probably reflects the possibility of interfering with tick infestations at many different levels that involve a Pleiades of gene products. Results from vaccination experiments against ticks employing recombinant antigens support this view (reviewed by Mulenga et al., 2000). Because of the complexity of the screening procedure in mice vaccinated and challenged with tick larvae, it was difficult to work with more than 9 protective cDNA pools. Therefore we did not continue screening new cDNA pools and focused our attention on the 9 pools selected after the primary screen.

Secondary screen

The secondary screen was done to verify the protective capacity of the cDNA pools selected after the primary screen (Fig. 2A and 2B). After the primary screen of 66 cDNA pools (2705 clones), 9 pools with $\geq 60\%$ were selected for the secondary screen (re-screening) employing 5 mice per group as described above. Engorged larvae were kept for molting in a 95% humidity atmosphere. Molting of engorged larvae was evaluated by visual examination of tick nymphs under a stereomicroscope

34 days after last larval collection. The inhibition of molting (M) for each test group was calculated with respect to vector-immunized controls as $[1 - (ML_n/ML_c \times RL_c/RL_n)] \times 100$, where ML_n is the number of nymphs for each test group, ML_c is the number of nymphs for the control group, RL_c is the number of larvae recovered for the control group, and RL_i is the number of larvae recovered for each test group. Control mice were immunized with the negative (I=0%) F2 cDNA pool or saline only. A group was included immunized SC with two doses of 100 μ g of total IDE8 tick cell proteins per dose in Freund's incomplete adjuvant.

All 9 protective cDNA pools gave positive results in the secondary screen (data not shown). The tick infestation levels were higher in this experiment (average 85 ± 6 and 84 ± 3 larvae/mouse for cDNA-immunized and control mice, respectively; $P > 0.05$). Nevertheless, the average number of engorged larvae recovered per mouse was 39 ± 7 and 26 ± 6 for control and cDNA-immunized mice, respectively ($P < 0.05$). The group immunized with total IDE8 tick cell proteins was protected with I=33%. Again, no reduction was observed in the number of larvae collected from mice that received the control cDNA (F2 negative pool after the primary screen; Fig. 2A) compared to saline-immunized controls.

In the secondary screen, molting of engorged larvae was evaluated after 34 days. Molting was affected in all but one test cDNA-immunized group. Inhibition of molting in test cDNA-immunized mice compared to the control cDNA-immunized group varied from 0% to 12% ($6 \pm 4\%$). The inhibition of molting was higher than 50% only in the larvae collected from mice immunized with cDNA pools B5 and A10, which showed a retardation of larval development in 1 to 2 days as in the primary screen. No differences were observed between control cDNA and saline-immunized mice. Among the larvae that did not molt to nymph, some were visibly damaged and

presented a strong red coloration. The percent of red larvae in cDNA-immunized mice varied between 3% to 18 % ($7\pm5\%$) while in the saline and control cDNA-immunized groups red larvae represented the 6% and 4%, respectively.

Tertiary screen

For the tertiary screen, 64 clones were grouped in 16 sub-pools each containing 1 to 17 plasmids according to the predicted function of encoded proteins (e.g., all the plasmids that encoded histone proteins were grouped together) and used with 4 sub-pools containing 182 clones of unknown function or with sequences without homology to sequence databases to immunize 4 mice per group. Mice were immunized with 0.3 $\mu\text{g/plasmid/dose}$ in 50 μl PBS and evaluated as described above. Control mice were immunized with a pool of 20 plasmids containing mitochondrial cDNAs.

Tick infestation levels were similar in all test groups (72 ± 2 larvae/mouse) and in control mice (69 ± 2 larvae/mouse) ($P>0.05$). The number of engorged larvae recovered per mouse was also similar between test (16 ± 7) and control (14 ± 6) mice ($P>0.05$). However, the groups immunized with cDNA sub-pools containing clones with putative endopeptidase, nucleotidase, ribosomal proteins, heat shock proteins, glutamine-alanine-rich proteins and 3 of the sub-pools with unknown function or with sequences without homology to sequence databases had $\geq 15\%$ (Fig. 3). Furthermore, among them, the groups immunized with sub-pools containing clones with a putative endopeptidase, nucleotidase and two of the cDNA sub-pools with unknown function or with sequences without homology to sequence databases resulted in lower infestation levels compared to control mice ($P\leq 0.05$) and $\geq 40\%$ (Fig. 3). Clones homologous to chorion proteins, vitellogenin receptors, and peptidoglycan recognition

proteins were selected for their potential protection capacity in other stages of tick development.

Statistical analysis

The number of larvae attached per mouse and the number of engorged larvae recovered per mouse 7 days after infestation were compared by Analysis of Variance (ANOVA) followed by a series of Tukey's *post-hoc* tests for pair comparisons between cDNA-immunized and control vector DNA-immunized mice (primary screen), and by Student's t-test between mice immunized with positive cDNA pools and the control negative F2 cDNA pool (secondary screen) or between test cDNA sub-pools-immunized and control mice immunized with mitochondrial cDNAs (tertiary screen).

Example 2: Sequence analysis of protective clones

All the 351 cDNA clones in the 9 pools that resulted positive in the secondary screen were sequenced. DNA from individual clones in these pools was purified (Wizard SV 96 plasmid DNA purification system, Promega) from the master plate and partially sequenced. In most cases a sequence larger than 700 nucleotides was obtained. Nucleotide sequences were analyzed using the program AlignX (Vector NTI Suite V 5.5, InforMax, North Bethesda, MD, USA). BLAST (Altschul et al., 1990) was used to search the NCBI databases to identify previously cloned sequences that may have homology to those that we sequenced. Sequence analysis allowed grouping the clones according to sequence identity to DNA databases and predicted protein function. The protective clones selected after the tertiary screen were fully sequenced.

Comparison to sequence databases permitted to identify sequence identity to previously reported genes with known function in 152 (43%) of the clones (Table 2).

Fifty seven percent of the sequences were homologous to genes with unknown function or had no significant identity to previously reported sequences (Table 2). Of the clones with sequence identity to genes with known function, 85% were homologous to arthropod sequences. Ninety-three clones (61%) contained sequences homologous to *Drosophila melanogaster*, 5 (3%) to other insects and 32 (21%) to Ixodid tick species. Thirty percent of the clones were eliminated from further analysis based on their sequence identity, including those containing similar sequences (Table 2). The protective clones included antigens homologous to endopeptidases, nucleotidases, chorion proteins, vitellogenin receptors, peptidoglycan recognition proteins, glutamine-alanine rich proteins, ribosomal proteins, and heat-shock proteins.

Summary of results

The results obtained with the various protective clones identified in the Sequence Listing, along with certain selected expressed proteins, are summarized in Table 4.

SEQ ID NO:1 denotes the clone designated 4E6, wherein the relevant protein encoding fragment has been identified as comprising residues 1-117, which encodes the polypeptide shown in SEQ ID NO: 2.

SEQ ID NO:3 denotes the clone designated 4D8, wherein the relevant protein encoding fragment has been identified as comprising residues 80-575, which encodes the polypeptide shown in SEQ ID NO: 4.

SEQ ID NO:5 denotes the clone designated 4F8, wherein the relevant protein encoding fragment has been identified as comprising residues 1-951, which encodes the polypeptide shown in SEQ ID NO: 6.

SEQ ID NO:7 denotes the clone designated 4G11, wherein the relevant protein encoding fragment has been identified as comprising residues 1-697, which encodes the polypeptide shown in SEQ ID NO: 8.

SEQ ID NO:9 denotes the clone designated 4D6, wherein the relevant protein encoding fragment has been identified as comprising residues 198-1025, which encodes the polypeptide shown in SEQ ID NO: 10.

SEQ ID NO:11 denotes the clone designated 3E1, wherein the relevant protein encoding fragment has been identified as comprising residues 3-578, which encodes the polypeptide shown in SEQ ID NO: 12.

SEQ ID NO:13 denotes the clone designated 1C10, wherein the relevant protein encoding fragment has been identified as comprising residues 1-1119, which encodes the polypeptide shown in SEQ ID NO: 14.

SEQ ID NO:15 denotes the clone designated 3E10, wherein the relevant protein encoding fragment has been identified as comprising residues 51-1544, which encodes the polypeptide shown in SEQ ID NO: 16.

SEQ ID NO:17 denotes the clone designated 4F11, wherein the relevant protein encoding fragment has been identified as comprising residues 31-2295, which encodes the polypeptide shown in SEQ ID NO: 18.

SEQ ID NO:19 denotes the clone designated 3C12, wherein the relevant protein encoding fragment has been identified as comprising residues 6-332, which encodes the polypeptide shown in SEQ ID NO: 20.

SEQ ID NO:21 denotes the clone designated 2C12, wherein the relevant protein encoding fragment has been identified as comprising residues 3-137, which encodes the polypeptide shown in SEQ ID NO: 22.

SEQ ID NOS: 22, 23 AND 24, denote, respectively, clones 1A9, 1B2 and 4A4, each comprising a partial sequence with no associated polypeptide.

* * * * *

As noted above, the present invention relates to the sequences identified in the Sequence Listing. More generally, the invention concerns the given cDNA sequences and any nucleotide sequence coding for a protein which is capable of eliciting an antibody or other immune response (e.g., T-cell response of the immune system) which recognizes an epitope(s) of the amino acid sequences depicted in the Sequence Listing, including less than the full cDNA sequences and mutants thereof. Hence the nucleotide sequence may encode a protein which is the entire antigen encoded by the variously identified bases, or a fragment or derivative of the antigen or a fusion product of the antigen or fragment and another protein, provided that the protein which is produced from such sequence is capable of eliciting an antibody or other immune response which recognizes an epitope(s) of the given amino acid sequences.

As a result, the invention encompasses DNA sequences which encode for and/or express in appropriate transformed cells, proteins which may be the full length antigen, antigen fragment, antigen derivative or a fusion product of such antigen, antigen fragment or antigen derivative with another protein.

Proteins included within the present invention have an amino acid sequence depicted in the Sequence Listing. Other included proteins consist of a fragment of said sequence capable of eliciting an antibody or other immune response which recognizes an epitope(s) of the amino acid sequences depicted and a mutant of said sequence capable of eliciting an antibody or other immune response which recognizes an epitope(s) of such amino acid sequences.

The nucleotide sequences may be inserted into any of a wide variety of expression vectors by a variety of procedures. Such procedures and others are deemed to be known by those skilled in the art. Suitable vectors include chromosomal, nonchromosomal and synthetic DNA sequences; e.g., derivatives of SV40; bacterial plasmids; phage DNAs; yeast plasmids; vectors derived from combinations of plasmids and phage DNAs, viral DNA such as baculovirus, vaccinia, adenovirus, fowl pox virus, pseudorabies, etc. The appropriate DNA sequence must be operatively linked in the vector to an appropriate expression control sequence(s) (promoter) to direct mRNA synthesis. As representative examples of such promoters, there may be mentioned LTR or SV40 promoter, the *E. coli* lac or trp, the phage lambda PL promoter and other promoters known to control expression of genes in prokaryotic and eukaryotic cells or their viruses. The expression vector also includes a non-coding sequence for a ribosome binding site for translation initiation and a transcription terminator. The vector may also include appropriate sequences for amplifying expression.

The vector containing the appropriate cDNA sequence as hereinabove described, as well as an appropriate promoter or control sequence, may be employed to transform an appropriate host to permit the host to express the protein. Examples of host organisms and cells include bacterial strains (e.g., *E. coli*, *Pseudomonas*, *Bacillus*, *Salmonella*, etc.), fungi (e.g., yeasts and other fungi), animal or plant hosts (e.g., mouse, swine or animal and human tissue cells). The selection of the host is deemed to be within the scope of those skilled in the art.

It is also understood that the appropriate cDNA sequence present in the vector when introduced into a host may express part or only a portion of the protein which is encoded within the noted terminology, it being sufficient that the expressed protein be

capable of eliciting an antibody or other immune response which recognizes an epitope(s) of the listed amino acid sequences.

The isolated cDNAs and/or polypeptide expressed by the host transformed by the vector may be harvested by methods which will occur to those skilled in the art and used in a vaccine for protection of a mammal, such as a bovine, swine, human, etc., against infestations of *Ixodes* species. Such protective recombinant proteins and/or modified cDNAs are used in an amount effective to induce an immune response against *Ixodes* species ticks and their associated pathogens and may be used in combination with a suitable physiologically acceptable carrier. The term "inducing an immune response" when used with respect to the vaccine described herein means that the vaccine prevents disease associated with a particular tick species or reduces the severity of the disease.

The carrier employed in conjunction with vaccine may be any one of a wide variety of carriers. As representative examples of suitable carriers, there may be mentioned mineral oil, synthetic polymers, etc. Carriers for vaccines are well known in the art and the selection of a suitable carrier is deemed to be within the scope of those skilled in the art. The selection of a suitable carrier is also dependent upon the manner in which the vaccine is to be administered.

The present invention provides a method of immunizing a susceptible mammal, against infestations and disease caused by *Ixodes* species with the vaccine described above. For purposes of this invention, the vaccine is administered in an effective amount. The vaccine may be administered by any of the methods well known to those skilled in the art, for example, by intramuscular, subcutaneous, intraperitoneal or intravenous injection. Alternatively, the vaccine may be administered intranasally or orally. It is also to be understood that the vaccine may

include active components, such as tick-borne pathogen components or adjuvants in addition to the antigen(s) or fragments hereinabove described.

The host expressing the antigen may itself be used to deliver antigen to non-human animals, by introducing killed or viable host cells that are capable of propagating in the animal. Direct incorporation of the cDNA sequences into host cells may also be used to introduce the sequences into animal cells for expression of antigen *in vivo*.

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Table 1. Primary screen of the *I. scapularis* cDNA library by ELI in mice.

Experimental group ^a	Number of pools screened (Number of clones)	Average±SD number of larvae attached per mouse ^b	Average±SD number of engorged larvae per mouse ^c	Average±SD inhibition of tick infestation (I) ^d	Number of pools selected for the secondary screen
Experiment 1	33 (1383)	50±13 (33-80)	9±3 (2-42)	39±55% (-183 - 87%)	6 (>75%)
Vector DNA-immunized controls for experiment 1	—	56±13 (45-67)	16±4 (5-27)	—	—
Experiment 2	33 (1322)	56±15 (29-79)	13±4 (1-27)	27±28% (-53 - 89%)	3 (>60%)
Vector DNA-immunized controls for experiment 2	—	54±18 (36-73)	17±3 (6-28)	—	—

^aNinety six LBA plates containing an average of 41 cDNA clones per plate were prepared. Replicas were made and clones from each plate were pooled, inoculated, grown for 2 hr in a 96 wells plate and plasmid DNA purified from each pool for ELI. Three mice per group were each immunized IM twice with 1 µg DNA/dose in 50 µl PBS two weeks apart. Two groups of 3 mice each were included as controls. One group was injected with vector DNA and the second with saline only.

^bFifteen days after the last immunization, mice were infested with 100 *I. scapularis* larvae per mouse. Twelve hrs later, larvae that did not attach were counted to calculate the number of attached larvae per mouse and mice were transferred to new cages.

^cEngorged larvae dropping from each mouse were collected daily and counted after 7 days.

^dThe inhibition of tick infestation (I) for each test group was calculated with respect to vector-immunized controls as $[1 - (RL_n/RL_c \times RL_{ic}/RL_{in})] \times 100$, where RL_n is the average number of replete larvae recovered per mouse for each test group, RL_c is the average number of replete larvae recovered per mouse for control group, RL_{ic} is the average number of larvae attached per mouse for control group, and RL_{in} is the average number of larvae attached per mouse for each test group.

Table 2. Classification of the clones in protective pools by putative protein function according to identity to sequence databases.

Putative protein Function	Number of clones
Biosynthetic ^a	2
Catabolism	4
Cell adhesion	2
Cell cycle ^a	2
Cytoskeletal ^a	8
Defense	2
DNA structure or replication ^a	3
Extracellular matrix	3
Endocytosis	2
Energy metabolism	10
Homeostasis	2
Morphogenetic	9
Mitochondrial ^a	34
Protein synthesis or processing ^{a,b}	34
RNA synthesis or processing ^a	7
Heat-shock proteins	4
Signal transduction	16
Transport	8
Unknown	199
Total	351

^aEliminated from further screening of protective antigens. Other clones were eliminated for containing similar sequences.

^bExcept for ribosomal proteins.

Table 3. Grouping of the clones according to the predicted function of encoded proteins in sub-pools for the tertiary screen.

Sub-pool (No. of clones)	Clone	Pool ^a
Ribosomal (17)	1A2, 1A10, 1C11 1F6 2B8 2F8, 2F10 3A10, 2C3, 3D2, 3D10 3G9, 3G10 4D11, 4D12, 4E7, 4F7	A5 D1 A10 E8 B4 E3 F1
Membrane protein (7)	1D8, 1D11, 1E10 2B12 2H5 3C9 3G11	D1 A10 E8 B4 E3
ATPase (6)	1A9, 1B2, 1C9 2C9 4A4 4G12	A5 A10 C3 F1
Cell channel/Transporter (5)	1F4 2H11 4A12 4G10, 4G11	D1 E8 C3 F1
Early development-specific (4)	1C8 3F4 4C7 4G9	A5 E3 C3 F1
G protein-coupled receptor (4)	2B7, 2C12 2F12 4C9	A10 E8 C3
Growth factor receptor (3)	2E8 3B8, 3C8	B5 B4
Lectin (3)	3E10 4B8, 4C8	E3 C3
Vitellogenin (3)	1F12 4A6 4G2	D1 C3 F1
Heat shock (3)	1C10 1F10 3F6	A5 D1 E3
EGF-like (2)	2H4 4C10	E8 C3
Secreted protein (2)	2F9 3C12	E8 B4
Glutamine-Alanine rich (2)	4D6, 4E6	F1
Adaptin (1)	3E1	E3
Endopeptidase (1)	4D8	F1
Nucleotidase (1)	4F8	F1

^acDNA pools refer to positive pools after primary and secondary screens (Fig. 2A and 2B).

+31
202Table 4: Summary of results with *I. scapularis* cDNA clones.

cDNA clone	Predicted Protein	Inhibition of tick infestation I (%)	Inhibition of molting M (%)	Efficacy E (%)
4D8	Endopeptidase	40*/54**	7*/8**	44*/58**
4F8	Nucleotidase	50*/64**	17*/9**	58*/61**
1C10	HSP70	17*	ND	ND
4D6	Glu-Ala-rich	61*	11	66*
4E6	Glu-Ala-rich	20*/46**	16**	55**
3E1	β -adaptin (appendage region)	27*	5*	31*
2C12	Beta-amyloid precursor protein (APP)	-8***	ND	ND
4F11	Block of proliferation Bop1	-39***	ND	ND
3E10	Mannose binding lectin	-48*/-10***	ND	ND
4G11	Chloride channel	38***	30	57
3C12	RNA polymerase III	-104***	ND	ND
1A9, 1B2, 4A4	ATPase	-57***	ND	ND

Mice were immunized with cDNA-containing expression plasmid DNA as described above (*) or with 100 μ g/dose of recombinant protein expressed in *E. coli* (**). I, M and E were calculated as described above. ND, not determined.

***Resulted in a pro-feeding activity. This effect could be due to the expression of cDNAs encoding for tick immunosuppressants, anticoagulants and other proteins with low antigenicity and a pro-feeding activity. Alternatively, they could encode for proteins homologous to host proteins with anti-tick activity, which neutralization results in a tick pro-feeding activity.

In view of the above, it will be seen that the several objectives of the invention are achieved and other advantageous results attained. As various changes could be made in the above DNA molecules, proteins, etc. without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. While the invention has been described with a certain degree of particularity, it is understood that the invention is not limited to the embodiment(s) set forth herein for purposes of exemplification, but is to be limited only by the scope of the attached claim or claims, including the full range of equivalency to which each element thereof is entitled.

WHAT IS CLAIMED IS:

1. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 1-117 of SEQ ID NO: 1.
2. An expression vector comprising the isolated cDNA molecule of claim 1.
3. An isolated cell transformed by the expression vector of claim 2.
4. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 1, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 1, and (iii) a combination of the isolated cDNA molecule of claim 1 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.
5. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 4.
6. The polypeptide encoded by the isolated cDNA molecule of claim 1.
7. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 80-575 of SEQ ID NO: 3.
8. An expression vector comprising the isolated cDNA molecule of claim 7.
9. An isolated cell transformed by the expression vector of claim 8.
10. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of

claim 7, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 7, and (iii) a combination of the isolated cDNA molecule of claim 7 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

11. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 10.

12. The polypeptide encoded by the isolated cDNA molecule of claim 7.

13. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 10-951 of SEQ ID NO: 5.

14. An expression vector comprising the isolated cDNA molecule of claim 13.

15. An isolated cell transformed by the expression vector of claim 14.

16. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 13, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 13, and (iii) a combination of the isolated cDNA molecule of claim 13 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

17. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 16.

18. The polypeptide encoded by the isolated cDNA molecule of claim 13.

19. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 1-697 of SEQ ID NO: 7.

20. An expression vector comprising the isolated cDNA molecule of claim 19.
21. An isolated cell transformed by the expression vector of claim 20.
22. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 19, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 19, and (iii) a combination of the isolated cDNA molecule of claim 19 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.
23. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 22.
24. The polypeptide encoded by the isolated cDNA molecule of claim 19.
25. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 198-1025 of SEQ ID NO: 9.
26. An expression vector comprising the isolated cDNA molecule of claim 25.
27. An isolated cell transformed by the expression vector of claim 26.
28. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 25, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 25, and (iii) a combination of the isolated cDNA molecule of claim 25 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

29. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 28.

30. The polypeptide encoded by the isolated cDNA molecule of claim 25.

31. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 3-578 of SEQ ID NO: 11.

32. An expression vector comprising the isolated cDNA molecule of claim 31.

33. An isolated cell transformed by the expression vector of claim 32.

34. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 31, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 31, and (iii) a combination of the isolated cDNA molecule of claim 31 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

35. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 34.

36. The polypeptide encoded by the isolated cDNA molecule of claim 31.

37. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 1-1119 of SEQ ID NO: 13.

38. An expression vector comprising the isolated cDNA molecule of claim 37.

39. An isolated cell transformed by the expression vector of claim 38.

40. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 37, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 37, and (iii) a combination of the isolated cDNA molecule of claim 37 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

41. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 40.

42. The polypeptide encoded by the isolated cDNA molecule of claim 37.

43. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 51-1544 of SEQ ID NO: 15.

44. An expression vector comprising the isolated cDNA molecule of claim 43.

45. An isolated cell transformed by the expression vector of claim 44.

46. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 43, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 43, and (iii) a combination of the isolated cDNA molecule of claim 43 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

47. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 46.

48. The polypeptide encoded by the isolated cDNA molecule of claim 43.

49. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 31-2295 of SEQ ID NO: 17.

50. An expression vector comprising the isolated cDNA molecule of claim 49.

51. An isolated cell transformed by the expression vector of claim 50.

52. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 49, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 49, and (iii) a combination of the isolated cDNA molecule of claim 49 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

53. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 52.

54. The polypeptide encoded by the isolated cDNA molecule of claim 49.

55. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 6-332 of SEQ ID NO: 19.

56. An expression vector comprising the isolated cDNA molecule of claim 55.

57. An isolated cell transformed by the expression vector of claim 56.

58. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 55, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 55,

and (iii) a combination of the isolated cDNA molecule of claim 55 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

59. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 58.

60. The polypeptide encoded by the isolated cDNA molecule of claim 55.

61. An isolated cDNA molecule which encodes an *Ixodes* associated antigenic polypeptide, said molecule having a nucleotide sequence comprising at least residues 3-137 of SEQ ID NO: 21.

62. An expression vector comprising the isolated cDNA molecule of claim 61.

63. An isolated cell transformed by the expression vector of claim 62.

64. A vaccine comprising an effective immunizing amount of an immunogen selected from the group consisting of (i) the isolated cDNA molecule of claim 61, (ii) the polypeptide encoded by the isolated cDNA molecule of claim 61, and (iii) a combination of the isolated cDNA molecule of claim 61 and the encoded polypeptide, and further comprising a pharmaceutically acceptable carrier or diluent.

65. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 64.

66. The polypeptide encoded by the isolated cDNA molecule of claim 61.

67. An isolated cDNA molecule comprising a nucleotide sequence of that show in SEQ ID NO: 23.

68. An expression vector comprising the isolated cDNA molecule of claim 67.

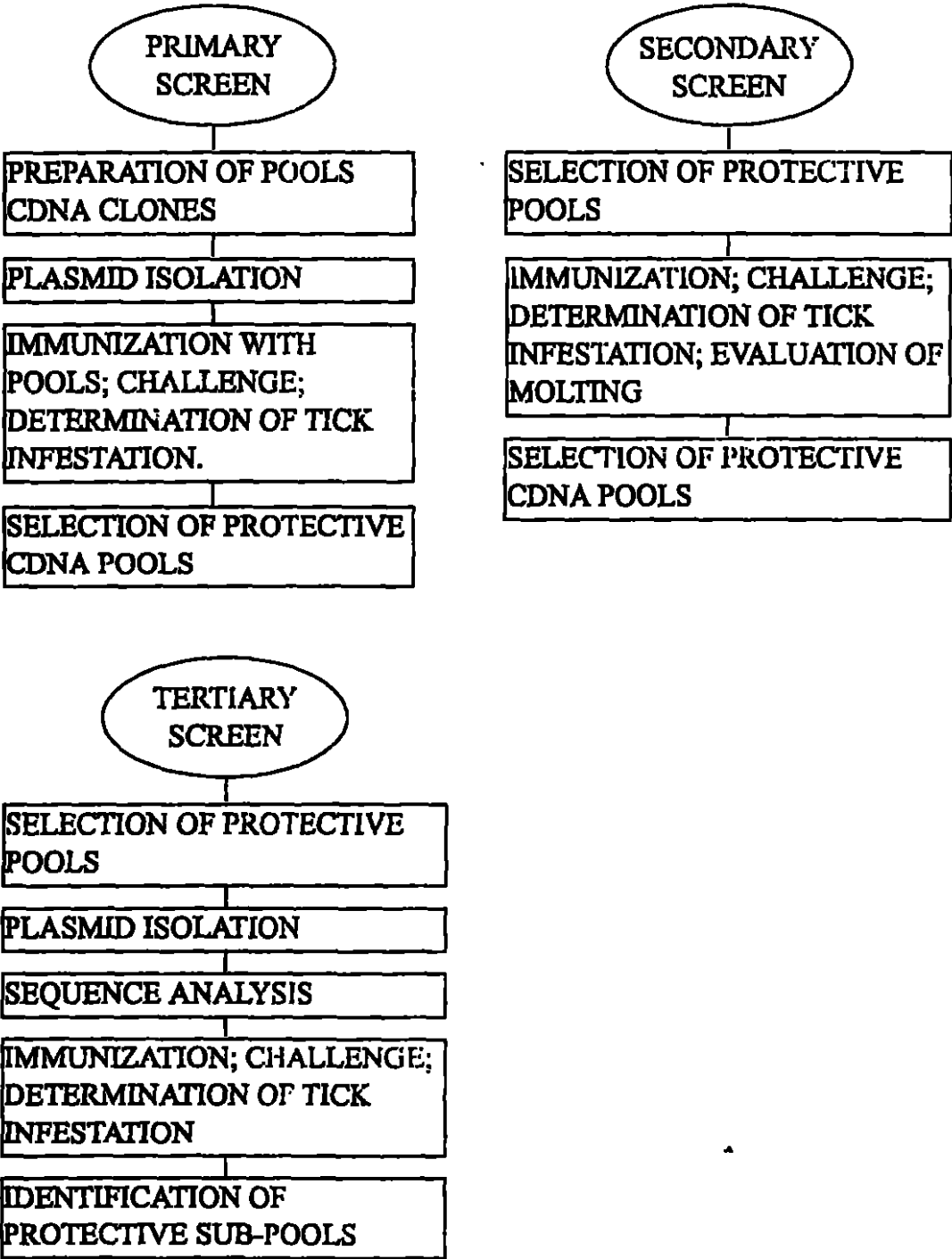
69. An isolated cell transformed by the expression vector of claim 68.
70. A vaccine comprising an effective immunizing amount of the isolated cDNA molecule of claim 67 and a pharmaceutically acceptable carrier or diluent.
71. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 70.
72. An isolated cDNA molecule comprising a nucleotide sequence of that shown in SEQ ID NO: 24.
73. An expression vector comprising the isolated cDNA molecule of claim 72.
74. An isolated cell transformed by the expression vector of claim 73.
75. A vaccine comprising an effective immunizing amount of the isolated cDNA molecule of claim 72 and a pharmaceutically acceptable carrier or diluent.
76. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 75.
77. An isolated cDNA molecule comprising a nucleotide sequence of that shown in SEQ ID NO: 25.
78. An expression vector comprising the isolated cDNA molecule of claim 77.
79. An isolated cell transformed by the expression vector of claim 78.
80. A vaccine comprising an effective immunizing amount of the isolated cDNA molecule of claim 77 and a pharmaceutically acceptable carrier or diluent.

119
212

81. A method of inducing an immune response in a mammal against *Ixodes* species ticks and their associated pathogens, comprising administering to the mammal the vaccine of claim 80.

150
23

FIG. 1



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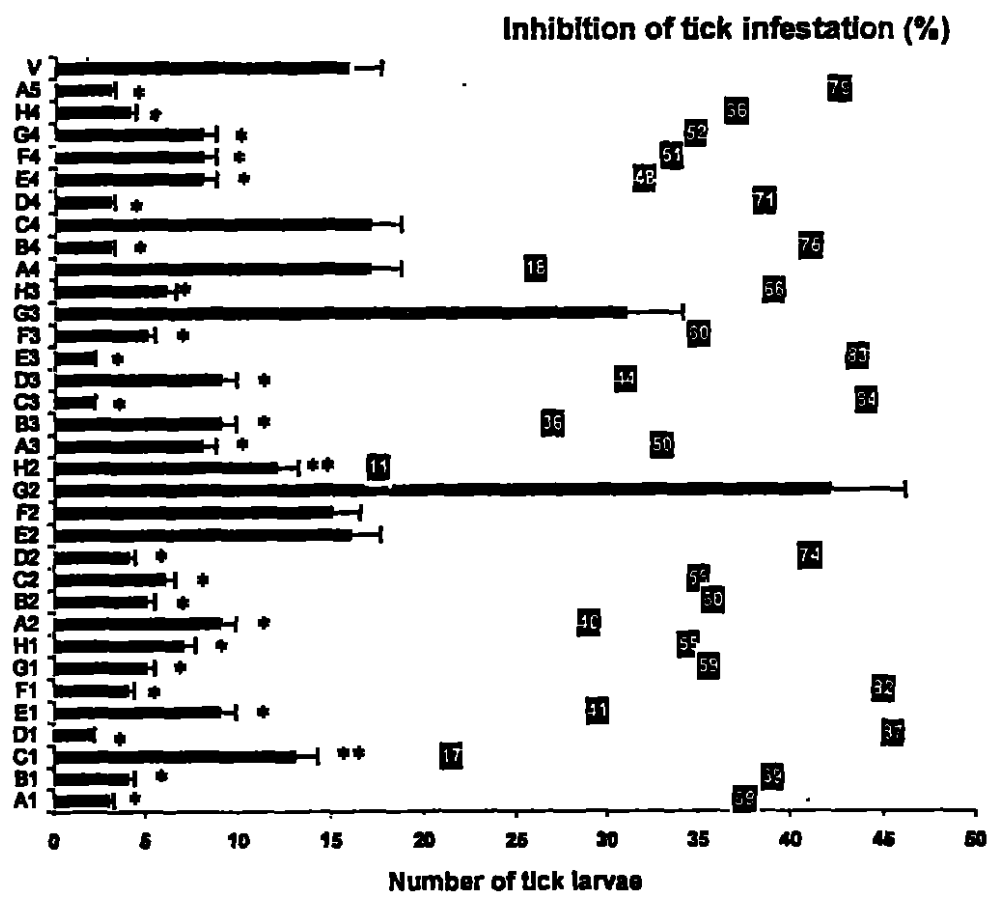


FIG. 2A

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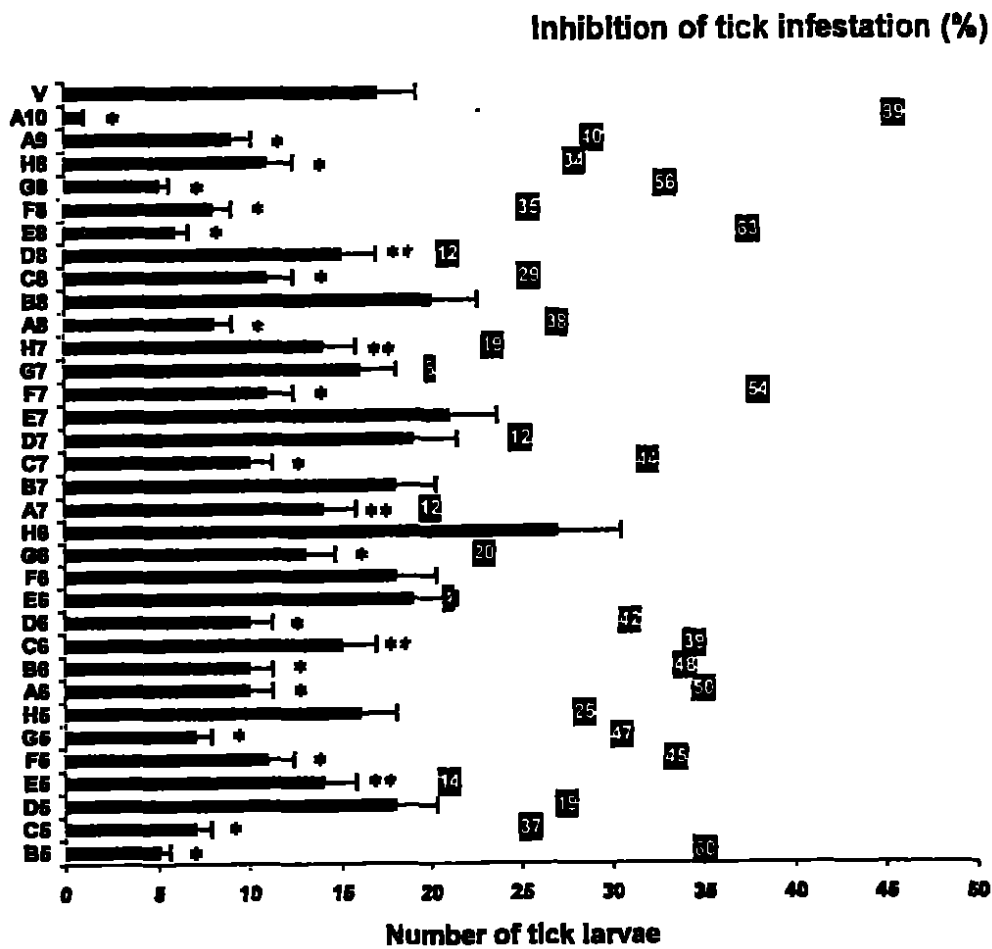


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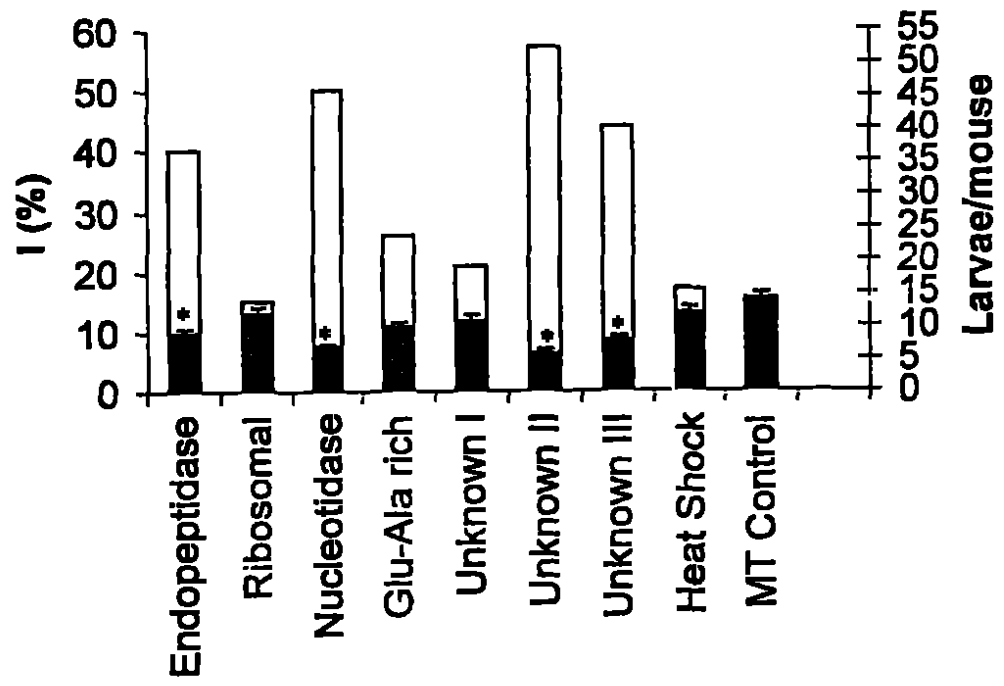


FIG. 3

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Cys Phe Ser Ser Pro Leu Glu Ser Gly Ser Pro Ser Ala Thr Pro Pro
85         90         95

Ala Ala Asp Cys Gly Pro Ala Ser Pro Thr Gly Leu Ser Pro Gly Gly
100        105        110

Leu Leu Ser Pro Val Arg Arg Asp Gln Pro Leu Phe Thr Phe Arg Gln
115        120        125

```

157
220

Fuente2.ST25.txt

Val Gly Leu Ile Cys Glu Arg Met Met Lys Glu Arg Glu Ser Gln Ile
130 135 140

Arg Asp Glu Tyr Asp His Val Leu Ser Ala Lys Leu Ala Glu Gln Tyr
145 150 155 160

Asp Thr Phe Val Lys Phe Thr Tyr Asp Gln Ile Gln Lys Arg Phe Glu
165 170 175

Gly Ala Thr Pro Ser Tyr Leu Ser
180

<210> 5
<211> 1821
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (1487)..(1487)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1595)..(1595)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1606)..(1606)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1623)..(1623)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1762)..(1762)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1789)..(1789)
<223> n is a, c, g, or t

<400> 5
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gttaaaatag ttaacagcgc cggaagata atcaaggaca tcatgaacag tggaaacctc 120
ggaatcgtcg aaaaggaagg catcaatgac ctgcaaacgg aggcagacag atctgttcag 180
cgctgcattg tgacttcgct ctcgagacag ttcccaaaac tgacaataat tggatgaagag 240
actctggagg agaaaaagat cagcgacgac tggatcatca ccgagcatga caaggatgtc 300
ctggccactt ctctgccgga caacctgaag aacatcaaag aggaagattt ggtagtctgg 360
gttgatcctc tggatggaac caaggagtac acacaggggt tcctggacca cgtgacgac 420

158
221

Fuente2.ST25.txt

```

ctggtgggga ttgcggttga cggtaaggca gtgggtggag tgatccacca gccgtactac 480
aactaccagg tggagaagga cgtctacaag cagggacgta ccatgtgggg cattgtcggc 540
gtcgggtgcct ttgggatctc gcgcattgcy cctccggaga acaagaggat catcactacy 600
acgcgctccc attccagccc caccatcaac agctgcattg aagccatgaa tccggacgag 660
gtgctgcgag ttggagggtgc cgggcacaag gtgctgctgt tgattgaggg caaggctcac 720
gcttacgtgt ttcccagcaa aggggtgcaag aaatgggaca cttgtgcccc cgaagcgatt 780
cttcatgcca ctggcggcct tcttacagat gttcacggga acagattgga gtaccacaag 840
gacgtggaac acgtcaatgc cggcggcggt cttgccacct gcctgaagga acaacacgaa 900
tggttcaaga accacattcc cgaagatgtc cgcaagacgc ttcctctatg agcaacctgc 960
cgttgtccgt tgcgatcaca ctcaagtcgc gtttttcctt taactttgtg gtgatgcggt 1020
tcaaagtctt atactattag tgttttgggtg gtccaaatat tattactaaa aaaacccgga 1080
gacatgggac acaaaaaaat ggaggggagg gacaataagg tctcgaacac agctcgtaca 1140
gaatTTTTTA aaataatgtt gatttcaggt ttatttgtgg aaactctgaa attaacctgt 1200
atgtcattat ttgggttgtg ccgtttgaaa ttttatgaaa tacgtaatag ctgcacgcat 1260
tttgaggcc actcagctcc ttgaatgctc gatgcttgat gcttctgcca acattatttg 1320
tatctcaagt ttttctacca caagaaacag taccctaaca ttttgaaata gtattactag 1380
cttggatttt atctggtatg catatataag atctatggat gttcctaagg agggcatgaa 1440
tttgaaacat accctgtcct taccaacctt caaacatttt tttttgngcc tgcttaaaaag 1500
catttacatt gcttgatcgt tgaattaatt ttttagctga tgtaaggac acttataata 1560
attaaggaaa tgagatcgat cttgagcttg tttngcctc tgtaanaatt gatgctcttt 1620
canacctaat gcttaatgca acaataatta tcaagtaatc cttactcagg tgtcagatat 1680
gcaagcagat gccaatgctt ctgttcattg agtggcaaaa ggcattgctc tttgtcacat 1740
tgcatgcatt tatgacagcc cnccttaata aactataatg cagctaant gaaaaaaaaa 1800
aaaaaaaaaa aaaaaaaaaa a 1821

```

<210> 6
 <211> 316
 <212> PRT
 <213> Ixodes scapularis

<400> 6

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Met Ala Ser Cys Gly Ala Ser Ala Thr Gly Pro Leu Val Leu Arg Val
1          5          10         15

Ile Ser Asn Thr Val Lys Ile Val Asn Ser Ala Gly Lys Ile Ile Lys
          20         25         30

Asp Ile Met Asn Ser Gly Asn Leu Gly Ile Val Glu Lys Glu Gly Ile
          35         40         45

```

159
222

Fuente2.ST25.txt

Asn Asp Leu Gln Thr Glu Ala Asp Arg Ser Val Gln Arg Cys Ile Val
50 55 60

Thr Ser Leu Ser Arg Gln Phe Pro Lys Leu Thr Ile Ile Gly Glu Glu
65 70 75 80

Thr Leu Glu Glu Lys Lys Ile Ser Asp Asp Trp Ile Ile Thr Glu His
85 90 95

Asp Lys Asp Val Leu Ala Thr Ser Leu Pro Asp Asn Leu Lys Asn Ile
100 105 110

Lys Glu Glu Asp Leu Val Val Trp Val Asp Pro Leu Asp Gly Thr Lys
115 120 125

Glu Tyr Thr Gln Gly Phe Leu Asp His Val Thr Ile Leu Val Gly Ile
130 135 140

Ala Val Asp Gly Lys Ala Val Gly Gly Val Ile His Gln Pro Tyr Tyr
145 150 155 160

Asn Tyr Gln Val Glu Lys Asp Val Tyr Lys Gln Gly Arg Thr Met Trp
165 170 175

Gly Ile Val Gly Val Gly Ala Phe Gly Ile Ser Arg Ile Ala Pro Pro
180 185 190

Glu Asn Lys Arg Ile Ile Thr Thr Thr Arg Ser His Ser Ser Pro Thr
195 200 205

Ile Asn Ser Cys Ile Glu Ala Met Asn Pro Asp Glu Val Leu Arg Val
210 215 220

Gly Gly Ala Gly His Lys Val Leu Leu Leu Ile Glu Gly Lys Ala His
225 230 235 240

Ala Tyr Val Phe Pro Ser Lys Gly Cys Lys Lys Trp Asp Thr Cys Ala
245 250 255

Pro Glu Ala Ile Leu His Ala Thr Gly Gly Leu Leu Thr Asp Val His
260 265 270

Gly Asn Arg Leu Glu Tyr His Lys Asp Val Glu His Val Asn Ala Gly
275 280 285

Gly Val Leu Ala Thr Cys Leu Lys Glu Gln His Glu Trp Phe Lys Asn
290 295 300

His Ile Pro Glu Asp Val Arg Lys Thr Leu Pro Leu
305 310 315

160
223

Fuente2.ST25.txt

<210> 7
<211> 697
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (573)..(573)
<223> n is a, c, g, or t

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<400> 7
gacctcaagg aaggcatctg cccgcaggcc ttctggctca acaaggagca gtgttgctgg      60
gcctccaacg ataccttctt taagggggac gactgcaagc agtggatctg gtggcccgag      120
atgttcgaca gcggcatgga caaggacggg gcaggctttt acctgctctc ctacctgctg      180
tacgtcatgt ggagtgtgct cttcgccacc ctggccgtca tgctcgttcg caccttcgcg      240
ccctatgcct gtggatctgg aatccccggag atcaagacga ttctgagcgg cttcatcatc      300
cgcggtacc tgggcaagtg gacgctgacc atcaaatacag tgtgtctggt gctggccgctc      360
ggggcgggcc tcagcctggg caaagagggg cccctgggtgc acgtggcctg ctgcatcggg      420
aacatcttct cctacctctt cccaagtac ggcaagaatg aggccaaagaa gagggagatc      480
ctgtcggctg ccgccgccgc gggagtttct gtggcctttg gggctcccat cggcgggtgtt      540
ctcttcagcc tcgaagaggt gagctactac ttnccttga agacgctgtg gcgttccttc      600
ttctgcgcc tggtggcagc ctcggtgctg cgctccatca acccctttgg caacgaccac      660
ctggtgatgt tctacgtcga gtacgacttt ccctggc                                697
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<210> 8
<211> 232
<212> PRT
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (191)..(191)
<223> Xaa can be any naturally occurring amino acid

```
<400> 8
Asp Leu Lys Glu Gly Ile Cys Pro Gln Ala Phe Trp Leu Asn Lys Glu
1          5          10          15
Gln Cys Cys Trp Ala Ser Asn Asp Thr Phe Phe Lys Gly Asp Asp Cys
20          25          30
Lys Gln Trp Tyr Arg Trp Pro Glu Met Phe Asp Ser Gly Met Asp Lys
35          40          45
Asp Gly Ala Gly Phe Tyr Leu Leu Ser Tyr Leu Leu Tyr Val Met Trp
50          55          60
Ser Val Leu Phe Ala Thr Leu Ala Val Met Leu Val Arg Thr Phe Ala
65          70          75          80
```

161
224

Fuente2.ST25.txt

Pro Tyr Ala Cys Gly Ser Gly Ile Pro Glu Ile Lys Thr Ile Leu Ser
85 90 95

Gly Phe Ile Ile Arg Gly Tyr Leu Gly Lys Trp Thr Leu Thr Ile Lys
100 105 110

Ser Val Cys Leu Val Leu Ala Val Gly Ala Gly Leu Ser Leu Gly Lys
115 120 125

Glu Gly Pro Leu Val His Val Ala Cys Cys Ile Gly Asn Ile Phe Ser
130 135 140

Tyr Leu Phe Pro Lys Tyr Gly Lys Asn Glu Ala Lys Lys Arg Glu Ile
145 150 155 160

Leu Ser Ala Ala Ala Ala Ala Gly Val Ser Val Ala Phe Gly Ala Pro
165 170 175

Ile Gly Gly Val Leu Phe Ser Leu Glu Glu Val Ser Tyr Tyr Xaa Pro
180 185 190

Leu Lys Thr Leu Trp Arg Ser Phe Phe Cys Ala Leu Val Ala Ala Ser
195 200 205

Val Leu Arg Ser Ile Asn Pro Phe Gly Asn Asp His Leu Val Met Phe
210 215 220

Tyr Val Glu Tyr Asp Phe Pro Trp
225 230

<210> 9
<211> 1221
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (713)..(713)
<223> n is a, c, g, or t

<400> 9
gtttcttggt acggtagtgg agtgctgagt ttactcgata atatctgaga aatagtgga 60
atatcaattt ttctgtaaat tagaaatgta accaatggcg tggctatctt ctagtcgaca 120
ctaacgtctc ggatctgctg ttcaaagtcc cgggcatca agccgtattt gttgtccagc 180
tgccaagtgc gtcgaatatg atgccgaaaa agaaagaatc agtcgagagc tctaaagaag 240
acgcgccgat cgacgtgacg ggcctgccct cccacaaacg acacaagaag cacaagcaca 300
aaaagcacia ggcgaagcga ggcacggacc aagacgaaga ccaatcgccc gccgagagcc 360
cgcagagcgg tggcgagggt agcagcagca agcccgcgt caagctcaag atcaagatcg 420

163
28

Fuente2.ST25.txt

```
gcggacagac ggtcgagaag aacgtgacca agctgaaaca gcagcggccg ccgccgccgg 480
accctagcga agccgatctc gccgaactcc tgatgaaacc caactcgggc gatacgagcg 540
cagacagcga tgacgaagag gaagcctggc tcgaagccct cgagtccggc aggctcgaag 600
aggctgacga cgagctccgc aaaatgaagg acccgaccct gatgacggcc aggcagcggg 660
ccctgctcga gagcaagtcg cagaaggacg aggtcccggc gacggggatg gcnggcgtcc 720
gcggagcccc tcaaagagat gtccgaggag atgattcagc ggcggatgct gcgggccaaa 780
aagcggaagc agcaggccga agagaagaaa gagaaggaga agaagcagac gatcgagcgt 840
ctgctcaaga agtccgactc gaggctgagg gccagcaaga agttggccaa gaagagcgat 900
actcccaagg tgctgctggc caacacgcag gcaggcacgc tgctctcgtt tcccgtcggc 960
gttgcgttcc cgctgtcggc agccgtggcc caggggtacc ccgagaagac gacgtgcggc 1020
attaaggggt gtcgtaaccc gaagaagtac tcgtgctcca agacaggcgt gcccctgtgc 1080
agcctcgagt gctacaagac gaacatgctg cagatgtgcg tctgagcggg cagctaggct 1140
tccgggctac agctgctcct tgtgtatatg tatataaagt cgagaatgct gaaaaaaaaa 1200
aaaaaaaaa aaaaaaaaaa a 1221
```

```
<210> 10
<211> 275
<212> PRT
<213> Ixodes scapularis
<400> 10
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Met Met Pro Lys Lys Lys Glu Ser Val Ala Ser Ser Lys Glu Asp Ala
1 5 10 15
Pro Ile Asp Val Ile Gly Leu Pro Ser His Lys Arg His Lys Lys His
20 25 30
Lys His Lys Lys His Lys Arg Lys Arg Gly Thr Asp Gln Asp Glu Asp
35 40 45
Gln Ser Pro Ala Ala Ser Pro Gln Ser Gly Gly Glu Gly Ser Ser Ser
50 55 60
Lys Pro Ala Leu Lys Leu Lys Ile Lys Ile Gly Gly Gln Thr Val Glu
65 70 75 80
Lys Asn Val Thr Lys Leu Lys Gln Gln Arg Pro Pro Pro Pro Asp Pro
85 90 95
Ser Glu Ala Asp Leu Ala Glu Leu Leu Met Lys Pro Asn Ser Gly Asp
100 105 110
Thr Ser Ala Asp Ser Asp Asp Glu Glu Glu Ala Trp Leu Glu Ala Leu
115 120 125
```

163
226

Fuente2.ST25.txt

Glu Ser Gly Arg Leu Glu Glu Val Asp Asp Glu Leu Arg Lys Met Lys
130 135 140

Asp Pro Thr Leu Met Thr Ala Arg Gln Arg Ala Leu Leu Glu Ser Lys
145 150 155 160

Ser Gln Lys Asp Glu Val Pro Ala Thr Gly Met Ala Gly Val Arg Gly
165 170 175

Ala Arg Gln Arg Asp Val Arg Gly Asp Asp Ser Ala Ala Asp Ala Ala
180 185 190

Gly Gln Lys Ala Glu Ala Ala Gly Arg Arg Glu Glu Arg Glu Gly Glu
195 200 205

Glu Ala Asp Asp Arg Ala Ser Ala Gln Glu Val Arg Leu Glu Ala Glu
210 215 220

Gly Gln Gln Glu Val Gly Gln Glu Glu Arg Tyr Ser Gln Gly Val Ala
225 230 235 240

Gly Gln His Ala Gly Arg His Ala Ala Leu Val Ser Arg Arg Arg Cys
245 250 255

Val Pro Ala Val Gly Ser Arg Gly Pro Gly Val Pro Arg Glu Asp Asp
260 265 270

Val Arg His
275

<210> 11
<211> 1942
<212> DNA
<213> Ixodes scapularis

<400> 11
cgatgcaggc gatgacgggc ttgcggtgc agttcaacaa aaacagtttc gggctgactc 60
cagctcagcc gctgcagttg cagattcccc tgcagcccaa cttcccagct gatgcgagct 120
tgcagctggg aaccaacggt cccgtgcaga agatggaccc cctcaccaac cttcaggtgg 180
ccatcaagaa caatgtggac gtgttctact tcagctgcct ggtgcccattg cacgtgtcta 240
gcacggagga cggcctgatg gacaagcggg tgttcctggc cacctggaaa gacatccccg 300
cccaaaacga ggtccagtac accctcgaca acgtcaacct cactgcagac caagtttccc 360
agaagctgca gaacaacaac attttcacga tagccaagag gaacgtggac ggccaggaca 420
tgctgtacca gtccctgaag ctcaccaacg gcatttgggg gttggcggag ctcaagatac 480
agccccggcaa tccaaggatc acgttgtctt tgaagacaag agcacctgaa gtggcagcag 540
gtgtacaaca aacttacgaa ctattctac acagctgagg ctgctgtgaa tgaaactctt 600
ctccaccccc cttcttttga tggcagtcaa tgtctcgttt cattttcttg ttttcttttg 660

169
22

Fuente2.ST25.txt

```

cggcgtgcta cggaacaagg tcctacattc ccaagttata tggigtgtgc gcgtaggggg 720
cagagtgccg ctgagcccg cagagccttg tttctgagga gagccgaacg caccacttcg 780
aaaaagaaaa agtgaaaacg gaaaaatgaa aaattttcca gttgcttcaa attaacattc 840
ctcgtagtca gtctgtggcc gttgagtttg gtgtaaagaa gaaaaaggtg tctcttttag 900
tgaaaatggt tgctttttat tggatatccc tatcacaccg agcacgaaca taagaaatcc 960
tgacaaggat tctccttttag ttgtattatg gtggctggag cacacgaggc acctgttgcc 1020
aattcgaccc agcaaatgcc caattctcaa gatttgagtt cattgaggtt gttttgctcc 1080
cccccccca ccccccaact ttgtcgttg gattgtctaac agtgtaaata ggcgacgact 1140
cgttattctt tttttcttca ttttttctt ttgttgtcac gcgccccggg ggacgcgaca 1200
caacttatgt gcataattga ttttcacagg ctgcgacgca gtctgtaaaa gaaggggaag 1260
tgaaactctg ctccgccgt gctagtgtca tcacgggacg accatcgct tttctctgac 1320
tatttaaaca aaactgcata gcttagggg cagtctgtgc aaagtggaac aaccaaactg 1380
agccctgccc tttcgggtgtg tgtacaagca tctctgtgta acatgaacta ctttacatga 1440
actacattgc atgaacggga gaagtttagt tgtttttttg ttttttttt caggtgacta 1500
tgtcaacaga ttagaaccat tttttggaac ggctggaaag ataaccgctc attttgtttc 1560
tactaaaaga ctacgaaaag tgttgacttt ttgcatcggg ttggcaacgt ttgtttggca 1620
tgcatgtagt tgagcgtaat ggtatcacc ctcgtaaaca ataacagtgc aatggagcag 1680
tactgtagtg tccattaaag agcgagagtt tggttaaagg ttgttaattg aggtccgtgt 1740
tatcctttga gtaggagagc ggcacttttt gcaaatagcg ctgctggggg cgtcatatct 1800
gccctccaaa acatgcacat ttttaagtgt aattgttgcg gcggcttgta caagtatgtg 1860
tgttatgtgt agaaaaagaa ctcttaatta aaatatttgt ggccaaaacg tcaaaaaaaa 1920
aaaaaaaaa aaaaaaaaaa aa 1942

```

<210> 12
 <211> 191
 <212> PRT
 <213> Ixodes scapularis
 <400> 12

Met Gln Ala Met Thr Gly Phe Ala Val Gln Phe Asn Lys Asn Ser Phe
 1 5 10 15

Gly Leu Thr Pro Ala Gln Pro Leu Gln Leu Gln Ile Pro Leu Gln Pro
 20 25 30

Asn Phe Pro Ala Asp Ala Ser Leu Gln Leu Gly Thr Asn Gly Pro Val
 35 40 45

Gln Lys Met Asp Pro Leu Thr Asn Leu Gln Val Ala Ile Lys Asn Asn
 50 55 60

165-
228

Fuente2.ST25.txt

Val Asp Val Phe Tyr Phe Ser Cys Leu Val Pro Met His Val Leu Ser
65 70 75 80

Thr Glu Asp Gly Leu Met Asp Lys Arg Val Phe Leu Ala Thr Trp Lys
85 90 95

Asp Ile Pro Ala Gln Asn Glu Val Gln Tyr Thr Leu Asp Asn Val Asn
100 105 110

Leu Thr Ala Asp Gln Val Ser Gln Lys Leu Gln Asn Asn Asn Ile Phe
115 120 125

Thr Ile Ala Lys Arg Asn Val Asp Gly Gln Asp Met Leu Tyr Gln Ser
130 135 140

Leu Lys Leu Thr Asn Gly Ile Trp Val Leu Ala Glu Leu Lys Ile Gln
145 150 155 160

Pro Gly Asn Pro Arg Ile Thr Leu Ser Leu Lys Thr Arg Ala Pro Glu
165 170 175

Val Ala Ala Gly Val Gln Gln Thr Tyr Glu Leu Ile Leu His Ser
180 185 190

<210> 13
<211> 1428
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (701)..(701)
<223> n is a, c, g, or t

<400> 13
cgcgccgtgc agaagctgcg tcgggaggtt gagaaggcaa agaggaccct gtccactgct 60
caccaggcca ggatcgagat tgaatcgttc ttcgagggag aggacttcag tgagaccctg 120
actcgtgcta agtttgagga gctgaacatg gaccttttcc gttccaccat gaagcctgtt 180
cagaagggtac tcgaggatgg tgacctcaag aagactgatg tggacgagat tgtgcttgtc 240
ggaggttcca ccaggatccc caaggttcaa cagctgggtca aggagttcct caatggcaag 300
gaaccacccc gtggcatcaa ccccgacgaa gcagtcgcct acggtgccgc cgtgcaygct 360
ggagtcctcg gcggagagga agacactggg gacctcgtgc tggtggacgt gaaccctctg 420
accctcggca tcgagacagt gggaggcgtc atgacgaaac tgatcccccg taacacagtc 480
atccccacga agaagtctca gatcttctcc acggcctcgg acgagcagag cactgtcacc 540
atccaggtct ttgaggggga gcgtcccctg acaaaggaca accaccagct gggcaagttc 600
gacctgactg gcatcccacc tgctcctcga ggtgtgcccc aaatcgaggt gaccttcgag 660
attgacgtca acggtatcct gcgggtcagt gcagaggaca ngggtacagg caacaagcag 720

166-
229

Fuente2.ST25.txt

aagatcacca tcaacaatga ccagaacagg ctgacgcctg aggacatcga gaggatggta 780
aaggacgccg aaaagtttgc cgacgaggac aagaagggtca aggagaaggt gyaggcccg 840
aacgaactgg agtccttatgc ctactccctc aagaaccaga ttggagacaa ggagaagatg 900
ggaggcaagc tctccgacga ggacaagaag actattgagc aagctgtgga cgagaaaatc 960
aaatggctgg agcagcacag tgacgctgat gcggaagaac tcaaggaaca gaagaaacag 1020
ctggctgata ctgtgcagcc gattgtagcc aagctgtacc ctgcaggagg caccaccgc 1080
ccgacggaca aagatgactc tacaaaggac gagttgtaaa aacaaggcca gatctcttgg 1140
gtacagcgaa aggcattggg cagcagcatt atcacaagtc atctgttacg atcatgagct 1200
catcatttca ccacctctac agtgctgctg ctgcctgcct tttggctggt tgagtgttct 1260
tggacctatt taccatgatc attctctgta caaaaacaat tctttctgtg tttttttttt 1320
tttcgttgta gtaacttaag ttatacagat gtcttctact ggytgggctt tctccatgag 1380
tgggaggggg ctgggtgtca aataaaagtg tttctattaa aaaaaaaa 1428

<210> 14
<211> 372
<212> PRT
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (234)..(234)
<223> Xaa can be any naturally occurring amino acid

<400> 14

Arg Ala Val Gln Lys Leu Arg Arg Glu Val Glu Lys Ala Lys Arg Thr
1 5 10 15

Leu Ser Thr Ala His Gln Ala Arg Ile Glu Ile Glu Ser Phe Phe Glu
20 25 30

Gly Glu Asp Phe Ser Glu Thr Leu Thr Arg Ala Lys Phe Glu Glu Leu
35 40 45

Asn Met Asp Leu Phe Arg Ser Thr Met Lys Pro Val Gln Lys Val Leu
50 55 60

Glu Asp Gly Asp Leu Lys Lys Thr Asp Val Asp Glu Ile Val Leu Val
65 70 75 80

Gly Gly Ser Thr Arg Ile Pro Lys Val Gln Gln Leu Val Lys Glu Phe
85 90 95

Phe Asn Gly Lys Glu Pro Thr Arg Gly Ile Asn Pro Asp Glu Ala Val
100 105 110

Ala Tyr Gly Ala Ala Val Gln Ala Gly Val Leu Gly Gly Glu Glu Asp
115 120 125

Fuente2.ST25.txt

Thr Gly Asp Leu Val Leu Leu Asp Val Asn Pro Leu Thr Leu Gly Ile
 130 135 140
 Glu Thr Val Gly Gly Val Met Thr Lys Leu Ile Pro Arg Asn Thr Val
 145 150 155 160
 Ile Pro Thr Lys Lys Ser Gln Ile Phe Ser Thr Ala Ser Asp Glu Gln
 165 170 175
 Ser Thr Val Thr Ile Gln Val Phe Glu Gly Glu Arg Pro Leu Thr Lys
 180 185 190
 Asp Asn His Gln Leu Gly Lys Phe Asp Leu Thr Gly Ile Pro Pro Ala
 195 200 205
 Pro Arg Gly Val Pro Gln Ile Glu Val Thr Phe Glu Ile Asp Val Asn
 210 215 220
 Gly Ile Leu Arg Val Ser Ala Glu Asp Xaa Gly Thr Gly Asn Lys Gln
 225 230 235 240
 Lys Ile Thr Ile Asn Asn Asp Gln Asn Arg Leu Thr Pro Glu Asp Ile
 245 250 255
 Glu Arg Met Val Lys Asp Ala Glu Lys Phe Ala Asp Glu Asp Lys Lys
 260 265 270
 Val Lys Glu Lys Val Glu Ala Arg Asn Glu Leu Glu Ser Tyr Ala Tyr
 275 280 285
 Ser Leu Lys Asn Gln Ile Gly Asp Lys Glu Lys Met Gly Gly Lys Leu
 290 295 300
 Ser Asp Glu Asp Lys Lys Thr Ile Glu Gln Ala Val Asp Glu Lys Ile
 305 310 315 320
 Lys Trp Leu Glu Gln His Ser Asp Ala Asp Ala Glu Glu Leu Lys Glu
 325 330 335
 Gln Lys Lys Gln Leu Ala Asp Thr Val Gln Pro Ile Val Ala Lys Leu
 340 345 350
 Tyr Pro Ala Gly Gly Thr Pro Pro Pro Thr Asp Lys Asp Asp Ser Thr
 355 360 365
 Lys Asp Glu Leu
 370

<210> 15
 <211> 1847

Fuente2.ST25.txt

<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (1814)..(1814)
<223> n is a, c, g, or t

<400> 15
cgacgtgttt gtgagtgcag cggatgaactg gacggtgtcg tggccacgcg atggcagcgg 60
cggatgatgaa ctgcctacgg actgcgcttt taggcgctct cgtcgtccaa ctctacycca 120
cgagatagg tcaccggaaa ttcgagtaca agtacagttt caagggaccc tacctggcgc 180
agaaggatgg atcgggtgcct ttctgggagt acggcggcaa ttgcatcgcc agtgaggaga 240
tggttcggat cagccctcc ctgaagagca agaaaggatc catctggtcc aagctgccga 300
catcgttccc ttggtgggag gtggagctgg tgtccgcac cacgggtacg ggcaggatag 360
gagctgacgg cctggccttc tggtagacag acaagaagca ggcggagggt cctgtctttg 420
gaagcagcga caagtggact ggcctggcca tcttcttcga ttccttcyac aatgataaca 480
agcacaacaa cccatacatc atgggcatgg tgaacgatgg aacaaaagcc tacgatcatg 540
agagtgcagg tgccaaccaa cagctagcgg gatgccagcg ggacttcgc aacaagcctt 600
accctgtcag ggccaagata gaataacttca acaacattct cacggtgctg ttccacaacg 660
gcaacaccaa caacgacggt gactacgaga tgtgcttccg tgcggagaac gtgttcctgc 720
cgaccaacgg ccactttggg gtgtccgccg ccacgggggg cctgycagac gaccacgacg 780
ccctcaagtt cctgacgacg agcctgcagc cggagggcac gcagccggcc ctggcccagg 840
gtatggccga ctgagagaag gagaagttct ccaaggagta tgaagtatac aaggacaagc 900
tggaagagca gaaggaggag taccggaaga cgcacccgga ggaggccgct aagcaggcca 960
tgagacacgg ccccgagcag gcctacgaca cgcagcagca gcgcgagctg cgccagatct 1020
tcgagggcca gagccacaaa ttgtttgagg ggctcaaggc actgcaccgc aagctggacg 1080
agggtgctcg gcgccaggag cgcaccctgt cgctggtgtc ggctggcggc gccggcgtgg 1140
ccgtgggagg tgttcgccca ccgcagatgg gtggagtgcc gtcgctgcag aggcacgaag 1200
cagagtccct gctgagcagc cagcgggagc tgctgcagac ggtggctcag gtcaagagct 1260
ttgtggccga ggtgcatcaa cgcacggcca ccctgcaaca ccagggggcg ggaggcacc 1320
agggcctcac ggccgagcag ctgcaagtgc tccaccaggc gcgggacagc gtygccagca 1380
tgcaccggga cgtctccaac aaccagccgc agaggactgg ctgcgcgaca tcctgtctca 1440
gcactacca cttcttgcgt tttgcaacgt tgcagttggc tgtcacgctg ggctacttgg 1500
tgtacaggag cagcaaagag gcggcgcca agaagttcta ctgagtgcag atctcyagcc 1560
ttgccttgcc ctccccctcc atggagtgga ccttaacccc acagactgcc agaaaccagt 1620
gttgccagag gagccccct cccttcttat tgggtggggg gccacagcca tcacccattc 1680
ttcgagacaa ggccactgtt tggggggagg ggcaagagat tcatccgggg tgcgcaacaa 1740

Fuente2.ST25.txt

aacatggccg tacagagggga ggggtgctcc agaactgggt cccagccaca tcgttgctg 1800

ggagcgcctt tctncctcac tctaaaaaaaa aaaaaaaaaa aaaaaaa 1847

<210> 16
<211> 497
<212> PRT
<213> Ixodes scapularis

<400> 16

Met Ala Ala Ala Val Met Asn Cys Leu Arg Thr Ala Leu Leu Gly Ala
1 5 10 15

Leu Val Val Gln Leu Tyr Ala Thr Gln Ile Gly His Arg Lys Phe Glu
20 25 30

Tyr Lys Tyr Ser Phe Lys Gly Pro Tyr Leu Ala Gln Lys Asp Gly Ser
35 40 45

Val Pro Phe Trp Glu Tyr Gly Gly Asn Cys Ile Ala Ser Glu Glu Met
50 55 60

Val Arg Ile Thr Pro Ser Leu Lys Ser Lys Lys Gly Ser Ile Trp Ser
65 70 75 80

Lys Leu Pro Thr Ser Phe Pro Trp Trp Glu Val Glu Leu Val Phe Arg
85 90 95

Thr Thr Gly Thr Gly Arg Ile Gly Ala Asp Gly Leu Ala Phe Trp Tyr
100 105 110

Thr Asp Lys Lys Gln Ala Glu Gly Pro Val Phe Gly Ser Ser Asp Lys
115 120 125

Trp Thr Gly Leu Ala Ile Phe Phe Asp Ser Phe Asp Asn Asp Asn Lys
130 135 140

His Asn Asn Pro Tyr Ile Met Gly Met Val Asn Asp Gly Thr Lys Ala
145 150 155 160

Tyr Asp His Glu Ser Asp Gly Ala Asn Gln Gln Leu Ala Gly Cys Gln
165 170 175

Arg Asp Phe Arg Asn Lys Pro Tyr Pro Val Arg Ala Lys Ile Glu Tyr
180 185 190

Phe Asn Asn Ile Leu Thr Val Leu Phe His Asn Gly Asn Thr Asn Asn
195 200 205

Asp Gly Asp Tyr Glu Met Cys Phe Arg Ala Glu Asn Val Phe Leu Pro
210 215 220

Fuente2.ST25.txt

Thr Asn Gly His Phe Gly Val Ser Ala Ala Thr Gly Gly Leu Ala Asp
 225 230 235 240

Asp His Asp Ala Leu Lys Phe Leu Thr Thr Ser Leu His Ala Glu Gly
 245 250 255

Thr Gln Pro Ala Leu Ala Gln Gly Met Ala Asp Ser Glu Lys Glu Lys
 260 265 270

Phe Ser Lys Glu Tyr Glu Val Tyr Lys Asp Lys Leu Glu Lys Gln Lys
 275 280 285

Glu Glu Tyr Arg Lys Thr His Pro Glu Glu Ala Ala Lys Gln Ala Met
 290 295 300

Glu His Gly Pro Glu Gln Ala Tyr Asp Thr Gln Gln Gln Arg Glu Leu
 305 310 315 320

Arg Gln Ile Phe Glu Gly Gln Ser His Lys Leu Phe Glu Gly Leu Lys
 325 330 335

Ala Leu His Arg Lys Leu Asp Glu Val Leu Gly Arg Gln Glu Arg Thr
 340 345 350

Leu Ser Leu Val Ser Ala Gly Gly Ala Gly Val Ala Val Gly Gly Val
 355 360 365

Pro Pro Pro Gln Met Gly Gly Val Pro Ser Leu Gln Arg His Glu Ala
 370 375 380

Glu Ser Leu Leu Ser Ser Gln Arg Glu Leu Leu Gln Thr Val Ala Gln
 385 390 395 400

Val Lys Ser Phe Val Ala Glu Val His Gln Arg Thr Ala Thr Leu Gln
 405 410 415

His Gln Gly Ala Gly Gly Thr Gln Gly Leu Thr Ala Glu Gln Leu Gln
 420 425 430

Val Leu His Gln Val Arg Asp Ser Val Ala Ser Met His Arg Asp Val
 435 440 445

Ser Asn Asn Gln Pro Gln Arg Thr Gly Cys Ala Thr Ser Cys Leu Ser
 450 455 460

Thr Thr His Phe Leu Leu Phe Ala Thr Leu Gln Leu Ala Val Thr Leu
 465 470 475 480

Gly Tyr Leu Val Tyr Arg Ser Ser Lys Glu Ala Ala Ala Lys Lys Phe
 485 490 495

Fuente2.ST25.txt

Tyr

<210> 17
<211> 2475
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (1342)..(1342)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (1388)..(1388)
<223> n is a, c, g, or t

<400> 17
catcactagt agcgagacac gtgcgtaaaa atggggccca aaacgctgtc taagcagccc 60
gctaaagctt cttcatccac ttccaagcgc accgccggcc ccacaataag caagcagacg 120
gaggacagcg atgacgaagg gtcaagcagc gcctactccg acttggagga ctccgaagga 180
gccgacagca gcgactcgaa cgatttgtcg gacacggagg cgtcggagga tgactacgat 240
gactcccaag acgaagaaaa cacgaagatt actttgactg ggggtggagg gaaggacctt 300
gagttgaggg ggaaggacca ggaggcaccg gtggagtctg gcaaaaggtc ggcatggcac 360
cggcagcaag aggacgcaa ggaggacaga cgaacgcaag tgggtggaaga tgaatatgcc 420
tttgactctt ccgacgaaga ggacgttcgc aacacggttg gcaacattcc tctggagtgg 480
tacgagcact atccgcacat cggttatgat ctggaaggca agccaatcct gaagccgcct 540
cgggttagtg acctggacga ctctctgagg aaaatggatg accccaacta ttggaggacg 600
gtgaaggaca agagcacggg acaggacgtt gtcctgaccg acgaagatgt ggacctgatt 660
cagaggctgc agaaaggaca gttccccagc tcgacgactg acccttacga gccatttgag 720
gacatctttt cgcacgagac catgatccac ccggtgacca ggcaccctcc ccagaaacgc 780
agcttcgtgc cttcaaggat agaaaaagca atggtgtcaa agatggtgca cgcaatcaag 840
atgggctgga tcaagccccg agtaaagaag catgaccag aaagattcag cctcctgtgg 900
gacaaggatg actcgacagc gggcagcaat gagcgaatgc agcgccacat cccggcacc 960
aagatgaagc tgccgggtca tgaggagtct tacaacccgc cggccgaata cctcttcacc 1020
gaggaagagg aggccaagtg gagagagcag gagccgaag aacggcgcat aaacttcctg 1080
cccgccaagt acccatgtct gcgcgcagtc ccagcctacg aacgcttcac tgaggagagg 1140
tttgagcgct gtctggatct ctacttgtgc ccgaggcagc ggaagatgag ggtgaatgtg 1200
gatgcagagg acctgattcc tcagctgccc aaaccaagg acctgcagcc tttcccaagc 1260
attcagtcta ttgtctatga gggtcatacg gactgtgtcc tctgcctgtc tttggagcct 1320
gcgggacagt tctttgcatc anggtcagag gacggcaccg ttcgcatttg ggagctcttg 1380
acgggcangt gcctcaagaa gttccagttc gaggcgcccg tgaagagcgt ggcctggtgt 1440

172
235

Fuente2.ST25.txt

ccagttgtcg ttcccatgaa actctgctg gacaagactg tttccatgct ggatgccgga 1500
gttacggaca aactgctgcc gttcaccacg ggacaccgag ttgtctgccc tccccgaaga 1560
gtcctcgggc caggcggcgg tagtggagtg ggagcagacg tcggcctcct ctccagagtt 1620
cctctcccgg ggggagcgtc tgcgggtcgt tcaccgccac ggtgtggtgc aggtgacgtg 1680
gcactcgagg ggagactact ttgccactyt cacgyacgag ggacaggcca ccgtgcttgt 1740
ccatcagttg tccacgcggc ggttcgcagg ctcccccttca gcaaggcgaa gggcggggtg 1800
tcccgggtgc tgttccaccg gctgcgcccc ttcttctgtg tggcgtgcca gcgcacagtg 1860
cgggtctacc acctgctcaa gcaggagctg gccaagaggc tcacatccaa ttgcaagtgg 1920
atctcgtgca tgggcccgtc acccccaggt gacaatctgc tgatcggcac gtacgagaag 1980
cggctgatgt ggttcgatct ggacctctcg accaaaccgt accagcagct gcgcatacac 2040
aatgccgcca tccgcagtgt ggcgttccat ccgcgctatc cactgtttgc gtccgccggc 2100
gacgatcgca gcgtgatcgt ttcgcacggt atggtgtaca atgatttact gcaaaaccca 2160
ctgatcgtgc cactgagacg gctgaagaac catgccatca gcaagggtat ggggtgtgtg 2220
gactgcgcct tccatcccca ccagccgtgg atagtcacgg ccggagcaga cagcacgctg 2280
cggctcttca cctaagccgg gacgtcgtct ggtgtacata gtgaatcgtc aagaccgtgc 2340
caataaaagg actccacacc taaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 2400
aaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 2460
aaaaaaaaa aaaaaa 2475

<210> 18
<211> 754
<212> PRT
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (438)..(438)
<223> Xaa can be any naturally occurring amino acid

<220>
<221> misc_feature
<222> (453)..(453)
<223> Xaa can be any naturally occurring amino acid

<400> 18

Met Gly Pro Lys Thr Leu Ser Lys Gln Pro Ala Lys Ala Ser Ser Ser
1 5 10 15

Thr Ser Lys Arg Thr Ala Gly Pro Thr Ile Ser Lys Gln Thr Glu Asp
20 25 30

Ser Asp Asp Glu Gly Ser Ser Ser Ala Tyr Ser Asp Leu Glu Asp Ser
35 40 45

173
236

Fuente2.ST25.txt

Glu Gly Ala Asp Ser Ser Asp Ser Asn Asp Leu Ser Asp Thr Glu Ala
50 55 60

Ser Glu Asp Asp Tyr Asp Asp Ser Gln Asp Glu Glu Asn Thr Lys Ile
65 70 75 80

Thr Leu Thr Gly Val Glu Gly Lys Asp Leu Glu Leu Arg Gly Lys Asp
85 90 95

Gln Glu Ala Pro Val Glu Ser Gly Lys Arg Ser Ala Trp His Arg Gln
100 105 110

Gln Glu Asp Ala Lys Glu Asp Arg Arg Thr Gln Val Val Glu Asp Glu
115 120 125

Tyr Ala Phe Asp Ser Ser Asp Glu Glu Asp Val Arg Asn Thr Val Gly
130 135 140

Asn Ile Pro Leu Glu Trp Tyr Glu His Tyr Pro His Ile Gly Tyr Asp
145 150 155 160

Leu Glu Gly Lys Pro Ile Leu Lys Pro Pro Arg Val Ser Asp Leu Asp
165 170 175

Asp Phe Leu Arg Lys Met Asp Asp Pro Asn Tyr Trp Arg Thr Val Lys
180 185 190

Asp Lys Ser Thr Gly Gln Asp Val Val Leu Thr Asp Glu Asp Val Asp
195 200 205

Leu Ile Gln Arg Leu Gln Lys Gly Gln Phe Pro Ser Ser Thr Thr Asp
210 215 220

Pro Tyr Glu Pro Phe Glu Asp Ile Phe Ser His Glu Thr Met Ile His
225 230 235 240

Pro Val Thr Arg His Pro Pro Gln Lys Arg Ser Phe Val Pro Ser Arg
245 250 255

Ile Glu Lys Ala Met Val Ser Lys Met Val His Ala Ile Lys Met Gly
260 265 270

Trp Ile Lys Pro Arg Val Lys Lys His Asp Pro Glu Arg Phe Ser Leu
275 280 285

Leu Trp Asp Lys Asp Asp Ser Thr Ala Gly Ser Asn Glu Arg Met Gln
290 295 300

Arg His Ile Pro Ala Pro Lys Met Lys Leu Pro Gly His Glu Glu Ser
305 310 315 320

Fuente2.ST25.txt

Tyr Asn Pro Pro Ala Glu Tyr Leu Phe Thr Glu Glu Glu Glu Ala Lys
 325 330 335
 Trp Arg Glu Gln Glu Pro Glu Glu Arg Arg Ile Asn Phe Leu Pro Ala
 340 345 350
 Lys Tyr Pro Cys Leu Arg Ala Val Pro Ala Tyr Glu Arg Phe Ile Glu
 355 360 365
 Glu Arg Phe Glu Arg Cys Leu Asp Leu Tyr Leu Cys Pro Arg Gln Arg
 370 375 380
 Lys Met Arg Val Asn Val Asp Ala Glu Asp Leu Ile Pro Gln Leu Pro
 385 390 395 400
 Lys Pro Lys Asp Leu Gln Pro Phe Pro Ser Ile Gln Ser Ile Val Tyr
 405 410 415
 Glu Gly His Thr Asp Cys Val Leu Cys Leu Ser Leu Glu Pro Ala Gly
 420 425 430
 Gln Phe Phe Ala Ser Xaa Ser Glu Asp Gly Thr Val Arg Ile Trp Glu
 435 440 445
 Leu Leu Thr Gly Xaa Cys Leu Lys Lys Phe Gln Phe Glu Ala Pro Val
 450 455 460
 Lys Ser Val Ala Trp Cys Pro Val Val Val Pro Met Lys Leu Cys Val
 465 470 475 480
 Asp Lys Thr Val Ser Met Leu Asp Ala Gly Val Thr Asp Lys Leu Leu
 485 490 495
 Pro Phe Thr Thr Gly His Arg Val Val Cys Pro Pro Arg Arg Val Leu
 500 505 510
 Gly Pro Gly Gly Gly Ser Gly Val Gly Ala Asp Val Gly Leu Leu Ser
 515 520 525
 Arg Val Pro Leu Pro Gly Gly Ala Ser Ala Gly Arg Ser Pro Pro Arg
 530 535 540
 Cys Gly Ala Gly Asp Val Ala Leu Glu Gly Arg Leu Leu Cys His Cys
 545 550 555 560
 His Gly Arg Gly Thr Gly His Arg Ala Cys Pro Ser Val Val His Ala
 565 570 575
 Ala Val Arg Arg Leu Pro Phe Ser Lys Ala Lys Gly Gly Val Ser Arg
 580 585 590

175
238

Fuente2.ST25.txt

Val Leu Phe His Pro Leu Arg Pro Phe Leu Leu Val Ala Cys Gln Arg
595 600 605

Thr Val Arg Val Tyr His Leu Leu Lys Gln Glu Leu Ala Lys Arg Leu
610 615 620

Thr Ser Asn Cys Lys Trp Ile Ser Cys Met Gly Arg Pro Pro Pro Gly
625 630 635 640

Asp Asn Leu Leu Ile Gly Thr Tyr Glu Lys Arg Leu Met Trp Phe Asp
645 650 655

Leu Asp Leu Ser Thr Lys Pro Tyr Gln Gln Leu Arg Ile His Asn Ala
660 665 670

Ala Ile Arg Ser Val Ala Phe His Pro Arg Tyr Pro Leu Phe Ala Ser
675 680 685

Ala Gly Asp Asp Arg Ser Val Ile Val Ser His Gly Met Val Tyr Asn
690 695 700

Asp Leu Leu Gln Asn Pro Leu Ile Val Pro Leu Arg Arg Leu Lys Asn
705 710 715 720

His Ala Ile Ser Lys Gly Met Gly Val Leu Asp Cys Ala Phe His Pro
725 730 735

His Gln Pro Trp Ile Val Thr Ala Gly Ala Asp Ser Thr Leu Arg Leu
740 745 750

Phe Thr

<210> 19
<211> 447
<212> DNA
<213> Ixodes scapularis

<400> 19
caaagatgct gctgttctgc ccgacgtgcg ccaacatcct cattgtggaa caaggcttgg 60
agtgccttccg ttctgcctgc aacacatgcc cctacgtgca caacatcaag gcgaagatgt 120
cgaatcggaa gtacccgcgg ctcaaggacg tggacgacgt gctcggcggt gcagccgcct 180
gggagaatgt tgactcgacc gaagagaagt gcccgaagtg tggccatgag cgggcctatt 240
ttatgcagat ccagactagg tcggccgacg agcccatgac caccttctac aagtgtgtgca 300
accagctctg tggccaccag tggagggact gacagatggc ggctttgacg aactcatgcc 360
cgtgcaaaat gcgtcggggg gagagagttt tggaataaaa catgcgcctt actttcataa 420
aaaaaaaaa aaaaaaaaaa aaaaaaa 447

<210> 20

Fuente2.ST25.txt

<211> 108
<212> PRT
<213> Ixodes scapularis

<400> 20

Met Leu Leu Phe Cys Pro Thr Cys Ala Asn Ile Leu Ile Val Glu Gln
1 5 10 15

Gly Leu Glu Cys Phe Arg Phe Ala Cys Asn Thr Cys Pro Tyr Val His
20 25 30

Asn Ile Lys Ala Lys Met Ser Asn Arg Lys Tyr Pro Arg Leu Lys Asp
35 40 45

Val Asp Asp Val Leu Gly Gly Ala Ala Ala Trp Glu Asn Val Asp Ser
50 55 60

Thr Glu Glu Lys Cys Pro Lys Cys Gly His Glu Arg Ala Tyr Phe Met
65 70 75 80

Gln Ile Gln Thr Arg Ser Ala Asp Glu Pro Met Thr Thr Phe Tyr Lys
85 90 95

Cys Cys Asn Gln Leu Cys Gly His Gln Trp Arg Asp
100 105

<210> 21
<211> 1567
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (785)..(785)
<223> n is a, c, g, or t

<400> 21
ccccccaggc gcagggcttc gttcaggtcg accagggggc cctccccgca agccccgagg 60
agcgccacct ggcaagcatg caggtcaatg gatatgagaa cccacctac aagtacttcg 120
aggccaacac caactgagcg gccacgcccc caggggaggg ggaaaagggg gcggacggac 180
gtattgtgcc tgctgcgggc tgcgggatta gtcgtcccg cgttgttccg ggagccagtt 240
ggtttgccctc gcgtcttagg agtaggcacg gcctcccttc tgcacccggt caaggacat 300
ggttgttggg gacacgagcg gcgtggggcg cagccagcct gagctttggg tcccggtacc 360
acggcaaacc gtttgttccc acccgcgga tgaaaatttt gtttgctca gtttctttcg 420
aatcgagcgt cggcgccgcc tccgacagcc ccgagtgcac tctgtctgtt gcgaaagacc 480
aatggagtag ttgacactcg ggtcgcagct cgaacaagct cccgtaaaac gctacttaac 540
cggggccggc gaccgagcgt agagcttgct gtgcgtagtt gtggataaaa cttttttttt 600
ttgtgtgtgt gcttggtcac agacaatggg caycttccga cgtagccac gcgccacacg 660

177
240

Fuente2.ST25.txt

ctcgcccttg ttttcttctt ctcgcggtg tcatacttag ttccattgg cgggtaaca 720
ttccagtcgc ggcgggcgcc cccgttcagg cgcgtcctga tcaaaattga gcatttggtt 780
gtgcngtgca tttattggcc gcagcagggg gttcccgggt gcacctggtg tcgtgacacg 840
catgtcgtga ctttccccctc agacggttgt cttgtctcat ggctcgttca cacctctagt 900
gctggtagtc tctgttgctt aggtttgtag gagcacacta cagcagaggg tgtcacaaag 960
ttttctaagc tgtatataca tgaggaaaac attgcgttgc acacacgcga gtttcggcct 1020
gttttttagtt gggacagtga acgttttttg tacaggttat tatgtagtgc ctacatttgt 1080
atgtgccagc tgcattgtgt ttcctgcatg tggggaagcc tccgtgctgc cccgagctgt 1140
gtgcggcccc tcctgagttt ccatgtgccca tgtgcccagc ctagggtgaa ctgggggtgc 1200
agatgccctt gcgcacggtg tgccccggcg agcattgtgt gtccgtaggc catcgacgct 1260
attcatgcga aattaatgtg gtcacagctg tcattgtctc agtgaacata tcatatgtcc 1320
aaatttgtct cccctgtcag tgtgtgcttc tcttggttct acacttgcct gcatttttgt 1380
tagtttgccg gactgtcctt ttcggtccca ggtcgacagc aggctataac aacaattccg 1440
gtattttcca gtatcgggtc acaccaggtg taacctattg tgcatttagt gtaacttgag 1500
tggaagagct aaaataaaaa ttgcaagag tctcactaaa aaaaaaaaaa aaaaaaaaaa 1560
aaaaaaaa 1567

<210> 22
<211> 44
<212> PRT
<213> Ixodes scapularis

<400> 22

Pro Gln Ala Gln Gly Phe Val Gln Val Asp Gln Gly Ala Leu Pro Ala
1 5 10 15

Ser Pro Glu Glu Arg His Leu Ala Ser Met Gln Val Asn Gly Tyr Glu
20 25 30

Asn Pro Thr Tyr Lys Tyr Phe Glu Ala Asn Thr Asn
35 40

<210> 23
<211> 704
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (534)..(534)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (598)..(598)
<223> n is a, c, g, or t

178.
241

Fuente2.ST25.txt

<400> 23
tgagaagaca ctagaggaca agttcttcga gcatgaggtg atgctgaatg tgaatgcgtt 60
catgcagcag ttccattccg gcgtttttta tgcctacgtg aagctgaagg aacaagagtg 120
ccgcaacatt gtctggattg ccgaatgcgt tgctcagcgt catcggtcca agatcgataa 180
ctacattcca atcttctagt cgctcgagga aaagaaatgg gccaatcgg tagtttgtcg 240
gtgtaatata tatatatata tatatctact tcgcaaaatt cttcagctag agtgtctatg 300
tctggtttagc tgcgattgtg cgagagggga aaaaaatgta gtcagtggca tgatcaagga 360
aggaaaaaaa ttggccaata acttttacct tttgaagtta aagcaagggt taaaataatg 420
tctattttta cttcgtttta ccytgtgctg gctattgctt tgcaaacytt ttttaaaatt 480
tttgcagttc gtctttcttc ttttgagcac atatttatcc cagagttcca atancctttt 540
atgtgtgaat gaatgactaa tccatgttgg ggttggttaa tgggtgcattg ttgaaaanat 600
aaacccaac tccagctggc ctttggaata aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa 660
aaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaaaaaaaa aaaa 704

<210> 24
<211> 681
<212> DNA
<213> Ixodes scapularis

<220>
<221> misc_feature
<222> (432)..(432)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (467)..(467)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (472)..(472)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (481)..(481)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (493)..(493)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (495)..(495)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (499)..(499)
<223> n is a, c, g, or t

<220>

Fuente2.ST25.txt

<221> misc_feature
<222> (507)..(507)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (515)..(515)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (518)..(518)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (528)..(528)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (533)..(533)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (547)..(547)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (550)..(550)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (559)..(559)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (565)..(565)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (567)..(567)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (571)..(571)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (586)..(586)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (593)..(593)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (599)..(599)
<223> n is a, c, g, or t

Fuente2.ST25.txt

<220>
<221> misc_feature
<222> (603)..(603)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (606)..(606)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (611)..(611)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (619)..(619)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (623)..(623)
<223> n is a, c, g, or t

<220>
<221> misc_feature
<222> (625)..(625)
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181
244

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aaccttnaan aacttaagnt tcaantncat ncgaacccca aatccnccgg ggnaggccng 600
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183
246

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
R. ALAN WEEKS
FELLERS, SNIDER, BLANKENSHIP, BAILEY & TIPPENS
P.C.
321 SOUTH BOSTON, SUITE 800
TULSA, OK 74103-3318

PCT

NOTIFICATION OF TRANSMITTAL OF
THE INTERNATIONAL SEARCH REPORT
OR THE DECLARATION

(PCT Rule 44.1)

Date of Mailing
(day/month/year)

11 FEB 2005

Applicant's or agent's file reference
03-368

FOR FURTHER ACTION Sec paragraphs 1 and 4 below

International application No.
PCT/US03/13229

International filing date
(day/month/year)

29 April 2003 (29.04.2003)

Applicant
THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY

1. ☒ The applicant is hereby notified that the international search report has been established and is transmitted herewith.

Filing of amendments and statement under Article 19:

The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):

When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.

Where? Directly to the International Bureau of WIPO, 34, chemin des Colombettes
1211 Geneva 20, Switzerland, Facsimile No.: (41-22) 740.14.35

For more detailed instructions, see the notes on the accompanying sheet.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect is transmitted herewith.

3. ☐ With regard to the protest against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. Reminders

Shortly after 18 months from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau as provided in Rules 90 bis.1 and 90 bis.3, respectively, before the completion of the technical preparations for international publication.

Within 19 months from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase until 30 months from the priority date (in some Offices even later); otherwise the applicant must, within 20 months from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

In respect of other designated Offices, the time limit of 30 months (or later) will apply even if no demand is filed within 19 months.

See the Annex to Form PCT/IB/301 and, for details about the applicable time limits, Office by Office, see the PCT Applicant's Guide, Volume II, National Chapters and the WIPO Internet site.

Name and mailing address of the ISA/US
Mail Stop PCT, Attn: ISA/US
Commissioner for Patents
P.O. Box 1430
Alexandria, Virginia 22313-1430
Facsimile No. (703) 305-3230

Authorized officer

Q. Janice Li

Telephone No. 703-308-0196

Form PCT/ISA/220 (April 2002)

(See notes on accompanying sheet)

RECEIVED

11 FEB 2005

P.S.G.E.L.

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 03-368	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/US03/13229	International filing date (<i>day/month/year</i>) 29 April 2003 (29.04.2003)	(Earliest) Priority Date (<i>day/month/year</i>) 29 April 2002 (29.04.2002)
Applicant THE BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 6 sheets.



It is also accompanied by a copy of each prior art document cited in this report.

1. Basis of the Report

a. With regard to the language, the international search was carried out on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.



the international search was carried out on the basis of a translation of the international application furnished to this Authority (Rule 23.1(b)).

b. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international search was carried out on the basis of the sequence listing:



contained in the international application in written form.



filed together with the international application in computer readable form.



furnished subsequently to this Authority in written form.



furnished subsequently to this Authority in computer readable form.



the statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.



the statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

2. ☐ Certain claims were found unsearchable (See Box I).

3. ☒ Unity of invention is lacking (See Box II).

4. With regard to the title,



the text is approved as submitted by the applicant.



the text has been established by this Authority to read as follows:

5. With regard to the abstract,



the text is approved as submitted by the applicant.



the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is Figure No. _____



as suggested by the applicant.



because the applicant failed to suggest a figure.



because this figure better characterizes the invention.



None of the figures

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248

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/13229

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claim Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claim Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claim Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:
Please See Continuation Sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.: 1-18
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐
☐

- The additional search fees were accompanied by the applicant's protest.
No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/13229

A. CLASSIFICATION OF SUBJECT MATTER IPC(7) : A61K 39/38, 48/00 US CL : 514/44; 424/184.1, 185.1 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) U.S. : 514/44; 424/184.1, 185.1 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched SEQUENCE DATABASE Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EAST, MEDLINE, BIOSIS, EMBASE, CAPLUS		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,312,915 B1 (NELSON ET AL) 06 November 2001, entire document.	1-6
A	US 5,587,311 A (COBON ET AL) 24 DECEMBER 1996, entire document.	7-18
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents:		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
"E" earlier application or patent published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
"P" document published prior to the international filing date but later than the priority date claimed		
Date of the actual completion of the international search 21 June 2004 (21.06.2004)	Date of mailing of the international search report 11 FEB 2005	
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US Commissioner for Patents P.O. Box 1450 Alexandria, Virginia 22313-1450 Facsimile No. (703) 305-3230	Authorized officer Q. Janice Li <i>Janice Li</i> Telephone No. 703-308-0196 <i>807</i>	

Form PCT/ISA/210 (second sheet) (July 1998)

BOX II. OBSERVATIONS WHERE UNITY OF INVENTION IS LACKING

This application contains the following inventions or groups of inventions, which are not so linked as to form a single inventive concept under PCT Rule 13.1. In order for all inventions to be examined, restriction is required.

Group 1. Claims 1-6, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 1-117 of SEQ ID No: 1, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 1-117 of SEQ ID No: 1, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 1-117 of SEQ ID No: 1 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 2. Claims 7-12, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 80-575 of SEQ ID No: 3, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 80-575 of SEQ ID No: 3, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 80-575 of SEQ ID No: 3, and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 3. Claims 13-18, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 10-951 of SEQ ID No: 5, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 10-951 of SEQ ID No: 5, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 10-951 of SEQ ID No: 5, and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 4. Claims 19-24, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 1-697 of SEQ ID No: 7, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 1-697 of SEQ ID No: 7, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 1-697 of SEQ ID No: 7 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 5. Claims 25-30, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 198-1025 of SEQ ID No: 9, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 198-1025 of SEQ ID No: 9, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 198-1025 of SEQ ID No: 9 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 6. Claims 31-36, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 3-578 of SEQ ID No: 11, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 3-578 of SEQ ID No: 11, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 3-578 of SEQ ID No: 11 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

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Group 7. Claims 37-42, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 1-1119 of SEQ ID No: 13, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 1-1119 of SEQ ID No: 13, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 1-1119 of SEQ ID No: 13 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 8. Claims 43-48, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 51-1544 of SEQ ID No: 15, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 51-1544 of SEQ ID No: 15, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 51-1544 of SEQ ID No: 15 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 9. Claims 49-54, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 31-2295 of SEQ ID No: 17, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 31-2295 of SEQ ID No: 17, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 31-2295 of SEQ ID No: 17 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 10. Claims 55-60, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 6-332 of SEQ ID No: 19, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 6-332 of SEQ ID No: 19, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 6-332 of SEQ ID No: 19 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 11. Claims 61-66, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising at least residues 3-137 of SEQ ID No: 21, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule; or drawn to a polypeptide encoded by a nucleotide sequence comprising at least residues 3-137 of SEQ ID No: 21, and a method of vaccination using the polypeptide; or drawn to a vaccine composition comprising a nucleotide sequence comprising at least residues 3-137 of SEQ ID No: 21 and a polypeptide encoded by the cDNA molecule, and a method of vaccination using a combination of the nucleotide and polypeptide.

Group 12. Claims 67-71, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising SEQ ID No: 23, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 13. Claims 72-76, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising SEQ ID No: 24, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

Group 14. Claims 77-80, drawn to a cDNA molecule which encodes an Ixodes associated antigen having a nucleotide sequence comprising SEQ ID No: 25, a vector comprising the nucleotide, an isolated cell transformed by the vector, and a method of vaccination using the cDNA molecule.

The invention listed as groups do not relate to a single inventive concept under PCT Rule 13.1, because under PCT Rule 13.2, they lack the same or corresponding special technical features for the following reasons:

The special technical feature linking groups 1-14 appears to be that they are drawn to a cDNA molecule which encodes an Ixodes associated antigen and method of using such. However, each of the Groups 1-14 is drawn to a different composition and a method of using such, wherein each composition is directed to a different polypeptide and coding sequence as evidenced by different sequence structure and identification number, which polynucleotide and polypeptide appear to be unrelated sequences with distinct properties and wherein each of the nucleotide or polypeptide has a different

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nucleic acid or amino acid sequence structure and antigenicity, therefore, the technical feature linking the inventions of groups 1-14 does not constitute a special technical feature as defined by PCT Rule 13.2, as it does not define one contribution as a whole over the prior art. Accordingly, Groups 2-14 and 1 are not so linked by the same or a corresponding special technical feature as to form a single general inventive concept.

Applicants are advised to see 37 CFR 1.475 (a)-(d) for details. 37 CFR 1.475 (a) recites "An international and a national stage application shall related to one invention only or to a group of inventions so linked as to form a single general inventive concept (requirement of unity of invention)" 37 CFR 1.475 (b) does not provide for more than one product as a combination of invention.

Traducción Oficial código: PCT-REP13229 de un documento escrito en inglés,
sellada por el suscrito Traductor Oficial, junio 9 de dos mil cinco, Bogotá, D.C.,
República de Colombia.

REPORTE DE BÚSQUEDA INTERNACIONAL

PCT/US03/13229

Formulario PCT/ISA/210 (segunda hoja)(julio de 1998)

CASILLA II. OBSERVACIONES EN DONDE FALTA UNIDAD DE INVENCION

Esta solicitud contiene las siguientes invenciones o grupos de invenciones, que no
están unidas como para formar un solo concepto inventivo bajo la Regla PCT 13.1.
Para que todos los inventos sean examinados, se requiere restricción.

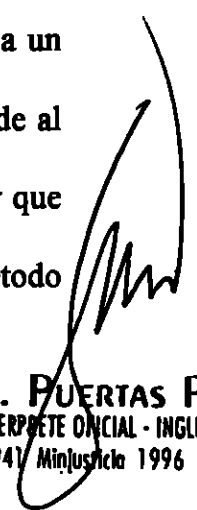
Grupo 1. Afirmaciones 1-6, se llega a una molécula de cDNA que codifica un
antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al
menos residuos 1-117 de Número de Identificación de Secuencia 1, un vector que
comprende el nucleótido, una célula aislada transformada por el vector, y un método
de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado
por una secuencia de nucleótidos que comprende al menos residuos 1-117 de
Número de Identificación de Secuencia 1, y un método de vacunación usando el

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TRADUCTOR E INTERPRETE OFICIAL - INGLÉS
Resolución 0941 Minjusticia 1996

polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 1-117 de Número de Identificación de Secuencia 1 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 2. Afirmaciones 7-12, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 80-575 de Número de Identificación de Secuencia 3, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 80-575 de Número de Identificación de Secuencia 3, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 80-575 de Número de Identificación de Secuencia 3 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 31. Afirmaciones 13-18, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 10-951 de Número de Identificación de Secuencia 5, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método



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Resolución 0941 Minjushcla 1996

de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 10-951 de Número de Identificación de Secuencia 5, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 10-951 de Número de Identificación de Secuencia 5 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 4. Afirmaciones 19-24, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 1-697 de Número de Identificación de Secuencia 7, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 1-697 de Número de Identificación de Secuencia 7, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 1-697 de Número de Identificación de Secuencia 7 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.



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Grupo 5. Afirmaciones 25-30, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 198-1025 de Número de Identificación de Secuencia 9, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 198-1025 de Número de Identificación de Secuencia 9, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 198-1025 de Número de Identificación de Secuencia 9 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

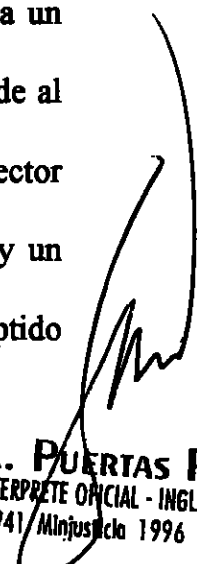
Grupo 6. Afirmaciones 31-36, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 3-578 de Número de Identificación de Secuencia 11, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 3-578 de Número de Identificación de Secuencia 11, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 3-578 de Número de Identificación

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de Secuencia 11 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 7. Afirmaciones 37-42, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 1-1119 de Número de Identificación de Secuencia 13, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 1-1119 de Número de Identificación de Secuencia 13, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 1-1119 de Número de Identificación de Secuencia 13 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 8. Afirmaciones 43-48, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 51-1544 de Número de Identificación de Secuencia 15, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido


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codificado por una secuencia de nucleótidos que comprende al menos residuos 51-1544 de Número de Identificación de Secuencia 15, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 51-1544 de Número de Identificación de Secuencia 15 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 9. Afirmaciones 49-54, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 31-2295 de Número de Identificación de Secuencia 17, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 31-2295 de Número de Identificación de Secuencia 17, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 31-2295 de Número de Identificación de Secuencia 17 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

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Grupo 10. Afirmaciones 55-60, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 6-332 de Número de Identificación de Secuencia 19, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 6-332 de Número de Identificación de Secuencia 19, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 6-332 de Número de Identificación de Secuencia 19 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 11. Afirmaciones 61-66, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende al menos residuos 3-137 de Número de Identificación de Secuencia 21, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA; o se llega a un polipéptido codificado por una secuencia de nucleótidos que comprende al menos residuos 3-137 de Número de Identificación de Secuencia 21, y un método de vacunación usando el polipéptido; o se llega a una composición de vacuna que comprende una secuencia de nucleótidos que comprende al menos residuos 3-137 de Número de Identificación

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de Secuencia 21 y un polipéptido codificado por la molécula de cDNA, y un método de vacunación usando una combinación del nucleótido y el polipéptido.

Grupo 12. Afirmaciones 67-71, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende el Número de Identificación de Secuencia 23, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA.

Grupo 13. Afirmaciones 72-76, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende el Número de Identificación de Secuencia 24, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA.

Grupo 14. Afirmaciones 77-80, se llega a una molécula de cDNA que codifica un antígeno asociado Ixodes que tiene una secuencia de nucleótidos que comprende el Número de Identificación de Secuencia 25, un vector que comprende el nucleótido, una célula aislada transformada por el vector, y un método de vacunación usando la molécula de cDNA.

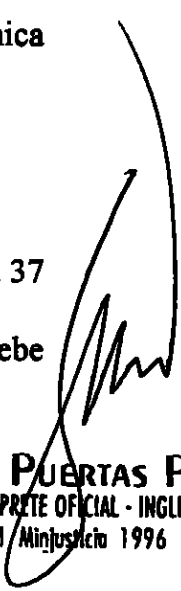


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La invención enumerada en grupos no se relaciona en un solo concepto inventivo bajo la Regla PCT 13.1, porque bajo la Regla PCT 13.2, carece de las mismas características técnicas especiales o correspondiente por las siguientes razones:

La característica técnica especial que une los grupos 1-14 parece ser que ellos llegaron a una molécula de cDNA que codifica un antígeno asociado Ixodes y el método para usarla. Sin embargo, cada uno de los Grupos 1-14 llega a una composición y a un método para usarla diferente, en donde cada composición se dirige a un polipéptido y secuencia de codificación diferente según se evidencia por la estructura de secuencia y número de identificación diferentes, cuyo polinucleótido y polipéptido parecen ser secuencias no relacionadas con propiedades distintas y en donde cada uno de los nucleótidos o polipéptidos tiene una estructura de secuencia de ácido nucleico o aminoácido y antigenicidad diferentes, por lo tanto, la característica técnica que une las invenciones de los grupos 1-14 no constituye una característica técnica especial según se define en la Regla PCT 13.2, ya que no define una contribución como un todo, sobre el estado del arte anterior. Del mismo modo, los Grupos 2-14 y 1 no están vinculados por la misma característica técnica especial o correspondiente como para formar un concepto inventivo general.

A los solicitantes se les aconseja ver 37 CFR 1.475 (a)-(d) para ver detalles. La 37 CFR 1.475 (a) dice "Una aplicación a escala nacional e internacional se debe



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relacionar con una invención solamente o a un grupo de invenciones unidas de tal modo que forman un solo concepto inventivo ("requisito de unidad de invención"). La 37 CFR 1.475 (b) no dispone de más de un producto como combinación de invención.

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Resolución 0941 del 30 de agosto de 1996 del Ministerio de Justicia y del Derecho


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